RESEARCH REPORT

External Research Program



Investigation of a Ground-Source Heat Pump Retrofit to an Electrically Heated Multi-Family Building: Appendix A





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Electric Baseboard Retrofit

-Literature Search-

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1.1) Water Furnace - Premier Series

PREMIER

Water-to-Water Heat Pumps: 34,000 and 56,000 BTUH

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Residential Specifications Catalog

- Applications
- Design Features
- Performance Data
- Electrical Schematics
- Dimensional Data
- Physical Data
- Engineering Guide, Specifications



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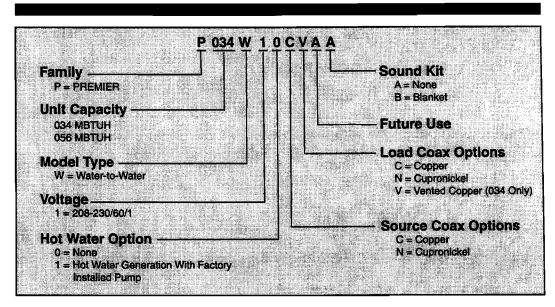
Water-to-Water Heat Pumps: 34,000 and 56,000 BTUH Specifications Catalog

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Model Nomenclature



Heating with hot water is versatile because there are many ways of distributing the heat through the building. The options range from heavy cast iron radiators seen in older buildings to modern, baseboard-style convection radiation, and from invisible radiant floor heating to forced air systems using fan coil units.

A boiler is often used to make domestic hot water and to heat swimming pools or hot tubs.

The various distribution systems have all been used successfully with a geothermal heat pump system. When designing or retrofitting an existing hydronic heating system, however, the water temperature produced by the heat pump is a major consideration.

Heat pumps using R-22 refrigerant are not designed to produce water above 130° F. The efficiency decreases as the temperature difference (ΔT) between the heat load (generally the earth loop) and the supply water (to the distribution system) increases. Figure 1 illustrates the effect of source and load temperatures on the system. The heating capacity of the heat pump also decreases as the temperature difference increases.

When using the various types of hydronic heat distribution systems, the temperature limits of the geothermal system must be considered. In new

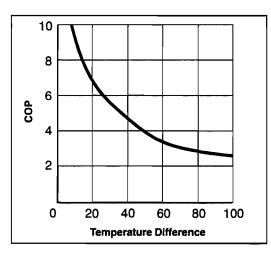


Figure 1: As the ΔT increases, the Coefficient of Performance (COP) decreases When the system produces 130° F water from a 30° F earth loop, the ΔT is 100°F, and the COP is approximately 2.5. If the system is producing water at 90° F, the ΔT is 60°F and the COP rises to about 3.8, an increase of over 50%.

construction, the distribution system can easily be designed with the temperature limits in mind. In retrofits, care must be taken to address the operating temperature limits of the existing distribution system.

Baseboard Radiation: In existing systems, baseboard radiation is typically designed to operate with 160 to 240°F water or steam. Baseboard units are

typically copper pipe with aluminum fins along the length of the pipe, as shown in Figure 2. A decorative cover is normally fitted over the fin tube.

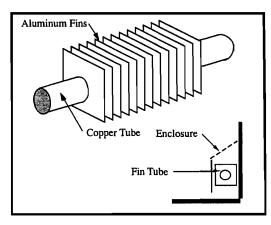


Figure 2: Baseboard radiators are typically constructed of copper tube with closely spaced aluminum fins attached to provide more surface area to dissipate heat. Some of the factors affecting the amount of heat given off by fin tube radiators are water temperature, water velocity, air temperature, and fin spacing and size

The operation of a baseboard radiation system depends on setting up a convection current in the room: air is warmed by the fin tube, rises and is displaced by cool air.

The heating capacity of a baseboard system is a factor of the area of copper tube and fins exposed to the air and the temperature difference between the air and the fin tube. The velocity and volume of water flowing through the baseboard affects the temperature of the copper and fins. Baseboard units are normally rated in heat output/length of baseboard at a standard water temperature and flow. Manufacturers can provide charts which will give the capacities at temperatures and flows below the standard. Figure 3 shows approximate heating capacities for fin tube radiation using water from 100 to 130°F water.

Baseboards are available using two or three fin tubes tiered above one another in the same cabinet (see Figure 4). With the additional surface area, the air can be heated enough to set up a convection current with water temperatures as low as 110 to 130°F (see Figure 3).

It is important to ensure that the heat output of the system is adequate to meet the heat loss of the room or building at the temperatures the geothermal system is capable of producing.

Baseboard radiation is limited to space heating. Cooling is typically provided by a separate, forced air distribution system.

Hydronic Heating Systems

Heating output per linear foot

110° F	190-380	160-320	150-300
120° F	240-480	205-410	195-390
130° F	295-590	265-532	245-490

Figure 3: The heating capacity (Btuh/linear foot) of baseboard radiators drops as the water temperature is reduced. The heating capacity of most baseboard radiators is rated using 200°F water, 65°F air temperature. Listed is the range of heating capacities of baseboard radiators at the standard temperatures and the range of capacities when the temperatures are reduced to the operating range of a heat pump system. Some of the factors that affect the capacity of a radiator are listed:

- Size of the fins range from 2.75" x 3" to 4" x 4"
- Fin spacing 24 to 48/foot
- Diameter of copper tube range from .75" to 2"
- · Fin material aluminum or steel
- Configuration and height of the enclosure
- Height unit is mounted from the floor
- Water flow through the radiator

Generally, the smaller fins with fewer fins/foot will have lower heating capacity. Larger copper tube diameter and aluminum fins will have a higher capacity. Higher water flow will increase capacity. Adding a second fin tube to the same enclosure will increase the capacity by 50 to 60%. Adding two fin tubes will increase the capacity by 75 to 80%.

Cast Iron Radiation: Retrofit applications for hydronic/geothermal heat pump systems are often required to work with existing cast iron radiators or their replacements (see Figure 4). Typically, cast iron radiator systems operate with water temperatures of 125 to 160°F.

These temperatures are higher than geothermal water-to-water heat pumps are capable of providing. Cast iron radiators can work with geothermal systems, provided the heat output of the radiators will meet the maximum heat loss of the building at the lower temperatures.

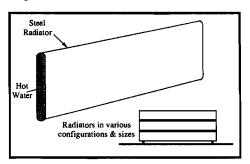


Figure 4: Many different configurations of radiators are available for replacements of old cast iron radiators to fit many different applications. Radiators are available for special applications such as towel drying racks. As with baseboard radiators, the heating capacity varies with water temperatures and velocities, air temperatures, and surface area.

If the insulation of the building has been upgraded since the original installation, it is possible that the

lower temperatures will be able to meet the reduced heat loss of the building.

Radiant Floor Heating: Radiant floor heating has been the system of choice in many parts of Europe for some time. Manufacturers have developed tubing designed for installation in concrete floors and raised wood floors.

Floor heating systems have several benefits in residential, commercial and industrial heating applications. In a building with a radiant floor heating system, the entire floor acts as a heat source for the room. People feel comfortable with lower air temperatures if their feet are warm. Typically the space will feel comfortable with air temperatures as low as 65° F. Since the heat loss of a building is directly related to the temperature difference (Δ T) between the inside and outside, a lower Δ T means the heat loss is lower.

Air temperatures in a room with a forced air heating system tend to be warmer nearer to the ceiling than the floor (see Figure 5). The hot air rises and creates a greater pressure imbalance between the inside and outside. The infiltration increases, resulting in a higher heat loss. Air temperatures in a room with radiant floor heating tend to be warmer at the floor than the ceiling, helping to cut down on infiltration in the building. The energy savings in a building with radiant floor heating can range from 10 to 20%.

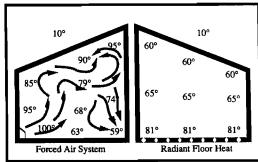


Illustration courtesy of WIRSBO Company

Figure 5: Temperatures in a forced air system tend to be more uneven than in a radiant floor heating system. The air temperatures in a forced air system tend to be much higher than with radiant floor heating, making the temperature difference between inside and outside higher. This results in a higher heat loss

A floor heat system can be designed to heat a building with water temperatures as low as $90^{\circ}F$. Figure 1 shows how a geothermal system operates more efficiently with a lower ΔT between the source and the load. With only a $60^{\circ}F$ temperature difference, a geothermal heat pump will operate at COPs over 4, about 20% higher than a forced air geothermal system in the same installation.

Some of the factors affecting the heating capacity of a floor heating system are as follows:

- The type of finish flooring
- The spacing of the pipe
- The water flow through the pipe
- The temperature of the supply water
- The floor material (wood, concrete or poured Gypcrete[™])
- Insulation value under the floor
- The piping layout

The spacing of the pipe in residential applications can vary from 4" to 12". If the spacing is too large, the temperature of the floor can vary noticeably. In industrial applications, variation in the floor temperature is not as important, and the spacing is related directly to the heat output required.

Radiant floor heating systems work well with geothermal heat pump systems. For efficient operation, the system must be designed with the lowest possible water temperatures.

There are some drawbacks with a radiant floor heating system. Air conditioning is only possible by adding a second system using forced air. This can add substantial cost to an installation where air conditioning is also needed. A separate air handling system is needed to clean the air or to introduce fresh air.

Industrial buildings, especially those with high ceilings and large overhead doors, have an advantage with a radiant floor heating system. Heat is stored in the concrete floor, and when a door is opened, the stored heat is immediately released to the space. The larger the ΔT between the air in the space and the floor, the quicker the floor releases its heat to the space.

Maintenance garages benefit from radiant floor heating systems. Cold vehicles brought into the garage are warmed from underneath. The snow melts off the vehicle and dries much more quickly than when heated from above.

Some pipe manufacturers include an oxygen diffusion barrier in the pipe to prevent oxygen diffusion. Good system design and careful installation, however, will eliminate virtually all of the problems encountered with air in the system. As with earth loop design, it is important to design the system to facilitate flushing the air initially and ensuring that the flows can be balanced properly.

Fan Coil Units & Air Handlers: Fan coil units, air handlers, force flow units, etc. are all basically a hot water radiator or coil (usually copper piping with aluminum fins) with a fan or blower to move the air over the coil (see Figure 6). The term "fan coil units"

typically applies to smaller units that are installed in the zone or area in which heating (or cooling) is needed. They are available in many different configurations, sizes and capacities. Fan coil units are designed to be connected to a ductwork system and can be used to replace a forced air furnace. Other units are designed for use without ductwork and are mounted in a suspended ceiling space with only a grill showing in place of a ceiling tile. Some can be mounted on a wall under a window, projecting 8" to 10" into the room or even flush to the wall surface, mounted between wall studs. Some are available with or without finished, decorative cabinets. For industrial applications, inexpensive "unit heaters" are available, with only a coil and an axial fan. Fan coil units and unit heaters are normally available with air handling capacities of 200 to 2.000 cfm.

The term "air handler" normally applies to larger units, mounted in mechanical rooms, mechanical crawl spaces or rooftops. They typically have an air handling capacity of over 2,000 cfm and are available for capacities of up to 50,000 cfm. Air handlers are typically built for a specific installation and are available with many different types of heating and cooling coils. They can include additional coils for heating make-up air, dehumidification and exhaust air heat recovery.

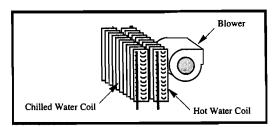


Figure 6: Fan coils and air handlers typically have one or two coils and a blower. Air is heated by hot water circulated through the hot water coil. Chilled water is circulated through the coil if air conditioning is needed. Blowers can be provided to fit various applications, with or without ductwork. Unit heaters typically use axial fans in applications where ductwork is not needed.

Fan coil units and air handlers are used in many different applications. They have been used to heat buildings using water temperatures as low as 90 to 100°F. New systems can be designed to operate very efficiently with a geothermal system.

In a retrofit situation when replacing a conventional boiler, care must be taken to ensure that any air handlers or fan coil units in the building will heat the building with water temperatures below 130°F.

Cooling a building with an existing radiant hydronic

Cooling with Hydronic Systems

heating system can be a challenge. If baseboard, cast iron radiators or a radiant floor heating system is cooled lower than the dew point, condensation will form on the floor or drip off the radiators.

There is generally minimal ductwork for ventilation or no ductwork in existing buildings with radiant hydronic heat. Typically, cooling is provided with separate units where it is needed. This is often done using through-the-wall or window air conditioners, ductless split air conditioning units, or rooftop units.

A water-to-water heat pump system can provide water to ducted or unducted fan coil units. The system can provide chilled water to cool the building, as well as hot water for the heating system when needed.

A limited amount of cooling can be done by circulating chilled water through the piping in the floor. This can be effective in buildings with high solar loads or lighting loads, where much of the heat gain is radiant heat being absorbed by the floor. Cooling fresh air used for ventilation as it is brought into the building, using a chilled water coil, can sometimes provide the additional

cooling needed. Care must be taken to avoid cooling the floor below the dew point because condensation may form on the floor.

Buildings with fan coil units and air handlers can generally be easily retrofitted for cooling. Often it is simply a matter of adding a cooling coil to the existing air handlers and fan coil units. Water-to-water heat pumps can provide hot water for the heating coils as well as chilled water for the air conditioning.

Integrated Systems: In buildings with fairly balanced heating and cooling loads, a hydronic/ geothermal system can provide a significant efficiency advantage. When a heat pump is making hot water, it will take heat from the building when cooling is needed. When cooling is not needed, heat will be taken from the earth loop.

While cooling, heat is rejected directly into another part of the building making the heat virtually free. If it can't be used, it is stored in the ground loop.

Additional System Design Reference materials are available from WaterFurnace.

Design Features

Flexibility

- Designed to operate with liquid temperatures of 30°F to 120°F (30-90 EST, 30-120 ELT).
- Source side flow rates as low as 1.5 gpm/ton for well water (50°F min. EWT).
- Heated and chilled water from the same compact unit.
- Modularized design for optimum capacity matching and staging.
- · Stackable for space conservation.
- · Compact size allows passage through most doors.

Operating Efficiencies

- Optional desuperheater with internal pump generates hot water at considerable savings while improving overall system efficiency.
- High-stability expansion valve delivers optimum refrigerant flow over a wide range of conditions and provides bidirectional operation without troublesome check valves.
- Efficient scroll compressors operate quietly.
- Oversized coaxial tube water-to-refrigerant heat exchanger operates at low liquid pressure drops.
 Convoluted copper (or optional cupronickel) water tube functions efficiently at low-flow rates and provides greater durability.

Service Advantages

- Removable front and rear access panels provide quick access to all internal components.
- Designed for front-access in tight applications.
- High-and low-pressure service ports in refrigerant circuit.

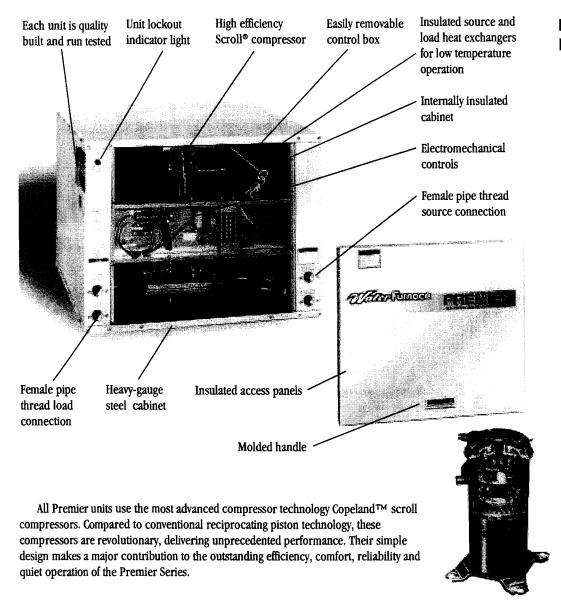
Factory Quality

- Heavy-gauge steel cabinets are finished with durable powder coat paint for long lasting beauty and service.
- All refrigerant brazing is performed in a nitrogen atmosphere.
- All units are deep evacuated to less than 150 microns prior to refrigerant charging.
- All joints are helium leak-tested to insure annual leak rate of less than 1/4 ounce.
- Coaxial heat exchangers, refrigerant suction lines, desuperheater coil, and all water pipes are fully insulated to reduce condensation problems in low temperature operation.
- Noise reduction features: isolation mounted compressors; insulated cabinet using 1/2" coated glass fiber.
- Safety features include high and low-pressure refrigerant controls to protect the compressor; hot water high-limit desuperheater pump shutdown.

Options & Accessories

- Optional desuperheater with internally mounted pump and water heater plumbing connector.
- · Optional cupronickel coaxial heat exchanger.
- · Closed loop flow center.

- Hose kits.
- Sound blanket for compressor.
- FPK Freeze protection kit 32°.
- FPKCL Freeze protection kit 15°.



Premier Features

Reference Calculations

Heating Calculations:	Cooling Calculations:
LWT = EWT - HE GPM x 500	$LWT = EWT + \frac{HR}{GPM \times 500}$

Legend

ELT = entering load fluid temperature to heat pump

SWPD = source coax water pressure drop

LLT = leaving load fluid temperature from heat pump

PSI = pressure drop in pounds per square inch

LGPM = load flow in gallons per minute

FT HD = pressure drop in feet of head

LWPD = load coax water pressure drop

LWT = leaving water temperature

EWT = entering water temperature

kW = kilowatts

EST = entering source fluid temperature to heat pump

HE = heat extracted in BTUH

LST = leaving source fluid temperature from heat pump

HC = total heating capacity in BTUH

COP = coefficient of performance, heating $[HC/(kW \times 3.413)]$

EER = energy efficiency ratio, cooling

TC = total cooling capacity in BTUH

HR = heat rejected in BTUH

Unit Selection Calculations

Example #1 Selecting a single unit to heat and/or cool.

A) Determine System Design Conditions:

- 1) The "source" (heat source/heat sink) side This could be an earth loop, well water, a boiler/tower loop, process water, condenser water, etc. The source liquid can be 25°F to 110°F entering the unit.
- 2) The "load" side This could be a water coil(s) in an air handler unit(s), a fan coil unit(s), hydronic baseboard, in-slab piping, swimming pool, etc. The load liquid can be 30°F to 120°F entering the unit.
- The load side of multiple units can be plumbed together in either parallel or series style to accomplish certain tasks.
 - Always use parallel flow for the source sides.
 - Use parallel flow for the load sides with the following needs:
- Heating and/or cooling capacity greater than the largest single unit can provide.
- To do staging of capacity.
- To reduce the pressure drop through the load side of the units, even when a single unit might meet capacity.
 - Use series flow for the load sides with the following needs:
- Leaving liquid temperature (LLT) greater than a single unit can produce on cooling. However, do not drop the entering liquid temperature (ELT) of any unit below 30°F.

B) Unit Selection Parameters:

	FIGHT	(0.86)	ist user	
Entering Water (liquid) Temp.	110°F ELT	50°F ELT	50°F EST	80°F EST
Water (Ilquid) Flow Rate*	8.0 GPM	11.0 GPM	8.0 GPM	8.0 GPM
Water (liquid) Pressure Drop	12.0 ft hd	12.0 ft hd	7.0 ft hd	7.0 ft hd
Unit Electrical		230/	/1/60	
Coax Material	Cupro	nickel	Cop	oper

^{*} As low as 1.5 GPM/ton for constant temperature liquid like well water that is in the 45° F to 60° F range to as high as 3 0 GPM/ton for variable temperature liquid.

C) Determine Unit Requirements:

					4310 A.
	-rediffe.				is and
Cooling	43,000	50°F	11	80°F	8
	3 6 tons				
Heating	54,000	110°F	8	50°F	8
	4 5 tons				

D) Initial Selection: Refer to the performance data tables (pages 14-17) and select possible units.

Unit possibility #1: P056W (pages 16 and 17) 5 ton unit—using interpolation.

			1								Ton.	nidi) a s
				(#1119)				XI.	43	023	eitle (
	50	11.0	11.2	43,900	2.91	53,800	15.1	41.80	70	8.0	6.70	83.90
Cooling	50	11.0	11.2	42,600	3.24	53,650	13.4	42.05	80	8.0	6.25	93.85
	50	11.0	11.2	41,300	3.56	53,500	11.6	42.03	90	8.0	5.80	103.80
	100	8.0	5.20	54,500	4.28	39,900	3.7	113.7	50	8.0	7.50	40.00
Heating	110	8.0	5.05	54,350	4.77	38,050	3.4	123.6	50	8.0	7.50	40.45
	120	8.0	4.90	54,200	5.26	36,200	3.0	133.5	50	8.0	7.50	40.90

E) Final Results:

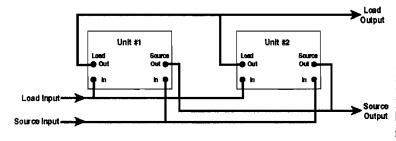
P056W (refer to Model Description Key on page 10)

Total Cooling Capacity (TC) = 42,600 BTUH (within 1% of needed capacity)

Total Heating Capacity (HC) = 54,350 BTUH

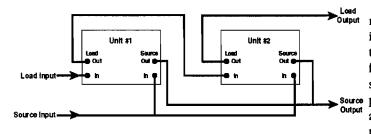
Since the LLT/LST are above freezing, no antifreeze is required

Example #2: Selecting multiple units to accomplish a heating and/or cooling task by piping the load sides in parallel flow.



By adding together the capacities of two units, increased capacities can be met, while the overall system pumping pressure drop is lowered, perhaps lowering the pump horsepower. In addition, by cycling one unit, capacity reduction can be accomplished.

Example #3: Selecting multiple units to accomplish a cooling task by piping the load sides in series flow.



This arrangement satisfies the requirement of achieving a 20°F drop in load liquid temperature. By piping the load sides in series, the LLT of the first unit becomes the ELT of the second unit. The overall system pumping pressure drop is increased and therefore requires increased pump horsepower. If at anytime, a

10°F drop would satisfy the requirements, one unit could be cycled off, but the pumping penalty would still remain.

P034W Heating Capacity Data

			i W	/PD		SOL	IRCE !	5.0 GP	м		SV	VPD		SOL	IRCE :	7.0 GP	M		SV	/PD		SOL	JRCE 9	0.0 GP	м		SW	VPD
ELT	EST	LGPM		FTHD	LLT	HC	KW		COP	LST		FTHD	LLT	HC				LST		FTHD	LLT	HC	KW		COP	LST		FT HD
		5.0	16	37	69 5	23 1	1.53	17.9	44	22.8	17	3.9	69 9	23 8		18.6	46	24.1	3.5	8.1	70.4	24.5	1 52	19 4	47	25 4	53	122
60	30	70	3.7	8.5	67.4	23.0	1.49	17.9	4.5	22.8	1.7	3.9	67.8	23 7	1.49	18.6	4.7	24.1	3.5	8.1	68 1	24.4	1.49	19.3	4.8	25.4	53	12.2
		9.0	5.1	11.8	65.4	22.9	1.45	17.9	4.6	22.8	1.7	3.9	65.6	23.5		18.6	4.8	24.1	3.5	8.1	65.8	24.2	1.45	19.2	4.9	25.4	5.3	12.2
l		50	16	3.7	712	27.1	1.56	21.8	5.1	310	1.7	3.9	71.6	28 0		22.7	5.3	32.7	3.5	8.0	72.0	28 9	1 55	23 6	5.5	34 5	5.3	12 2
60	40	70	3.7	8.5	68 8	27.0	1.51	21.9	5.2	31.0	17	3.9	69.1		1.51	22.8	54	32.7	3.5	8.0	69.4	28.8	1.51	23.7	5.6	34 4	53	122
		9.0	5.1	11.8	66.3	26.9	1.47	21.9	5.4	31.0	1.7	3.9	66.6	27.8 32.2	1.47	22.8	5.6	32.7 41.4	3.5	8.0 7.9	66.8 73.7	28.7 33.3	1.47 1 58	23.7 27.9	5.7 6.2	34.4 43.5	5.3 5.2	12.2 12.0
60	50	50 70	1.6 3.7	37 85	72.9 70 1	31.1 31 1	1.59 1.53	25.7 25 8	5.7 5 9	39.3 39.3	1.6 1.6	37	73.3 70 4	32.2		26.8 26.9	6.0 6.1	41.4	3.4 3.4	7.9	70.8	33.3	1 53	28 0	6.4	43.5	5.2	120
00	30	9.0	5.1	11.8	67.3	31.0	1.48	26.0	6.1	39.3	1.6	3.7	67.5	32.1		27.1	6.3	41.4	3.4	7.9	67.8	33.2	1.48	28.2	6.6	43.4	5.2	12.0
		5.0	16	37	74.4	35 1	1 61	29.6	64	47.6	16	3.7	74.9	36 4		30.9	6.6	50.1	34	77	75.4	37.7	1 61	32 2	6.9	52 5	51	118
60	60	7.0	37	8.5	713	35.1	1.56	29.8	66	47.6	1.6	3.7	71.7	38.4		31,1	6.8	50.0	3.4	7.7	72.1	37.7	1.56	32.4	7.1	52 5	51	118
		9.0	5.1	11.8	68.2	35.1	1.50	30.0	6.9	47.5	1.6	3.7	68.5	36.5		31.3	7.1	50.0	3.4	7.7	68.8	37.8	1.51	32.6	7.3	52.5	5.1	11.8
		5.0	16	3.7	75 9	39.1	1.64	33.5	70	55 9	1.6	3.7	76.4	40 6	1.64	35.0	7.2	58.7	3.3	7.6	77.0	42.0	1 64	36 4	7.5	61.6	50	116
60	70	7.0	37	8.5	72 5	39 1	1.58	33 8	73	55.8	16	3.7	730	40 7		35 2	7.5	58 7	3.3	76	73.4	42.2	1.59	36.7	7.8	61.5	50	11 6
		9.0	5.1	11.8	69.2	39.2	1,52	34.0	7.6	55.7	1.6	3.7	69.5	40.8		35.5	7.8	58.6	3.3	7.6	69.9	42.3	1.55	37.1	8.0	61.5	5.0	11.6
		5.0	1.5	35	89 6	23.0	1.90	16.5	35	23.5	1.7	3.9	89.9	23.6	1.90	17.1	3.6	24.7	3.5	8.1	90.1	24.2	1.90	17.7	3.7	25.9	53	12.2
80	30	70	33	76	87.5	22.9	1.85	16.6	36	23.5	1.7	3.9	877	23 5		17.2	3.7	24 7	3.5	8.1	67.8	24.1	1 86	17.8	3.8	25 9	53	12.2 12.2
		9.0	5.0	11.6	85.3	22.8	1.80	16.7	3.7	23.5	1.7	3.9	85.5	23.4	1,81	17.2	3.8	24.7	3.5	8.1	85.6	24.0 28.4	1.81	17.8 21 8	3.9 4.3	25.9 35 0	5.3 5.3	12.2
80	40	5 0 7.0	1 5 3.3	3 5 7.6	91 1 88.7	26.8 26.8	1.93 1.88	20.2	4 1 4.2	31.9 31.9	1.7	3.9	91.4 88.9	27 6 27.6		21.0 21.1	4.2 4.3	33.4 33.4	3.5 3.5	8.0 8.0	91.7 89.2	28.3	1.89		4.4	35.0	5.3	122
80	40	9.0	5.0	11.6	86.2	26.7	1.82	20.4	4.2	31.8	1.7	3.9	86.4	27.5		21.1	4.4	33.4	3.5	8.0	86.6	28.3	1.83		4.5	34.9	5.3	12.2
	 	5.0	1.5	3.5	92 6	30.7	1.97	24.0	4.6	40.3	1.6	3.5	93.0	31 7		24.9	4.7	42.2	3.4	7.9	93.4	32.6	1 98		4.8	44.0	5.2	12.0
80	50	7.0	3.3	76	89.9	30.6	1.90	24.1	47	40.2	1.6	3.7	90 2	31 6		25.1	4.9	42.1	3.4	7.9	90.5	32 6			5.0	44 0	52	12 0
	**	9.0	5.0	11.6	87.1	30.6	1.84	24.3	4.9	40.2	1.6	3.7	87.4	31.6		25.3	5.0	42.1	3.4	7.9	87.6	32.6	1.86	26.2	5.1	44.0	5.2	12.0
		5.0	1.5	35	94.1	34.5	2.00	27.7	51	48.6	1.6	37	94.6	35 7	2.01	28.9	5.2	50.9	3.4	76	95.0	36.9	2 01	30 0	5.4	53 1	5.1	118
80	60	70	33	7.6	91 1	34.5	1.93	27 9	52	48.6	1.6	3.7	914	35.7		29.1	5.4	50.6	3.4	78	91.8	36 9			5.6	53 1	5 1	11 8
		9.0	5.0	11.6	88.0	34.4	1.86	28.1	5.4	48.5	1.6	3.7	88.3	35.7		29.3	5.6	50.8	3.4	7.8	88.6	36.9			5.8	53.1	5.1	11.8
		5.0	15	35	95.7	38.4	2.03	31.5	5.5	57 0	1.6	3.7	96.2	39 7		32.8	5.7	59.6	3.3	7.6	96.7	41.1			5.9	62.2	50	116
80	70	7.0	33	76	923	38.3	1.96	31.7	5.7	57.0	1.6	3.7	927	39 7		33.0	5.9	59.6 59.5	3.3	7.6	93.1 69.6	41.1 41.2	1.98		6.1 6.3	62.2 62.1	5.0 5.0	11.6
		9.0	5.0	11.6 3 2	88.9 109.4	38.3 22.9	1.88	31.9	6.0 2.7	56.9 24.3	1.6	3.7	89.3 109 6	39.7		33,3	6.2 2.8	25.3	3.3	7.6 8 1	109.8	23.8				26 4		12.2
100	30	5 0 7.0	1.4 3 1	72	107.3	22.6	2.49	14.4 14.5	2.7	24 3	1.7	3.9 3.9	107.5				2.8	25.3	3.5	8.1	107.6					26 4		12.2
100	30	9.0	4.7	10.9	105.2	22.7	2.39	14.6	2.8	24.2	1.7	3.9	105.3			15.1	2.9	25.3	3.5	8.1	105.4				2.9	26.4	5.3	12.2
		5.0	1.4	3 2	110.9	26.6	2.52	18.0	31	32 7	17	3.9	111.2				3.2	34.1	3.5	8.0	111.4					35 5		12.2
100	40	7.0	3.1	7.2	108 5	26 5	2.46	18.1	32	32.7	1.7	3.9	1087				3.2	34.1	3.5	8.0	106 9					35.5	53	12 2
		9.0	4.7	10.9	106.1	26.4	2.40	18.2	3.2	32.6	1.7	3.9	106.2	27.1	2.40	18.9	3.3	34.1	3.5	8.0	106.4	27.9	2.40	19.7	3.4	35.5	5.3	12.2
		50	14	3 2	112 4		2.56	21.6	35	412	1.6	37	1127				36	42 9		7.9	113.1					44 6		12 0
100	50	70	3.1	72	109.7	30.2	2.49	21.7	3.6	41.2	1.6	3.7	109.9				3.7	42 9		7.9	110.2					44 6		12 0
	-	9.0	4.7	10.9	107.0		2.41	21.8	3.7	41.1	1.6	3.7	107.2				3.8	42.8		7.9	107.4					44.6		12.0
1.00		5.0	14	3.2	1139		2.60	25.1	38	49.7	1.6	3.7	114.3					51 7		77	114.7							11.8
100	60	9.0	3 1 4.7	7 2 10.9	110.9 107.8	33.9 33.7	2.51	25.3 25.5	4.0 4.1	49.6 49.6	1.6	3.7	111 2					51.7 51.6		7.7	111.5	36.0				53.7		11.8
	+	5.0	14	3.2	115 4		2.43	28.7	4.1	58.1	1.6	3.7	108.1 115.9					60.5		7.6	116.3							
100	70	7.0	3.1	72	112.1		2.54	28.9	4.3	58.1		3.7	112.4				4.5	60.4		76	112.8							1
1	.	9.0	4.7	10.9	108.7	37.4	2.44	29.1	4.5	58.0		3.7	109.0					60.4		7.6	109.3							11.6
	1	50	13	30	129 1	22.8	3.07	12.3	22	25.0	1.7	4.0	129 3		3.07	12.6	2.2	25 9	3.5	81	129.5	23.5	3.07	13.0	2.2	26 8	53	122
120	30	7.0	3.0	6.9	127.1	22.7	3.02	12.4	2.2	24.9	1.7	4.0	127.2	23.1	3.02		2.2	25.9	3.5	8.1	127.4							
L	<u> </u>	9.0	4.5	10.4	125.1		2.98	12.5	2.2	24.9	1.7	4.0	125.2					25.9		8.1	125.3							
1		5.0	1.3	3.0	130 6		3.11	15.7	25	33 6		3.9	130.9			16.3		34.8		8.0	131.1							
120	40	70	30	69	128.3		3.05	15.8	25	33 5		3 9	128 5					34.7		80	126 7							
\vdash	+	9.0	4.5	10.4	126.0		2.98	16.0	2.6	33.5		3.9	126.1							8.0	126.2							
120	E0.	5.0 7.0	1 3 3.0	30	132 2 129.5		3.07	19.1	2.8	42.1 42.1		3.7	132 5 129.7					43.6		7 9 7.9	132.8							
120	50	9.0	4.5	6.9 10.4	126.8	29.7	2.99	19.3	2.9	42.1		3.7	127.0							7.9	127.1							
 	\vdash	5.0	1.3	3.0	133.7		3.19	22.5	3.1	50.7		3.7	134.0							7.7	134.4							
120	60	7.0	3.0	6.9	130.7			22.7	3 1	50.7		3.7	130.9							7.7	131.2							
L		9.0	4.5	10.4	127.6		2.99	22.8	3.2	50.6		3.7	127.8							7.7	128.1		3.00	24.8				
		50	13	30	135 2	37.0	3.24	26.0	34	59.3		3.7	135.6	38.1	3.24	27.1	3.5	61.4		7.6	136.0							
120	70	70	30	69	131.9		3.12	26 1	35	59 2		3.7	132 2							76	132.5							
		9.0	4.5	10.4	128.5	36.5	3.00	26.3	3.6	59.2	1.6	3.7	128.7	37.7	3.01	27.4	3.7	61.3	3.3	7.6	129.0	38.9	9 3.0	1 28.0	3.8	63.4	5.0	11.6

ELT = entering load fluid temperature to heat pump
LLT = leaving load fluid temperature from heat pump
LGPM = load flow in gallons per minute
LWPD = load coax water pressure drop
EST = entering source fluid temperature to heat pump
LST = leaving source fluid temperature from heat pump

SWPD = source coax water pressure drop
PSI = pressure drop in pounds per square inch
FT HD = pressure drop in feet of head
KW = kilowatts HE = heat extracted in BTUH HC = total heating capacity in BTUH COP = coefficient of performance [HC/(KW x 3.413)]

Multiple Flow Rates for Source Side and Load Side are shown. When selecting units and designing the system, actual operating parameters must fall within the temperature and flow rate ranges shown on the table. Using temperature/flow rate combinations outside the range of the table will result in performance problems.

P034W Cooling Capacity Data

			Ľ	WPD		SC	URCE	5.0 G	РМ		S	WPD		SO	URCE	7.0 G	РМ		S	WPD		SC	URCE	9.0 G	PM		S	WPD
ELT	EST	LGPM	PSI	FTHD	LLT	TC	KW	HR	EER	LST	PSI	FTHD	LLT	TC I	KW	HR	EER	LST	PSI	FT HD	LLT	TC	KW	HR	EER	LST	PSI	FT HD
		50	17	3.9	22 4	18 5	1.33	23 0	13.9	59.5	1.6	37	22.4	18 3	1.29	22 7	14 2	56.7	3.9	9.0	22 5	18 2	1.25	22 4	14.5	55 1	5.2	120
30	50	7.0	4.0	9.2	24.3	19.2	1.35	23.8	14.3	59.8	1.6	3.7	24.4	19.0	1.30	23.4	14.6	56.9	3.9	9.0	24.5	18.7	1.26	23 0	14.8	55 3	5.2	120
••		9.0	5.3	12.2	25.4	20.0	1.36	24.6	14.7	60.1	1.6	3.7	25.5	19.8	1.32	24.3	15.1	57.2	3.9	9.0	25.5	19.6	1.27	24.0	15.5	55.5	5.2	12.0
		5.0	17	39	23.0	16 9	1.71	22.7	9.9	79 4	16	3.7	23.1	16.8	1.66	22.4	10.1	76.6	3.5	8.1	23.1	16.6	1 61	22 1	10.3	75.1	50	116
30	70	7.0	4.0	92	24.8	17.6	1.72	23.4	10 2	79.7	1.6	3.7	24.9	17.4	1.67	23.1	10.4	76.8	3.5	8.1	24.9	17.3	1.62	22 8	10.7	75.2	5.0	116
30	,,,	9.0	5.3	12.2	25.8	18.3	1.73	24.1	10.6	80.0	1.6	3.7	25.9	18.1	1.68	23.8	10.8	77.0	3.5	8.1	25.9	18.0	1.64	23.5	11.0	75.4	5.0	11.6
		5.0	17	3.9	23.7	15.3	2.08	22.4	7.4	99.2	1.5	3.5	23.7	15.2	2.03	22.1	7.5	96.5	3.2	7.4	23.8	15 1	1.97	21.8	7.6	95.0	4.9	11.3
30	90	7.0	4.0	9.2	25.3	15.9	2.09	23.1	7.6	99.5	1.5	3.5	25.6	14 9	2.04	21.8	7.3	96.4	3.2	7.4	25.9	13.8	1.99	20.6	7.0	94.7	49	113
ا ا	30	9.0	5.3	12.2	26.2	16.6	2.09	23.7	7.9	99.8	1.5	3.5	26.2	16.4	2.05	23.4	8.0	96.9	3.2	7.4	26.3	16.3	2.00	23.1	8.1	95.3	4.9	11.3
				37	_																			_	24.2		5.3	12.2
		5.0	16		39 2	26 1	1.12	29 9	23 3	423	17	3.9	39.4	25 7	1.09	29 4	23.7	38.7	40	9.2	39.5	25 4	1 05	28 9		36.6		
50	30	70	39	9.0	42.0	27.1	1.13	31 0	24.0	42.8	1.7	3.9	42.1	26 7	1.10	30.5	24.4	39.0	4.0	9.2	42.2	26 4	1.06	30.0	24.9	36.9	5.3	12 2
	-	9.0	5.2	12.0	43.6	28.1	1.14	32.0	24.7	43,2	1.7	3.9	43.6	27.9	1.11	31.7	25.3	39.3	4.0	9.2	43.7	27.7	1.07	31.3	25.9	37.2	5.3	12.2
l		50	1.6	37	39 5	25.6	1.35	30.2	18 9	62.4	1.6	3.7	39.4	25 6	1.31	30 1	19.5	58.9	3.9	9.0	39.4	25 7	1.27	30 1	20.2	56.9	52	120
50	50	7.0	3.9	9.0	42 2	26.6	1.36	31.2	19 5	62.9	1.6	3.7	42.1	26.7	1.32	31.2	20.2	59.2	3.9	9.0	42.1	26.7	1.28	31.1	20.9	57.1	52	120
├	-	9.0	5.2	12.0	43.7	27.6	1.38	32.3	20.1	63.3	1.6	3.7	43.7	27.7	1.33	32.2	20.8	59.5	3.9	9.0	43.6	27.7	1.29	32.1	21.6	57.4	5.2	12.0
		5.0	16	3 7	40.2	23.7	1.78	29 8	13.3	82.3	1.6	3.7	40.2	23.8	1.73	29 7	13.8	78 7	3.5	8.1	40.2	23.8	1 67	29 6	14.3	768	5.0	116
50	70	7.0	3.9	9,0	427	24.6	1.79	30.8	13.7	82.7	1.6	3.7	42.7	24.7	1.74	30.7	14.2	79.0	3.5	8.1	42.7	24.8	1.68	30.5	14.7	77.0	5.0	11 6
_		9.0	5.2	12.0	44.1	25.6	1.80	31.7	14.2	83.1	1.6	3.7	44.1	25.7	1.75	31.6	14.7	79.3	3.5	8.1	44.1	25.8	1.69	31.5	15.2	77.2	5.0	11.6
		5.0	1.6	3.7	41.0	21.8		29 4	9.9	102.1	1.5	3 5	41.0	21.9	2 14	29.2	10.2	98.6	3.2	7.4	40.9	22.0	2.07	29 1	10.6	96.7	4.9	113
50	90	7.0	3.9	9.0	43.3	22.7	2.22	30.3	10.2	102.5	1.5	3.5	43.3	22.8	2.15	30.1	10.6	98.9	3.2	7.4	43.3	22.9	2.09	30.0	11.0	96.9	4.9	113
		9.0	5.2	12.0	44.6	23.6	2.23	31.2	10.6	102.9	1.5	3.5	44.6	23.7	2.17	31.1	10.9	99,2	3.2	7.4	44.6	23.8	2.10	30.9	11.3	97.1	4.9	11.3
	1	5.0	16	3.7	57.0	31.4	1.17	35.4	26.8	44.6	1.7	3.9	57.7	29.9	1.12	33.7	26.7	39.9	4.0	9.2	58.3	28 4	1 07	32.0	26.5	37.3	5.3	12 2
70	30	70	35	8 1	60 4	32.7	1.18	36.7	27.6	45 1	17	3 9	60.9	30.9	1.13	34.8	27.3	40.2	4.0	9.2	61 4	29 1	1 08	32.8	27.0	37.5	5.3	12 2
		9.0	5.0	11.6	62.2	34.0	1.20	38.1	28.4	45.7	1.7	3.9	62.7	31.9	1.14	35.8	27.9	40.6	4.0	9.2	63.2	29.9	1.09	33.6	27.4	37.7	5.3	12.2
	T	5.0	1.6	3.7	56.8	31.9	1.51	37.1	21 1	65.3	1.6	3.7	57.2	31.1	1.45	36.0	21.4	60.6	3.9	9.0	57.5	30.3	1.39	35.0	21.7	58 0	5.2	120
70	50	7.0	3 5	8 1	60.2	33.2	1.53	38 4	218	658	1.6	37	605	32.2	1.46	37 2	22.0	61.0	3.9	9.0	60.8	31 2	1 40	36 0	22.2	58.2	5 2	12 0
		9.0	5.0	11.6	62.1	34.5	1.54	39.8	22.4	66.4	1.6	3.7	62.4	33.3	1.48	38.4	22.6	61.3	3.9	9.0	62.6	32.1	1.41	36.9	22.7	58.5	5.2	12.0
		5.0	1.6	37	56 6	32.4	1.85	38 7	17.5	86.0	16	37	56.7	32.3	1 78	38 4	18.1	813	3.5	8.1	56.7	32 2	1 71	38 0	18 8	78.7	5.0	116
70	70	7.0	3.5	8.1	60 1	33.7	1.87	40.1	18.1	86.5	1.6	3.7	60.1	33.5	1.80	39.6	18.6	81.7	3.5	8.1	60.2	33 3	1 72	39 1	193	79.0	5.0	116
		9.0	5.0	11.6	62.0	35.1	1.88	41.5	18.6	87.1	1.6	3.7	62.0	34.7		40.9	19.2	82.0	3.5	8.1	62.1	34.3	1.74	40.3	19.8	79.2	5.0	11.6
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70	90	7.0	3.5	8.1	60.7	31.5		39.3	13.8	106.2	1.5	3.5	60.7	31.7		39.2		101.6		7.4	60.6	31 9	2.11	39 2	15 1	99.0	4.9	11 3
1		9.0	5.0	11.6	62.5	32.7		40.5	14.3	106.7	1.5	3.5	62.4	33.0		40.6		102.0		7.4	62.4	33.4			15.7	99.3	4.9	11.3
		5.0	1.5	3.5	74.9	36.7		40.9	30.1	46.9	1.7	3.9	76.0	34.0				41.2	4.0	9.2	77.1	31.4		35 1	28.8	38.0	53	12 2
90	30	7.0	3 2	7.4	787	38 3		42 5	30 9	47.5	1.7	3 9	79.7	35 0				41.5	40	9.2	80.7	31 7				38.1	53	12 2
1		9.0	4.9	11.3	80.9	39.8		44.1	31.7	48.2	1.7	3.9	81.8	35.9				41.8	4.0	9.2	82.6	32.1	1.11			38.2	5.3	12.2
h		5.0	1.5	3.5	72.1	43.5		48.7	28.6	70.1	1.6	3.7	72.4	42.7	1.45			64.0	3.9	9.0	72.7	41.9				60.7	5.2	120
90	50	7.0	3 2	7.4	76 6	45 4		50.6	29 4	70.1	1.6	3.7	77.1	43 9				64.4	3.9	9.0	77.5	42 4				60 B	5.2	120
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	+	5.0	1.5	3.5	73.0	41.1		47.7	21.4	89.7	1.6	3.7	73.2						3.5	8.1	73.3	40.5				80.6	5.0	
90	70	7.0	3.2		77.4	42.8		49 5	22.1	90 4	1.6	3.7	77.5						3.5		77.7	41 7				80.9	5.0	
1 30	'	9.0	4.9	11.3	79.8	44.6		51.2	22.7	91.1	1.6	3.7	80.0					84.8	3.5		80.2	42.9				81.2	5.0	
\vdash	+	5.0	1.5	_	74 0	38.7		46.7	16.6	109.0	1.5	3.5	74.0			_			3.2		73.9	39.0	_	_	_	99.2	4.9	
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ELT = entering load fluid temperature to heat pump LLT = leaving load fluid temperature from heat pump LGPM = load flow in gallons per minute LWPD = load coax water pressure drop EST = entering source fluid temperature to heat pump LST = leaving source fluid temperature from heat pump

SWPD = source coax water pressure drop
PSI = pressure drop in pounds per square inch
FT HD = pressure drop in feet of head
KW = klowatts
HR = heat rejected in BTUH
TC = total cooling capacity in BTUH
EER = energy efficiency ratio (TC/KW)

Multiple Flow Rates for Source Side and Load Side are shown. When selecting units and designing the system, actual operating parameters must fall within the temperature and flow rate ranges shown on the table. Using temperature/flow rate combinations outside the range of the table will result in performance problems.

P056W Heating Capacity Data

				ΙV	VPD		SO	URCE	8.0 GPI	м		SV	VPD		SOL	IRCE 1	1.0 GP	M		SW	/PD		SOU	RCE 1	4.0 GPI	м		SV	/PD
No. 26 59 70 71 71 72 73 74 75 75 75 75 75 75 75	ELT	EST	LGPM			LLT				$\overline{}$	LST	$\overline{}$		LLT					LST			LLT					LST	PSI	FT HD
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14.0 61.0 14.1 67.7 52.4 21.0 44.9 70 38.5 33.0 75 68.1 58.4 27.0 37.0 77.0	60	50																											196
10				6.1					ı	7.0									40.6		13.6	68.5	58.4	2.20	50.9	7.8	42.8	8.5	19.6
			80	26	60	75 8	62 3	2 39	54.1	7.6	46.4	3.1	7.2	760	62 7	2 39	54 5	77	49.2	5.6	130	763	63 1	2 39	55 0	77			18 7
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14.0 58 13.4 88.5 83.7 30.5 29.3 3.8 22.6 3.5 8.1 88.0 41.4 30.4 31.0 24.0 24.0 24.0 30.2 30.2 32.7 4.2 28.4 9.2 9.0 9.0 10.0 10.0 11.0 58 13.4 88.5 88.7 48.5 31.5 36.2 4.4 30.9 34.7 78.8 87.7 48.5 32.5 38.5 36.5 4.5 34.5 36.5 34.5 36.5 34.5 36.5 34.5 36.5 34.5 36.5 34.5 36.5 34.5 36.5 34.5 36.5 34.5 36.5 34.5 36.5 34.5 36.5 34.5 36.5 34.5 36.5 34.5 36.5 34.5	80	30	ı					l	ı	1									l	1 1					l	l			213
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140 58 134 877 821 312 814 89 394 33 75 880 848 312 318 81			80	24	55	93 9	54 9	3 30	43 6	49	39 1	33	75	94.2	55.2	3.31	43.9	49	41 3	59	136	94 4	55 5	3 32	44 2	49		85	196
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14.0 5.5 12.7 108.8 45.6 4.01 31.9 3.3 31.8 34 7.8 106.9 47.5 4.01 33.8 3.5 33.4 6.2 14.1 107.1 49.4 4.00 35.8 3.6 34.9 8.9			80	23	53	1120	47 7	4 19	33 4	33	316	34	78	112 2	47 8	4 21	33 5	33	33 4	62	14 1					1		1	20 4
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80 2.1 49 130.2 40.9 507 23.6 24 24.0 3.5 81 130.3 40.7 510 23.3 2.3 254 64 14.7 130.4 40.5 512 23.0 23 26.7 92 120 30 110 3.7 8.4 1281 40.1 498 23.1 2.4 24.1 3.5 8.1 128.1 40.6 4.99 23.5 2.4 25.4 6.4 14.7 128.1 41.0 4.99 24.0 2.4 26.6 9.2 120 40 110 3.7 8.5 129.3 46.4 50.5 29.2 2.7 32.6 3.4 78 132.0 47.4 519 29.7 7 34.1 6.2 14.1 132.2 47.3 521 29.6 2.7 35.7 8.9 120 40 110 3.7 8.5 129.3 46.4 50.5 29.2 2.7 32.6 3.4 78 132.0 47.4 519 29.7 7 34.1 6.2 14.1 132.2 47.3 521 29.6 2.7 35.7 8.9 120 40 110 3.7 8.5 129.3 46.4 50.5 29.2 2.7 32.6 3.4 78 132.0 47.4 519 29.7 27 34.1 6.2 14.1 132.2 47.3 521 29.6 2.7 35.7 8.9 120 40 110 3.7 8.5 129.3 46.4 50.5 29.2 2.7 32.6 3.4 78 132.9 47.2 50.6 29.9 2.7 34.1 6.2 14.1 132.5 48.0 50.7 30.7 2.8 35.6 85.1 14.0 5.2 12.0 126.8 45.4 4.94 28.5 2.7 32.7 3.4 7.8 126.8 47.0 4.93 30.1 2.8 34.1 6.2 14.1 126.9 48.6 4.92 31.8 2.9 35.5 8.5 12.0 12.0 12.0 126.8 45.4 4.94 28.5 2.7 32.7 3.4 7.8 126.8 47.0 4.93 30.1 2.8 34.1 6.2 14.1 126.9 48.6 4.92 31.8 2.9 35.5 8.5 12.0 12.0 12.0 12.0 12.0 12.0 12.0 12.0	100	70	11 0	39	90	113.3	66 0	4 30	513	4 5	56 9	30	69			1		48			1						1	77	17 8
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ELT = entering load fluid temperature to heat pump LLT = leaving load fluid temperature from heat pump LGPM = load flow in gallons per minute LWPD = load coax water pressure drop EST = entering source fluid temperature to heat pump LST = leaving source fluid temperature from heat pump

SWPD = source coax water pressure drop PSI = pressure drop in pounds per square FT HD = pressure drop in feet of head KW = kilowatts
HR = heat rejected in BTUH
TC = total cooling capacity in BTUH
EER = energy efficiency ratio (TC/KW)

Multiple Flow Rates for Source Side and Load Side are shown. When selecting units and designing the system, actual operating parameters must fall within the temperature and flow rate ranges shown on the table. Using temperature/flow rate combinations outside the range of the table will result in performance problems.

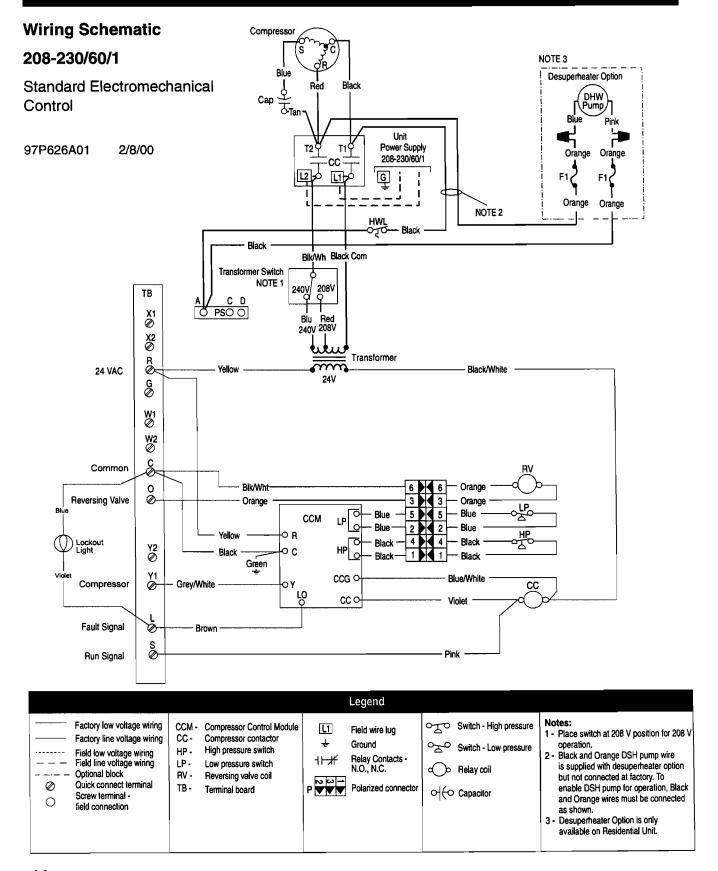
P056W Cooling Capacity Data

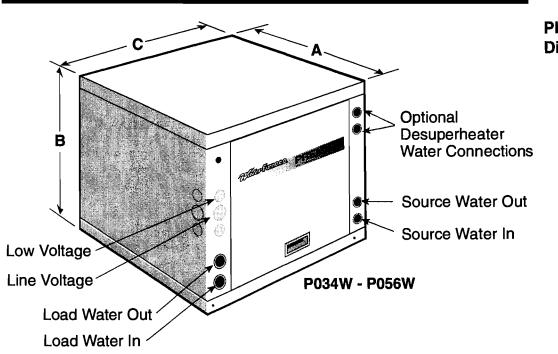
			LV	VPD		so	URCE	8.0 GPM	Л		SV	VPD		SOL	JRCE 1	1.0 GPI	И		SW	/PD		SO	JRCE 1	4.0 GPI	м		ŞW	PD
ELT	EST	LGPM	PSI	FT HD	LLT	TC	kW	HR	EER	LST	PSI	FT HD	LLT	TC	kW	HR	EER	LST	PSI	FT HD	LLT	TC	kW	HR	EER	LST	PSI	FT HD
		80	28	64	21 2	34 1	2 18	415	15.8	60 7	32	74	21 4	33 4	2 09	40 5	15 9	57 6	57	13 1	21 6	32 7	2 01	39 5	163	55 8	81	18 7
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		14.0	8.0	18.4	24.8	35.1	2.16	42.4	16.2	60.9	3.2	7.4	24.6	36.9	2.12	44.1	17.4	58.3	5.7	13.1	24.3	38.7	2.09	45.8	18.5	56.7	8.1	18.7
		80	28	84	22 4	29 3	2 91	39 2	10 1	80 1	29	67	22 8	27 9	2 77	37 3	101	77 0	53	122	23 2	28 5	2 63	35 5	10 1	75 2	77	178
30	70	11 0	54	124	243	30 2	2 82	39 8	10 7	803	29	67	24.5	293	2 75	38 7	107	77 2	53	122	24 7	28 4	2 67	37 5	106	75 5	77	178
	-	14.0	8.0	18.4	25.4	31.1	2.74	40.5	11.4	80.4	2.9	6.7	25.5	30.7	2.73	40.0	11.2	77.5	5.3	12.2	25.5	30.2	2.72	39.5	11.1	75.8	7.7	17.8
		80	26	64	23 4	25 6	3 66	38.0	70	99 8	25	5.8	23 7	24 5	3 44	36 2	7.1	96 8	4.9	113	24 0	23 4	3 22	34 3	73	95 1	73	169
30	90	11 0	54	124	24 9	27 0	3 51	38 9	77	100.0	25	58	25 2	25.5	3 39	37 1	7.5	96 9	49	113	25 5	24 0	3 27	35 2	74	95 2	73	169
1		14.0	8.0	18.4	25.8	28.4	3.35	39.8	8.5	100.3	2.5	5.8	26.1	26.6	3.33	37.9	8.0	97.1	4.9	11.3	26.4	24.7	3.32	36.0	7.5	95.3	7.3	16.9
		80	25	5.8	37 5	48 4	1.62	53 9	298	43 9	36	83	377	47.7	1.56	53 1	30.5	39 9	6.1	140	37 9	47 1	1 51	52 2	31 3	37 7	8.5	196
50	30	11 0	49	112	40 6	49 1	1 62	54 8	30 4	44 1	36	83	40 7	49 4	1.58	54.8	31 4	40 3	81	140	40 7	49 8	1 54	55 0	324	38 1	8.5	196
		14.0	7.2	16.6	42.7	49.9	1.62	55.4	30.9	44.3	3.6	8.3	42.5	51.2	1.59	56.6	32.2	40.6	6.1	14.0	42.3	52.5	1.57	57.8	33.5	38.5	8.5	19.6
		60	25	56	38 3	45.5	2 27	53 2	20 0	83 7	32	74	38 4	45 1	2.20	52 5	20 5	59 8	57	13 1	38 5	44 8	2 12	51 8	21 0	57.6	81	16 7
50	50	11 0	49	11 2	413	46 5	2 27	54 2	20.5	64 0	32	74	41.3	467	2.21	54.2	21 1	60 2	57	13 1	41 2	48 9	2 15	54 2	216	58 0	8 1	187
"	••	14.0	7.2	16.6	43.0	47.5	2.26	55.2	21.0	64.2	3.2	7.4	42.9	48.3	2.22	55.9	21.8	60.5	5.7	13.1	42.8	49.1	2.18	56.5	22.5	58.3	8.1	18.7
_		60	2.5	5.8	39 0	42 7	2 92	52 6	146	83 6	29	6.7	39 1	42 4	2.83	52 0	15.0	79 B	53	12.2	39 1	42 1	2 74	51 4	15 4	77.6	77	178
50	70	11 0	49	11 2	416	43 9	2 91	53 8	15 1	83.9	2.9	67	41.8	43.9	2.84	53 6	15.5	80.0	53	122	41 8	43 9	277	53 4	159	77 9	77	178
30	'	14.0	7.2	16.6	43.4	45.2	2.91	55.1	15.5	84.2	2.9	6.7	43.3	45.5	2.85	55.2	15.9	80.3	5.3	12.2	43.3	45.8	2.80	55.3	16.4	78.1	7.7	17.8
	-	80	25	5.8	39 7	39.8	3 57	52 0	11 1	103 4	2.5	5.8	39 8	39 7	3 46	51.5	11 5	99 7	4.9	11.3	39 8	39 6	3 35	51.0	11.8	97.5	73	16.9
50	90	110	49	11 2	423	41 3	3 56	53 5	11 6	103.8	2.5	58	423	412	347	53.0	119	99 9	49	113	423	41.0	3 38	52 5	12 1	97 7	73	169
"	30	14.0	7.2	16.6	43.7	42.8	3.55	54.9	12.1	104.2	2.5	5.8	43.7	42.6	3.48	54.5	12.2	100.2	4.9	11.3	43.8	42.4	3.41	54.0	12.4	98.0	7.3	16.9
-		80	23	5.2	56 2	53 5	1 78	59 6	30 0	45 3	36	83	56.5	52.2	1 70	58 0	30.6	40.9	61	14 0	56.9	51 0	1 62	56 5	314	38 3	8.5	196
70	30	110	44	100	59 7	54 9	1 72	60 7	31 9	457	36	83	60 0	533	1 68	59.0	31 8	41 1	61	140	60 3	51 7	1 65	57 4	31 4	38 4	85	196
'*	"	14.0	6.5	14.9	61.7	56.2	1.66	61.9	34.0	46.0	3.6	8.3	62.0	54.4	1.66	60.1	32.7	41.3	6.1	14.0	62.3	52.5	1.67	58.2	31.4	38.6	8.5	19.6
_		60	23	5.2	55 9	54 7	2.36	62.8	23.2	66 2	32	7.4	58 1	53.8	2 30	61 6	23 4	61 6	5.7	131	56 4	52 9	2 23	60.5	23 7	58 9	81	167
70	50	110	44	100	59 5	56 2	2 36	643	23 8	66 6	32	74	59 7	55 1	2 31	63 0	23 9	61 8	57	13.1	59 9	54 0	2 25	617	24 0	59 1	81	187
′°	30	14.0	6.5	14.9	61.5	57.7	2.36	65.8	24.4	67.0	3.2	7.4	61.7	56.5	2.32	64.4	24.4	62.1	5.7	13.1	61.9	55.2	2.27	63.0	24.3	59.3	8.1	18.7
\vdash		80	23	52	55.6	56.0	2.94	66.0	191	87.0	29	6.7	55.7	55 4	2 89	65.2	19 2	82.2	5.3	12.2	55.9	54.8	284	64.5	193	79.5	7.7	17.8
70	70	11 0	44	100	59 2	57 6	3 00	67.8	19 2	87 5	29	67	593	57 0	2 93	67 0	194	82 6	53	122	59 4	564	2 86	66 1	197	79 7	77	178
۱"	,,,	14.0	6.5	14.9	61.3	59.2	3.07	69.7	19.3	88.0	2.9	6.7	61.4	58.6	2.97	68.7	19.7	82.9	5.3	12.2	61.5	57.9	2.87	67.7	20.2	80.0	7.7	17.8
-	-	80	23	52	56 1	54.1	3 48	65.9	15.5	107.0	2.5	5.8	56.2	53.7	3 48	65.5	15.4	102 3	49	113	56.3	53.3	3 48	65 1	153	99.6	73	169
70	90	110	44	100	59 8	55.6	3 62	68 0	15.4	107 5	25	5.8	59 6	55 5	3 55	67.6	15.4	102 7	49	113	59 6	55 3	3 49	67 2	158	99 9	73	169
١″	30	14.0	6.5	14.9	61.6	57.2	3.75	70.0	15.3	108.0	2.5	5.8	61.6	57.3	3.63	69.7	15.8	103.1	4.9	11.3	61.6	57.4	3.51	69.3	16.4	100.2	7.3	16.9
-		80	2.0	46	74.9	58.6	1.95	65.2	30 1	46.8	3.6	63		56.7		63.0	30.7	41.6	61	14.0	75.9	54.8	1 74	60.6	31 4	39 0	6.5	196
90	30				786								75 4		1.65				1		799	53 7	1 76	59 7	30 5	38 8	85	196
30	30	110	39	89		60 6	1 82	66 8	33 3	47.2	36	83	79 3	57 2	1 79	63 3	31 9	419	61	140								19.6
-		14.0	5.7	13.2	80.8	62.6	1.70	68.4	36.9	47.6	3.6	8.3	81.5	57.6	1.74	63.5	33.1	41.9	6.1	14.0	82.3	52.6	1.78	58.6	29.5 29.6	38.6	8.5	18.7
۱ ۵۰	-	60	20	46	719	70.4	2 51	79 0	28.0	70 4	32	74	72 2	69 2	2 40	77 4	26 9	84.5	57	131	72.5	68 0	2 28	75 8		61 2	1 -	
90	50	110	39	69	76 4	72 6	2 52	61 2	26 9	709	32	74	76 6	703	2 40	78.5	29 3	647	57	131	773	66 0	2 29	75 8	29 7	61 2	81	187
-	├	14.0	5.7	13.2	79.0	74.8	2.52	83.4	29.7	71.5	3.2	7.4	79.5	71.4	2.41	79.6	29.6	64.9	5.7	13.1	80.0	67.9	2.30	75.7	29.5	61.2	8.1	18.7
١		80	20	48	72 1	89 4	2 95	79 4	23 5	90.5	29	6.7	72 4	88 4	2.95	78.5	23.2	64.7	53	122	72 6	67.5	2 95	77.5	22 9	81 4	77	178
90	70	110	39	89	78 8	71.3	3 09	81 8	23 0	91 1	29	67	78.9	70.0	3 02	803	23 2	85 1	53	122	77 1	68.8	2 95	78 8	23 3	81 6	7.7	17.8 17.8
Ь	Ц	14.0	5.7	13.2	79.2	73.2	3.24	84.2	22.6	91.7	2.9	6.7	79.4	71.7	3.09	82.2	23.2	85.4	5.3	12.2	79.7	70.1	2.95	80.2	23.8	81.8	1./	17.6

ELT = entering load fluid temperature to heat pump LLT = leaving load fluid temperature from heat pump LGPM = load flow in gallons per minute LWPD = load coax water pressure drop EST = entering source fluid temperature to heat pump LST = leaving source fluid temperature from heat pump

SWPD = source coax water pressure drop PSI = pressure drop in pounds per square FT HD = pressure drop in feet of head KW = kilowatts
HR = hast rejected in BTUH
TC = total cooling capacity in BTUH
EER = energy efficiency ratio (TC/KW)

Multiple Flow Rates for Source Side and Load Side are shown. When selecting units and designing the system, actual operating parameters must fall within the temperature and flow rate ranges shown on the table. Using temperature/flow rate combinations outside the range of the table will result in performance problems.





Physical Dimensions

Modal V							X 2011 (2) X 11 11 11 (2) 11 X 27 11 11 (2) 11		
P034W	30.50	23.50	30.50	.75	.75	.75	.75	.50	.50
P056W	30.50	23.50	30.50	1.00	1.00	1.00	1.00	.50	.50

All dimensions are in inches.

Compressor	Scroll	Scroll
Ref. Charge - R22 (oz.)	49.0	84.0
Unit Weight (lbs.)	244 0	275.0

Physical Data

					12.7						
P034W	208-230/60/1	197/254	21.0	13.5	72.5	0.4	5.4	19.3	22.6	35	35
P056W	208-230/60/1	197/254	31.0	19.9	137.0	0.4	5.4	25.7	30.6	50	50

Electrical Data

All units rated 208-230 (min 197) volt single phase 60 cycle. All fuses type "D" time delay (or HACR circuit breaker in USA)

Engineering Guide Specifications

General - The liquid source water-to-water heat pump shall be a single packaged reverse-cycle heating/cooling unit. The unit shall be listed by a nationally recognized safety-testing laboratory or agency, such as ETL Testing Laboratory. Each unit shall be computer run-tested at the factory. Each unit shall be pallet mounted and stretch-wrapped for shipping.

The geothermal water-to-water heat pump unit, manufactured by WaterFurnace International, Fort Wayne, Indiana, shall be designed to operate with source liquid temperature between 30°F and 90°F.

Casing and Cabinet - The cabinet shall be fabricated from heavy-gauge steel and finished with a corrosion-resistant powder coating. The interior shall be insulated with 1/2-inch thick, multi-density, coated glass fiber with edges sealed or tucked under flanges. All units shall have 7/8-inch and 1-1/8-inch knockouts for entrance of low and line voltage wiring.

Refrigerant Circuit - All units shall contain a sealed refrigerant circuit including a hermetic motor-compressor, bidirectional thermal expansion valve assembly, reversing valve, two (2) coaxial tube water-to-refrigerant heat exchangers, factory-installed high and low-pressure safety switches and service ports, and a liquid line filter-dryer.

Compressors shall be high-efficiency compliant scroll designed for heat pump duty and mounted on rubber vibration isolators. Compressor motors shall be single-phase PSC with overload protection.

Accessories and Other Options

Desuperheater - An optional heat reclaiming desuperheater coil of vented double-wall copper construction suitable for potable water shall be provided. The coil and hot water circulating pump shall be factory mounted inside the unit. A coaxial design fitting for the DHW tank connection and a high temperature limit pump shut-off are supplied.

FPK - Freeze protection kit 39° +/-2°

The coaxial water-to-refrigerant heat exchangers shall be designed for low water pressure drop and constructed of a convoluted copper (optional cupronickel) inner tube and a steel outer tube. The thermal expansion valve assembly shall provide proper superheat over the liquid temperature range with minimal "hunting." The valve shall operate bidirectionally without the use of check valves.

The water-to-refrigerant heat exchangers, optional desuperheater coil and refrigerant suction lines shall be insulated to prevent condensation at low liquid temperatures.

Electrical - Controls and safety devices will be factory wired and mounted within the unit. Controls shall include compressor contactor, high and low pressure switches, 24VAC-75VA transformer with built-in circuit breaker, reversing valve coil, compressor control module with intergal lockout mode and antishort cycle protection. A terminal block with screw terminals will be provided for field control wiring.

Piping - All supply and return water connections (and optional desuperheater connections) shall be FPT flush-mounted copper threaded fittings mechanically fastened to the unit cabinet, eliminating the need for backup wrenches when making field piping connections. All water piping shall be insulated to prevent condensation at low liquid temperatures.

Earth Loop Pump Kit (Field Installed) - A

specially designed one- or two-pump module shall provide all liquid flow, fill and connection requirements for independent single unit systems, 230/1/60 only. The one-pump module is good to 20 feet of head at 16.0 GPM while the two-pump module is good to 40 feet of head at 16.0 GPM.

FPKCL - Freeze protection kit 20° +/-2°

1.2) Florida Heat Pump

1.2.1) WP Series



GUIDE SPECIFICATIONS

WP Series Water-to-Water Reverse Cycle Chillers & Low Temp Boilers

WP036-072 Reverse Cycle Chillers / Low Temp Boilers

GENERAL

Units shall be Underwriter Laboratories (UL) listed for safety on all models. Each unit shall be run tested at the factory. Each unit shall be pallet mounted and stretch wrapped.

The units shall be warranted by the manufacturer against defects in materials and workmanship for a period of one year on all parts, and 5 years on the compressor

The units shall be designed to operate with entering fluid temperatures between 20°F (-7°C) and 120°F (49°C) as manufactured by FHP Manufacturing in Fort Lauderdale, Florida

CASING & CABINET

The cabinet shall be fabricated from heavy-gauge galvanized steel. The interior shall be insulated with $\frac{1}{2}$ " (12 7mm) thick, multi density, coated, glass fiber. All units shall allow front service access to replace the compressor and/or electrical components without unit removal

REFRIGERATION CIRCUITS

All units shall contain a sealed refrigerant circuit including a hermetic reciprocating or scroll compressor, bidirectional thermal expansion valve metering device, coaxial style fluid-to-refrigerant heat exchangers, refrigerant reversing valve and service ports. Compressor shall be high efficiency, designed for heat pump duty, and mounted on rubber vibration isolators. Compressor motors shall be equipped with overload protection. Refrigerant reversing valves shall be pilot operated sliding piston type with replaceable encapsulated magnetic coils energized only during the chiller cycle. The coaxial water-to-refrigerant heat exchanger shall be constructed of a convoluted copper (optional cupronickel) inner tube and steel outer tube with a designed refrigerant working pressure of 450 PSIG (3100 kPa) and a designed water side working pressure of no less than 400 PSIG (2750 kPa). Due to their susceptibility to fouling, brazed plate heat exchangers are not acceptable. The fluid-to-refrigerant heat exchangers shall be insulated to prevent condensation at low fluid temperatures.

ELECTRICAL

Controls and safety devices will be factory wired and mounted within the unit. Controls shall include compressor contactor, 24V transformer, reversing valve coil, lock-out relay and low pressure bypass timer (or a solid-state device incorporating the functions of these two components) to prevent nuisance low pressure lock-outs during operation with low fluid temperatures. A terminal block with screw terminals shall be provided for control wiring. When the safety controls are activated the lock-out circuit must be reset at the aquastat or main circuit breaker to prevent compressor operation during fault conditions. A lock-out indicating terminal shall be provided in the low voltage circuit. Safety devices include a low pressure cutout set at 20 PSIG (140 kPa) for loss of charge protection (freezestat and/or high discharge gas temperature sensor is not acceptable) and a high pressure cutout control set at 380 PSIG (2600 kPa). An optional energy management relay to allow unit control by an external source shall be factory installed.

PIPING

Water piping connections shall be female pipe thread with a single set of source and load connections flush mounted to the unit cabinet

WP120-420 Modular Reverse Cycle Chillers / Low Temp Boilers

GENERAL

Units shall be Underwriter Laboratories (UL) listed for safety on all models. Each unit shall be run tested at the factory. Each unit shall be pallet mounted and stretch wrapped.

The units shall be warranted by the manufacturer against defects in materials and workmanship for a period of one year on all parts, and 5 years on the compressor.

The units shall be designed to operate with entering fluid temperatures between 20°F (-7°C) and 120°F (49°C) as manufactured by FHP Manufacturing in Fort Lauderdale, Florida

CASING & CABINET

The cabinet shall be fabricated from heavy-gauge galvanized steel and shall be supported by a full angle iron frame, all to be finished with two coats of lacquer acrylic. The interior shall be insulated with $\frac{1}{2}$ " (12 7mm) thick, multi density, coated, glass fiber. All units shall allow front service access to replace the compressor and/or electrical components without unit removal.

REFRIGERATION CIRCUITS

All units shall contain a sealed refrigerant circuit including hermetic scroll compressor(s), bidirectional thermal expansion valve metering device(s), coaxial style fluid-to-refrigerant heat exchangers, refrigerant reversing valve(s) and service ports. Compressor shall be high efficiency, designed for heat pump duty, and mounted on rubber vibration isolators Compressor motors shall be equipped with overload protection. Refrigerant reversing valves shall be pilot operated sliding piston type with replaceable encapsulated magnetic coils energized only during the chiller cycle. The coaxial water-to-refrigerant heat exchanger shall be constructed of a convoluted copper (optional cupronickel) inner tube and steel outer tube with a designed refrigerant working pressure of 450 PSIG (3100 kPa) and a designed water side working pressure of no less than 400 PSIG (2750 kPa) Due to their susceptibility to fouling, brazed plate heat exchangers are not acceptable. The fluid-to-refrigerant heat exchangers shall be insulated to prevent condensation at low fluid temperatures

ELECTRICAL

Controls and safety devices will be factory wired and mounted within the unit. Controls shall include compressor contactor(s), 24V transformer, reversing valve coil(s), lock-out relay and low pressure bypass timer (or a solid-state device incorporating the functions of these two components) to prevent nuisance low pressure lock-outs during operation with low fluid temperatures. A terminal block with screw terminals shall be provided for control wiring. When the safety controls are activated the lock-out circuit must be reset at the aquastat or main circuit breaker to prevent compressor operation during fault conditions. A lock-out indicating terminal shall be provided in the low voltage circuit. Safety devices include a low pressure cutout set at 20 PSIG (140 kPa) for loss of charge protection (freezestat and/or high discharge gas temperature sensor is not acceptable) and a high pressure cutout control set at 380 PSIG (2600 kPa). An optional energy management relay to allow unit control by an external source shall be factory installed.

PIPING

Water piping connections shall be female pipe thread with a single set of source and load connections per unit

WPSPECS P65

REV: 4-01



Reverse Cycle Chillers Fort Lauderdale, FL 33309 http://www.fhp-mfg.com Phone: (954) 776-5471 FHP Manufacturing Co. 601 N.W. 65th Court Fax: (800) 776-5529

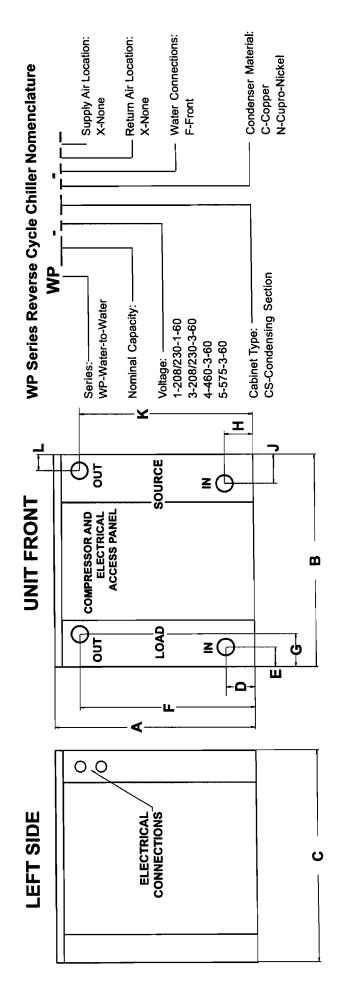
WP036-072 Series

					Dimensions	sions						
MODEL	4	В	ပ	۵	ш	ட		I	ſ	У	7	Water
	Height	Width	Depth									Conn.
WP036	24.25	32.50	24.00	2.50	2.00	14.88	2.25	2.50	8.25	14.88	2.25	0.75 FPT
WP060	24.25	32.50	24.00	3.00	2.50	17.00	2.50	4.00	3.38	18.00	3.38	1.00 FPT
WP072	24.25	32.50	24.00	3.38	2.50	22.75	4.38	3.38	4.38	22.75	2.50	1.00 FPT



NOTES: All dimensions within +/- 0.125".

Specifications subject to change without notice.





Fort Lauderdale, FL 33309 http://www.fhp-mfg.com Phone: (954) 776-5471 FHP Manufacturing Co. 601 N.W. 65th Court Fax: (800) 776-5529

WP120-420 Series

Reverse Cycle Chillers

G CHINET NOTIFE I CLAUME			Supply Air Location:	Supply All Eddings:	D COL	Botura Air I ocation:	X-None		Water Connections:	
WP Series Reverse Cycle Chiller Nomeliciature	- dM				WP-Water-to-water		Nominal Capacity:	2	Voltage:	0-5-057007-5
	Water	Conn.	1.25 FPT	5.00 1.50 FPT	5.00 1.50 FPT	2.00 FPT	10.50 25.25 5.00 2.00 FPT	2.00 FPT		
	7		9.00 1.25 FPT	5.00	5.00	9.00	5.00	5.00		
	I		9.25	9.25	9.25	25.25	25.25	25.25		
	9		10.50 9.25	10.50 9.25	10.50	10.50 25.25 9.00 2.00 FPT	10.50	10.50		
sions	u.		28.50	28.50	28.50	44.50	44.50	44.50 10.50 25.25 5.00 2.00FPT		
Dimension	ш		10.50	10.50	10.50	10.50	10.50	10.50		
	۵		3.75	3.75	3.75	19.75	19.75	19.75		
	ပ		8.50	4.50	T	8.50	1	4.50		
	8		32.00 23.00	23.00	_		1		4	m debin.
	4	Height	32.00	32.00	32.00	64.00	64.00		90	are 40.00
	MODEL		WP120	WP180	WP210	WP240	WP360	WP420		NOTES: All units are 40.00 in deptil.

NOTES: All units are 46.00 in depth.

All dimensions within +/- 0.125". Specifications subject to change without notice.

Condenser Material: C-Copper N-Cupro-Nickel 5-575-3-60

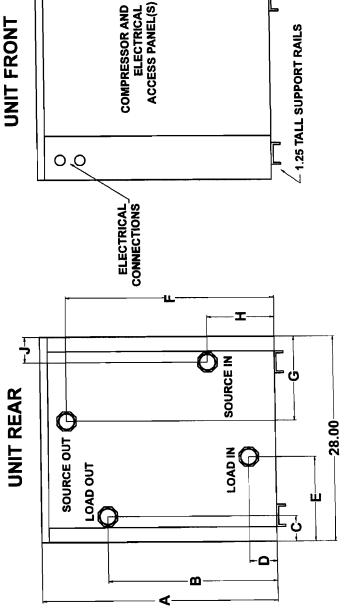
R-Rear

4-460-3-60



REV: 4-01

WPLDGIP.P65





WP036

ELECTRICAL SPECIFICATIONS

Electrical	Elect.	Comp	ressor	Min.	Max.
Characteristics	Symbol	RLA	LRA	Circuit Ampacity	Fuse Size
208/230-1-60	-1	18.9	96	23.6	40
208/230-3-60	-3	12.2	75	15.3	25
460-3-60	-4	6.2	40	7.8	15

FLUID FLOW & PRESSURE DROP

Chilled Fluid S	Side (@ 55°F)	Cond. Fluid S	ide (@ 85°F)
Flow (GPM)	ΔP (FOH)	Flow (GPM)	ΔP (FOH)
4	2.8	4	2.7
5	5.9	5	5.6
7	9.9	7	9.3
9	14.8	9	14.0
11	20.6	11	19.4

UNIT WEIGHT

Unit Weight (lbs) 250 Shipping Weight (lbs) 270

CHILLER PERFORMANCE

Based on 7 GPM chilled fluid & 10°F condenser fluid temp. rise.

Leaving	Entering	Total	Total	Power		Heat
Chilled	Cond.	Capacity	Capacity	Input	EER	Rejection
Fluid (F)	Fluid (F)	(Tons)	(BtuH)	(Watts)		(BtuH)
	75°	2.66	31,965	2,251	14.2	39,645
	80°	2.56	30,717	2,330	13.2	38,667
4 0 °	85°	2.45	29,456	2,403	12.3	37,654
	90°	2.35	28,184	2,469	11.4	36,609
	95°	2.24	26,906	2,529	10.6	35,536
	75°	2.78	33,410	2,277	14.7	41,177
	80°	2.68	32,120	2,360	13.6	40,174
42°	85°	2.57	30,817	2,438	12.6	39,135
	90°	2.46	29,505	2,509	11.8	38,066
	95°	2.35	28,187	2,574	11.0	36,969
	75°	2.91	34,899	2,300	15.2	42,749
	80°	2.80	33,565	2,389	14.1	41,717
44°	85°	2.68	32,219	2,471	13.0	40,651
	90°	2.57	30,864	2,548	12.1	39,556
	95°	2.46	29,504	2,617	11.3	38,434
	75°	2.97	35,669	2,311	15.4	43,555
	80°	2.86	34,312	2,402	14.3	42,509
45°	85°	2.75	32,943	2,487	13.3	41,429
	90°	2.63	31,566	2,566	12.3	40,320
	95°	2.51	30,167	2,639	11.4	39,171
	75°	3.04	36,450	2,322	15.7	44,371
	80°	2.92	35,054	2,416	14.5	43,298
46º	85°	2.81	33,662	2,503	13.5	42,203
	90°	2.69	32,262	2,584	12.5	41 ,080
	95°	2.57	30,858	2,659	11.6	39,931
	75°	3.17	38,032	2,342	16.2	46,023
	80°	3.05	36,603	2,440	15.0	44,930
48°	85°	2.93	35,148	2,533	13.9	43,792
	90°	2.81	33,701	2,619	12.9	42,638
	95°	2.69	32,250	2,699	12.0	41,460
1	75°	3.31	39,663	2,361	16.8	47,717
	80°	3.18	38,183	2,464	15.5	46,589
50°	85°	3.06	36,693	2,561	14.3	45,431
	90°	2.93	35,181	2,653	13.3	44,232
	95°	2.81	33,682	2,738	12.3	43,022

HEATING PERFORMANCE

Based on 10°F load temp. rise & 7 GPM source fluid flow.

Leaving	Entering	Heating	Power	1	Heat of
Load	Source	Capacity	Input	COP	Absorb.
Fluid (F)	Fluid (F)	(BtuH)	Watts		(BtuH)
` '	35°	29,085	2,219	3.8	21,513
	40°	31,872	2,321	4.0	23,953
100°	50°	37,802	2,502	4.4	29,266
	60°	44,205	2,651	4.9	35,158
	70°	51,090	2,767	5.4	41,649
	35°	27,432	2,296	3.5	19,599
	40°	30,205	2,417	3.7	21,958
110°	50°	36,035	2,640	4.0	27,027
	60°	42,308	2,831	4.4	32,649
	70°	49,024	2,988	4.8	38,829
	35°	25,686	2,350	3.2	17,667
	40°	28,418	2,494	3.3	19,910
120°	50°	34,177	2,759	3.6	24,765
	60°	40,311	2,993	3.9	30,098
	70°	46,859	3,193	4.3	35,963
	35°	24,772	2,370	3.1	16,685
	40°	27,508	2,524	3.2	18,897
125°	50°	33,210	2,811	3.5	23,618
	60°	39,282	3,068	3.8	28,813
	70°	45,747	3,291	4.1	34,519
	35°	23,839	2,385	2.9	15,703
	40°	26,565	2,549	3.1	17,866
130°	50°	32,227	2,860	3.3	22,470
	60°	38,236	3,139	3.6	27,526
	70°	44,606	3,385	3.9	33,056

Units are complete packages featuring 1 stage operation and containing refrigeration compressor, reversing valve, expansion valve metering device and water to refrigerant heat exchangers. Also included are safety controls: Overload protection for compressor, high and low refrigerant pressure switches and a lock-out control circuit.

FHP MANUFACTURING

601 N.W. 65th Court Fort Lauderdale, FL 33309 Phone: (954) 776-5471 Fax: (800) 776-5529 http://www.fhp-mfg.com

As a result of continuing research and development, specifications are subject to change without notice

WP036IP6 P65



ELECTRICAL SPECIFICATIONS

Electrical	Elect.	Comp	ressor	Min.	Max.
Characteristics	Symbol			Circuit	Fuse
	,	RLA	LRA	Ampacity	Size
208/230-1-60	-1	25.1	169	31.4	50
208/230-3-60	-3	17.7	123	22.1	40
460-3-60	-4	8.1	49.5	10.1	15

FLUID FLOW & PRESSURE DROP

Chilled Fluid S	Side (@ 55°F)	Cond. Fluid S	ide (@ 85°F)
Flow (GPM)	ΔP (FOH)	Flow (GPM)	ΔP (FOH)
6	2.3	6	2.2
9	4.7	9	4.5
12	8.0	12	7.5
18	16.5	18	15.6
20	20.0	20	18.8

UNIT WEIGHT

Unit Weight (lbs) 310 Shipping Weight (lbs) 330

HEATING PERFORMANCE

Based on 10°F load temp. rise & 12 GPM source fluid flow.

C	I)	US
ICE		

CHILLER PERFORMANCE

Based on 12 GPM chilled fluid & 10°F condenser fluid temp. rise.

Chilled Cond. Capacity Ca	Leaving	Entering	Total	Total	Power		Heat
Fluid (F) Fluid (F) (Tons) (BtuH) (Watts) (BtuH) 75° 3.76 45,168 3,177 14.2 56,007 80° 3.70 44,416 3,370 13.2 55,916 85° 3.63 43,612 3,578 12.2 55,822 90° 3.56 42,746 3,804 11.2 55,727 95° 3.49 41,831 4,047 10.3 55,638 75° 3.90 46,849 3,180 14.7 57,698 80° 3.84 46,075 3,373 13.7 57,583 80° 3.84 46,075 3,373 11.7 57,382 90° 3.70 44,369 3,802 11.7 57,342 95° 3.62 43,425 4,045 10.7 57,225 75° 4.05 48,577 3,181 15.3 59,432 80° 3.98 47,774 3,376 14.2 59,292 44° 85° 3.91 46,927 3,581 13.1 59,146 90° 3.84 46,025 3,802 12.1 58,999 95° 3.76 45,067 4,041 11.2 58,855 75° 4.12 49,449 3,184 15.5 60,314 80° 4.05 48,643 3,376 14.4 60,162 45° 85° 3.98 47,784 3,581 13.3 69,004 90° 3.81 46,864 3,804 12.3 59,842 95° 3.82 45,895 4,042 11.4 59,685 75° 4.19 50,339 3,185 15.8 61,207 80° 4.13 49,521 3,377 14.7 61,044 46° 85° 4.05 48,652 3,582 13.6 60,873 90° 3.98 47,721 3,803 12.5 60,698 95° 3.90 46,741 4,040 11.6 60,526 75° 4.35 52,148 3,188 16.4 63,025 80° 4.28 51,301 3,381 15.2 62,836 48° 85° 4.20 50,410 3,585 14.1 62,640 90° 4.12 49,465 3,803 13.0 62,440 95° 4.04 48,455 4,040 12.0 62,239 75° 4.50 53,992 3,193 16.9 64,885 80° 4.43 53,130 3,383 15.7 64,674 50° 85° 4.35 52,216 3,586 14.6 64,452 90° 4.27 51,242 3,805 13.5 64,224		_	l I			EER	
40° 3.76 45,168 3,177 14.2 56,007 80° 3.70 44,416 3,370 13.2 55,916 85° 3.63 43,612 3,578 12.2 55,822 90° 3.56 42,746 3,804 11.2 55,727 95° 3.49 41,831 4,047 10.3 55,638 75° 3.90 46,849 3,180 14.7 57,693 80° 3.84 46,075 3,731 13.7 57,693 90° 3.70 44,369 3,802 11.7 57,342 95° 3.62 43,425 4,045 10.7 57,225 75° 4.05 48,577 3,181 15.3 59,432 44° 85° 3.91 46,927 3,581 13.1 59,146 90° 3.84 46,025 3,802 12.1 58,999 95° 3.76 45,067 4,041 11.2 58,55	1				-		-
40° 80° 3.70 44,416 3,370 13.2 55,916 85° 3.63 43,612 3,578 12.2 55,822 90° 3.56 42,746 3,804 11.2 55,727 95° 3.49 41,831 4,047 10.3 55,638 75° 3.90 46,849 3,180 14.7 57,698 80° 3.84 46,075 3,373 13.7 57,638 42° 85° 3.77 45,249 3,580 12.6 57,463 90° 3.70 44,369 3,802 11.7 57,342 95° 3.62 43,425 4,045 10.7 57,225 75° 4.05 48,577 3,181 15.3 59,432 44° 85° 3.91 46,927 3,581 13.1 59,146 90° 3.84 46,025 3,802 12.1 58,999 95° 3.76 45,067 4,041 11.2	1 2 2 2 3 4 7					14,2	
40° 85° 3.63 43,612 3,578 12.2 55,822 90° 3.56 42,746 3,804 11.2 55,727 95° 3.49 41,831 4,047 10.3 55,638 75° 3.90 46,849 3,180 14.7 57,698 80° 3.84 46,075 3,373 13.7 57,583 42° 85° 3,77 45,249 3,580 12.6 57,463 90° 3,70 44,369 3,802 11.7 57,342 95° 3,62 43,425 4,045 10.7 57,225 75° 4.05 48,577 3,181 15.3 59,432 44° 85° 3.98 47,774 3,376 14.2 59,292 45° 85° 3.91 46,927 3,802 12.1 58,999 95° 3.76 45,067 4,041 11.2 58,855 75° 4.12 49,449 3,184							
90° 3.56 42,746 3,804 11.2 55,727 95° 3.49 41,831 4,047 10.3 55,638 75° 3.90 46,849 3,180 14.7 57,698 80° 3.84 46,075 3,373 13.7 57,583 90° 3.77 45,249 3,580 12.6 57,463 90° 3.70 44,369 3,802 11.7 57,342 95° 3.62 43,425 4,045 10.7 57,225 75° 4.05 48,577 3,181 15.3 59,432 80° 3.98 47,774 3,376 14.2 59,292 44° 85° 3.91 46,927 3,581 13.1 59,146 90° 3.84 46,025 3,802 12.1 58,999 95° 3.76 45,067 4,041 11.2 58,855 75° 4.12 49,449 3,184 15.5 60,314 80° 4.05 48,643 3,376 14.4 60,162 85° 3.98 47,784 3,581 13.3 60,004 90° 3.98 47,784 3,581 13.3 60,004 90° 3.91 46,864 3,804 12.3 59,842 95° 3.82 45,895 4,042 11.4 59,685 75° 4.19 50,339 3,185 15.8 61,207 80° 4.05 48,652 3,582 13.6 60,873 90° 3.98 47,721 3,803 12.5 60,698 95° 3.90 46,741 4,040 11.6 60,526 75° 4.35 52,148 3,188 16.4 63,025 80° 4.28 51,301 3,381 15.2 62,636 85° 4.05 48,652 3,582 13.6 60,673 90° 3.98 47,721 3,803 12.5 60,698 95° 3.90 46,741 4,040 11.6 60,526 75° 4.35 52,148 3,188 16.4 63,025 80° 4.28 51,301 3,381 15.2 62,636 85° 4.05 48,652 3,582 13.6 60,673 90° 3.98 47,721 3,803 12.5 60,698 95° 3.90 46,741 4,040 11.6 60,526 75° 4.35 52,148 3,188 16.4 63,025 80° 4.28 51,301 3,381 15.2 62,836 80° 4.28 51,301 3,381 15.2 62,836 85° 4.20 50,410 3,585 14.1 62,640 90° 4.12 49,465 3,803 13.0 62,440 95° 4.04 48,455 4,040 12.0 62,239 75° 4.50 53,992 3,193 16.9 64,885 80° 4.43 53,130 3,383 15.7 64,674 50° 85° 4.35 52,216 3,586 14.6 64,452 90° 4.27 51,242 3,805 13.5 64,224	40°	85°					
95° 3.49 41,831 4,047 10.3 55,638 75° 3.90 46,849 3,180 14.7 57,698 80° 3.84 46,075 3,373 13.7 57,583 85° 3.77 45,249 3,580 12.6 57,463 90° 3.70 44,369 3,802 11.7 57,342 95° 3.62 43,425 4,045 10.7 57,225 75° 4.05 48,577 3,181 15.3 59,432 80° 3.98 47,774 3,376 14.2 59,292 44° 85° 3.91 46,927 3,581 13.1 59,146 90° 3.84 46,025 3,802 12.1 58,999 95° 3.76 45,067 4,041 11.2 58,855 75° 4.12 49,449 3,184 15.5 60,314 80° 4.05 48,643 3,376 14.4 60,162		90°	3.56			11.2	
42° 3.90 46,849 3,180 14.7 57,698 80° 3.84 46,075 3,373 13.7 57,583 85° 3.77 45,249 3,580 12.6 57,463 90° 3.70 44,369 3,802 11.7 57,342 95° 3.62 43,425 4,045 10.7 57,225 75° 4.05 48,577 3,181 15.3 59,432 80° 3.98 47,774 3,376 14.2 59,292 44° 85° 3.91 46,927 3,581 13.1 59,146 90° 3.84 46,025 3,802 12.1 58,999 95° 3.76 45,067 4,041 11.2 58,855 75° 4.12 49,449 3,184 15.5 60,314 80° 4.05 48,643 3,376 14.4 60,162 45° 85° 3.98 47,784 3,581 13.3 60,004 <td></td> <td>95°</td> <td>3.49</td> <td>41,831</td> <td></td> <td>10.3</td> <td>55,638</td>		95°	3.49	41,831		10.3	55,638
42° 80° 3.84 46,075 3,373 13.7 57,583 85° 3.77 45,249 3,580 12.6 57,463 90° 3.70 44,369 3,802 11.7 57,342 95° 3.62 43,425 4,045 10.7 57,225 75° 4.05 48,577 3,181 15.3 59,432 80° 3.98 47,774 3,376 14.2 59,292 90° 3.84 46,927 3,581 13.1 59,146 90° 3.84 46,025 3,802 12.1 58,999 95° 3.76 45,067 4,041 11.2 58,855 75° 4.12 49,449 3,184 15.5 60,314 80° 4.05 48,643 3,376 14.4 60,162 85° 3.98 47,784 3,581 13.3 60,004 90° 3.91 46,864 3,804 12.3 59,842		75°	3.90		_	14.7	
90° 3.70		80°	3.84			13.7	
95° 3.62 43,425 4,045 10.7 57,225 75° 4.05 48,577 3,181 15.3 59,432 80° 3.98 47,774 3,376 14.2 59,292 44° 85° 3.91 46,927 3,581 13.1 59,146 90° 3.84 46,025 3,802 12.1 58,999 95° 3.76 45,067 4,041 11.2 58,855 75° 4.12 49,449 3,184 15.5 60,314 80° 4.05 48,643 3,376 14.4 60,162 45° 85° 3.98 47,784 3,581 13.3 60,004 90° 3.91 46,864 3,804 12.3 59,842 95° 3.82 45,895 4,042 11.4 59,685 75° 4.19 50,339 3,185 15.8 61,207 80° 4.13 49,521 3,377 14.7 61,044 46° 85° 4.05 48,652 3,582 13.6 60,873 90° 3.98 47,721 3,803 12.5 60,698 95° 3.90 46,741 4,040 11.6 60,526 75° 4.35 52,148 3,188 16.4 63,025 80° 4.28 51,301 3,381 15.2 62,836 85° 4.20 50,410 3,585 14.1 62,640 90° 4.12 49,465 3,803 13.0 62,440 95° 4.04 48,455 4,040 12.0 62,239 75° 4.50 53,992 3,193 16.9 64,885 80° 4.43 53,130 3,383 15.7 64,674 50° 85° 4.35 52,216 3,586 14.6 64,452 90° 4.27 51,242 3,805 13.5 64,224	42°	85°	3.77	45,249	3,580	12.6	57,463
44° 4.05 48,577 3,181 15.3 59,432 80° 3.98 47,774 3,376 14.2 59,292 85° 3.91 46,927 3,581 13.1 59,146 90° 3.84 46,025 3,802 12.1 58,999 95° 3.76 45,067 4,041 11.2 58,855 75° 4.12 49,449 3,184 15.5 60,314 80° 4.05 48,643 3,376 14.4 60,162 45° 85° 3.98 47,784 3,581 13.3 60,004 90° 3.91 46,864 3,804 12.3 59,842 95° 3.82 45,895 4,042 11.4 59,685 75° 4.19 50,339 3,185 15.8 61,207 80° 4.13 49,521 3,377 14.7 61,044 46° 85° 4.05 48,652 3,582 13.6 60,873 <td></td> <td>90°</td> <td>3.70</td> <td>44,369</td> <td>3,802</td> <td>11.7</td> <td>57,342</td>		90°	3.70	44,369	3,802	11.7	57,342
44° 80° 3.98 47,774 3,376 14.2 59,292 85° 3.91 46,927 3,581 13.1 59,146 90° 3.84 46,025 3,802 12.1 58,999 95° 3.76 45,067 4,041 11.2 58,855 75° 4.12 49,449 3,184 15.5 60,314 80° 4.05 48,643 3,376 14.4 60,162 85° 3.98 47,784 3,581 13.3 60,004 90° 3.91 46,864 3,804 12.3 59,842 95° 3.82 45,895 4,042 11.4 59,685 75° 4.19 50,339 3,185 15.8 61,207 80° 4.13 49,521 3,377 14.7 61,044 46° 85° 4.05 48,652 3,582 13.6 60,873 90° 3.98 47,721 3,803 12.5 60,698 <td></td> <td>95°</td> <td>3.62</td> <td>43,425</td> <td>4,045</td> <td>10.7</td> <td></td>		95°	3.62	43,425	4,045	10.7	
44° 85° 3.91 46,927 3,581 13.1 59,146 90° 3.84 46,025 3,802 12.1 58,999 95° 3.76 45,067 4,041 11.2 58,855 75° 4.12 49,449 3,184 15.5 60,314 80° 4.05 48,643 3,376 14.4 60,162 45° 85° 3.98 47,784 3,581 13.3 60,004 90° 3.91 46,864 3,804 12.3 59,842 95° 3.82 45,895 4,042 11.4 59,685 75° 4.19 50,339 3,185 15.8 61,207 80° 4.13 49,521 3,377 14.7 61,044 46° 85° 4.05 48,652 3,582 13.6 60,873 90° 3.98 47,721 3,803 12.5 60,698 95° 3.90 46,741 4,040 11.6		75°	4.05	48,577	3,181	15.3	59,432
90° 3.84 46,025 3,802 12.1 58,999 95° 3.76 45,067 4,041 11.2 58,855 75° 4.12 49,449 3,184 15.5 60,314 80° 4.05 48,643 3,376 14.4 60,162 90° 3.91 46,864 3,804 12.3 59,842 95° 3.82 45,895 4,042 11.4 59,685 75° 4.19 50,339 3,185 15.8 61,207 80° 4.13 49,521 3,377 14.7 61,044 85° 4.05 48,652 3,582 13.6 60,873 90° 3.98 47,721 3,803 12.5 60,698 95° 3.90 46,741 4,040 11.6 60,526 75° 4.35 52,148 3,188 16.4 63,025 80° 4.28 51,301 3,381 15.2 62,836 85° 4.20 50,410 3,585 14.1 62,640 90° 4.12 49,465 3,803 13.0 62,440 95° 4.04 48,455 4,040 12.0 62,239 75° 4.50 53,992 3,193 16.9 64,885 80° 4.43 53,130 3,383 15.7 64,674 50° 85° 4.35 52,216 3,586 14.6 64,452 90° 4.27 51,242 3,805 13.5 64,224		80°	3.98	47,774	3,376	14.2	59,292
95° 3.76 45,067 4,041 11.2 58,855 75° 4.12 49,449 3,184 15.5 60,314 80° 4.05 48,643 3,376 14.4 60,162 90° 3.91 46,864 3,804 12.3 59,842 95° 3.82 45,895 4,042 11.4 59,685 75° 4.19 50,339 3,185 15.8 61,207 80° 4.13 49,521 3,377 14.7 61,044 46° 85° 4.05 48,652 3,582 13.6 60,873 90° 3.98 47,721 3,803 12.5 60,698 95° 3.90 46,741 4,040 11.6 60,526 75° 4.35 52,148 3,188 16.4 63,025 80° 4.28 51,301 3,381 15.2 62,836 85° 4.20 50,410 3,585 14.1 62,640 90° 4.12 49,465 3,803 13.0 62,440 95° 4.04 48,455 4,040 12.0 62,239 75° 4.50 53,992 3,193 16.9 64,885 80° 4.43 53,130 3,383 15.7 64,674 50° 85° 4.35 52,216 3,586 14.6 64,452 90° 4.27 51,242 3,805 13.5 64,224	44°	85°	3.91	46,927	3,581	13.1	59,146
45° 4.12 49,449 3,184 15.5 60,314 80° 4.05 48,643 3,376 14.4 60,162 85° 3.98 47,784 3,581 13.3 60,004 90° 3.91 46,864 3,804 12.3 59,842 95° 3.82 45,895 4,042 11.4 59,685 75° 4.19 50,339 3,185 15.8 61,207 80° 4.13 49,521 3,377 14.7 61,044 85° 4.05 48,652 3,582 13.6 60,873 90° 3.98 47,721 3,803 12.5 60,698 95° 3.90 46,741 4,040 11.6 60,526 75° 4.35 52,148 3,188 16.4 63,025 80° 4.28 51,301 3,381 15.2 62,836 48° 85° 4.20 50,410 3,585 14.1 62,640		90°	3.84	46,025	3,802	12.1	58,999
45° 80° 4.05 48,643 3,376 14.4 60,162 85° 3.98 47,784 3,581 13.3 60,004 90° 3.91 46,864 3,804 12.3 59,842 95° 3.82 45,895 4,042 11.4 59,685 75° 4.19 50,339 3,185 15.8 61,207 80° 4.13 49,521 3,377 14.7 61,044 46° 85° 4.05 48,652 3,582 13.6 60,873 90° 3.98 47,721 3,803 12.5 60,698 95° 3.90 46,741 4,040 11.6 60,526 75° 4.35 52,148 3,188 16.4 63,025 80° 4.28 51,301 3,381 15.2 62,836 48° 85° 4.20 50,410 3,585 14.1 62,640 95° 4.04 48,455 4,040 12.0			3.76	45,067		11.2	58,855
45° 85° 3.98 47,784 3,581 13.3 60,004 90° 3.91 46,864 3,804 12.3 59,842 95° 3.82 45,895 4,042 11.4 59,685 75° 4.19 50,339 3,185 15.8 61,207 80° 4.13 49,521 3,377 14.7 61,044 46° 85° 4.05 48,652 3,582 13.6 60,873 90° 3.98 47,721 3,803 12.5 60,698 95° 3.90 46,741 4,040 11.6 60,526 75° 4.35 52,148 3,188 16.4 63,025 80° 4.28 51,301 3,381 15.2 62,836 48° 85° 4.20 50,410 3,585 14.1 62,640 90° 4.12 49,465 3,803 13.0 62,440 95° 4.04 48,455 4,040 12.0			4.12	49,449	3,184	15.5	60,314
90° 3.91 46,864 3,804 12.3 59,842 95° 3.82 45,895 4,042 11.4 59,685 75° 4.19 50,339 3,185 15.8 61,207 80° 4.13 49,521 3,377 14.7 61,044 46° 85° 4.05 48,652 3,582 13.6 60,873 90° 3.98 47,721 3,803 12.5 60,698 95° 3.90 46,741 4,040 11.6 60,526 75° 4.35 52,148 3,188 16.4 63,025 80° 4.28 51,301 3,381 15.2 62,836 85° 4.20 50,410 3,585 14.1 62,640 90° 4.12 49,465 3,803 13.0 62,440 95° 4.04 48,455 4,040 12.0 62,239 75° 4.50 53,992 3,193 16.9 64,885 80° 4.43 53,130 3,383 15.7 64,674 50° 85° 4.35 52,216 3,586 14.6 64,452 90° 4.27 51,242 3,805 13.5 64,224			4.05	48,643	3,376	14.4	60,162
95° 3.82 45,895 4,042 11.4 59,685 75° 4.19 50,339 3,185 15.8 61,207 80° 4.13 49,521 3,377 14.7 61,044 46° 85° 4.05 48,652 3,582 13.6 60,873 90° 3.98 47,721 3,803 12.5 60,698 95° 3.90 46,741 4,040 11.6 60,526 75° 4.35 52,148 3,188 16.4 63,025 80° 4.28 51,301 3,381 15.2 62,836 80° 4.28 51,301 3,585 14.1 62,640 90° 4.12 49,465 3,803 13.0 62,440 95° 4.04 48,455 4,040 12.0 62,239 75° 4.50 53,992 3,193 16.9 64,885 80° 4.43 53,130 3,383 15.7 64,674 50° 85° 4.35 52,216 3,586 14.6 64,452 90° 4.27 51,242 3,805 13.5 64,224	45°	85°	3.98	47,784	3,581	13.3	. 60,004
46° 4.19 50,339 3,185 15.8 61,207 46° 85° 4.05 48,652 3,582 13.6 60,873 90° 3.98 47,721 3,803 12.5 60,698 95° 3.90 46,741 4,040 11.6 60,526 75° 4.35 52,148 3,188 16.4 63,025 80° 4.28 51,301 3,381 15.2 62,836 85° 4.20 50,410 3,585 14.1 62,640 90° 4.12 49,465 3,803 13.0 62,440 95° 4.04 48,455 4,040 12.0 62,239 75° 4.50 53,992 3,193 16.9 64,885 80° 4.43 53,130 3,383 15.7 64,674 50° 4.35 52,216 3,586 14.6 64,452 90° 4.27 51,242 3,805 13.5 64,224		90°	3.91	46,864	3,804	12.3	59,842
46° 80° 4.13 49,521 3,377 14.7 61,044 85° 4.05 48,652 3,582 13.6 60,873 90° 3.98 47,721 3,803 12.5 60,698 95° 3.90 46,741 4,040 11.6 60,526 75° 4.35 52,148 3,188 16.4 63,025 80° 4.28 51,301 3,381 15.2 62,836 85° 4.20 50,410 3,585 14.1 62,640 90° 4.12 49,465 3,803 13.0 62,440 95° 4.04 48,455 4,040 12.0 62,239 75° 4.50 53,992 3,193 16.9 64,885 80° 4.43 53,130 3,383 15.7 64,674 50° 85° 4.35 52,216 3,586 14.6 64,452 90° 4.27 51,242 3,805 13.5 64,224 <td></td> <td>95°</td> <td>3.82</td> <td>45,895</td> <td>4,042</td> <td>11.4</td> <td>59,685</td>		95°	3.82	45,895	4,042	11.4	59,685
46° 85° 4.05 48,652 3,582 13.6 60,873 90° 3.98 47,721 3,803 12.5 60,698 95° 3.90 46,741 4,040 11.6 60,526 75° 4.35 52,148 3,188 16.4 63,025 80° 4.28 51,301 3,381 15.2 62,836 48° 85° 4.20 50,410 3,585 14.1 62,640 90° 4.12 49,465 3,803 13.0 62,440 95° 4.04 48,455 4,040 12.0 62,239 75° 4.50 53,992 3,193 16.9 64,885 80° 4.43 53,130 3,383 15.7 64,674 50° 85° 4.35 52,216 3,586 14.6 64,452 90° 4.27 51,242 3,805 13.5 64,224		75°	4.19	50,339	3,185	15.8	61,207
90° 3.98 47,721 3,803 12.5 60,698 95° 3.90 46,741 4,040 11.6 60,526 75° 4.35 52,148 3,188 16.4 63,025 80° 4.28 51,301 3,381 15.2 62,836 48° 85° 4.20 50,410 3,585 14.1 62,640 90° 4.12 49,465 3,803 13.0 62,440 95° 4.04 48,455 4,040 12.0 62,239 75° 4.50 53,992 3,193 16.9 64,885 80° 4.43 53,130 3,383 15.7 64,674 50° 85° 4.35 52,216 3,586 14.6 64,452 90° 4.27 51,242 3,805 13.5 64,224			4.13	49,521	3,377	14.7	61,044
95° 3.90 46,741 4,040 11.6 60,526 75° 4.35 52,148 3,188 16.4 63,025 80° 4.28 51,301 3,381 15.2 62,836 48° 85° 4.20 50,410 3,585 14.1 62,640 90° 4.12 49,465 3,803 13.0 62,440 95° 4.04 48,455 4,040 12.0 62,239 75° 4.50 53,992 3,193 16.9 64,885 80° 4.43 53,130 3,383 15.7 64,674 50° 85° 4.35 52,216 3,586 14.6 64,452 90° 4.27 51,242 3,805 13.5 64,224	46°		4.05	48,652	3,582	13.6	60,873
48° 4.35 52,148 3,188 16.4 63,025 48° 80° 4.28 51,301 3,381 15.2 62,836 90° 4.20 50,410 3,585 14.1 62,640 90° 4.12 49,465 3,803 13.0 62,440 95° 4.04 48,455 4,040 12.0 62,239 75° 4.50 53,992 3,193 16.9 64,885 80° 4.43 53,130 3,383 15.7 64,674 50° 85° 4.35 52,216 3,586 14.6 64,452 90° 4.27 51,242 3,805 13.5 64,224			3.98	47,721	3,803	12.5	60,698
48° 4.28 51,301 3,381 15.2 62,836 85° 4.20 50,410 3,585 14.1 62,640 90° 4.12 49,465 3,803 13.0 62,440 95° 4.04 48,455 4,040 12.0 62,239 75° 4.50 53,992 3,193 16.9 64,885 80° 4.43 53,130 3,383 15.7 64,674 50° 85° 4.35 52,216 3,586 14.6 64,452 90° 4.27 51,242 3,805 13.5 64,224			3.90	46,741	4,040	11.6	60,526
48° 85° 4.20 50,410 3,585 14.1 62,640 90° 4.12 49,465 3,803 13.0 62,440 95° 4.04 48,455 4,040 12.0 62,239 75° 4.50 53,992 3,193 16.9 64,885 80° 4.43 53,130 3,383 15.7 64,674 50° 85° 4.35 52,216 3,586 14.6 64,452 90° 4.27 51,242 3,805 13.5 64,224		75°	4.35	52,148	3,188		63,025
90° 4.12 49,465 3,803 13.0 62,440 95° 4.04 48,455 4,040 12.0 62,239 75° 4.50 53,992 3,193 16.9 64,885 80° 4.43 53,130 3,383 15.7 64,674 50° 85° 4.35 52,216 3,586 14.6 64,452 90° 4.27 51,242 3,805 13.5 64,224			4.28	51,301	3,381		
95° 4.04 48,455 4,040 12.0 62,239 75° 4.50 53,992 3,193 16.9 64,885 80° 4.43 53,130 3,383 15.7 64,674 50° 85° 4.35 52,216 3,586 14.6 64,452 90° 4.27 51,242 3,805 13.5 64,224	48°	85°	4.20	50,410	3,585	14.1	62,640
75° 4.50 53,992 3,193 16.9 64,885 80° 4.43 53,130 3,383 15.7 64,674 50° 85° 4.35 52,216 3,586 14.6 64,452 90° 4.27 51,242 3,805 13.5 64,224		90°	4.12	49,465	3,803	13.0	62,440
80° 4.43 53,130 3,383 15.7 64,674 50° 85° 4.35 52,216 3,586 14.6 64,452 90° 4.27 51,242 3,805 13.5 64,224		95°	4.04	48,455	4,040	12.0	62,239
50° 85° 4.35 52,216 3,586 14.6 64,452 90° 4.27 51,242 3,805 13.5 64,224		75°	4.50	53,992	3,193	16.9	64,885
90° 4.27 51,242 3,805 13.5 64,224			4.43	53,130	3,383	15.7	64,674
31,2 31,2 31,2 31,2 31,2 31,2	50°	85°	4.35	52,216	3,586	14.6	64,452
95° 4.18 50,219 4,038 12.4 63,997		90°	4.27	51,242	3,805	13.5	64,224
		95°	4.18	50,219	4,038	12.4	63,997

Leaving	Entering	Heating	Power		Heat of
Load	Source	Capacity	Input	COP	Absorb.
Fluid (F)	l	(BtuH)	Watts	· · ·	(BtuH)
1.0.0 (.)	35°	47,724	3,812	3.7	34,718
	40°	50,896	3,808	3.9	37,904
100°	50°	57,779	3,802	4.5	44,806
	60°	65,378	3,805	5.0	52,395
	70°	73,690	3,817	5.7	60,665
	35°	48,028	4,340	3.2	33,220
	40°	51,094	4,326	3.5	36,332
110°	50°	57,768	4,302	3.9	43,089
	60°	65,167	4,290	4.5	50,529
	70°	73,287	4,287	5.0	58,659
	35°	48,428	4,962	2.9	31,498
	40°	51,377	4,935	3.1	34,539
120°	50°	57,825	4,888	3.5	41,147
	60°	65,004	4,852	3.9	48,448
	70°	72,914	4,827	4.4	56,442
	35°	48,674	5,312	2.7	30,551
	40°	51,563	5,280	2.9	33,546
125°	50°	57,890	5,218	3.3	40,086
	60°	64,952	5,168	3.7	47,319
	70°	72,748	5,132	4.2	55,239
	35°	48,960	5,695	2.5	29,529
	40°	51,782	5,651	2.7	32,500
130°	50°	57,985	5,575	3.0	38,962
	60°	64,926	5,509	3.5	46,129
	70°	72,604	5,457	3.9	53,984

Units are complete packages featuring 1 stage operation and containing refrigeration compressor, reversing valve, expansion valve metering device and water to refrigerant heat exchangers. Also included are safety controls: Overload protection for compressor, high and low refrigerant pressure switches and a lock-out control circuit.

FHP MANUFACTURING

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WP060IP6 P65





ELECTRICAL SPECIFICATIONS

Electrical	Elect.	Elect. Compressor		Min.	Max.
Characteristics	Symbol			Circuit	Fuse
Onaraotensios	Cymbol	RLA	LRA	Ampacity	Size
208/230-1-60	-1	28.8	169	36.0	60
208/230-3-60	-3	19.1	137	23.9	40
460-3-60	-4	9.1	62	11.4	20

FLUID FLOW & PRESSURE DROP

Chilled Fluid S	ide (@ 55°F)	Cond. Fluid Side (@ 85°F)		
Flow (GPM)	Flow (GPM) ΔP (FOH)		ΔP (FOH)	
7	2.7	7	2.5	
11	5.6	11	5.2	
14	9.3	14	8.8	
17	12.9	17	12.2	
21	19.3	21	18.2	

UNIT WEIGHT

Unit Weight (lbs) 430 Shipping Weight (lbs) 450

CHILLER PERFORMANCE

Based on 14 GPM chilled fluid & 10°F condenser fluid temp. rise.

Leaving	Entering	Total	Total	Power		Heat
Chilled	Cond.	Capacity	Capacity	Input	EER	Rejection
Fluid (F)	Fluid (F)	(Tons)	(BtuH)	(Watts)		(BtuH)
	75°	4.55	54,612	3,649	15.0	67,063
	80°	4.46	53,492	3,868	13.8	66,690
40°	85°	4.36	52,324	4,101	12.8	66,315
	90°	4.26	51,080	4,352	11.7	65,927
	95°	4.15	49,760	4,621	10.8	65,526
	75°	4.71	56,524	3,652	15.5	68,985
	80°	4.61	55,376	3,870	14.3	68,580
42°	85°	4.51	54,172	4,103	13.2	68,171
	90°	4.41	52,904	4,353	12.2	67,755
	95°	4.30	51,571	4,619	11.2	67,331
	75°	4.87	58,484	3,656	16.0	70,957
	80°	4.78	57,306	3,872	14.8	70,518
44°	85°	4.67	56,074	4,104	13.7	70,077
	90°	4.56	54,780	4,353	12.6	69,631
	95°	4.45	53,413	4,619	11.6	69,175
	75°	4.96	59,483	3,657	16.3	71,962
	80°	4.86	58,289	3,873	15.0	71,505
45°	85°	4.75	57,043	4,105	13.9	71,047
	90°	4.64	55,734	4,353	12.8	70,585
	95°	4.53	54,355	4,619	11.8	70,115
	75°	5.04	60,494	3,659	16.5	72,980
	80°	4.94	59,284	3,875	15.3	72,505
46°	85°	4.84	58,022	4,105	14.1	72,030
	90°	4.72	56,700	4,353	13.0	71,552
	95°	4.61	55,307	4,619	12.0	71,066
	75°	5.21	62,555	3,663	17.1	75,055
	80°	5.11	61,311	3,878	15.8	74,542
48°	85°	5.00	60,017	4,107	14.6	74,031
	90°	4.89	58,664	4,354	13.5	73,520
	95°	4.77	57,243	4,619	12.4	73,002
	75°	5.39	64,669	3,668	17.6	77,183
	80°	5.28	63,388	3,881	16.3	76,631
50°	85°	5.17	62,060	4,110	15.1	76,083
	90°	5.06	60,675	4,355	13.9	75,536
	95°	4.94	59,224	4,619	12.8	74,985

HEATING PERFORMANCE

Based on 10°F load temp, rise & 14 GPM source fluid flow.

Based on 10°F load temp. rise & 14 GPM source fluid flow.								
Leaving	Entering	Heating	Power		Heat of			
Load	Source	Capacity	Input	COP	Absorb.			
Fluid (F)	Fluid (F)	(BtuH)	Watts		(BtuH)			
	35°	56,626	4,359	3.8	41,752			
	40°	60,280	4,354	4.1	45,422			
100°	50°	68,118	4,352	4.6	53,268			
	60°	76,728	4,357	5.2	61,862			
	70°	86,182	4,367	5.8	71,284			
	35°	56,285	4,932	3.3	39,458			
	40°	59,877	4,920	3.6	43,089			
110°	50°	67,555	4,907	4.0	50,812			
	60°	75,958	4,903	4.5	59,228			
70°		85,156	4,909	5.1	68,407			
3	35°	55,849	5,588	2.9	36,782			
	40°	59,394	5,571	3.1	40,387			
120°	50°	66,941	5,547	3.5	48,016			
	60°	75,162	5,537	4.0	56,270			
	70°	84,136	5,537	4.5	65,242			
	35°	55,587	5,954	2.7	35,272			
	40°	59,114	5,933	2.9	38,871			
125°	50°	66,606	5,903	3.3	46,464			
	60°	74,749	5,890	3.7	54,652			
	70°	83,620	5,888	4.2	63,531			
	35°	55,294	6,341	2.6	33,658			
	40°	58,807	6,317	2.7	37,252			
130°	50°	66,253	6,283	3.1	44,815			
	60°	74,324	6,266	3.5	52,943			
	70°	83,098	6,264	3.9	61,724			

Units are complete packages featuring 1 stage operation and containing refrigeration compressor, reversing valve, expansion valve metering device and water to refrigerant heat exchangers. Also included are safety controls: Overload protection for compressor, high and low refrigerant pressure switches and a lock-out control circuit.

FHP MANUFACTURING

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WP072IP6 P65

WP SEI

ELECTRICAL SPECIFICATIONS

Electrical	Elect.	Compressor		Min.	Max.
Characteristics	Symbol	RLA	LRA	Circuit Ampacity	Fuse Size
208/230-3-60	-3	37.8	239	47.3	80
460-3-60	-4	17.2	125	21.5	35
575-3-60	-5	12.4	80	15.5	25

FLUID FLOW & PRESSURE DROP

Chilled Water	Side (@ 55°F)	Cond. Water Side (@ 85°F)		
Flow (GPM)	Flow (GPM) ΔP (FOH)		ΔP (FOH)	
12	2.5	12	2.4	
18	5.2	18	4.9	
24	8.7	24	8.2	
30	13.0	30	12.2	
36	18.1	36	17.0	

UNIT WEIGHT

Unit Weight (lbs) 500 Shipping Weight (lbs) 520

CHILLER PERFORMANCE

Based on 24 GPM chilled fluid & 10°F condenser fluid temp. rise.

Leaving	Entering	Total	Total	Power		Heat
Chilled	Cond.	Capacity	Capacity	Input	EER	Rejection
Fluid (F)	Fluid (F)	(Tons)	(BtuH)	(Watts)		(BtuH)
	75°	8.80	105,641	7,421	14.2	130,960
	80°	8.62	103,480	7,801	13.3	130,095
40°	85°	8.44	101,234	8,208	12.3	129,240
	90°	8.24	98,910	8,643	11.4	128,398
	95°	8.04	96,484	9,108	10.6	127,561
	75°	9.12	109,473	7,452	14.7	134,898
	80°	8.94	107,241	7,830	13.7	133,959
42º	85°	8.74	104,927	8,237	12.7	133,030
	90°	8.54	102,525	8,672	11.8	132,113
	95°	8.34	100,033	9,136	10.9	131,205
	75°	9.45	113,400	7,484	15.2	138,935
	80°	9.26	111,095	7,861	14.1	137,918
44º	85°	9.06	108,709	8,266	13.2	136,914
	90°	8.85	106,237	8,700	12.2	135,921
	95°	8.64	103,676	9,163	11.3	134,940
	75°	9.62	115,399	7,501	15.4	140,991
	80°	9.42	113,057	7,877	14.4	139,935
45°	85°	9.22	110,634	8,282	13.4	138,891
	90°	9.01	108,117	8,716	12.4	137,856
	95°	8.79	105,520	9,179	11.5	136,837
	75°	9.79	117,422	7,517	15.6	143,072
	80°	9.59	115,042	7,894	14.6	141,976
46º	85°	9.38	112,573	8,299	13.6	140,889
	90°	9.17	110,028	8,731	12.6	139,818
	95°	8.95	107,395	9,193	11.7	138,760
	75°	10.13	121,542	7,553	16.1	147,311
	80°	9.92	119,084	7,927	15.0	146,132
48°	85°	9.71	116,547	8,330	14.0	144,967
	90°	9.49	113,917	8,762	13.0	143,812
	95°	9.27	111,209	9,222	12.1	142,674
	75°	10.48	125,769	7,588	16.6	151,659
	80°	10.27	123,221	7,963	15.5	150,389
50°	85°	10.05	120,604	8,363	14.4	149,139
	90°	9.82	117,896	8,794	13.4	147,901
	95°	9.59	115,112	9,252	12.4	146,681

HEATING PERFORMANCE

Based on 10°F load temp, rise & 24 GPM source fluid flow.

based of 10 F load temp. Tise & 24 GF W source had now.								
Leaving	Entering	Heating	Power		Heat of			
Load	Source	Capacity	Input	COP	Absorb.			
Fluid (F)		(BtuH)	Watts		(BtuH)			
	35°	108,518	8,485	3.7	79,567			
	40°	115,727	8,543	4.0	86,578			
100°	50°	131,227	8,665	4.4	101,661			
	60°	148,212	8,796	4.9	118,201			
	70°	166,727	8,947	5.5	136,199			
	35°	108,057	9,460	3.3	75,779			
	40°	115,067	9,517	3.5	82,597			
110º	50°	130,118	9,629	4.0	97,263			
	60°	146,583	9,750	4.4	113,316			
	70°	164,507	9,891	4.9	130,758			
	35°	107,625	10,560	3.0	71,592			
	40°	114,442	10,615	3.2	78,223			
120°	50°	129,052	10,720	3.5	92,475			
	60°	145,004	10,830	3.9	108,053			
	70°	162,348	10,958	4.3	124,958			
_	35°	107,417	11,164	2.8	69,326			
	40°	114,142	11,214	3.0	75,880			
125°	50°	128,533	11,315	3.3	89,926			
	60°	144,232	11,421	3.7	105,265			
	70°	161,290	11,541	4.1	121,911			
	35°	107,216	11,800	2.7	66,956			
	40°	113,847	11,850	2.8	73,415			
130°	50°	128,024	11,945	3.1	87,267			
	60°	143,473	12,044	3.5	102,380			
	70°	160,245	12,159	3.9	118,760			

Units are complete packages featuring 1 stage operation and containing refrigeration compressor, reversing valve, expansion valve metering device and water to refrigerant heat exchangers. Also included are safety controls: Overload protection for compressor, high and low refrigerant pressure switches and a lock-out control circuit

FHP MANUFACTURING

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WP120IP6.P65



WP SFRIFS

ELECTRICAL SPECIFICATIONS

Electrical	Elect.	Elect. Compressor		Min.	Max.
Characteristics	Symbol			Circuit	Fuse
Characteristics	Cynnbon	RLA	LRA	Ampacity	Size
208/230-3-60	-3	41.0	350	51.3	90
460-3-60	4	21.8	158	27.3	45
575-3-60	-5	17.3	125	21.6	35

FLUID FLOW & PRESSURE DROP

Chilled Fluid S	Side (@ 55°F)	Cond. Fluid Side (@ 85°F)		
Flow (GPM)	ΔP (FOH)	Flow (GPM)	ΔP (FOH)	
24	5.2	24	4.9	
30	7.7	30	7.3	
36	10.8	36	10.1	
42	14.2	42	13.4	
48	18.1	48	17.0	

UNIT WEIGHT

Unit Weight (lbs) 740 Shipping Weight (lbs) 760

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CHILLER PERFORMANCE

Based on 36 GPM chilled fluid & 10°F condenser fluid temp. rise.

Leaving	Entering	Total	Total	Power	-	Heat
Chilled	Cond.	Capacity	Capacity	Input	EER	Rejection
Fluid (F)	Fluid (F)	(Tons)	(BtuH)	(Watts)		(BtuH)
`	75°	10.61	127,340	8,980	14.2	157,978
	80°	10.42	125,016	9,464	13.2	157,308
40°	85°	10.23	122,728	9,981	12.3	156,784
	90°	10.04	120,454	10,532	11.4	156,389
	95°	9.85	118,179	11,117	10.6	156,111
_	75°	10.98	131,792	9,009	14.6	162,530
	80°	10.78	129,361	9,492	13.6	161,746
42°	85°	10.58	126,955	10,007	12.7	161,099
ļ	90°	10.38	124,545	10,559	11.8	160,572
	95°	10.18	122,132	11,144	11.0	160,156
	75°	11.37	136,389	9,037	15.1	167,224
	80°	11.15	133,842	9,519	14.1	166,322
44°	85°	10.94	131,311	10,035	13.1	165,550
	90°	10.73	128,781	10,584	12.2	164,895
	95°	10.52	126,222	11,171	11.3	164,338
	75°	11.56	138,732	9,053	15.3	169,621
	80°	11.34	136,131	9,534	14.3	168,662
45°	85°	11.13	133,549	10,047	13.3	167,831
	90°	10.91	130,948	10,598	12.4	167,108
	95°	10.69	128,320	11,184	11.5	166,481
	75°	11.76	141,118	9,068	15.6	172,058
	80°	11.54	138,464	9,548	14.5	171,040
46°	85°	11.32	135,815	10,061	13.5	170,145
	90°	11.10	133,158	10,610	12.6	169,358
	95°	10.87	130,453	11,198	11.6	168,660
	75°	12.17	145,998	9,098	16.0	177,041
	80°	11.94	143,237	9,575	15.0	175,907
48°	85°	11.71	140,471	10,087	13.9	174,888
	90°	11.47	137,678	10,635	12.9	173,966
	95°	11.24	134,836	11,223	12.0	173,128
	75°	12.59	151,025	9,129	16.5	182,174
	80°	12.35	148,157	9,603	15.4	180,924
50°	85°	12.11	145,266	10,114	14.4	179,776
	90°	11.86	142,346	10,661	13.4	178,722
	95°	11.61	139,366	11,248	12.4	177,743

HEATING PERFORMANCE

Based on 10°F load temp, rise & 36 GPM source fluid flow.

Based on 10°F load temp. rise & 36 GPM source fluid flow.								
Leaving	Entering	Heating	Power		Heat of			
Load	Source	Capacity	input	COP	Absorb			
Fluid (F)	Fluid (F)	(BtuH)	Watts		(BtuH)			
	35°	136,373	10,384	3.8	100,944			
	40°	144,542	10,449	4.1	108,889			
100°	50°	162,647	10,571	4.5	126,579			
ļ	60°	183,247	10,683	5.0	146,795			
	70°	206,495	10,791	5.6	169,676			
	35°	137,648	11,580	3.5	98,137			
	40°	145,261	11,654	3.7	105,496			
110°	50°	162,273	11,788	4.0	122,053			
	60°	181,807	11,900	4.5	141,203			
	70°	204,017	11,999	5.0	163,077			
	35°	139,379	12,926	3.2	95,276			
	40°	146,365	13,014	3.3	101,960			
120°	50°	162,147	13,169	3.6	117,215			
	60°	180,482	13,295	4.0	135,120			
	70°	201,526	13,395	4.4	155,824			
	35°	140,378	13,659	3.0	93,774			
	40°	147,024	13,758	3.1	100,082			
125°	50°	162,139	13,927	3.4	114,620			
	60°	179,825	14,063	3.7	131,842			
	70°	200,239	14,168	4.1	151,899			
	35°	141,446	14,436	2.9	92,191			
	40°	147,733	14,544	3.0	98,108			
130°	50°	162,147	14,734	3.2	111,877			
	60°	179,150	14,882	3.5	128,374			
	70°	198,898	14,996	3.9	147,731			

Units are complete packages featuring 1 stage operation and containing refrigeration compressor, reversing valve, expansion valve metering device and water to refrigerant heat exchangers. Also included are safety controls: Overload protection for compressor, high and low refrigerant pressure switches and a lock-out control circuit.

FHP MANUFACTURING

601 N.W. 65th Court Fort Lauderdale, FL 33309 Phone: (954) 776-5471 Fax: (800) 776-5529 http://www.fhp-mfg.com

As a result of continuing research and development, specifications are subject to change without notice.

WP180IP6.P65

ELECTRICAL SPECIFICATIONS

Electrical Characteristics	Elect. Symbol	Comp	ressor	Min.	Max.
			T	Circuit	Fuse
		RLA	LRA	Ampacity	Size
208/230-3-60	-3	48.1	425	60.1	100
460-60-3	-4	23.8	187	29.6	50
575-3-60	-5	21.8	148	27.3	45
		-			

FLUID FLOW & PRESSURE DROP

Chilled Fluid S	Side (@ 55°F)	Cond. Fluid Side (@ 85°F)		
Flow (GPM)	Flow (GPM) ΔP (FOH)		ΔP (FOH)	
24	5.2	24	4.9	
30	7.7	30	7.3	
36	10.8	36	10.1	
42	14.2	42	13.4	
48	18.1	48	17.0	

UNIT WEIGHT

Unit Weight (lbs) Shipping Weight (lbs) 790

770

CHILLER PERFORMANCE

Based on 42 GPM chilled fluid & 10°F condenser fluid temp. rise.

Leaving	Entering	Total	Total	Power		Heat
Chilled	Cond.	Capacity	Capacity	Input	EER	Rejection
Fluid (F)	Fluid (F)	(Tons)	(BtuH)	(Watts)		(BtuH)
40°	75°	12.48	149,760	11,216	13.4	188,028
	80°	12.21	146,509	11,862	12.4	186,981
	85°	11.92	143,050	12,541	11.4	185,840
	90°	11.62	139,414	13,251	10.5	184,627
	95°	11.30	135,602	13,996	9.7	183,354
	75°	12.96	155,519	11,227	13.9	193,825
	80°	12.68	152,138	11,873	12.8	192,649
42°	85°	12.38	148,556	12,553	11.8	191,387
	90°	12.07	144,801	13,266	10.9	190,063
	95°	11.74	140,866	14,015	10.1	188,686
	75°	13.45	161,449	11,237	14.4	199,788
	80°	13.16	157,933	11,882	13.3	198,475
44°	85°	12.85	154,222	12,563	12.3	197,086
	90°	12.53	150,334	13,278	11.3	195,640
	95°	12.19	146,281	14,031	10.4	194,154
	75°	13.71	164,477	11,241	14.6	202,833
	80°	13.41	160,882	11,888	13.5	201,444
45°	85°	13.09	157,113	12,567	12.5	199,992
	90°	12.76	153,162	13,283	11.5	198,485
	95°	12.42	149,037	14,039	10.6	196,938
	75°	13.96	167,548	11,246	14.9	205,920
	80°	13.66	163,882	11,892	13.8	204,458
46°	85°	13.34	160,035	12,573	12.7	202,934
	90°	13.00	156,018	13,290	11.7	201,363
	95°	12.65	151,841	14,045	10.8	199,761
	75°	14.49	173,828	11,255	15.4	212,230
	80°	14.17	170,016	11,899	14.3	210,617
48°	85°	13.83	166,019	12,581	13.2	208,946
	90°	13.49	161,867	13,299	12.2	207,242
	95°	13.13	157,550	14,057	11.2	205,512
	75°	15.02	180,288	11,264	16.0	218,721
	80°	14.69	176,314	11,908	14.8	216,944
50°	85°	14.35	172,169	12,589	13.7	215,124
	90°	13.99	167,876	13,307	12.6	213,280
	95°	13.62	163,425	14,066	11.6	211,419

HEATING PERFORMANCE

Based on 10°F load temp. rise & 42 GPM source fluid flow

sased on 10-r load temp. Tise & 42 Gr W source hald now								
Leaving	Entering	Heating	Power		Heat of			
Load	Source	Capacity	Input	COP	Absorb.			
Fluid (F)	Fluid (F)	(BtuH)	Watts		(BtuH)			
	35°	158,397	13,133	3.5	113,586			
	40°	169,313	13,193	3.8	124,299			
100°	50°	192,769	13,273	4.3	147,482			
	60°	218,696	13,313	4.8	173,272			
ļ	70°	247,430	13,339	5.4	201,918			
	35°	157,272	14,608	3.2	107,429			
	40°	167,962	14,696	3.3	117,820			
110°	50°	190,804	14,815	3.8	140,255			
	60°	215,905	14,877	4.3	165,144			
	70°	243,619	14,906	4.8	192,761			
	35°	155,892	16,217	2.8	100,559			
	40°	166,428	16,339	3.0	110,678			
120°	50°	188,794	16,516	3.4	132,440			
	60°	213,208	16,617	3.8	156,510			
	70°	240,028	16,668	4.2	183,158			
	35°	155,147	17,074	2.7	96,891			
	40°	165,630	17,220	2.8	106,876			
125°	50°	187,811	17,431	3.2	128,337			
	60°	211,929	17,559	3.5	152,019			
	70°	238,352	17,627	4.0	178,208			
	35°	154,384	17,972	2.5	93,065			
	40°	164,835	18,138	2.7	102,949			
130°	50°	186,865	18,388	3.0	124,126			
	60°	210,723	18,548	3.3	147,438			
	70°	236,781	18,638	3.7	173,186			

Units are complete packages featuring 1 stage operation and containing refrigeration compressor, reversing valve, expansion valve metering device and water to refrigerant heat exchangers. Also included are safety controls: Overload protection for compressor, high and low refrigerant pressure switches and a lock-out control circuit

FHP MANUFACTURING

601 N.W. 65th Court Fort Lauderdale, FL 33309 Phone: (954) 776-5471 Fax: (800) 776-5529 http://www.fhp-mfg.com

As a result of continuing research and development, specifications are subject to change without notice.

WP210IP6.P65



WATER COOLED CHILLERS AND LOW TEMP BOILERS

SPECIFICATION DATA SHEET

FHP MANUFACTURING ENERGY WISE HVAC EQUIPMENT



ELECTRICAL SPECIFICATIONS

Electrical	Elect.	Compres	sor (Ea)	Min.	Max.
Characteristics	Symbol			Circuit	Fuse
Characteristics	Cymbol	RLA	LRA	Ampacity	Size
208/230-3-60	-3	37.8	239	85.1	110
460-3-60	-4	17.3	125	38.7	50
575-3-60	-5	12.4	80	27.9	40

FLUID FLOW & PRESSURE DROP

Chilled Fluid S	Side (@ 55°F)	Cond. Fluid Side (@ 85°F)		
Flow (GPM)	∆P (FOH)	Flow (GPM)	ΔP (FOH)	
24	4.3	24	4.1	
36	9.0	36	8.5	
48	15.1	48	14.2	
60	22.6	60	21.2	
72	31.3	72	29.5	

UNIT WEIGHT

Unit Weight (lbs) 970 Shipping Weight (lbs) 990

CHILLER PERFORMANCE

Based on 48 GPM chilled fluid & 10°F condenser fluid temp. rise.

Leaving	Entering	Total	Total	Power		Heat
Chilled	Cond.	Capacity	Capacity	Input	EER	Rejection
Fluid (F)	Fluid (F)	(Tons)	(BtuH)	(Watts)		(BtuH)
	75°	17.61	211,275	14,843	14.2	261,917
	80°	17.25	206,960	15,601	13.3	260,190
40°	85°	16.87	202,468	16,416	12.3	258,480
	90°	16.48	197,810	17,287	11.4	256,792
	95°	16.08	192,967	18,217	10.6	255,123
ļ	75°	18.24	218,938	14,905	14.7	269,792
	80°	17.87	214,474	15,662	13.7	267,914
42°	85°	17.49	209,844	16,475	12.7	266,057
	90°	17.09	205,050	17,343	11.8	264,225
	95°	16.67	200,065	18,272	10.9	262,410
	75°	18.90	226,791	14,969	15.2	277,866
	80°	18.52	222,181	15,724	14.1	275,833
44°	85°	18.12	217,409	16,534	13.1	273,824
	90°	17.71	212,465	17,401	12.2	271,839
	95°	17.28	207,342	18,328	11.3	269,876
	75°	19.23	230,790	15,002	15.4	281,978
	80°	18.84	226,105	15,756	14.4	279,865
45°	85°	18.44	221,259	16,565	13.4	277,779
	90°	18.02	216,234	17,432	12.4	275,713
	95°	17.59	211,039	18,357	11.5	273,674
	75°	19.57	234,836	15,036	15.6	286,140
	80°	19.17	230,076	15,789	14.6	283,947
46°	85°	18.76	225,146	16,598	13.6	281,777
	90°	18.34	220,056	17,462	12.6	279,636
	95°	17.90	214,789	18,385	11.7	277,520
	75°	20.26	243,084	15,105	16.1	294,623
	80°	19.85	238,159	15,856	15.0	292,260
48°	85°	19.42	233,084	16,661	14.0	289,930
	90°	18.99	227,834	17,523	13.0	287,624
	95°	18.53	222,419	18,444	12.1	285,349
	75°	20.96	251,529	15,177	16.6	303,313
	80°	20.54	246,441	15,925	15.5	300,778
50 °	85°	20.10	241,199	16,728	14.4	298,275
	90°	19.65	235,792	17,588	13.4	295,801
	95°	19.18	230,214	18,506	12.4	293,357

HEATING PERFORMANCE

Based on 10°F load temp, rise & 48 GPM source fluid flow.

Based on 10°F load temp. Tise & 46 GFW source field flow.								
Leaving	Entering	Heating	Power		Heat of			
Load	Source	Capacity	Input	COP	Absorb.			
Fluid (F)	Fluid (F)	(BtuH)	Watts		(BtuH)			
	35°	217,035	16,970	3.7	159,134			
	40°	231,453	17,089	4.0	173,147			
100°	50°	262,454	17,331	4.4	203,322			
	60°	296,422	17,593	4.9	236,395			
	70°	333,451	17,896	5.5	272,390			
	35°	216,113	18,920	3.3	151,558			
	40°	230,135	19,033	3.5	165,193			
110°	50°	260,236	19,259	4.0	194,525			
	60°	293,163	19,502	4.4	226,623			
	70°	329,013	19,782	4.9	261,516			
	35°	215,248	21,124	3.0	143,175			
	40°	228,884	21,231	3.2	156,445			
120°	50°	258,103	21,440	3.5	184,951			
	60°	290,006	21,662	3.9	216,096			
	70°	324,693	21,919	4.3	249,907			
	35°	214,834	22,328	2.8	138,652			
	40°	228,282	22,430	3.0	151,750			
125°	50°	257,067	22,630	3.3	179,852			
	60°	288,464	22,841	3.7	210,529			
	70°	322,577	23,085	4.1	243,812			
	35°	214,432	23,602	2.7	133,900			
1	40°	227,692	23,702	2.8	146,819			
130°	50°	256,048	23,891	3.1	174,534			
	60°	286,944	24,090	3.5	204,749			
	70°	320,486	24,319	3.9	237,509			

Units are complete packages featuring 2 stage operation and containing refrigeration compressors, reversing valves, expansion valve metering devices and water to refrigerant heat exchangers. Also included are safety controls: Overload protection for compressors, high and low refrigerant pressure switches and a lock-out control circuit

FHP MANUFACTURING

601 N.W. 65th Court Fort Lauderdale, FL 33309 Phone: (954) 776-5471 Fax: (800) 776-5529 http://www.fhp-mfg.com

As a result of continuing research and development, specifications are subject to change without notice.

WP240IP6 P65

Rev:4-01



WATER COOLED CHILLERS AND LOW TEMP BOILERS

SPECIFICATION DATA SHEET

FHP MANUFACTURING ENERGY WISE HVAC EQUIPMENT



ELECTRICAL SPECIFICATIONS

Electrical	Elect.	Compres	sor (Ea)	Min.	Max.
Characteristics	Symbol			Circuit	Fuse
Characteristics	Cyrribor	RLA	LRA	Ampacity	Size
208/230-3-60	-3	41.0	350	92.3	125
460-3-60	-4	23.7	158	49.1	70
575-3-60	-5	17.3	125	38.9	50

FLUID FLOW & PRESSURE DROP

Chilled Fluid S	ide (@ 55°F)	Cond. Fluid Side (@ 85°F)		
Flow (GPM)	ΔP (FOH)	Flow (GPM)	ΔP (FOH)	
54	11.1	54	10.4	
60	13.4	60	12.6	
72	18.6	72	17.5	
84	24.6	84	23.1	
96	31.2	96	29.4	

UNIT WEIGHT

Unit Weight (lbs) 1490 Shipping Weight (lbs) 1510



CHILLER PERFORMANCE

Based on 72 GPM chilled fluid & 10°F condenser fluid temp. rise.

Leaving	Entering	Total	Total	Power		Heat
Chilled	Cond.	Capacity	Capacity	Input	EER	Rejection
Fluid (F)	Fluid (F)	(Tons)	(BtuH)	(Watts)		(BtuH)
	75°	21.22	254,680	17,959	14.2	315,956
	80°	20.84	250,032	18,929	13.2	314,616
40°	85°	20.45	245,449	19,964	12.3	313,566
	90°	20.08	240,908	21,064	11.4	312,779
	95°	19.70	236,350	22,237	10.6	312,221
	75°	21.97	263,584	18,017	14.6	325,060
	80°	21.56	258,713	18,985	13.6	323,489
42°	85°	21.16	253,902	20,016	12.7	322,195
	90°	20.76	249,090	21,118	11.8	321,145
	95°	20.35	244,256	22,290	11.0	320,311
	75°	22.73	272,770	18,076	15.1	334,445
	80°	22.31	267,676	19,040	14.1	332,641
44°	85°	21.89	262,622	20,070	13.1	331,100
	90°	21.46	257,562	21,168	12.2	329,789
	95°	21.04	252,437	22,344	11.3	328,675
	75°	23.12	277,464	18,106	15.3	339,242
	80°	22.69	272,263	19,068	14.3	337,324
45°	85°	22.26	267,091	20,096	13.3	335,659
	90°	21.82	261,896	21,196	12.4	334,215
	95°	21.39	256,640	22,369	11.5	332,963
	75°	23.52	282,236	18,136	15.6	344,115
	80°	23.08	276,928	19,095	14.5	342,081
46°	85°	22.64	271,631	20,123	13.5	340,290
	90°	22.19	266,308	21,221	12.5	338,714
	95°	21.74	260,906	22,396	11.6	337,320
	75°	24.33	291,996	18,196	16.0	354,081
	80°	23.87	286,466	19,152	15.0	351,812
48°	85°	23.41	280,934	20,175	13.9	349,773
	90°	22.95	275,349	21,272	12.9	347,930
	95°	22.47	269,672	22,446	12.0	346,256
	75°	25.17	302,050	18,258	16.5	364,347
	80°	24.69	296,307	19,208	15.4	361,844
50°	85°	24.21	290,533	20,229	14.4	359,553
	90°	23.72	284,692	21,323	13.4	357,445
	95°	23.23	278,732	22,495	12.4	355,486

HEATING PERFORMANCE

Based on 10°F load temp. rise & 72 GPM source fluid flow.

based off to 1 load temp. Tise & 72 of Wisource fluid flow.								
Leaving	Entering	Heating	Power		Heat of			
Load	Source	Capacity	Input	COP	Absorb			
Fluid (F)		(BtuH)	Watts		(BtuH)			
	35°	272,747	20,768	3.8	201,888			
	40°	289,084	20,899	4.1	217,777			
100°	50°	325,293	21,142	4.5	253,157			
	60°	366,491	21,369	5.0	293,582			
	70°	412,986	21,583	5.6	339,344			
	35°	275,298	23,162	3.5	196,269			
	40°	290,523	23,311	3.7	210,986			
110°	50°	324,546	23,575	4.0	244,107			
	60°	363,614	23,801	4.5	282,405			
	70°	408,032	23,999	5.0	326,146			
	35°	278,758	25,851	3.2	190,553			
	40°	292,732	26,031	3.3	203,914			
120°	50°	324,294	26,338	3.6	234,430			
	60°	360,963	26,589	4.0	270,240			
	70°	403,053	26,789	4.4	311,647			
	35°	280,759	27,321	3.0	187,542			
	40°	294,049	27,516	3.1	200,165			
125°	50°	324,278	27,854	3.4	229,240			
	60°	359,649	28,125	3.7	263,685			
	70°	400,475	28,337	4.1	303,788			
	35°	282,893	28,872	2.9	184,381			
	40°	295,469	29,091	3.0	196,209			
130°	50°	324,295	29,467	3.2	223,753			
	60°	358,298	29,766	3.5	256,738			
	70°	397,793	29,994	3.9	295,452			

Units are complete packages featuring 2 stage operation and containing refrigeration compressors, reversing valves, expansion valve metering devices and water to refrigerant heat exchangers. Also included are safety controls: Overload protection for compressors, high and low refrigerant pressure switches and a lock-out control circuit

FHP MANUFACTURING

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WP360IP6 P65

Rev 4-01



WATER COOLED CHILLERS AND LOW TEMP BOILERS

SPECIFICATION DATA SHEET

FHP MANUFACTURING ENERGY WISE HVAC EQUIPMENT



ELECTRICAL SPECIFICATIONS

Electrical	Elect.	lect. Compressor (Ea)			Max.
Characteristics	Symbol	RLA LRA		Circuit	Fuse Size
208/230-3-60	-3	48.1	425	Ampacity 108.2	150
460-3-60	-3	23.8	187	53.3	70
575-3-60	-5	21.8	148	49.1	70
373-3-00	-5	21.0	140	49.1	70

FLUID FLOW & PRESSURE DROP

Chilled Fluid S	side (@ 55°F)	Cond. Fluid Side (@ 85°F)		
Flow (GPM)	ΔP (FOH)	Flow (GPM)	ΔP (FOH)	
54	11.1	54	10.4	
60	13.4	60	12.6	
72	18.6	72	17.5	
84	24.6	84	23.1	
96	31.2	96	29.4	

UNIT WEIGHT

Unit Weight (lbs) 1550 Shipping Weight (lbs) 1570

CHILLER PERFORMANCE

Based on 84 GPM chilled fluid & 10°F condenser fluid temp. rise.

Chilled Cond. Capacity (BtuH) (Watts) EER Rejection (BtuH)	Leaving	Entering	Total	Total	Power		Heat
40° 75° 24.96 299,511 22,433 13.4 376,053 80° 24.42 293,008 23,725 12.3 373,959 85° 23.84 286,110 25,080 11.4 371,683 90° 23.24 278,828 26,502 10.5 369,254 95° 22.60 271,192 27,993 9.7 366,705 75° 25.92 311,038 22,454 13.9 387,651 80° 25.36 304,267 23,748 12.8 385,294 85° 24.76 297,111 25,107 11.8 382,775 90° 24.13 289,592 26,533 10.9 380,123 95° 23.48 281,732 28,030 10.1 377,371 75° 26.91 322,898 22,473 14.4 399,576 80° 26.32 315,858 23,766 13.3 394,168 90° 25.05 300,658 26,559 11	Chilled	Cond.	Capacity	Capacity	Input	EER	Rejection
40° 85° 24.42 293,008 23,725 12.3 373,959 85° 23.84 286,110 25,080 11.4 371,683 90° 23.24 278,828 26,502 10.5 369,254 95° 22.60 271,192 27,993 9.7 366,705 75° 25.92 311,038 22,454 13.9 387,651 80° 25.36 304,267 23,748 12.8 385,294 42° 85° 24.76 297,111 25,107 11.8 382,775 90° 24.13 289,592 26,533 10.9 380,123 95° 23.48 281,732 28,030 10.1 377,371 75° 26.91 322,898 22,473 14.4 399,576 80° 26.32 315,858 23,766 13.3 396,946 90° 25.05 300,688 26,559 11.3 391,277 95° 24.38 292,552 28,06	Fluid (F)	Fluid (F)	(Tons)	(BtuH)	(Watts)		(BtuH)
40° 85° 23.84 286,110 25,080 11.4 371,683 90° 23.24 278,828 26,502 10.5 369,254 95° 22.60 271,192 27,993 9.7 366,705 75° 25.92 311,038 22,454 13.9 387,651 80° 25.36 304,267 23,748 12.8 385,294 42° 85° 24.76 297,111 25,107 11.8 382,775 90° 24.13 289,592 26,533 10.9 380,123 95° 23.48 281,732 28,030 10.1 377,371 75° 26.91 322,898 22,473 14.4 399,576 80° 26.32 315,858 23,766 13.3 391,277 95° 24.38 292,552 28,063 10.4 388,304 45° 26.81 321,765 23,776 13.5 402,889 45° 26.81 321,765 23,77		75°	24.96	299,511	22,433	13.4	376,053
90° 23.24 278,828 26,502 10.5 369,254 95° 22.60 271,192 27,993 9.7 366,705 75° 25.92 311,038 22,454 13.9 387,651 80° 25.36 304,267 23,748 12.8 385,294 85° 24.76 297,111 25,107 11.8 382,775 90° 24.13 289,592 26,533 10.9 380,123 95° 23.48 281,732 28,030 10.1 377,371 75° 26.91 322,898 22,473 14.4 399,576 80° 25.32 315,858 23,766 13.3 396,946 85° 25.70 308,434 25,127 12.3 394,168 90° 25.05 300,658 26,559 11.3 391,277 95° 24.38 292,552 28,063 10.4 388,304 75° 27.41 328,954 22,483 14.6 405,665 80° 26.81 321,765 23,776 13.5 402,889 85° 26.18 314,217 25,136 12.5 399,981 90° 25.53 306,314 26,569 11.5 396,966 95° 24.84 298,074 28,078 10.6 393,875 75° 27.92 335,095 22,492 14.9 411,840 80° 27.31 327,763 23,785 13.8 408,917 86° 26.67 320,069 25,146 12.7 405,869 90° 25.53 303,682 28,089 10.8 399,521 75° 28.97 347,648 22,511 15.4 424,456 80° 28.34 340,023 23,800 14.3 421,229 88° 26.68 315,100 28,114 11.2 411,025 75° 30.05 360,568 22,530 16.0 437,438 80° 29.39 352,627 23,816 14.8 433,888 80° 29.39 352,627 23,816 14.8 433,888 80° 29.39 352,627 23,816 14.8 433,888 80° 29.39 352,627 23,816 14.8 433,888 80° 29.39 352,627 23,816 14.8 433,888 80° 29.39 352,627 23,816 14.8 433,888		80°	24.42	293,008	23,725	12.3	373,959
95° 22.60 271,192 27,993 9.7 366,705 75° 25.92 311,038 22,454 13.9 387,651 80° 25.36 304,267 23,748 12.8 385,294 85° 24.76 297,111 25,107 11.8 382,775 90° 24.13 289,592 26,533 10.9 380,123 95° 23.48 281,732 28,030 10.1 377,371 75° 26.91 322,898 22,473 14.4 399,576 80° 26.32 315,858 23,766 13.3 396,946 85° 25.70 308,434 25,127 12.3 394,168 90° 25.05 300,658 26,559 11.3 391,277 95° 24.38 292,552 28,063 10.4 388,304 75° 27.41 328,954 22,483 14.6 405,665 80° 26.81 314,217 25,136 12.5 3	40°	85°	23.84	286,110	25,080	11.4	371,683
42° 75° 25.92 311,038 22,454 13.9 387,651 80° 25.36 304,267 23,748 12.8 385,294 85° 24.76 297,111 25,107 11.8 382,775 90° 24.13 289,592 26,533 10.9 380,123 95° 23.48 281,732 28,030 10.1 377,371 75° 26.91 322,898 22,473 14.4 399,576 80° 26.32 315,858 23,766 13.3 396,946 85° 25.70 308,434 25,127 12.3 394,168 90° 25.05 300,658 26,559 11.3 391,277 95° 24.38 292,552 28,063 10.4 388,304 75° 27.41 328,954 22,483 14.6 405,665 80° 26.81 314,217 25,136 12.5 399,881 90° 25.53 306,314 26,569 1		90°	23.24	278,828	26,502	10.5	369,254
42° 80° 25.36 304,267 23,748 12.8 385,294 85° 24.76 297,111 25,107 11.8 382,775 90° 24.13 289,592 26,533 10.9 380,123 95° 23.48 281,732 28,030 10.1 377,371 75° 26.91 322,898 22,473 14.4 399,576 80° 26.32 315,858 23,766 13.3 396,946 85° 25.70 308,434 25,127 12.3 394,168 90° 25.05 300,658 26,559 11.3 391,277 95° 24.38 292,552 28,063 10.4 388,304 75° 27.41 328,954 22,483 14.6 405,665 80° 26.81 314,217 25,136 12.5 399,981 90° 25.53 306,314 26,569 11.5 396,966 95° 24.84 298,074 28,078 1		95°	22.60	271,192	27,993	9.7	366,705
42° 85° 24.76 297,111 25,107 11.8 382,775 90° 24.13 289,592 26,533 10.9 380,123 95° 23.48 281,732 28,030 10.1 377,371 75° 26.91 322,898 22,473 14.4 399,576 80° 26.32 315,858 23,766 13.3 396,946 85° 25.70 308,434 25,127 12.3 394,168 90° 25.05 300,658 26,559 11.3 391,277 95° 24.38 292,552 28,063 10.4 388,304 75° 27.41 328,954 22,483 14.6 405,665 80° 26.81 321,765 23,776 13.5 402,889 45° 85° 26.18 314,217 25,136 12.5 399,981 90° 25.53 306,314 26,569 11.5 396,966 95° 24.84 298,074 28,0		75°	25.92	311,038	22,454	13.9	387,651
90° 24.13 289,592 26,533 10.9 380,123 95° 23.48 281,732 28,030 10.1 377,371 75° 26.91 322,898 22,473 14.4 399,576 80° 26.32 315,858 23,766 13.3 396,946 85° 25.70 308,434 25,127 12.3 394,168 90° 25.05 300,658 26,559 11.3 391,277 95° 24.38 292,552 28,063 10.4 388,304 75° 27.41 328,954 22,483 14.6 405,665 80° 26.81 321,765 23,776 13.5 402,889 85° 26.18 314,217 25,136 12.5 399,981 90° 25.53 306,314 26,569 11.5 396,966 95° 24.84 298,074 28,078 10.6 393,875 75° 27.92 335,095 22,492 14.9 411,840 80° 27.31 327,763 23,785 13.8 408,917 46° 85° 26.67 320,069 25,146 12.7 405,869 90° 26.00 312,035 26,580 11.7 402,727 95° 25.31 303,682 28,089 10.8 399,521 75° 28.97 347,648 22,511 15.4 424,456 80° 28.34 340,023 23,800 14.3 421,229 48° 85° 27.67 332,037 25,163 13.2 417,892 90° 26.98 323,723 26,600 12.2 414,481 95° 26.26 315,100 28,114 11.2 411,025 75° 30.05 360,568 22,530 16.0 437,438 80° 29.39 352,627 23,816 14.8 433,888 50° 27.98 335,742 26,616 12.6 426,555		80°	25.36	304,267	23,748	12.8	385,294
PSO	42°	85°	24.76	297,111	25,107	11.8	382,775
44° 75° 26.91 322,898 22,473 14.4 399,576 80° 26.32 315,858 23,766 13.3 396,946 85° 25.70 308,434 25,127 12.3 394,168 90° 25.05 300,658 26,559 11.3 391,277 95° 24.38 292,552 28,063 10.4 388,304 75° 27.41 328,954 22,483 14.6 405,665 80° 26.81 321,765 23,776 13.5 402,889 45° 85° 26.18 314,217 25,136 12.5 399,981 90° 25.53 306,314 26,569 11.5 396,966 95° 24.84 298,074 28,078 10.6 393,875 75° 27.92 335,095 22,492 14.9 411,840 80° 27.31 327,763 23,785 13.8 408,917 46° 85° 26.67 320,069<		90°	24.13	289,592	26,533	10.9	380,123
44° 75° 26.91 322,898 22,473 14.4 399,576 80° 26.32 315,858 23,766 13.3 396,946 85° 25.70 308,434 25,127 12.3 394,168 90° 25.05 300,658 26,559 11.3 391,277 95° 24.38 292,552 28,063 10.4 388,304 75° 27.41 328,954 22,483 14.6 405,665 80° 26.81 321,765 23,776 13.5 402,889 45° 85° 26.18 314,217 25,136 12.5 399,981 90° 25.53 306,314 26,569 11.5 396,966 95° 24.84 298,074 28,078 10.6 393,875 75° 27.92 335,095 22,492 14.9 411,840 80° 27.31 327,763 23,785 13.8 408,917 46° 85° 26.67 320,069<		95°	23.48	281,732	28,030	10.1	377,371
44° 85° 25.70 308,434 25,127 12.3 394,168 90° 25.05 300,658 26,559 11.3 391,277 95° 24.38 292,552 28,063 10.4 388,304 75° 27.41 328,954 22,483 14.6 405,665 80° 26.81 321,765 23,776 13.5 402,889 45° 85° 26.18 314,217 25,136 12.5 399,981 90° 25.53 306,314 26,569 11.5 396,966 95° 24.84 298,074 28,078 10.6 393,875 75° 27.92 335,095 22,492 14.9 411,840 80° 27.31 327,763 23,785 13.8 408,917 46° 85° 26.67 320,069 25,146 12.7 405,869 90° 26.00 312,035 26,580 11.7 402,727 95° 25.31 303,682<		75°	26.91	322,898		14.4	399,576
90° 25.05 300,658 26,559 11.3 391,277 95° 24.38 292,552 28,063 10.4 388,304 75° 27.41 328,954 22,483 14.6 405,665 80° 26.81 321,765 23,776 13.5 402,889 45° 85° 26.18 314,217 25,136 12.5 399,981 90° 25.53 306,314 26,569 11.5 396,966 95° 24.84 298,074 28,078 10.6 393,875 75° 27.92 335,095 22,492 14.9 411,840 80° 27.31 327,763 23,785 13.8 408,917 85° 26.67 320,069 25,146 12.7 405,869 90° 26.00 312,035 26,580 11.7 402,727 95° 25.31 303,682 28,089 10.8 399,521 75° 28.97 347,648 22,511 15.4 424,456 80° 28.34 340,023 23,800 14.3 421,229 48° 85° 27.67 332,037 25,163 13.2 417,892 90° 26.98 323,723 26,600 12.2 414,481 95° 26.26 315,100 28,114 11.2 411,025 75° 30.05 360,568 22,530 16.0 437,438 80° 29.39 352,627 23,816 14.8 433,888 50° 27.98 335,742 26,616 12.6 426,555		80°	26.32	315,858	23,766	13.3	396,946
95° 24.38 292,552 28,063 10.4 388,304 75° 27.41 328,954 22,483 14.6 405,665 80° 26.81 321,765 23,776 13.5 402,889 45° 85° 26.18 314,217 25,136 12.5 399,981 90° 25.53 306,314 26,569 11.5 396,966 95° 24.84 298,074 28,078 10.6 393,875 75° 27.92 335,095 22,492 14.9 411,840 80° 27.31 327,763 23,785 13.8 408,917 46° 85° 26.67 320,069 25,146 12.7 405,869 90° 26.00 312,035 26,580 11.7 402,727 95° 25.31 303,682 28,089 10.8 399,521 75° 28.97 347,648 22,511 15.4 424,456 80° 28.34 340,023 23,8	44°	85°	25.70	308,434	25,127	12.3	
45° 27.41 328,954 22,483 14.6 405,665 80° 26.81 321,765 23,776 13.5 402,889 45° 85° 26.18 314,217 25,136 12.5 399,981 90° 25.53 306,314 26,569 11.5 396,966 95° 24.84 298,074 28,078 10.6 393,875 75° 27.92 335,095 22,492 14.9 411,840 80° 27.31 327,763 23,785 13.8 408,917 46° 85° 26.67 320,069 25,146 12.7 405,869 90° 26.00 312,035 26,580 11.7 402,727 95° 25.31 303,682 28,089 10.8 399,521 75° 28.97 347,648 22,511 15.4 424,456 80° 28.34 340,023 23,800 14.3 421,229 48° 85° 27.67 332,037<		90°	25.05	300,658	26,559	11.3	391,277
45° 80° 26.81 321,765 23,776 13.5 402,889 90° 26.18 314,217 25,136 12.5 399,981 90° 25.53 306,314 26,569 11.5 396,966 95° 24.84 298,074 28,078 10.6 393,875 75° 27.92 335,095 22,492 14.9 411,840 80° 27.31 327,763 23,785 13.8 408,917 46° 85° 26.67 320,069 25,146 12.7 405,869 90° 26.00 312,035 26,580 11.7 402,727 95° 25.31 303,682 28,089 10.8 399,521 75° 28.97 347,648 22,511 15.4 424,456 80° 28.34 340,023 23,800 14.3 421,229 48° 85° 27.67 332,037 25,163 13.2 417,892 90° 26.98 323,723<		95°	24.38	292,552	28,063	10.4	388,304
45° 26.81 321,765 23,776 13.5 402,889 85° 26.18 314,217 25,136 12.5 399,981 90° 25.53 306,314 26,569 11.5 396,966 95° 24.84 298,074 28,078 10.6 393,875 75° 27.92 335,095 22,492 14.9 411,840 80° 27.31 327,763 23,785 13.8 408,917 46° 85° 26.67 320,069 25,146 12.7 405,869 90° 26.00 312,035 26,580 11.7 402,727 95° 25.31 303,682 28,089 10.8 399,521 75° 28.97 347,648 22,511 15.4 424,456 80° 28.34 340,023 23,800 14.3 421,229 48° 85° 27.67 332,037 25,163 13.2 417,892 90° 26.98 323,723 26,6		75°	27.41	328,954	22,483	14.6	405,665
90° 25.53 306,314 26,569 11.5 396,966 95° 24.84 298,074 28,078 10.6 393,875 75° 27.92 335,095 22,492 14.9 411,840 80° 27.31 327,763 23,785 13.8 408,917 46° 85° 26.67 320,069 25,146 12.7 405,869 90° 26.00 312,035 26,580 11.7 402,727 95° 25.31 303,682 28,089 10.8 399,521 75° 28.97 347,648 22,511 15.4 424,456 80° 28.34 340,023 23,800 14.3 421,229 48° 85° 27.67 332,037 25,163 13.2 417,892 90° 26.98 323,723 26,600 12.2 414,481 95° 26.26 315,100 28,114 11.2 411,025 75° 30.05 360,568 22,5		80°	26.81	321,765	23,776	13.5	
90° 25.53 306,314 26,569 11.5 396,966 95° 24.84 298,074 28,078 10.6 393,875 75° 27.92 335,095 22,492 14.9 411,840 80° 27.31 327,763 23,785 13.8 408,917 85° 26.67 320,069 25,146 12.7 405,869 90° 26.00 312,035 26,580 11.7 402,727 95° 25.31 303,682 28,089 10.8 399,521 75° 28.97 347,648 22,511 15.4 424,456 80° 28.34 340,023 23,800 14.3 421,229 48° 85° 27.67 332,037 25,163 13.2 417,892 90° 26.98 323,723 26,600 12.2 414,481 95° 26.26 315,100 28,114 11.2 411,025 75° 30.05 360,568 22,530 1	45°	85°	26.18	314,217	25,136	12.5	399,981
46° 27.92 335,095 22,492 14.9 411,840 80° 27.31 327,763 23,785 13.8 408,917 85° 26.67 320,069 25,146 12.7 405,869 90° 26.00 312,035 26,580 11.7 402,727 95° 25.31 303,682 28,089 10.8 399,521 75° 28.97 347,648 22,511 15.4 424,456 80° 28.34 340,023 23,800 14.3 421,229 90° 26.98 323,723 26,600 12.2 414,481 95° 26.26 315,100 28,114 11.2 411,025 75° 30.05 360,568 22,530 16.0 437,438 80° 29.39 352,627 23,816 14.8 433,888 50° 28.69 344,339 25,178 13.7 430,247 90° 27.98 335,742 26,616 12.6		90°	25.53	306,314	26,569	11.5	
46° 80° 27.31 327,763 23,785 13.8 408,917 85° 26.67 320,069 25,146 12.7 405,869 90° 26.00 312,035 26,580 11.7 402,727 95° 25.31 303,682 28,089 10.8 399,521 75° 28.97 347,648 22,511 15.4 424,456 80° 28.34 340,023 23,800 14.3 421,229 90° 26.98 323,723 26,600 12.2 414,481 95° 26.26 315,100 28,114 11.2 411,025 75° 30.05 360,568 22,530 16.0 437,438 80° 29.39 352,627 23,816 14.8 433,888 50° 28.69 344,339 25,178 13.7 430,247 90° 27.98 335,742 26,616 12.6 426,555		95°	24.84	298,074	28,078	10.6	393,875
46° 85° 26.67 320,069 25,146 12.7 405,869 90° 26.00 312,035 26,580 11.7 402,727 95° 25.31 303,682 28,089 10.8 399,521 75° 28.97 347,648 22,511 15.4 424,456 80° 28.34 340,023 23,800 14.3 421,229 90° 26.98 323,723 25,163 13.2 417,892 90° 26.98 323,723 26,600 12.2 414,481 95° 26.26 315,100 28,114 11.2 411,025 75° 30.05 360,568 22,530 16.0 437,438 80° 29.39 352,627 23,816 14.8 433,888 50° 28.69 344,339 25,178 13.7 430,247 90° 27.98 335,742 26,616 12.6 426,555		75°	27.92	335,095	22,492	14.9	411,840
90° 26.00 312,035 26,580 11.7 402,727 95° 25.31 303,682 28,089 10.8 399,521 75° 28.97 347,648 22,511 15.4 424,456 80° 28.34 340,023 23,800 14.3 421,229 48° 85° 27.67 332,037 25,163 13.2 417,892 90° 26.98 323,723 26,600 12.2 414,481 95° 26.26 315,100 28,114 11.2 411,025 75° 30.05 360,568 22,530 16.0 437,438 80° 29.39 352,627 23,816 14.8 433,888 50° 28.69 344,339 25,178 13.7 430,247 90° 27.98 335,742 26,616 12.6 426,555		80°	27.31	327,763	23,785	13.8	408,917
90° 26.00 312,035 26,580 11.7 402,727 95° 25.31 303,682 28,089 10.8 399,521 75° 28.97 347,648 22,511 15.4 424,456 80° 28.34 340,023 23,800 14.3 421,229 90° 26.98 323,723 25,163 13.2 417,892 90° 26.98 323,723 26,600 12.2 414,481 95° 26.26 315,100 28,114 11.2 411,025 75° 30.05 360,568 22,530 16.0 437,438 80° 29.39 352,627 23,816 14.8 433,888 50° 28.69 344,339 25,178 13.7 430,247 90° 27.98 335,742 26,616 12.6 426,555	46°	85°	26.67	320,069	25,146	12.7	405,869
48° 28.97 347,648 22,511 15.4 424,456 80° 28.34 340,023 23,800 14.3 421,229 48° 85° 27.67 332,037 25,163 13.2 417,892 90° 26.98 323,723 26,600 12.2 414,481 95° 26.26 315,100 28,114 11.2 411,025 75° 30.05 360,568 22,530 16.0 437,438 80° 29.39 352,627 23,816 14.8 433,888 50° 85° 28.69 344,339 25,178 13.7 430,247 90° 27.98 335,742 26,616 12.6 426,555		90°	26.00	312,035	26,580	11.7	402,727
48° 80° 28.34 340,023 23,800 14.3 421,229 85° 27.67 332,037 25,163 13.2 417,892 90° 26.98 323,723 26,600 12.2 414,481 95° 26.26 315,100 28,114 11.2 411,025 75° 30.05 360,568 22,530 16.0 437,438 80° 29.39 352,627 23,816 14.8 433,888 85° 28.69 344,339 25,178 13.7 430,247 90° 27.98 335,742 26,616 12.6 426,555		95°	25.31	303,682	28,089	10.8	399,521
48° 85° 27.67 332,037 25,163 13.2 417,892 90° 26.98 323,723 26,600 12.2 414,481 95° 26.26 315,100 28,114 11.2 411,025 75° 30.05 360,568 22,530 16.0 437,438 80° 29.39 352,627 23,816 14.8 433,888 50° 85° 28.69 344,339 25,178 13.7 430,247 90° 27.98 335,742 26,616 12.6 426,555		75°	28.97	347,648	22,511	15.4	424,456
90° 26.98 323,723 26,600 12.2 414,481 95° 26.26 315,100 28,114 11.2 411,025 75° 30.05 360,568 22,530 16.0 437,438 80° 29.39 352,627 23,816 14.8 433,888 50° 85° 28.69 344,339 25,178 13.7 430,247 90° 27.98 335,742 26,616 12.6 426,555		80°	28.34	340,023	23,800	14.3	421,229
95° 26.26 315,100 28,114 11.2 411,025 75° 30.05 360,568 22,530 16.0 437,438 80° 29.39 352,627 23,816 14.8 433,888 50° 85° 28.69 344,339 25,178 13.7 430,247 90° 27.98 335,742 26,616 12.6 426,555	48°	85°	27.67	332,037	25,163	13.2	417,892
95° 26.26 315,100 28,114 11.2 411,025 75° 30.05 360,568 22,530 16.0 437,438 80° 29.39 352,627 23,816 14.8 433,888 50° 28.69 344,339 25,178 13.7 430,247 90° 27.98 335,742 26,616 12.6 426,555	1	90°					
75° 30.05 360,568 22,530 16.0 437,438 80° 29.39 352,627 23,816 14.8 433,888 50° 85° 28.69 344,339 25,178 13.7 430,247 90° 27.98 335,742 26,616 12.6 426,555		95°	26.26				
80° 29.39 352,627 23,816 14.8 433,888 50° 85° 28.69 344,339 25,178 13.7 430,247 90° 27.98 335,742 26,616 12.6 426,555		75°		360,568		16.0	437,438
50° 85° 28.69 344,339 25,178 13.7 430,247 90° 27.98 335,742 26,616 12.6 426,555		80°					
90° 27.98 335,742 26,616 12.6 426,555	50°	85°	28.69				
		95°	27.24	326,849	28,133		422,838

HEATING PERFORMANCE

Based on 10°F load temp. rise & 84 GPM source fluid flow.

Landa	Cotorie -	Hooting	Device		Heat of
Leaving	Entering	Heating	Power	000	
Load	Source	Capacity	Input	COP	Absorb.
Fluid (F)	Fluid (F)	(BtuH)	Watts		(BtuH)
	35°	316,794	26,266	3.5	227,173
'	40°	338,625	26,388	3.8	248,590
100°	50°	385,537	26,546	4.3	294,964
	60°	437,388	26,627	4.8	346,536
	70°	494,860	26,677	5.4	403,837
	35°	314,542	29,219	3.2	214,847
	40°	335,924	29,392	3.3	235,640
110º	50°	381,607	29,630	3.8	280,510
	60°	431,811	29,755	4.3	330,288
	70°	487,235	29,813	4.8	385,512
	35°	311,785	32,434	2.8	201,118
	40°	332,856	32,679	3.0	221,355
120°	50°	377,588	33,032	3.4	264,881
	60°	426,412	33,236	3.8	313,010
	70°	480,053	33,337	4.2	366,306
	35°	310,292	34,151	2.7	193,770
	40°	331,259	34,440	2.8	213,752
125°	50°	375,621	34,862	3.2	256,673
	60°	423,859	35,118	3.5	304,038
	70°	476,704	35,254	4.0	356,417
	35°	308,767	35,943	2.5	186,129
	40°	329,667	36,278	2.7	205,885
130°	50°	373,727	36,778	3.0	248,240
	60°	421,443	37,098	3.3	294,865
	70°	473,561	37,277	3.7	346,372

Units are complete packages featuring 2 stage operation and containing refrigeration compressors, reversing valves, expansion valve metering devices and water to refrigerant heat exchangers. Also included are safety controls: Overload protection for compressors, high and low refrigerant pressure switches and a lock-out control circuit.

FHP MANUFACTURING

601 N.W. 65th Court Fort Lauderdale, FL 33309 Phone: (954) 776-5471 Fax: (800) 776-5529 http://www.fhp-mfg.com

As a result of continuing research and development, specifications are subject to change without notice.

WP420IP6.P65

Rev:4-01

1.2.2) Domestic Water Heater

FLORIDA HEAT PUMP WATER TO WATER DOMESTIC WATER HEATER

Hermetic compressor. Load side double wall heat exchanger. Expansion valve. High and low refrigerant pressure switches and lockout impedance relay. Insulated heat exchangers and refrigerant lines. Pump relay. Low pressure time delay relay. Low voltage terminal strip. Finished in beige.

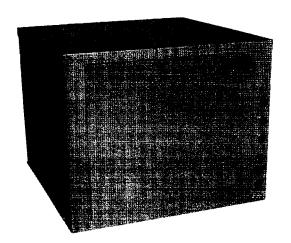
ELECTRICAL SPECIFICATIONS

ELECTRICAL	ELECTR.	COMPR	ESSOR	PUMP	TOTAL	MIN. CIRCUIT	FUSE (T/D) HACR
CHARACTERISTICS	SYM	RLA	LRA	FLA FLA (1) (2)		AMPACITY (3)	CIRCUIT BREAKER (2)
115-1-60	-0	16.2	62	5.0	21.2	20 3	35
208/230-1-60	-1	7.6	33	2.5	10 1	9.5	15
265-1-60	-2	6.9	26	1.5	7.4	8.6	15

NOTES: (1) Maxium pump FLA: 5 amps at 115V, 2.5 amps at 230V, 1.5 amps at 265V

(2) includes Pump FLA.

(3) Does not include Pump FLA



HEATING (All BTUH in Thousands)

Entering Source Temp *F	Entering Tank Temp F	Water Heating Capacity BTUH	Heat Of Absorbtion BTUH	Power Input Watts	C O P.
	40	12.3	10.3	575	6.30
	60	11.1	8.8	680	4.80
25	80	8.7	6.2	735	3.50
	100	7.4	4.3	910	2.40
	120	6.2	2.5	1070	1.70
	40	14.1	12.2	550	7.50
١	60	12.9	10.7	620	6.10
45	80	11.7	9.0	785	4.40
	100	10.2	7.2	880	3.30
	120	9.1	5.8	950	2.80
	40	18.5	16.1	675	8.00
	60	17.2	14.8	700	7.20
65	80	15.1	12.2	850	5.20
	100	13.0	9.9	905	4.20
	120	12.1	8.7	985	3.60
	40	22.3	20.1	645	10.10
	60	21.1	18.6	710	8.70
85	80	18.0	15.3	790	6.70
	100	16.1	13.1	875	5.40
	120	15.2	12.0	930	4.80
	40	26.3	23.9	675	11.40
	60	25.2	22.6	740	10.00
105	80	23.4	20.5	835	8.20
	100	21.3	18.2	890	7.00
	120	20.4	17.2	920	6.50

NOTE: Performance based on 3.00 GPM flow on both source and tank sides. Source fluid 15% methanol by volume.

At 105' entering source temperature - maximum source flow is 3.0 GPM

CORRECTION FACTORS FOR VARIATION IN ENTERING FLUID FLOW

GPM	CAPACITY	WATTS
1.5	.93	1. <u>20</u>
3.0	1.00	1.00
5.0	1.07	.80

FLUID FLOW PRESSURE DROP

1 2015 1 2017 1 112000112 21101												
GPM	LOAD Pressure Drop (Ft. of Hd.)	SOURCE Pressure Drop (Ft of Hd)										
1.5	3.5	7.4										
3.0	6.9	11.9										
5.0	11.6	24.1										

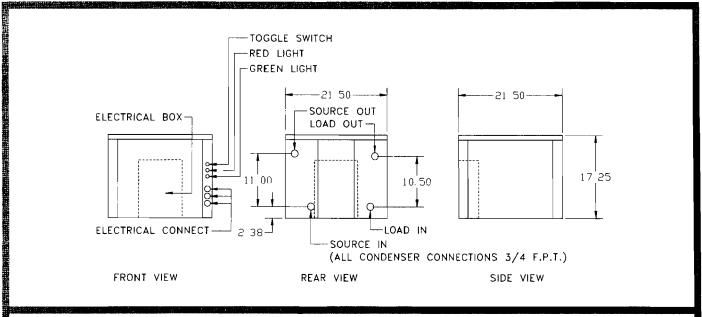
RECOVERY RATE

Approximate Recovery Rate In Hours	= (Tank Capacity)(8.33 Lbs/Gal)(TankΔT)(1 BTU/Lb *F) Average Heat Pump Capacity BTUH
	= BTUH BTUH
	= Hours
Example	How long will it take 50 gallons of tank water to heat from 60 F to 120 F with 3 GPM of 65 F entering source temperature fluid?
Approximate Recovery Rate	= \frac{(50) (8.33) (60) (1)}{17,200}
	= 24,990 BTU 17,200 BTUH
	= 145 Hours

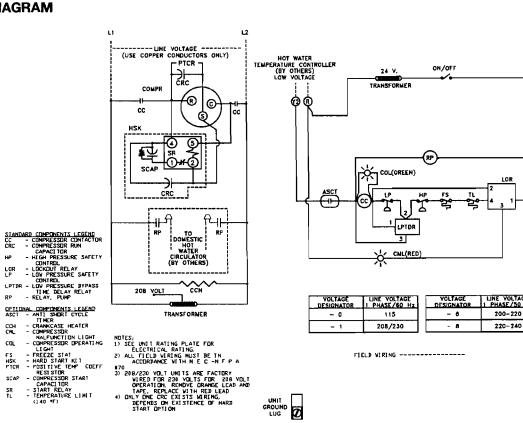


WH018

PHYSICAL CHARACTERISTICS



WIRING DIAGRAM





LOR LP

FHP MANUFACTURING

601 N.W. 65th COURT FT. LAUDERDALE, FL 33309 PHONE: (954) 776-5471 FAX: 776-5529 http://www.fhp-mfg.com

As a result of continuing research and development, all ratings and specifications are subject to change without notice Rev. 1/96 1.3) Carrier - 50RWS Series

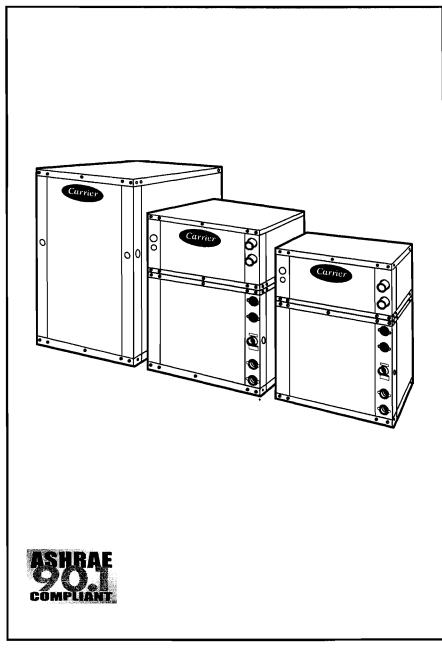


Product Data

50RWS Water-to-Water Source Heat Pumps

3 to 10 Nominal Tons





Features/Benefits

Carrier's Aquazone™ Waterto-Water source heat pumps are a flexible solution for tempering ventilation air. Aquazone water-to-water units can also be used in hydronic applications as a stand-alone boiler/chiller.

- Performance certified to ARI/ISO/ ASHRAE 13256-2
- Provides both chilled and hot water for a variety of applications
- Dual refrigerant circuits for 2-stage operation (50RWS120)
- High efficiency scroll compressors
- Thermostatic expansion valve (TXV) provides efficient and reliable refrigerant flow
- Available mute package for quiet operation
- Standard low temperature insulation for extended range operation
- Stackable, space-saving cabinets designed for applications with space limitation
- Flexible and reliable controls accommodate all systems

Operating efficiency

Carrier's Aquazone Water-to-Water Source Heat Pumps (WSHP) are designed for quality and high performance over a lifetime of operation. Aquazone units offer cooling EERs (Energy Efficiency Ratio) to 14.3 and heating COPs (Coefficient of Performance) to 5.0. Efficiencies stated are in accordance with standard conditions under ISO (International Organization for Standardization) Standard 13256-2 and provide among the highest ratings in the industry, exceeding ASHRAE (American Society of Heating, Refrigerant and Air Conditioning Engineers) 90.1 Energy Standards.

Form 50RWS-1PD



High quality construction and testing

All units are manufactured to meet extensive quality control protocol from start to finish through an automated control system, which provides continuous monitoring of each unit and performs quality control checks as equipment progresses through the production process. Standard construction features of the Carrier Aquazone™ units include:

Cabinet — Standard unit fabrication consists of heavy gage galvanized sheet metal cabinet construction that provides maximum strength. Cabinet interior surfaces are lined with $^{1}/_{2}$ in. thick, $1^{1}/_{2}$ lb. acoustic type insulation. All exterior sheet metal surfaces are powder-painted for maximum corrosion protection to ensure resilience for long term vitality. Compact, stackable cabinets are designed to minimize installation space.

Compressor — Standard high efficiency scroll compressor design for all units. Compressor isolating springs are specially selected for each compressor size. The external isolating springs are mounted on an isolated railing system to minimize vibrations to the unit structure.

Refrigeration/water circuit —

Units have a sealed refrigerant circuit including scroll compressor(s). Refrigerant circuits are provided with a standard thermostatic expansion valve (TXV) for higher accuracy and performance. Also standard are a reversing valve (4-way valve), load and source water-to-refrigerant coaxial (tube in tube) coils.

ARI/ISO — Aquazone™ units have ARI (Air Conditioning & Refrigeration Institute)/ISO, NRTL (Nationally Recognized Testing Lab), or CSA (Canadian Standards Association) labels and are factory tested under normal operating conditions at nominal water flow rates. Quality assurance is provided via testing report cards shipped with each unit to indicate specific unit performance under cooling and heating modes of operation. Water source heat pumps are New York City MEA (Materials Equipment and Acceptance) 60-00-E rated.

Quiet operation

Compressor springs are provided for sound isolation and cabinets are fully insulated to reduce noise transmission.

Design flexibility

Extended water temperature range between 20 F and 110 F offers maximum design flexibility for all applications. Water flow rates as low as 1.5 gpm per ton assist with selection from a various range of circulating pumps. Factory-installed options are offered to meet specific design requirements.

Safe, reliable operation

Standard safety features for the refrigerant circuit include high-pressure switch and low-pressure sensor to detect loss of refrigerant. Equipment safety features include water loop temperature monitoring, voltage protection, water coil freeze protection. All safety features are tested and run at the factory to assure proper operation of all components and safety switches.

All components are carefully designed and selected for endurance, durability, and carefree day-to-day operation.

The unit is shipped to provide internal and external equipment protection. Shipping supports are placed under the compressor feet.

Ease of installation

The unit is packaged for simple low cost handling, with minimal time required for installation. All units are pre-wired and factory charged with refrigerant. Water connections (FPT), high and low voltage knockouts along with a stackable design reduce installation time and minimize floor space.









As an Energy Star Partner, Carrier Corporation has determined that this product meets the ENERGY STAR guidelines for energy efficiency

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Features/Benefits (cont)



Access for maintenance or service is provided from three sides of the unit for better flexibility in confined spaces. Large access panels on each side of the unit and control box maximize exposure for all components. Easy removal of the control box from the unit provides access to all refrigeration components. The refrigeration circuit is easily tested and serviced through the use of high and low pressure ports integral to the refrigeration circuit.

Maximum control flexibility

Aquazone™ water source heat pumps provide reliable control operation using a standard microprocessor board with flexible alternatives for many direct digital control (DDC) applications including the Carrier Comfort Network (CCN) and open protocol systems.

Carrier's Aquazone standard unit solid-state control system, the Complete C, provides control of the unit compressor, reversing valve, fan, safety features, and troubleshooting fault indication features. The Complete C is one of the most user friendly, low cost, and advanced control boards found in the WSHP industry. Many features are field selectable to provide the ultimate in field installation flexibility. The overall features of this standard control system include:

75 VA transformer — Assists in accommodating accessory loads.

Anti-short cycle timer — Provides a minimum off time to prevent the unit from short cycling. The 5-minute timer energizes when the compressor is deenergized, resulting in a 5-minute delay before the unit can be restarted.

Random start relay — Ensures a random delay in energizing each different WSHP unit. This option minimizes peak electrical demand during start-up from different operating modes or after building power outages.

High and low pressure refrigerant protection — Safeguards against

unreliable unit operation and prevents refrigerant from leaking.

High and low voltage protection— Safety protection in the case of excessive or low voltage conditions.

Automatic intelligent reset — Unit shall automatically restart 5 minutes after shutdown if the fault has cleared. Should a fault occur 3 times sequentially, then lockout will occur.

Accessory output — 24 V output is provided to cycle a motorized water valve, damper actuator, etc. with compressor for applications such variable speed and primary secondary pumping arrangements.

Performance Monitor (PM) -

Unique feature monitors water temperatures to warn when the heat pump is operating inefficiently or beyond typical operating range. Field selectable switch initiates a warning code on the unit display.

Water coil freeze protection (selectable for water or antifreeze) — Field selectable switch for water and water/glycol solution systems initiates a fault when temperatures exceed the selected limit for 30 continuous seconds.

Alarm relay setting — Selectable 24 V or pilot duty dry contact for providing activation of a remote alarm.

Service test mode with diagnostic LED (light-emitting diode) — The

Test mode allows service personnel to check the operation of the WSHP and control system efficiently. Upon entering Test mode, time delays are sped up and the Status LED will flash a code to indicate the last fault experienced for easy diagnosis. Based on the fault code flashed by the status LED, system diagnostics are assisted through the use of Carrier provided troubleshooting tables for easy reference to typical problems.

LED visual output — An LED panel indicates high pressure, low pressure, low voltage, high voltage, air/water freeze protection, condensate overflow, and control status.



Carrier PremierLink™ controller adds reliability, efficiency, and simplification

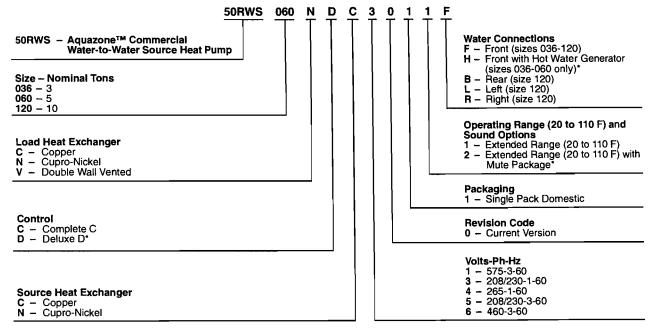
The PremierLink direct digital controller can be ordered as a factory-installed option. Designed and manufactured exclusively by Carrier, the controller can be used to actively monitor and control all modes of operation as well as monitor the following diagnostics and features: unit number, zone temperature, zone set point, zone humidity set point, discharge air temperatures, fan status, stages of heating, stages of cooling, outdoor-air temperature, leaving water temperature, alarm status, and alarm lockout condition.

This controller has a 38.4K baud communications capability and is compatible with ComfortLink™ Controls, CCN and ComfortVIEW™ Software. The Scrolling Marquee and Navigator are optional tools that can be used for programming and monitoring the unit for optimal performance. The addition of the Carrier CO2 sensor in the conditioned space provides ASHRAE 62-99 compliance and Demand Control Ventilation (DCV). A DCV control strategy is especially beneficial for a water source heat pump system to minimize the energy utilized to condition ventilation air. In combination with energy efficient Aquazone units, DCV may be the most energy efficient approach ever developed for a water source heat pump system.

The PremierLink peer-to-peer, Internet ready communicating control is designed specifically for Constant Volume and Variable Volume and Temperature applications. This comprehensive controls system allows water source heat pumps to be linked together to create a fully functional HVAC (heating, ventilation, and air conditioning) automation system.

Model number nomenclature





^{*}Factory-installed option.

Options and accessories

Factory-installed options

Sound attenuation package (mute package) is available for applications that require especially low noise levels. With this option, a double application of sound attenuating material is applied. Access panels are double dampened with $^{1}/_{2}$ -in. thick density fiberglass insulation. The mute package in combination with standard unit noise reduction features provides high levels of noise reduction.

Water connection can be on left, right, or back of unit (50RWS120).

Heat exchanger options are available for both the load and source coaxial heat exchangers. The source heat exchanger is available in cupronickel and the load heat exchanger is available in either cupronickel or double walled vented.

Deluxe D control system provides the same functions as the standard Complete C while incorporating additional functions to include:

Thermostat input capabilities — Accommodates emergency shutdown mode and night setback with override (NSB) potential. Night setback from low temperature thermostat with 2-hour override is initiated by a momentary signal from the thermostat.

<u>Compressor relay staging</u> — Used with dual stage units (units with 2 compressors and 2 D controls) or in master/slave applications.

<u>Boilerless electric heat control system</u> — Allows automatic changeover to electric heat at low loop water temperature.

<u>Intelligent reversing valve operation</u> — Minimizes reversing valve operation for extended life and quiet operation.

Thermostat type select (Y, O or Y, W) — Provides ability to work and select heat pump or heat/cool thermostats (Y, W).

Reversing valve signal select (O or B) — Provides selection for heat pump O/B thermostats.

<u>Dehumidistat input</u> — Provides operation of fan control for dehumidification operation.

<u>Multiple units on one thermostat/wall sensor</u> — Provides for communication for up to three heat pumps on one thermostat.

<u>Boilerless changeover temperature</u> — Provides selection of boilerless changeover temperature set point.

Accessory relays — Allow configuration for multiple applications including fan and compressor cycling, digital night setback (NSB), mechanical night setback, water valve operation, and outside air damper operation.

PremierLink™ controller is compatible with the Carrier Comfort Network (CCN) and other building automation systems (BAS). This control is designed to allow users the access and ability to change factory-defined settings, thus expanding the function of the standard unit.

Field-installed accessories

Carrier's line of Aquazone™ thermostats are both attractive and multi-functional, accommodating standalone water source heat pump installations.

Programmable 7-day thermostat — Offers 2-stage heat, 2-stage cool, auto changeover, 7-day programmable with copy command, 4 settings per day, fully electronic, 24 vac, backlit LCD, keypad lockout, no batteries required, 5-minute compressor protection, NEVERLOST™ memory, 3 security levels, temperature display in degrees F or C



Programmable 7-day light-activated thermostat — Offers same features as the 7-day programmable thermostat adding occupied comfort settings with lights on and unoccupied energy savings with lights off.

Programmable 7-day flush-mount thermostat — Offers same features as the 7-day programmable thermostat and includes locking coverplate with tamper proof screws, flush to wall mount, holiday/vacation programming, set point limiting, dual point with adjustable deadband, O or B terminal, and optional wall or duct mounted remote sensor.

Programmable 5-day thermostat — Offers 2-stage heat, 2-stage cool, auto changeover, 5-minute built-in compressor protection, locking cover included, temperature display in degrees F or C, keypad lockout, backlit display, 5-1-1 programming, O or B terminal, dual set point with adjustable deadband, configurable display, self-prompting program, 4 settings per day.

Non-programmable thermostat — Offers 2 heat stages, 2 cool stages, auto changeover, 5-minute built in compressor protection, locking cover included, temperature display in degrees F or C, keypad lockout, large display, back-lit display, O or B terminal, dual set point with adjustable deadband, backplate with terminals.

Loop controller with six stages (2 stages for heating and 4 stages for heat rejection) includes:

- Loop temperature alarms
- Two pump single loop flow monitoring with the ability to manually select the lead pump
- One common alarm signal with indicating light and one audible alarm
- Loop water temperature sensor test circuit
- Functional test simulation from operator keypad
- Real timeclock, industrial noise ratings
- Loop water temperature control switch
- Loop controller with six stages (2 stages for heating and 4 stages for cooling)

Remote sensors are available for Aquazone flush mount thermostats. Available sensors are for wall (wired and wireless) or duct mounted applications.

PremierLink accessories are available for providing a fully integrated WSHP DDC system. Accessories include supply air temperature sensors (with override and/or set point adjustment), communicating room sensors, CO₂ sensors (for use in demand control ventilation), and linkage thermostats (to control multiple units from one thermostat).

Fire-rated hose is 2 ft long and has a fixed MPT on one end and a swivel with an adapter on the other end. Hose kits are provided with both a supply and return hose and can be either stainless steel or galvanized. Five sizes are available $(1/2, 3/4, 1, 1^1/4, 1^1/2 \text{ in.})$.

Ball valves (brass body) used for shut off and balancing water flow. Available with memory, memory stop, and pressure temperature ports. UL-listed brass body, ball and stem type with Teflon seats and seals. Five sizes are available $(\frac{1}{2}, \frac{3}{4}, 1, \frac{11}{4}, \frac{11}{2}$ in.).

Y strainers (bronze body) are "Y" type strainers with a brass cap. Maximum operating pressure rating of 450 psi. Strainer screen made of stainless steel. Available with blow down valves. Four sizes are available $(^{3}/_{4}, 1, 1^{1}/_{4}, 1^{1}/_{2} \text{ in.})$.

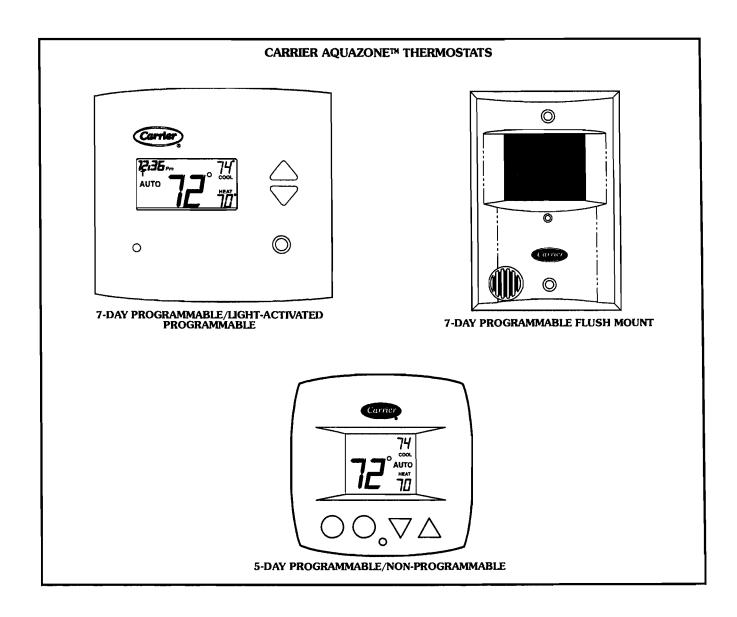
Options and accessories (cont)



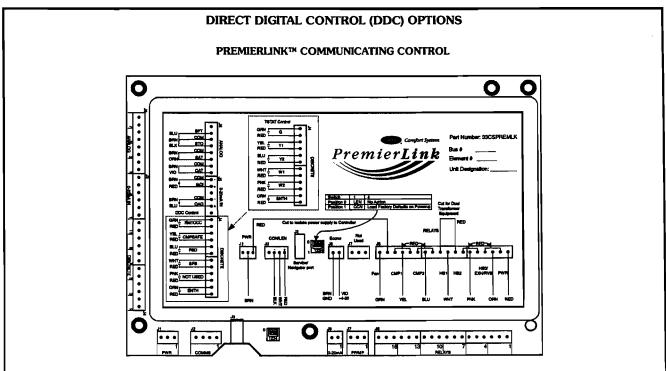
Solenoid valves (brass body) offer 3.5 watt coil, 24 volt, 50/60 Hz, 740 amps inrush, .312 amps holding. Slow operation or quiet system application. Four sizes are available ($^{3}/_{4}$, 1, $^{1}/_{4}$, $^{1}/_{2}$ in.).

Hose kit assemblies provide all the necessary components to hook up a water-side system. Supply hose includes

a ported ball valve with pressure temperature (P/T) plug ports, flexible stainless steel hose with swivel and nipple. Return hose includes a ball valve, preset automatic balancing valve (gpm) with two P/T ports, flexible stainless steel hose with a swivel and nipple, balancing valve, and low-pressure drop water control valve.







ARI capacity ratings



50RWS WATER LOOP APPLICATIONS

		_	EW	T			
UNIT 50RWS	GPM	Co	ooling	Heating			
5011175		TC	EER Btuh/W	TC	COP		
036	9.0	29,000	14.3	43,000	5.0		
060	15.0	44,400	12.0	63,300	4.2		
120	30.0	88,600	11.6	126,900	4.1		

Coefficient of Performance
Energy Efficiency Ratio
Entering Water Temperature (F) GPM - Gallons per minute EER TC - Total Capacity

NOTES:

Cooling EWT based on load coil temperature of 53.6 F and source coil temperature of 86 F. Heating EWT based on load coil temperature of 104 F and source coil temperature of 68 F. Certified in accordance with the ARI/ISO/ASHRAE Standard 13256-2 certification program

All ratings based upon 208 v operation.

50RWS GROUND WATER APPLICATIONS

			EWT			
UNIT 50RWS	GPM	Co	ooling	Heating		
JUNITS		TC	EER Btuh/W	TC	COP	
036	9.0	31,200	20.6	33,400	4.0	
060	15.0	49,200	17.5	53,000	3.5	
120	30.0	98,100	16.9	106,200	3.5	

GPM — Gallons per minute TC — Total Capacity COP — Coefficient of Performance EER — Energy Efficiency Ratio EWT — Entering Water Temperature (F)

- Cooling EWT based on load coil temperature of 53 6 F and source coil temperature of 59 F. Heating EWT based on load coil temperature of 104 F and source coil temperature of 50 F. Certified in accordance with the ARI/ISO/ASHRAE Standard 13256-2 certification program.

All ratings based upon 208 v operation.

50RWS GROUND LOOP APPLICATIONS

	_	EWT											
UNIT 50RWS	GPM	C	ooling	Heating									
SURWS		TC	EER Btuh/W	TC	COP								
036	9.0	29,800	16.2	27,200	3.3								
060	15.0	46,100	13.6	40,900	2.9								
120	30.0	91,800	13.2	82,000	2.8								

LEGEND

GPM — Gallons per minute TC — Total Capacity COP — Coefficient of Performance EER — Energy Efficiency Ratio EWT — Entering Water Temperature (F)

- NOTES:
 1 Cooling EWT based on load coil temperature of 53.6 F and source coil temperature of 77 F.
 2 Heating EWT based on load coil temperature of 104 F and source coil temperature of 32 F.
 3 Certified in accordance with the ARI/ISO/ASHRAE Standard 13256-2 certification program.
 4 All ratings based upon 208 v operation.

Physical data

50RWS036,060,120 UNITS

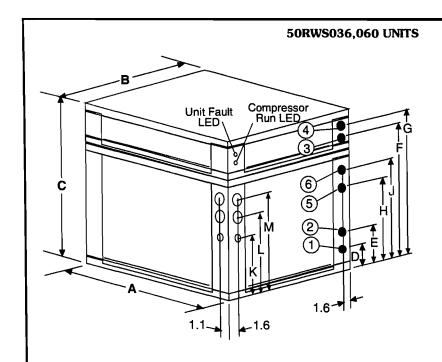
UNIT 50RWS	036	060	120
COMPRESSOR (Qty)	Scro	oll (1)	Scroll (2)
FACTORY CHARGE (R-22) (Each Circuit) (oz)	48	64	64
WATER CONNECTIONS Load FPT (in.) Source FPT (in.) HWG FPT (in.)	3/ ₄ 3/ ₄ 1/ ₂	1 1 1/ ₂	1½ 1½ —
WEIGHT Operating (lbs) Shipping (lbs)	236 255	343 362	725 765

LEGEND

FPT — Female pipe thread HWG — Hot Water Generator (036,060 Only)

Base unit dimensions





LEGEND

- Source Water Connection - In 0

2 Source Water Connection — Out

3 - Load Water Connection - In

① - Load Water Connection - Out

 HWG Connection — In (5)

HWG Connection — Out

EXT — External Pump

HWG — Hot Water Generator Coil

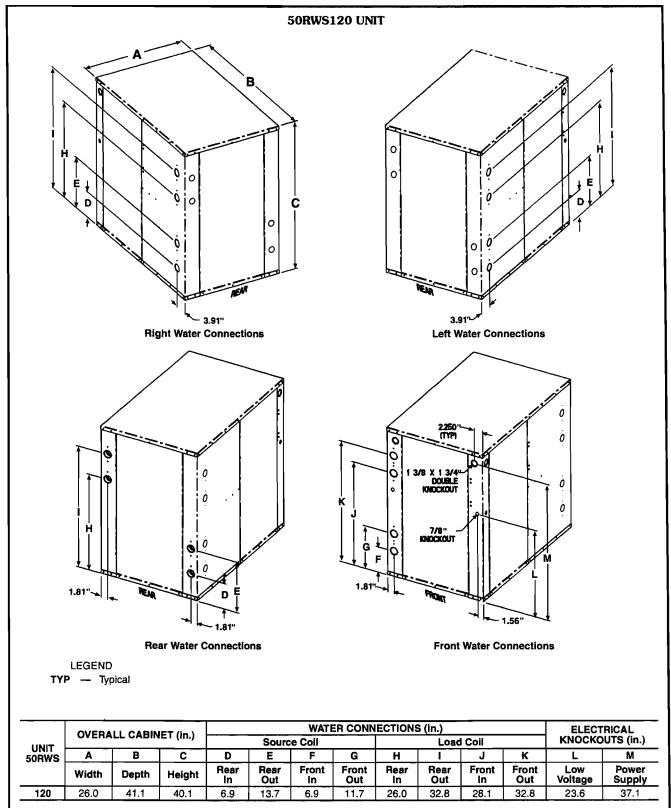
LED — Light-Emitting Diode

NOTE: Dimensions are in inches.

,					WATE	R CONN	IECTION	S (in.)									
	OVERA	LL CABIN	IET (in.)	Sourc	e Coil	Load Coil		HV	VG	ELECTRIC KNOCKOUTS (in.)							
UNIT 50RWS			-	In	Out	In	Out	In	Out								
3011113	Α	В	С	_	_	_			T .	K	L	М					
	Depth	Width	Height	D	=	"	G	н	」	Low Voltage	Ext Pump	Power Supply					
036	25.6	22.4	29.5	2.4	5.4	22.7	26.1	13.9	16.9	5.6	9.6	12.1					
060	30.6	25.4	33.0	2.4	5.4	26.8	30.9	15.6	18.9	8.1	11.6	14.1					

Base unit dimensions (cont)





Selection procedure (with 50RWS060 example)



I	Determine the	unit	application	designation
	for the source	and lo	ad heat excl	angers.

Source Coil								l	poiler/tower loop
Load Coil									air-handling unit

NOTE: The source could be an earth loop, well water, process water, condenser water, etc.

NOTE: The load could be a water coil in an air-handling unit(s), fan coil(s), hydronic baseboard, in-slab piping, swimming pool, etc.

II Determine the actual cooling and heating load requirements required for the application.

The load requirements will be the necessary heating and/or cooling required by the load of the 50RWS unit.

NOTE: In this example, the load requirements represent the air-handling unit cooling and heating loads.

Ill Determine the following design parameters.

The design conditions for the source and load coaxial heat exchangers need to be identified to closely match the load heat exchanger requirements.

Enter the 50RWS060 heating table with the following parameters:

Source Coil:

F
иg
F M
wg.
,) [?]

Enter the 50RWS060 cooling table with the following parameters:

Source Coil:

Entering Water	Temperature	 	 110 F
Water Flow		 	 11.3 GPM
Water Pressure	Drop	 	 6.4 ft wg

Load Coil:

Entering Water Temperature	70 F
Water Flow	
Water Pressure Drop	3.3 ft wg

NOTE: The source entering water temperature can be 20 F to 110 F. The load entering water temperature can be 50 F to 120 F. Also, water flow can be as low as 1.5 gpm per ton for constant temperature liquid (e.g., well water) or as high as 3.0 gpm per ton for variable liquid temperature.

IV Evaluate a unit based on total cooling and heating conditions. Unit selected should be closest to the actual loads.

At the conditions identified, the unit heating and cooling performance is read on the heating and cooling performance tables for a 50RWS060 unit.

NOTE: Interpolation is permissible if the design criteria are not identified in the tables.

V Evaluate the leaving water temperature.

The leaving water temperature should be appropriate for the application (e.g., chilled water or hot water for tempering ventilation air). If the leaving load water temperature is above freezing then freeze protection (e.g., glycol/water solution) is not required.

Leaving Water Temp (Cooling) 57.7 F Leaving Water Temp (Heating) 114.9 F

NOTES:

Selecting multiple units to accomplish a heating and/or cooling load by piping the load heat exchanger sides in parallel flow:

If design heating and/or cooling loads for the load heat exchanger cannot be accomplished with a single 50RWS unit, then the same selection procedure can be utilized to add multiple units. The capacities of two units can be added together when piped in parallel. Refer to the application section for details on parallel operation.

2. Selecting multiple units to accomplish a lower cooling leaving water temperature than can be accomplished by one 50RWS unit:

If design leaving water temperature from the load heat exchanger for cooling cannot be accomplished with a single 50RWS unit, then the same selection procedure can be utilized to add multiple units. The leaving water temperature can be further lowered for multiple units when piped in series. Refer to the application section for details on series operation.

Performance data



COOLING CAPACITIES 50RWS036

S	OURC	E CC)IL									LOA	D COIL									
		D	ssure			Water	Flow 5.0	(Gpm)			Water	Flow 7.0	(Gpm				Water	Flow 9.0	(Gpm		
EWT (F)	GPM	ū	rop Ft Wa	EWT (F)	TC (MBtuh)	Power (kW)	THR (MBtuh)	LWT (F)	Ď	ssure rop Ft Wa	TC (MBtuh)	Power (kW)	THR (MBtuh)	LWT (F)	D	ssure rop Ft Wg	TC (MBtuh)	Power (kW)	THR (MBtuh)	LWT (F)	D	ssure rop Ft Wg
	5.0	2.6	61	50 60 70 80 90	28.9 33 3 37.4 41.3 44.7	1.34 1.36 1.38 1.39 1.41	33.4 37.9 42.1 46.0 49.6	38.5 46.7 55.0 63.5 72.1	2.3 2.0 1.6 1.5 1.3	5.3 4.5 3.7 3.5 3.0	30.5 35.0 39.2 43.0 46.5	1 35 1.36 1.38 1.40 1.42	35.1 39.7 43.9 47.8 51.3	41.3 50.0 58.8 67.7 76.7	2.8	8.5 7.8 6.7 6.4 5.8	31.4 36.0 40.2 44.1 47.4	1.35 1.37 1.39 1.41 1.43	36.0 40.7 45.0 48.9 52.3	43.0 52.0 61.1 70.2 79.5	5.3 5.1 4.3 4.3 3.9	12 3 11 7 10 6 10 0 8.9
50	7.0	4.1	95	50 60 70 80 90	29.2 33.7 37.9 41.8 45.3	1.28 1.29 1.31 1.33 1.35	33.6 38.1 42.4 46.3 49.9	38.3 46.5 54.8 63.3 71.9	2.3 2.0 1.6 1.5 1.3	5.3 4.5 3.7 3.5 3.0	30.8 35.5 39 7 43 6 47.1	1.28 1.30 1.32 1.34 1.36	35.2 39.9 44.2 48.1 51.7	41.2 49.9 58.7 67.6 76.6	37 3.4 2.9 2.8 2.5	8.5 7.8 6.7 6.4 5.8	31.8 36.5 40.7 44.6 48.0	1 29 1.30 1.32 1.34 1.36	36.2 40.9 45.2 49.2 52.7	42.9 51.9 60.9 70.1 79.3	5.3 5 1 4 6 4.3 3.9	12.3 11.7 10.6 10.0 8.9
	9.0	6.0	13.8	50 60 70 80 90	29.5 34 1 38.3 42.2 45.8	1.24 1.25 1.27 1.29 1.30	33.7 38.3 42.6 46.6 50.2	38.2 46.4 54.7 63.1 71.7	2.3 2.0 1.6 1.5 1.3	5.3 4.5 3.7 3.5 3.0	31 2 35.8 40.1 44.0 47.5	1.24 1.26 1.28 1.29 1.31	35.4 40.1 44.5 48.4 52.0	41.1 49.8 58.5 67 4 76.4	2.9 2.8	8.5 7.8 6.7 6.4 5.8	32.1 36.8 41.1 45.0 48.5	1.25 1.26 1.28 1.30 1.32	36.4 41.1 45.5 49.5 53.0	42.9 51.8 60.9 70.0 79.2	5.3 5.1 4.6 4.3 3.9	12 3 11 7 10 6 10 0 8.9
	5.0	2.3	5.4	50 60 70 80 90	27 4 32.0 36.2 40 0 43.5	1.70 1 72 1.74 1 76 1.79	33 2 37.8 42 1 46.0 49.6	39.0 47.2 55.5 64.0 72.6		5.3 4 5 3.7 3.5 3.0	29.0 33.6 37.9 41.8 45.2	1.70 1.72 1.75 1.77 1.81	34.8 39.5 43.9 47.8 51.4	41.7 50.4 59.2 68.1 77.1	2.9	8.5 7.8 6.7 6.4 5.8	29.9 34.6 38.9 42.8 46.2	1 71 1 73 1 75 1 78 1 .82	35.7 40.5 44.9 48.8 52.3	43.4 52 3 61 4 70.5 79.7	53 51 46 4.3 3.9	12 3 11 7 10 6 10 0 8.9
70	7.0	36	84	50 60 70 80 90	27.8 32.4 36.6 40.5 44.1	1.62 1.63 1.65 1.68 1.70	33.3 37 9 42 3 46 2 49.9	38.9 47.1 55.4 63.8 72.4		5.3 4.5 3.7 3.5 3.0	29.3 34 1 38.4 42.3 45.8	1.62 1.64 1.66 1.69 1.72	34.9 39.7 44.0 48.1 51.6	41.6 50.3 59.0 67.9 76.9	3.4 2.9 2.8	8.5 7.8 6.7 6.4 5.8	30.3 35.0 39.4 43.3 46.7	1.63 1.65 1.67 1.70 1.73	35.8 40.7 45.1 49.1 52.6	43.3 52.2 61 2 70.4 79.6	5 1 4 6 4.3	100
	9.0	5 4	12.6	50 60 70 80 90	28 0 32.7 37.0 40 9 44.5	1 57 1.58 1.60 1.63 1.65	33 4 38.1 42.5 46.5 50.2	38.8 46.9 55.2 63.6 72.2	2.0 1.6 1.5	5.3 4.5 3.7 3.5 3.0	29 6 34 4 38 8 42 7 46.2	1.57 1.59 1.61 1.64 1.67	35.0 39.8 44.3 48.3 51.9	41.5 50.2 58.9 67.8 76.8	3.4 2.9 2.8	8.5 7.8 6.7 6.4 5.8	30.6 35.4 39.8 43.7 47.2	1 58 1 60 1.62 1.65 1.68	36.0 40 8 45.3 49 3 52.9	43.2 52.1 61.2 70.3 79.5	5 1 4.6 4.3	11 7 10.6 10.0
	5.0	18	41	50 60 70 80 90	26 0 30.4 34.4 38.3 41.8	2.16 2.19 2.21 2.22 2.24	33 4 37.8 42.0 45.8 49.4	39.6 47.9 56.2 64.7 73.3	2.0 1.6 1.5	5.3 4.5 3.7 3.5 3.0	27.4 31.9 36.1 39.9 43.4	2.17 2.19 2.21 2.23 2.24	34.8 39.4 43.6 47.5 51.1	42.2 50.9 59.7 68.6 77.6	3.4 2.9 2.8	8.5 7.8 6.7 6.4 5.8	28.3 32.8 37.0 40.9 44.4	2 18 2.20 2.22 2.23 2.25	35.7 40 3 44.6 48.5 52.0	43.7 52.7 61.8 70.9 80.1	46	11 7 10 6 10 0
90	7.0	31	7.1	50 60 70 80 90	26 4 30 7 34.9 38.7 42.3	2.06 2.08 2.10 2.12 2.13	33.4 37 9 42.0 45.9 49.6	39.5 47.7 56.0 64.5 73.1	2.0 1.6 1.5	5.3 4.5 3.7 3.5 3.0	27.8 32.3 36.5 40.4 44.0	2.07 2 09 2.11 2 12 2.14	34.8 39.4 43.7 47.7 51.3	42.1 50.8 59.6 68.5 77.4	2.9 2.8	64	28.6 33.2 37.5 41.4 44.9	2.07 2 09 2.11 2 13 2.14	35 7 40 4 44.7 48.6 52.2	43.6 52.6 61.7 70.8 80.0	5.1 4.6	11 7 10.6 10.0
	9.0	4.9	11.3	50 80 70 80 90	26.6 31.1 35.2 39.1 42.7	2.00 2.02 2.04 2.05 2.06	33.4 37.9 42.2 46.1 49.8	39.4 47.6 55.9 64.4 72.9	2.0 1.6 1.5	5.3 4.5 3.7 3.5 3.0	28.1 32.6 36.9 40.8 44.4	2.00 2.03 2.04 2.06 2.07	34.9 39.5 43.9 47.8 51.5	42.0 50.7 59.5 68.3 77.3	3.4 2.9 2.8	6.7 6.4	28.9 33.6 37.8 41.8 45.4	2.01 2.03 2.05 2.06 2.07	35.8 40.5 44.8 48.8 52.4	43.6 52.5 61.6 70.7 79.9	5 1 5 4 6 7 4.3	11 7 10.6 1 10 0
	5.0	1 4	3.2	50 60 70 80 90	23.7 28.0 32.1 36.1 39.9	2.79 2.82 2.85 2.86 2.87	33.2 37.6 41.8 45.8 49.7	40.5 48.8 57.2 65.6 74.1	2.0 1.6 1.5	5.3 4.5 3.7 3.5 3.0	24 9 29 4 33.7 37 7 41.6	2.80 2.83 2.85 2.87 2.88	34.5 39.0 43.4 47.5 51.5	42.9 51.6 60.4 69.2 78.1	3.4 2.9 2.8	6.7 6.4	25.7 30.2 34.6 38.7 42.7	2.81 2.84 2.86 2.87 2.88	35.3 39 9 44 3 48 5 52.5	44.3 53.3 62.3 71.4 80.5	3 5 1 3 4.6 4 4 3	11 7 3 10 6 3 10 0
110	7.0	26	5.9	50 60 70 80 90	24.0 28.3 32.5 36.5 40.4	2.66 2.69 2.71 2.73 2.74	33.0 37.5 41.7 45.8 49.7	40.4 48.7 57.0 65.4 73.9	2.0 1.6 1.5	5.3 4.5 3.7 3.5 3.0	25.2 29.8 34.1 38.2 42.1	2.67 2.70 2.72 2.73 2.74	34.3 38.9 43.3 47.5 51.5		3.4 2.9 2.8	7.8 6.7 6.4	26.0 30.6 35.0 39.2 43.2	2.67 2.70 2.72 2.73 2.74	35.1 39 8 44.3 48 5 52.5	44 2 53.2 62.2 71.3 80.4	2 5.1 2 4.6 3 4.3	1 11 7 3 10 6 3 10 0
	9.0	42	97	50 60 70 80 90	24.2 28.6 32.8 36.9 40.8	2.58 2.60 2.83 2.64 2.65	33.0 37.5 41.8 45.9 49.8	40.3 48.6 56.9 65.2 73.7	2.0 1.6 1.5	5.3 4.5 3.7 3.5 3.0	25.5 30.1 34.4 38.6 42.6	2.59 2.61 2.63 2.65 2.66	34.3 39.0 43.4 47.6 51.6		3.4 2 2.9 2 2.8	7.8 6.7 6.4	26 3 30.9 35.4 39.6 43.6	2.59 2.62 2.64 2.65 2.66	35.1 39.8 44.4 48.7 52.7	44.2 53 62.7 71.2 80.3	1 5 1 1 4 6 2 4.3	1 11 7 5 10.6 3 10 0

LEGEND

EWT — Entering Water Temperature (F)
GPM — Gallons Per Minute
LWT — Leaving Water Temperature (F)
MBtuh — Btuh in Thousands
PSI — Pounds per Square Inch
TC — Total Capacity (MBtuh)
THR — Total Heat of Rejection (MBtuh)

- NOTES:
 1. Interpolation is permissible, extrapolation is not.
 2. All performance data is based upon the lower voltage of dual voltage rated units
 3. All performance data is based upon a load coaxial heat exchanger of single-walled copper construction For vented double-walled performance consult Carrier representative



COOLING CAPACITIES (cont) 50RWS060

S	OURC	E CC	DIL										D COIL									
		Pre	ssure			Water	Flow 7.5	(Gpm				Water	Flow 11.3	(Gpn	_			Water	Flow 15.0	(Gpn	1	
(F)	GPM		rop Ft Wg	EWT (F)	TC (MBtuh)	Power (kW)	THR (MBtuh)	LWT (F)	D	ssure rop Ft Wa	TC (MBtuh)	Power (kW)	THR (MBtuh)	LWT (F)	r	ssure Prop Ft Wa	TC (MBtuh)	Power (kW)	THR (MBtuh)	LWT (F)	D	ssure rop Ft Wg
	7.5	2.2	5.2	50 60 70 80 90	46.3 51.4 56.0 60.1	2.43 2.47 2.50 2.53	54.5 59.8 64.5 68.7	37.7 463 55.1 64.0	1.8 1.6 1.4 1.3	4.2 3.7 3.3 3.0	48.6 53.7 58.2 62.2	2.45 2.48 2.52 2.54	56.9 62.1 66.8 70.8 74.2	41.4 50.5 59.7 69.0 78.4	3.4 3.1 2.8 2.6 2.2	8.0 7.1 6.5 5.9 5.2	49.7 54.8 59.3 63.1 66.4	2.45 2.49 2.52 2.55 2.56	58.1 63.3 67.9 71.8 75.1	43.4 52.7 62.1 71.6 81.2	56 5.0 46 4.2 3.8	12 9 11 6 10 6 9 7 8.8
50	11.3	4.0	9.2	50 60 70 80 90	63.6 46.7 51.9 56.5 60.7 64.3	2.55 2.32 2.36 2.39 2.42 2.44	72.3 54.6 59.9 64.7 68.9 72.6	73.0 37.5 46.2 54.9 63.8 72.9	1.1 1.8 1.6 1.4 1.3 1.1	2.6 4.2 3.7 3.3 3.0 2.6	65.5 49.0 54.2 58.8 62.8 66.2	2.56 2.34 2.38 2.41 2.43 2.45	57.0 62.3 67.0 71.1 74.5	41.3 50.4 59.6 68.9 78.3	3.4 3.1 2.8 2.6 2.2	8.0 7.1 6.5 5.9 5.2	50.2 55.4 59.9 63.8 67.0	2.35 2.38 2.41 2.44 2.45	58.2 63.5 68.1 72.1 75.4	43.3 52.6 62.0 71.5 81.1	5.6 5.0	12 9 11 6 10 6 9 7 8.8
	15.0	6.1	14.1	50 60 70 80 90	47.4 52.6 57.4 61.6 65.3	2.27 2.31 2.34 2.36 2.38	55.2 60.5 65.4 69.6 73.4	37 4 46.0 54.7 63 6 72.6	1.8 1.6 1.4 1.3 1.1	4.2 3.7 3.3 3.0 2.6	49.8 55.0 59.7 63.7 67.2	2.29 2.32 2.35 2.37 2.39	57.6 62.9 67.7 71.8 75.3	41.2 50.3 59.4 68.7 78.1	3.4 3.1 2.8 2.6 2.2	8.0 7.1 6.5 5.9 5.2	51.0 56.2 60.8 64.7 68.1	2.29 2.33 2.36 2.38 2.39	58.8 64.1 68.8 72.9 76.2	43.2 52.5 61.9 71.4 80.9	5 6 5.0 4 6 4.2 3.8	12 9 11 6 10 6 9 7 8.8
	7.5	1.9	4.5	50 60 70 80 90	43.1 48.5 53.4 57.9 62.0	3.04 3.09 3.14 3.18 3.22	53.5 59.0 64.1 68.8 73.0	38.5 47 1 55.8 64.5 73.5	1 8 1.6 1 4 1.3 1.1	4.2 3.7 3.3 3.0 2.6	45 4 50 8 55.8 60.2 64.2	3.06 3.11 3.16 3.20 3.24	55.8 61.4 66.5 71.1 75.2	42.0 51.0 60.1 69.3 78.6	2.6	8.0 7.1 6.5 5.9 5.2	46.5 52 0 56 9 61 3 65.2	3 07 3.12 3.17 3.21 3.25	57 0 62 6 67.7 72.3 76.3	43 8 53 1 62 4 71 8 81.3	4 2 3.8	12 9 11 6 10 6 9 7 8.8
70	11.3	36	82	50 60 70 80 90	43 6 49 0 54 0 58.5 62.6	2.91 2.96 3.00 3.04 3.08	53.5 59.1 64.2 68.9 73.1	38.4 46.9 55.6 64.4 73.3	1.8 1.6 1.4 1.3 1.1	4.2 3.7 3.3 3.0 2.6	45.8 51 3 56.3 60.8 64.8	2.93 2.98 3.02 3.06 3.10	55.8 61.5 66.6 71.3 75.4	41.9 50.9 60.0 69.2 78.5	3 1 2.8 2.6	5.9	47.0 52.5 57.5 62.0 65.9	2.94 2.99 3.03 3.07 3.11	57.0 62.7 67.8 72.4 76.5	43 7 53 0 62.3 71.7 81.2	46	12 9 11 6 10 6 9 7 8.8
	15.0	5.5	12.7	50 60 70 80 90	44.2 49.7 54.8 59.4 63.6	2.84 2.89 2.93 2.97 3.01	53 9 59.6 64.8 69.5 73.8	38.2 46.7 55.4 64.2 73.0	1.8 1.6 1.4 1.3 1.1	4.2 3.7 3.3 3.0 2.6	46.5 52.1 57.2 61 7 65.8	2.86 2.91 2.95 2.99 3.03	56.3 62.0 67.2 71.9 76.1	41.8 50.8 59.9 69.1 78.4	3 1 2.8 2 6	7.1 6.5 5.9	47 7 53.3 58.4 62 9 66.8	2.97 2.92 2.96 3.00 3.03	57.5 63.3 68.5 73.1 77.2	43.6 52.9 62.2 71.6 81.1	5.0 4.6	12 9 11 6 10.6 9 7 8.8
	7.5	15	3.5	50 60 70 80 90	39.9 45.2 50.0 54.4 58.2	3.87 3.94 3.99 4.04 4.07	53.1 58.6 63.6 68.1 72.1	39.4 47 9 56.7 65.5 74.5	1.8 1.6 1.4 1.3 1.1	4.2 3.7 3.3 3.0 2.6	42 0 47 3 52.1 56.4 60.1	3.90 3.96 4.02 4.05 4.08	55.3 60.8 65.8 70.2 74.0		3 1 2.8 2.6	7.1 6.5 5.9	43 0 48.4 53.2 57.4 60.9	3 91 3.97 4.03 4.06 4.08	56.4 62.0 66.9 71.2 74.9	44 3 53.5 62.9 72.4 81.9	5.0 4 6 4 2	11 10 9
90	11.3	3 1	7.1	50 60 70 80 90	40.3 45.7 50.5 54.9 58.8	3.70 3.77 3.82 3.86 3.89	53.0 58.5 63.6 68.1 72.0	39.2 47.8 56.5 65.4 74.3		4.2 3.7 3.3 3.0 2.6	42.4 47.8 52.7 56.9 60.7	3.73 3.79 3.84 3.88 3.90	55.1 60.7 65.8 70.2 74.0	42.5 51.5 60.7 69.9 79.3	3.1 2.8 2.6	7 1 6.5 5.9	43.5 48.9 53.7 57.9 61.6	3.74 3.80 3.85 3.88 3.90	56.2 61.9 66.9 71.2 74.9	44 2 53.5 62.6 72.3 81.6	5 0 4.6 4.2	11 10 9.
	15.0	5.0	11.6	50 60 70 80 90	40.9 46.4 51.3 55.7 59.7	3.61 3.68 3.73 3.77 3.80	53.3 58.9 64.0 68.6 72.6	39.1 47.6 56.3 65 1 74.1		4.2 3.7 3.3 3.0 2.6	43.1 48.5 53.4 57.8 61.6	3.64 3.70 3.75 3.79 3.81	55.5 61.2 66.3 70.7 74.6	42 4 51 4 60.5 69.8 79.1	3.1 2.8 2.6	7 1 6.5 5 9	44.1 49.6 54.5 58.8 62.5	3.65 3.71 3.76 3.80 3.81	56 6 62.3 67 4 71.8 75.5	44.1 53.4 62.7 72.2 81.7	5 0 4 6 4 2	11 10 9
	7.5	1.3	3.0	50 60 70 80 90	35.1 40 6 45.6 50.2 54.4	4.87 4.96 5.04 5.10 5.16	51.8 57.5 62.8 67.6 72.0	40.6 49.2 57.8 66.6 75.5	1.4	4.2 3.7 3.3 3.0 2.6	37.0 42.5 47.6 52.2 56.4	4.90 4.99 5.07 5.13 5.18	53.7 59.6 64.9 69.7 74.1	43.5 52.5 61.6 70.8 80.0	3.1 2.8 2.6	7.1 6.5 5.9	38.0 43.5 46.7 53.3 57.3	4.92 5.01 5.08 5.14 5.19	54 7 60.6 66.0 70.8 75.1	44.9 54.2 63.5 72.9 82.4	5.0 4.6 4.2	11 10 9
110	11.3	2.8	64	50 60 70 80 90	35.5 41.0 46.0 50.7 55.0	4.66 4.75 4.82 4.88 4.93	51.4 57.2 62.5 67.4 71.8	40.5 49 1 57.7 66.5 75.3	1.8 1.6 1.4 1.3 1.1	4,2 3,7 3,3 3,0 2,6	37.4 43.0 48.1 52.8 56.9	4.69 4.77 4.85 4.91 4.96	53.4 59.3 64.6 69.5 73.9	43.4 52.4 61.5 70.7 79.9	3.1 2.8 2.6	7.1 6.5 5.9	38.3 44.0 49.1 53.8 57.9	4 71 4 79 4.86 4 92 4.97	54.4 60.3 65 7 70.6 74.9	44.9 54.1 63.4 72.8 82.3	5.0 4.6 4.2	11 10 9
	15.0	4 6	10.5	50 60 70 80 90	36.0 41.6 46.7 51.5 55.8	4.55 4.64 4.71 4.77 4.82	51.6 57.4 62.8 67.7 72.2	40.4 48.9 57.5 66.3 75.1	14	4.2 3.7 3.3 3.0 2.6	37.9 43.6 48.8 53.6 57.8	4.58 4.67 4.74 4.60 4.84	53.6 59.5 65.0 69.9 74.3	43.3 52.3 61.4 70.5 79.8	3.1 2.8 3 2.6	7.1 6.5 5 5.9	38.9 44.6 49.9 54.6 58.8	4.60 4 68 4.75 4.81 4.85	54.6 60.6 66.1 71.0 75.3	44.8 54.0 63.3 72.3	5.0 3 4.6 7 4.2	11.

LEGEND

- NOTES:

 1. Interpolation is permissible, extrapolation is not.

 2. All performance data is based upon the lower voltage of dual voltage rated units.

 3. All performance data is based upon a load coaxial heat exchanger of single-walled copper construction. For vented double-walled performance consult Carrier representative

Performance data (cont)



COOLING CAPACITIES (cont) 50RWS120

S	OURC	E CC	JIL,		-		=1. 4= -	'					D COIL					122-1-	F1 0c ^	/ 0		
	1		ssure			Water	Flow 15.0	(Gpm				Water	Flow 22.6	(Gpm				Water	Flow 30.0	(Gpn		
WT (F)	GPM		rop Ft Wg	(F)	TC (MBtuh)	Power (kW)	THR (MBtuh)	LWT (F)	D	ssure rop Ft Wa	TC (MBtuh)	Power (kW)	THR (MBtuh)	LWT (F)	D	ssure rop Ft Wg	TC (MBtuh)	Power (kW)	THR (MBtuh)	LWT (F)	D	ssure rop Ft Wo
	15.0	31	7.3	50 60 70 80 90	92.5 102.7 111.9 120.1 127.3	4.85 4.93 5.00 5.06 5.10	109.1 119.5 129.0 137.4 144.7	37 7 46.3 55.1 64.0 73.0	2.6 2.2 2.0 1.8 1.6	5.9 5.1 4.6 4.2 3.6	97.1 107.3 116.4 124.3 131.0	4.89 4.97 5.03 5.08 5.11	113.8 124.3 133.6 141.6 148.5	41.4 50.5 59.7 69.0 78.4	4.8 4.3 3.9 3.6 3.1	11.1 9.9 9.0 8.3 7.2	99.4 109.6 118.6 126.3 132.7	4.91 4.99 5.05 5.09 5.12	116.2 126.6 135.8 143.7 150.2	43.4 52.7 62.1 71.6 81.2	7.8 7.0 6 4 5 9	18.1 16.2 14.9 13.6 12.3
50	22.6	56	12.8	50 60 70 80 90	93.4 103.7 113.1 121.4 128.6	4.64 4.72 4.78 4.84 4.88	109.3 119.8 129.4 137.9 145.2	37.5 46.2 54.9 63.8 72.9	2.6 2.2 2.0 1.8 1.6	5.9 5.1 4.6 4.2 3.6	98.1 108.4 117.6 125.6 132.3	4.68 4.75 4.81 4.86 4.89	114.1 124.6 134.0 142.1 149.0	41.3 50.4 59.6 68.9 78.3	4.8 4.3 3.9 3.6 3.1	11.1 9.9 9.0 8.3 7.2	100.4 110.7 119.8 127.6 134.1	4.70 4.77 4.83 4.87 4.90	116.5 127.0 136.2 144.2 150.8	43.3 52.6 62.0 71.5 81.1	7.8 7.0 6.4	18 16 14 13 12.
	30.0	8.5	19.7	50 60 70 80 90	94.9 105.3 114.8 123.2 130.5	4.54 4.61 4.67 4.73 4.76	110 3 121.0 130 7 139.3 146.8	37.4 46.0 54.7 63.6 72.6	2.6 2.2 2.0 1.8 1.6	5.9 5.1 4.6 4.2 3.6	99.6 110.0 119.3 127 4 134.3	4.57 4.64 4.70 4.75 4.78	115.2 125.9 135.4 143.6 150.6	41.2 50.3 59.4 68.7 78.1	4.8 4.3 3.9 3.6 3.1	11 1 9.9 9.0 8.3 7.2	102.0 112.4 121.6 129.5 136.1	4.59 4.66 4.72 4.76 4.79	117.6 128.3 137.7 145.7 152.4	43.2 52.5 61.9 71.4 80.9	7.0 6.4 5.9	18 16 14 13 12
	15.0	27	63	50 60 70 80 90	86 3 97 0 106.9 115.9 124.0	6.08 6.18 6.27 6.36 6.43	107 0 118.1 128.3 137 6 146.0	38.5 47.1 55.8 64.5 73.5	2.6 2.2 2.0 1.8 1.6	5.9 5.1 4.6 4.2 3.6	90.8 101.6 111.5 120.4 128.3	6.12 6.22 6.32 6.40 6.47	111.7 122.9 133.1 142.3 150.4	42.0 51.0 60.1 69.3 78.6	4.8 4.3 3.9 3.6 3.1	11.1 9 9 9 0 8.3 7.2	93.1 104.0 113.9 122.7 130.4	6.14 6.25 6.34 6.42 6.49	114 0 125.3 135.5 144.6 152.5	43 8 53 1 62.4 71.8 81.3	7 0 6.4 5 9	18 16 14 13 12
70	22.6	5.0	11.5	50 60 70 80 90	87.2 98 0 107.9 117 0 125.3	5.82 5 91 6.00 6.08 6.15	107.0 118 1 128 4 137.8 146.3	38.4 46.9 55.6 64.4 73.3	2.6 2.2 2.0 1.8 1.6	5.9 5 1 4 6 4.2 3.6	91 7 102.7 112.6 121.6 129.6	5.86 5.95 6.04 6.12 6.19	111 7 123.0 133.3 142.5 150.7	41.9 50.9 60.0 69.2 78.5	4.8 4.3 3.9 3.6 3.1	11.1 9.9 9.0 8.3 7.2	94.0 105.0 115.0 123.9 131.7	5.88 5 97 6 06 6.14 6.21	114 1 125 4 135.7 144.9 152.9	43.7 53.0 62.3 71.7 81.2	70 64 59	13
	30.0	77	17.8	50 60 70 80 90	88.5 99.4 109.6 118.8 127.1	5.68 5.78 5.86 5.94 6.01	107 8 119.1 129 6 139 1 147.7	38.2 46.7 55.4 64.2 73.0	2.6 2.2 2.0 1.8 1.6	5.9 5.1 4.6 4.2 3.6	93.1 104.2 114.3 123.5 131.6	5.72 5.82 5.90 5.98 6.05	112.6 124.0 134.5 143.9 152.2	41.8 50.8 59.9 69.1 78.4	3.6	11 1 9 9 9 0 8.3 7.2	95.4 106 6 116 7 125.8 133.7	5.74 5.84 5.92 6.00 6.07	115.0 126.5 136 9 146.2 154.4	43.6 52.9 62.2 71.6 81.1	7 0 6.4 5 9	14
	15.0	21	5.0	50 60 70 80 90	79.9 90.4 100 0 108.7 116.4	7.74 7.87 7.99 8.07 8.13	106 3 117 3 127.3 136.3 144.1	39.4 47.9 56.7 65.5 74.5	2.6 2.2 2.0 1.8 1.6	5 9 5.1 4 6 4.2 3.6	84.0 94.7 104.3 112.8 120.1	7 79 7.92 8.03 8.11 8.15	110.6 121 7 131.7 140.4 147.9		4.3 3.9 3.6	11.1 9.9 9.0 8.3 7.2	86.1 96 8 106.4 114 7 121.9	7.82 7.95 8.05 8.12 8.16	112.8 123.9 133.8 142.4 149.7	44.3 53.5 62.9 72.4 81.9	7.0 6 4 5 9	16 14 13
90	22.6	43	99	50 60 70 80 90	80.7 91.3 101.1 109.8 117.6	7.40 7.53 7.64 7.72 7.78	105.9 117 0 127.1 136.2 144.1	39.2 47.8 56.5 65.4 74.3	1.8	5.9 5.1 4.6 4.2 3.6	84 8 95.6 105.3 113.9 121.3	7.45 7.58 7.68 7.75 7.80	110.3 121.5 131.5 140.4 147.9	42.5 51.5 60.7 69.9 79.3	4.3 3.9 3.6	11 1 9 9 9.0 8.3 7.2	87.0 97.8 107.4 115.9 123.1	7.48 7.60 7.70 7.77 7.81	112.5 123 7 133.7 142.4 149.7	44.2 53.5 62.8 72.3 81.8	70 64 55.9	10 14 13
	30.0	7.0	16.2	50 60 70 80 90	81 9 92 7 102.6 111.5 119.3	7.23 7.36 7.46 7.54 7.60	106.5 117.8 128.0 137.2 145.3	39 1 47.6 56.3 65.1 74.1		5.9 5.1 4.6 4.2 3.6	86 1 97.1 106.9 115.6 123.1	7.28 7.41 7.50 7.58 7.62	110.9 122.3 132.5 141.5 149.1	42.4 51.4 60.5 69.8 79.1	4.3 3.9 3.6	11.1 9.9 9.0 8.3 7.2	88.3 99.2 109.0 117.6 125.0	7.31 7.43 7.52 7.59 7.63	113.2 124.6 134.7 143.5 151.0	44.1 53.4 62.7 72.2 81.7	7 0 7 6.4 2 5.9	10
	15.0	18	4.2	50 60 70 80 90	70.3 81.1 91.2 100.4 108.8	9.75 9.92 10.08 10.21 10.32	103.5 115.0 125.5 135.2 144.0	40.6 49.2 57.8 66.6 75.5	2.2	5.9 5 1 4.6 4.2 3.6	74.0 85.1 95.2 104.5 112.8	9.81 9.98 10.14 10.26 10.36	107.4 119.1 129.8 139.5 148.1	43.5 52.5 61.6 70.8 80.0	4.3 3.9 3.6	11 1 9 9 9 0 8.3 7.2	75.9 87 1 97.3 106.5 114.7	9.84 10.01 10 16 10.29 10.38	141.6	44.9 54.2 63.5 72.9 82.4	7 0 6 4 5 5.9	10
10	22.6	3.9	9.0	50 60 70 80 90	71.0 81.9 92.1 101 4 109.9	9.32 9.49 9.64 9.76 9.87	102.8 114.3 125.0 134.7 143.6	40.5 49.1 57.7 66.5 75.3	2.2	5.9 5.1 4.6 4.2 3.6	74.7 85.9 96.2 105.5 113.9	9.38 9.55 9.69 9.82 9.91	106.7 118.5 129.3 139.0 147.7	43.4 52.4 61.5 70.7 79.9	4.3 3.9 3.6	9.0	76.7 88.0 98.3 107.6 115.8	9.41 9.58 9.72 9.84 9.93	108.8 120 7 131.5 141.2 149.7	44.9 54.1 63.4 72.8 82.3	7.0 4 6 4 3 5 9) 1 1 1 1
	30.0	6 4	14 7	50 60 70 80 90	72 0 83.2 93.5 102.9 111.5	9.11 9.27 9.42 9.54 9.64	103 1 114 8 125.6 135.5 144.4	40.4 48.9 57.5 66.3 75.1	2.2 2.0 1.8	5.9 5 1 4.6 4.2 3.6	75.9 87.2 97 7 107.1 115.6	9.17 9.33 9.47 9.59 9.68	107.1 119.1 130.0 139.8 148.6	43.3 52.3 61.4 70.5 79.8	4.3 3.9 3.6	9.0	77 8 89 3 99.8 109.2 117.6	9.19 9.36 9.50 9.61 9.70	109 2 121 2 132.2 142 0 150.7	44.8 54.0 63.3 72.7 82.2	0 7 0 3 6.4 7 5 9) 1 1 1

LEGEND

EWT — Entering Water Temperature (F)
GPM — Gallons Per Minute
LWT — Leaving Water Temperature (F)
MBtuh — Btuh in Thousands
PSI — Pounds per Square Inch
TC — Total Capacity (MBtuh)
THR — Total Heat of Rejection (MBtuh)

NOTES:

- NOTES:

 1. Interpolation is permissible, extrapolation is not.

 2. All performance data is based upon the lower voltage of dual voltage rated units.

 3. All performance data is based upon a load coaxial heat exchanger of single-walled copper construction. For vented double-walled performance consult Carrier representative.



HEATING CAPACITIES 50RWS036

S	OURC	E C	OIL										ı	OAD CO	IL										
EWT	0014		essure Prop	EWT			ter Flow	l	pm)	Pre	ssure			ter Flow		om)	Pre	ssure			ter Flow		pm)	Pre	ssure
(F)	GPM		Ft Wg	(F)	TC (MBtuh)	Power (kW)	THA (MBtuh)	LWT (F)	COP	-	rop Ft Wg	TC (MBtuh)	Power (kW)	THA (MBtuh)	LWT (F)	COP		rop Ft Wg	TC (MBtuh)	Power (kW)	THA (MBtuh)	(F)	COP	_	rop Ft Wg
20	9.0	9 9	22 9	60 80 100 120	24.1 23.5 23.0 22.6	1 41 1.78 2.29 2.94	19 3 17 5 15 2 12.5	69 6 89.4 109.2 129.0	3.87 2.94	2 0 1.5 1.1 0.9	45 35 24 2.1	24.2 23.6 23.1 22.6	1 37 1.72 2 21 2.84	19.5 17.8 15.6 12.9	66.9 86 7 106.6 126.4	5 19 4 03 3.07 2.33	3.4 2.8 2.2 2.0	7.8 6.4 5.2 4.6	24.2 23.7 23.2 22.7	1 34 1.68 2 16 2.78	19.6 17 9 15.8 13.2	85 2 105 1	5 29 4 12 3 14 2.39	5 1 4 3 3 6 3.3	11 7 10 0 8 2 7.6
	5.0	38	8 7	60 80 100 120	25.4 24.8 24.3 23.8	1 42 1.80 2.32 2.97	20 5 18 7 16 4 13.6	70.2 89.9 109 7 129.5	5 22 4.04	2.0 1 5 1 1	4 5 3.5 2 4 2.1	25 5 24.9 24 4 23.8	1.38 1.73 2.23 2.87	20 8 19 0 16.8 14.1	67.3 87 1 107.0 126.8	4.21 3.20	3 4 2.8 2.2 2.0	7 8 6 4 5.2 4.6	25 5 25 0 24 4 23.9	1.35 1 70 2 18 2.81	20.9 19.2 17.0 14.3	105 4	4 31	5 1 4 3 3 6 3.3	11 7 10 0 8 2 7.6
30	7.0	5 8	135	60 80 100 120	27.2 26.6 26.0 25.5	1 43 1.81 2 33 2.99	22 3 20 4 18 1 15.3	70 9 90.6 110 4 130.2	3 27	11	45 35 24 2.1	27 3 26 7 26 1 25.6	1 39 1 75 2 25 2.89	22.6 20.8 18.5 15.7	107 5	5.77 4 48 3 41 2.60	3 4 2.8 2.2 2.0	7 8 6 4 5 2 4.6	27 4 26 8 26 2 25.6	1 36 1 71 2.20 2.83	22 7 20 9 18 7 16.0	66 1 85 9 105 8 125.7	4 59 3 49	36	11 7 10 0 8 2 7.6
	9.0	8 5	195	60 80 100 120	27 7 27 1 26 5 25.9	1 44 1 82 2.34 3.00	22 8 20 9 18.5 15.7	71 1 90.8 110.6 130.4		1.1	4.5 3.5 2.4 2.1	27.8 27 2 26.6 26.0	1 39 1.75 2.25 2.90	23.0 21 2 18.9 16.1	107.6	5 84 4 54 3.45 2.63	3 4 2 8 2.2 2.0	7 8 6.4 5 2 4.6	27 8 27.2 26 6 26.0	1 37 1 72 2.21 2.84	23 2 21 4 19.1 16.4	105 9	5.96 4 65 3 53 2.69	5 1 4 3 3 6 3.3	11 7 10 0 8 2 7.6
	5.0	3.2	74	60 80 100 120	28.2 27 5 26.8 26.0	1.45 1 68 2.16 2.76	23.2 21 8 19.4 16.6	71.3 91.0 110.7 130.4		2.0 1.5 1.1 0.9	4.5 3.5 2.4 2.1	28 3 27.7 26 9 26.2	1.39 1 60 2.06 2.64	23.6 22.2 19.9 17.2		5 97 5.07 3.84 2.91	3 4 2.8 2.2 2.0	78 64 52 4.6	28.4 27 7 27 0 26.3	1 36 1.56 2.00 2.57	23.7 22 4 20.2 17.5		6 12 5.21 3.95 2.99	4 3 3 6	11 7 10 0 8 2 7.6
40	7.0	5 0	11.5	60 80 100 120	30.2 29.5 28.8 27.9	1.46 1.69 2.17 2.78	25 2 23.8 21.3 18.5	72.1 91.8 111.5 131.2	6.06 5 12 3 88 2.95	1.5 1.1	4 5 3.5 2.4 2.1	30 4 29.7 28.9 28.1	1.40 1.61 2.07 2.66	25 6 24 2 21.8 19.0	108.3	6.35 5.39 4.09 3.10	2.8 2.2	6.4 5.2	30 4 29 7 29.0 28.2	1.37 1 57 2.02 2.59	25.8 24.4 22.1 19.3	86.6 106.4	6.52 5 55 4 21 3.18	4 3	11 7 10 0 8 2 7.6
	9.0	7 2	16 7	60 80 100 120	30.7 30.0 29.2 28.4	1.47 1.70 2.18 2.79	25 7 24 2 21 8 18.9	72.3 92.0 111 7 131.4	5.19 3.93	1.5 1 1	24	30.9 30.2 29 4 28.5	1.41 1.62 2.08 2.67	26.1 24.6 22.3 19.4	88.6 108.4	6.44 5.46 4.14 3.14	2.8 2.2	6 4 5.2	30 9 30.2 29 5 28.6	1 37 1.58 2.03 2.60	26.3 24.9 22.6 19.8	86 7 106 5	6 60 5 62 4 26 3.23	4 3 3 6	11 7 10 0 8 2 7.6
	5.0	2 €	61	60 80 100 120	32.0 31.2 30 4 29.6	1 48 1.88 2.41 3.08	26.9 24.8 22.2 19.0	72.8 92.5 112.2 131.8	3 70 2.81	1.5 1 1 0.9	45 3.5 24 2.1	32 1 31 4 30 6 29.7	1.42 1.79 2.30 2.95	27 3 25 3 22 7 19.6	108.7	6 64 5 14 3 89 2.95		6 4 5 2 4.6	32.2 31.5 30.7 29.8	1 39 1.74 2.24 2.88	27.5 25.5 23.0 20.0	87.0 106 8	6 81 5 29 4 01 3.03	4 3 3 6 3.3	11 7 10 0 8 2 7.6
50	7.0	4 1	95	60 80 100 120	34.3 33.5 32.6 31.7	1 49 1 89 2 43 3.11	29.2 27 1 24 3 21.1	73.7 93 4 113 1 132.7		1.5	45 3.5 24 2.1	34.5 33.7 32.8 31.9	1 43 1.80 2.32 2.97	29.6 27.5 24.9 21.7	109.4	7.07 5 47 4 15 3.14		6 4 5 2	34 6 33.8 32.9 32.0	1 40 1 76 2 26 2.90	29.8 27.8 25.2 22.1	67 7 87 5 107 3 127.1	5 63 4 27	4 3	11 7 10 0 8 2 7.6
	9.0	60	13 8	60 80 100 120	34.9 34 1 33.2 32.2	1.50 1 90 2 44 3.12	29 8 27 6 24 9 21.6	74.0 93.6 113.3 132.9	5.26 3 99	1.5	45 35 24 2.1	35 1 34 2 33 4 32.4	1 43 1.81 2.33 2.98	30.2 28.1 25.4 22.2	109.5	5.54	2.8 2.2	6.4 5.2	35.1 34 3 33 5 32.5	1 40 1 76 2 27 2.91	30 4 28.3 25.7 22.6	87 6	7 34 5 7 1 4 33 2 3.27	43	
	5.0	2 9	66	60 80 100 120	35.5 34.7 33 8 32.8	1.50 1 68 2.16 2.76	30 4 28.9 26 4 23.4	74.2 93 9 113 5 133.1	6 06 4 59 3.49	1.5 1.1 0.9	45 35 24 2.1	35 7 34 8 33 9 33.0	1 44 1.60 2.06 2.64	30 8 29.4 26.9 24.0	109.7	6 38	2.2	6.4 5.2	35.8 34.9 34.0 33.1	1 40 1 56 2.00 2.57	31.0 29.6 27.2 24.3		6 57	4 3 3 6	82
60	7.0	3 9	89	60 80 100 120	38.1 37.2 36.2 35.2	1.51 1.69 2.17 2.78	32.9 31.4 28.8 25.7	75.2 94.9 114.5 134.1	6 45 4.89	1.5	45 35 24 2.1	38.3 37 4 36 4 35.4	1 45 1 61 2.07 2.66	33.3 31.9 29.3 26.3	70.9 90.7 110.4 130.1	6.80 5 15 3.90	2.8 2.2 2.0	6 4 5.2	38 4 37.5 36.5 35.5	1 41 1 57 2 02 2.59	33.5 32 1 29 6 26.6	68 5 88 3 108 1 127.5	7 00 1 5 30 9 4.01	4 3 3 6 3.3	8 2 7.6
	9.0	5.0	11 4	60 90 100 120	38 7 37.8 36.8 35.8	1 52 1.70 2.18 2.79	33.6 32.0 29.4 26.3	114.7 134.3	6.53 4.95 3.76	1.5 1.1 0.9	3.5 2.4 2.1	38 9 38.0 37.0 36.0	1 45 1 62 2.08 2.67	33.9 32.5 29.9 26.9	71. 100.9 110.6 130.3	6.88 5.22 3.95	2.8 2.2 2.0	6.4 5.2 4.6	39.0 38 1 37 1 36.1	1.42 1.58 2.03 2.60	34.1 32.7 30.2 27.2	108 2 128.0	5 7 09 2 5.37 0 4.06	4 3 7 3 6 3 3.3	8.2 7.6
	5.0	2.3	5 4	60 80 100 120	40 3 39.6 38.8	1.56 1.97 2.53 PERATI	35.0 32.9 30.1 ON NOT	95.8 115.5	7.58 5 90 4.50 MMEN	1.5	3.5 2.4	42.1 41.5 40.6 39.6	1 49 1.87 2 39 3.07	37.1 35.1 32.5 29.1	91.9	8.31 9 6.52 6 4.97 3 3.77	2.8	6.4 5.2	42.2 41.6 40.8 39.7	1.44 1 80 2.31 2.97	37.3 35.4 32.9 29.6	109	4 8.57 2 6.76 1 5 17 8 3.92	3 4.3 7 3.6	10 0 8 2 7.6
70	7.0	3 6	84	60 80 100 120	43.2 42.5 41.6	1 57 1.98 2.54 PERATI	37.9 35.7 32.9 ON NOT	97 0 116.6	8 08 6.28 4.79 MMEN	1.5 1.1	3.5 2.4	45.2 44.5 43.6 42.4	1.50 1 88 2 41 3.09	40 1 38 1 35.3 31.9	92.	4 5.30	2.8	6 4 5.2	45 3 44.6 43.7 42.6	1 45 1 82 2 33 2.99	38 4	70 89 109 129.	9 7.20 7 5.50	3.6	10 0
	9.0	5 4	12 6	60 80 100 120	43.9 43.2 42.3	1.57 1.99 2.55 PERATI	38 6 36 4 33.5 ON NOT	97.3 116.9	8.18 6.37 4.85 MMEN	1.5	3.5 2.4	46.0 45.2 44.3 43.1	1 50 1.89 2 42 3.10	40.8 38 8 36 0 32.6	112	9 7 03	2.2	6.4 5.2	46 0 45.3 44 4 43.3	1 46 1 82 2.34 3.00	39.1 36.5			9 4.3 7 3 6	8 2

LEGEND

COP — Coefficient of Performance
EWT — Entering Water Temperature (F)
GPM — Gailons Per Minute
LWT — Leaving Water Temperature (F)
MBtuh — Btuh in Thousands
PSI — Pounds per Square Inch
TC — Total Capacity (MBtuh)
THA — Total Heat of Absorption (Btuh)

- NOTES:

 1 Interpolation is permissible, extrapolation is not
 2 All performance data is based upon the lower voltage of dual voltage rated units
 3 All performance data is based upon a load coaxial heat exchanger of single-walled copper construction For vented double-walled performance consult the factory.
 4. Operation below 40 F EWT is based upon 15% antifreeze solution

Performance data (cont)



HEATING CAPACITIES (cont) 50RWS060

s	OURC	E CC)IL										ı	OAD CO	IL.				_						
		Pre	ssure			Wa	ter Flow	7.5 (G	om)				Wat	er Flow 1	1.3 (G	pm)				Wat	er Flow 1	5.0 (G	pm)	_	
EWT (F)	GPM	L	rop Ft Wg	EWT (F)	TC (MBtuh)	Power (kW)	THA (MBtuh)	LWT (F)	СОР		sure op Ft Wg	TC (MBtuh)	Power (kW)	THA (MBtuh)	LWT (F)	СОР	D	ssure rop Ft Wg	TC (MBtuh)	Power (kW)	THA (MBtuh)	LWT (F)	СОР	Di	ssure rop Ft Wg
20	15.0	79	18 2	60 80 100 120	36 8 35 0 33 9 33.6	2 53 3 17 4 01 5.08	28 2 24 2 20 2 16.3	69 8 89 3 109 0 129.0	3 24 2 48	16 13 09 0.6	37 30 21 1.5	37 2 35 2 34 0 33.6	2 44 3 04 3 86 4.89	28.9 24 9 20 9 17.0	66.6 86.2 106.0 126.0		3 1 2.6 1 9 1.6	7 1 5 9 4 5 3.6	37 4 35 4 34 1 33.6	2 39 2 98 3 78 4.79	29 3 25.2 21 2 17.3	65 0 84 7 104 5 124.5	3 48 2 64	5 0 4 2 3 5 2.9	11 6 9 7 8 1 6.7
	7.5	3 1	72	60 80 100 120	38 2 36 3 35 2 35.0	2 55 3 19 4 04 5.12	29 5 25 4 21 4 17.5	70 2 89 7 109 4 129.3	3 34 2 55	16 13 09 0.6	37 30 21 1.5	38 7 36.6 35 4 34.9	2.46 3.06 3.88 4.92	30 3 26 1 22 1 18.1	66 8 86 5 106 3 126.2	4 62 3 50 2 67 2.08	3 1 2.6 1.9 1.6	71 59 45 3.6	38 9 36 7 35 4 34.9	2 41 3 00 3 81 4.83	30 7 26 5 22 4 18.5	65 2 84 9 104.7 124.7	3 58 2 73	50 42 35 2.9	11 6 9 7 8 1 6.7
30	11.3	50	11 5	60 80 100 120	40 5 38 5 37 3 37.0	2 57 3 22 4 08 5.16	31 7 27 5 23 4 19.4	70 8 90 3 109 9 129 9	3 50 2 68	16 13 09 0.6	37 30 21 1.5	41 0 38.8 37 4 37.0	2 48 3 09 3 92 4.97	32 5 28 2 24 1 20.1	67 2 86 9 106 6 126.5	4.84 3.68 2.80 2.18	3 1 2 6 1 9 1.6	45	41 2 38 9 37 5 37.0	2 43 3 03 3 84 4.87	32 9 28 6 24 4 20.4	124.9	3 76 2 86 2.23	50 42 35 2.9	11 6 9 7 8 1 6.7
	15 .0	74	17 0	60 80 100 120	42 3 40 2 39 0 38.7	2 58 3 23 4 09 5.18	33 5 29 2 25 0 21.0	71 3 90 7 110 4 130.3	3 65 2 79	1 6 1 3 0 9 0.6	37 30 21 1.5	42 8 40 5 39 1 38.7	2 49 3 10 3 93 4.99	34 3 29 9 25 7 21.6	67 6 87 2 106 9 126.8	3 82 2 91	2 6 1 9	45	43 0 40 7 39 2 38.7	2 44 3 04 3 86 4.89	34 7 30 3 26 0 22.0	65 7 85 4 105 2 125.2	5 16 3.92 2 98 2.32	5 0 4 2 3 5 2.9	11 6 9 7 8 1 6.7
	75	27	62	60 80 100 120	44 1 43 1 41 8 40.3	2 62 3 32 4 21 5.28	35 1 31 8 27 5 22.2	71 8 91 5 111.2 130.7	3 80 2 91	09	37 30 21 1.5	44 3 43 4 42 1 40.6	2 48 3 14 3 99 5.03	35 8 32 6 28 5 23.5	67 8 87 7 107 5 127.2		26	4.5	44 3 43 5 42 3 40.8	2 42 3 06 3 89 4.91	36 1 33 1 29 0 24.1	85 8 105 6	5 37 4 17 3 19 2.44	42	11 6 9 7 8 1 6.7
40	11.3	4 4	102	60 80 100 120	46 7 45 6 44 3 42.6	2.64 3 35 4 25 5.33	37 7 34 2 29 8 24.5	72 4 92 2 111 8 131.4	3 99 3 06	09	37 30 21 1.5	46 9 45 9 44 6 43.0	2 50 3 17 4 03 5.07	38 3 35 1 30 9 25.7	88 1 107 9	5 49 4 25 3 25 2.49	2 6 1 9	45	47 0 46 0 44 8 43.2	2 44 3 08 3 92 4.95	38.6 35.5 31.4 26.3	86.1 106.0	5 64 4.38 3 35 2.56	4 2 3 5	11 6 9 7 8 1 6.7
	15.0	é 6	152	60 80 100 120	48 8 47 7 46 3 44.5	2 66 3 36 4 26 5.35	39 7 36 2 31 7 26.3	927	3 18	13	37 30 21 1.5	49 0 48 0 46 6 45.0	2 51 3 18 4 04 5.09	40 4 37 1 32 8 27.6		5 71 4 42 3 38 2.59	19	45	49 1 48 1 46 8 45.1	2 45 3 10 3 94 4.97	40 7 37 5 33 4 28.2	106.2	5 87 4 56 2 3 48 2 2.66	4 2 3 5	
	7.5	22	52	60 80 100 120	50 0 48 9 47 5 45.7	2 67 3 38 4 28 5.37	40 9 37 4 32 9 27.4	73 3 93 0 112 7 132.2	4 24 3 25	13	37 30 21 1.5	50 3 49 2 47 8 46.1	2 53 3 20 4 06 5.12	41 6 38 3 34 0 28.7	88 7 108 5	5 83 4 51 3 45 2.64	2.6	4.5	50 3 49 4 48 0 46.3	2 46 3 11 3 95 5.00	41 9 38 7 34 5 29.3	106 4	7 5 99 6 4 65 4 3 56 2 2.72	4 2 3 5	11 6 9 7 8 1 6.7
50	11.3	40	92	60 80 100 120	53 0 51 8 50 3 48.4	2 69 3 41 4 32 5.42	43 8 40 2 35 6 29.9	74 1 93 8 113 4 132.9	4 45 3 41	09	37 30 21 1.5	53 2 52 1 50 7 48.9	2 55 3 22 4 10 5.16	44 5 41 1 36 7 31.2	89 2 109 0	6 12 4 74 3 63 2.77	26	4.5	53 3 52 3 50 9 49.1	2 48 3 14 3 99 5.04	44 8 41 6 37 2 31.9	67 87 (106 8 126 9	3 74	3 5	97 81
	15.0	6 1	14 1	60 80 100 120	55 4 54 1 52 5 50.6	2 70 3 42 4 34 5 44	46 1 42 5 37 7 32.0	74 8 94 4 114 0 133.5	4 64 3 55	13	37 30 21 1.5	55 6 54 5 52 9 51.0	2 56 3 24 4 11 5.18	46 9 43 4 38 9 33.3	89.6 109.4	6 37 4 93 3 77 2.88	19	4.5	55 7 54.6 53 1 51.3	2 49 3 15 4 01 5.06	47 2 43 9 39 5 34.0	107	4 6 55 3 5 08 1 3 89 8 2.97	3 5	9 7 8 1
	7.5	2 1	48	60 80 100 120	55 5 54 3 52 7 50.7	2 71 3 43 4 35 5.46	46 3 42 6 37 9 32.1	74 8 94 5 114 1 133.5	4 64 3 55	13	37 30 21 1.5	55 8 54 6 53 1 51.2	2 57 3 25 4 13 5.20	47 0 43 5 39 0 33.4	89.7 109 4	6 37 4 93 3 77 2.88	1.9	45	55 9 54.8 53 3 51.4	2 50 3 16 4 02 5.08	47 3 44 0 39 6 34.1	67 87 107 126.	3 5 08 1 3 89	3 4 2	97
60	11.3	38	8 7	60 80 100 120	58 8 57 5 55 8 53.7	2 73 3 46 4 39 5.51	49 5 45 7 40 8 34.9	75 7 95.3 114 9 134.3	4 87 3 73	0.9	37 30 21 1.5	59.1 57 9 56 2 54.2	2 59 3.27 4 16 5.24	50 2 46 7 42 0 36.3	110.0	6.69 5 18 3.96 3.03	1 2 6	5 9 4 5	59.2 58 0 56.4 54.4	2 52 3 19 4 05 5.12	47 1 42 6		7 5 34 5 4.0	4 4 2	97
	15.0	5 7	133	60 80 100 120	61 4 60 1 58 3 56.1	2 74 3 48 4 41 5.53	52 1 48 2 43 3 37.3	76 4 96 0 115 5 135.0	6 56 5 06 3 88 2.98	13	37 30 21 1.5	61 7 60 4 58 8 56.6	2.60 3 29 4 18 5.27	52 8 49 2 44 5 38.7	70.9 90.7 110.4 130.0	7 5 39 1 4.12	1.9	59	61.8 60.6 59 0 56.9	2 53 3 20 4 07 5.14	49 7 45 1	68 88 107. 127.	1 5 5 9 4 2	5 4 2	97
	7.5	1 9	4.5	60 80 100 120	59 7 58 7 57.7	2 79 3 53 4.46 PERATI	50 2 46 7 42.5 ON NOT I	95 7 115.4	6 27 4 87 3.80 MMEN	1.3	37 30 2.1	60 0 59 0 58 0 57.0	2.61 3 31 4 18 5.24	51.1 47 7 43 7 39.1	90 4	6 73 5.23 4 06 3 .19	1 2 6	5 9 4 5	60.2 59.2 58 1 57.1	2 53 3 20 4 05 5.09	48.2 44.3	68 87 107. 127.	9 5 4 8 4 2	5 5 0 2 4 2 0 3 5 9 2.9	97
70	11.3	36	82	60 80 100 120	63 3 62 2 61.1	2 82 3 56 4.49 PERATI	53 7 50 0 45.8 ON NOT I	96 6 116.3	6 59 5 12 3.99 MMEN	1 3	3 7 3 0 2.1	63 6 62 5 61.4 60.4	2.64 3.33 4 22 5.29	54 6 51 1 47 0 42.3	71 3 91 110 9 130.3	5 49 4 27	2.6	5 9 4.5	63 7 62.6 61.6 60.5	2 55 3 23 4.09 5.14	51.6 47.6	68 88 108 128	2 4 4	9 4 2	97
	15.0	5 5	12 7	60 80 100 120	66 1 65 0 63.9	2 83 3 58 4.51 PERATI	56 5 52 8 48.5 ON NOT I		5 32 4.15	1 3 0.9	37 30 2.1	66 4 65 3 64 2 63.1	2 65 3 35 4 24 5.31	57.4 53 9 49 7 44.9	71.0 91.0 111.4 131.3	5 72 4 4 44	2 2.6	5 9 4 5	66.6 65.4 64.3 63.2	2 56 3 24 4 11 5.16	54 4 50 3			2 4 2 9 3 5	97

LEGEND

COP — Coefficient of Performance
EWT — Entering Water Temperature (F)
GPM — Gallons Per Minute
LWT — Leaving Water Temperature (F)
MBtuh — Btuh in Thousands
PSI — Pounds per Square Inch
TC — Total Capacity (MBtuh)
THA — Total Heat of Absorption (Btuh)

- NOTES:
 Interpolation is permissible, extrapolation is not
 All performance data is based upon the lower voltage of dual voltage rated units
 All performance data is based upon a load coaxial heat exchanger of single-walled copper construction For vented double-walled performance consult Carrier representative
 Operation below 40 F EWT is based upon 15% antifreeze solution



HEATING CAPACITIES (cont) 50RWS120

S	OURC	E CO	IL										L	OAD CO	IL_				_						
		Pres	sure			Wat	ter Flow 1	5.0 (G	pm)	_			Wat	er Flow 2	2.6 (G	pm)	_			Wat	er Flow 3	0.0 (G	pm)		_
(F)	GPM		rop Ft Wa	(F)	TC (MBtuh)	Power (kW)	THA (MBtuh)	LWT (F)	СОР	Di	sure op Ft Wa	TC (MBtuh)	Power (kW)	THA (MBtuh)	LWT (F)	СОР	Ď	ssure rop Ft Wg	TC (MBtuh)	Power (kW)	THA (MBtuh)	LWT (F)	СОР	Pressu Drop PSI Ft \	
20	30.0	11 1	25.5	60 80 100 120	73 6 69 9 67 8 67.3	5.06 6.33 8 03 10.16	56.3 48 3 40 4 32.6	69.8 89.3 109.0 129.0		2.2 1.8 1.3 0.9	5 1 4.2 2.9 2.1	74.4 70.5 68 1 67.3	4.88 6.08 7 71 9.77	57.8 49.7 41 7 33.9	106.0	4 48 3.39 2.59 2.02	43 36 2.7 2.2	99 83 63 5.1	74.9 70.7 68.2 67.3	4.79 5.96 7.56 9.59	58.5 50.4 42.4 34.6	84.7	3 48 2 64	7 0 16 5 9 13 4.9 11	2
	15.0	43	10 0	60 80 100 120	76 5 72 7 70.4 69.9	5.10 6 38 8.09 10.23	59.1 50.9 42.9 35.0	70.2 89 7 109.4 129.3	3.34 2.55	2.2 1.8 1.3 0.9	5.1 4.2 2.9 2.1	77 3 73 2 70.7 69.9	4.91 6 13 7 77 9.84	60 6 52.3 44 2 36.3	68 8 86.5 106.3 126.2	3 50 2 67	4.3 3 6 2 7 2.2	9.9 8 3 6.3 5.1	77 8 73 5 70 8 69.9	4.82 6 01 7 62 9.66	61 3 53.0 44 9 36.9	65 2 84 9 104 7 124.7			36
30	22.6	70	162	60 80 100 120	81 0 76 9 74 6 74.0	5 15 6 44 8 16 10.32	63 4 55.0 46 8 38.8	70.8 90 3 109.9 129.9	3 50 2 68	2.2 1 8 1 3 0.9	5 1 4.2 2.9 2.1	81 9 77 5 74 9 74.0	4.95 6 18 7.84 9.93	65.0 56.4 48.1 40.1	67.2 86.9 108.6 126.5	3.68 2.80	43 36 2.7 2.2	9.9 8.3 6.3 5.1	82 4 77.8 75 0 74.0	4 86 6 06 7 69 9.74	65.8 57.2 48.8 40.8	85 2 105 0	4 96 3 76 2.86 2.23	5 9 13 4.9 11	3 6 1 3 9.3
	30.0	10 3	23 8	60 80 100 120	84.6 80 4 77 9 77.3	5 17 6 46 8 19 10.36	67 0 58 3 50 0 42.0	71.3 90 7 110.4 130.3	3 65	2.2 1 8 1.3 0.9	5.1 42 29 2.1	85 6 81 0 78 2 77.3	4 97 6 21 7.87 9.97	68.6 59.8 51.4 43.3	126.8	3 82 2.91 2.27	43 36 27 2.2	99 83 63 5.1	86 1 81.3 78 4 77.3	4 88 6 09 7 72 9.78	69 4 60.5 52 1 43.9	105.2	5 16 3.92 2.98 2.32	5.9 13 4 9 11	3 6 1 3 9.3
	15.0	37	86	60 80 100 120	88 2 86.2 83 7 80.5	5 24 6 64 8 42 10.56		71 8 91 5 111.2 130.7	3.80 2.91	11.3	5 1 4.2 2.9 2.1	88 5 86.7 84 3 81.3	4.97 6.28 7.98 10.06	71.6 65.3 57.1 46.9	87.7 107.5	5 23 4 05 3.10 2.37	43 36 27 2.2	6.3	88 7 87.0 84.6 81.6	4 84 6 11 7.77 9.82	72.2 66 1 58.1 48.1	125.4	4 17 3 19 2.44	5 9 13 4.9 11 4.0 9	6 2 3 6 1 3 9.3
40	22.6	62	143	60 80 100 120	93.4 91.3 88 6 85.3	5 29 6.70 8.49 10.65		131.4	3 99 3 06 2.35	1.3	5.1 4.2 2.9 2.1	93 8 91.8 89.3 86.1	5.01 6.34 8.05 10.15	76 7 70.2 61.8 51.4	107.9	5 49 4.25 3.25 2.49	27	6.3	93.9 92 1 89 6 86.4	4 88 6 17 7 84 9.91	77.3 71 1 62 8 52.6	86 1	+	5 9 13 4 9 1 4.0 9	6 2 3 6 1 3 9.3
	30.0	92	21 3	60 80 100 120	97.5 95.4 92.6 89.1	5.31 6.73 8.52 10.70	63.5	73.0 92.7 112.3 131.9	4.16 3.18	1.8 1.3	5 1 4 2 2.9 2.1	97 9 95.9 93 3 89.9	5.03 8.36 8.08 10.19	80 8 74.2 65 7 55.1	88.5 108.5	5.71 4 42 3 3 38 2.59	27	8.3 63	98.1 96.2 93.6 90.3	4 90 6.19 7 87 9.95	66 7		4.56 3 48 2.66	5.9 13 4.9 1 4.0	6 2 3 6 1 3 9.3
	15.0	31	73	60 80 100 120	100.1 97 9 95.0 91.4	5 34 6.76 8 56 10.75	74 8 65.8	73.3 93.0 112.7 132.2	4.24	1.8	5.1 4.2 2.9 2.1	100 5 98 4 95.7 92.3	5 05 6.39 8 12 10.24	83.3 76 6 68.0 57.3	68.9 88.1 108.9 128.2	7 4 51 5 3 45	3.6	83 63	100 7 98 7 96 0 92.7	4 92 6 22 7 91 9.99	69.0	106.4	4.65 3.56 2.72	5 9 13 4.9 1 4.0	6 2 3 6 1 3 9.3
50	22.6	5 6	128	60 80 100 120	100.6	5 38 6 82 8 64 10.84	80.4 71 1	74.1 93.8 113.4 132.9	4 45 3.41	1.8	5 1 4.2 2.9 2.1	106 4 104 3 101 3 97.7	5 10 6.45 8 19 10.33	89.0 82.3 73 4 82.5	69.4 89.2 109.4 128.4	2 4 74 3 63	36	8.3 6.3	106 6 104 5 101 7 98.1	4 97 6 27 7 98 10.08		67 1 87.0 106.6 126.5	4 88 3 74	5 9 1: 4 9 1	62 36 13 9.3
	30.0	8 5	19 7	60 80 100 120	108 3 105 1	5 40 6 85 8.68 10.89	84 9 75 5	74.8 94.4 114.0 133.5	4 4.64 3 55	1.8	5.1 4.2 2.9 2.1	111.2 108 9 105 9 102.1	5 12 6 47 8.23 10.37	93.7 86.8 77.8 66.7	89.4 109.4		3 6 2.7	8 3 6.3	111 4 109 2 106 3 102.5	4.99 6.30 8 01 10.12	87 7 78.9	67 4 87 3 107 126.8	5 08 3 89	5 9 1 4 9 1	62 36 13 9.3
-	15.0	29	67	60 80 100 120	108 6 105 4	5.42 6 87 8 70 10.92	85 2 75.7	74.8 94.5 114.1 133.5	3.55	1.8	5.1 4.2 2.9 2.1	111 5 109 3 106.2 102.4	5 13 6 49 8 25 10.40	94.0 87 1 78.0 66.9	89. 109	9 6 37 7 4 93 4 3.77 1 2.88	3.6	83	111.7 109 6 106.6 102.8	5 00 6 32 8 04 10.15	88 0 79 2	67 4 87 3 107 126.9	5.08	5 9 1 4 9 1	6 2 3 6 1 3 9.3
60	22.6	5 3	12.2	80 100 120	115.0 111.6	5 47 6 93 8 78 11.01	91.4	75.3 95.3 114.9 134.3		1.8	5.1 4.2 2.9 2.1	118.1 115.7 112.5 108.4	5.18 6 55 8.32 10.49	100 5 93.4 84 1 72.6	70. 90. 110. 129.	2 5.18 0 3.96	3 6	83	118 3 116.0 112.9 108.9	5 04 6 37 8.10 10.24	94 3	67 9 87 107 9 127.	5 4 08 3 3.12	5 9 1 4 9 1 4.0	6 2 3 6 1 3 9.3
	30.0	80	18.6	100 120	120.2 116.6 112.2	5 49 6.95 8 81 11.06	96 4 86.6 74.5	115.9 135.0	5.06 5 3.88 2.98	1 8 1.3 0.9	5.1 4.2 2.9 2.1	123 4 120 9 117 5 113.3	5.20 6.58 8.35 10.53	105.7 98 4 89.0 77.3	130.	7 5.39 4 4.12 0 3.15	3.6 2.7 2.2	8.3 6.3 5.1	123.6 121.2 117.9 113.8	5.06 6.40 8.14 10.28	99 4 90.2 78.7	107 t 127.	1 5 55 9 4 25 6 3.24	5 9 1 4 9 1 4.0	6 2 3 6 11 3 9.3
	15.0	27	63	100 120	117.5 115.4	5.58 7.07 8.91 PERAT	93.4	95.1 115.4	4 3.80	7 1.8 1.3	5 1 4.2 2.9	120.1 118.0 116.0 114.0	5 23 6.61 8.37 10.49	102.2 95.5 87.5 78.2	90.	6 6.73 4 5.23 3 4 06 1 3.19	3 6	8.3 6.3	120.4 118.3 116.3 114.3	5.07 6 40 8 11 10.19	96.5 88.6 79.5	87 107. 127.	0 6 96 9 5 42 8 4.20 6 3.29	5 9 1 4 9 1 4.0	6 2 13 6 11 3 9.3
70	22.6	5.0	11 5	60 80 100 120	124 4 122.3	5.63 7.13 8.99 OPERAT	100 1	116.	5.12 3 3.99	1.8 1.3		127.2 125 0 122 9 120.7	5.27 6.67 8.44 10.58	109.2 102.2 94.1 84.6	71 91. 110. 130.	1 5.49 9 4 27	3.6	8.3 7 63		5 11 6.46 8 18 10.27	103.3 95.2	68. 88 108. 128.	4 5 69 2 4 41	5 9 1 4.9 1 5 4.0	16 2 13 6 11 3 9.3
	30.0	77	178	60 80 100 120	130.0 127.7	7.15 9.02	105.6	97 117.	6 6 8 3 5 3 0 4.1 0 MME	2 1.8 5 1.3	4.2 2.9	132.8 130 6 128 3 126.1	5.29 6 70 8.47 10.62	107.7	111	8 7 3: 6 5.7; 4 4.4 2 3.4	2 3.6 1 2.7	6 8 3 7 6.3	130.9	6.48 8.21	3 108.8 1 100.6			5 9 1	16.2 13 6 11 3 9.3

LEGEND

COP — Coefficient of Performance
EWT — Entering Water Temperature (F)
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THA — Total Heat of Absorption (Btuh)

NOTES:

Interpolation is permissible, extrapolation is not

All performance data is based upon the lower voltage of dual voltage rated units

All performance data is based upon a load coaxial heat exchanger of single-walled copper construction For vented double-walled performance consult Carrier representative

Operation below 40 F EWT is based upon 15% antifreeze solution

Application data

Utilize Aquazone[™] products to provide optimal energy efficient solutions in the most challenging design applications. Aquazone water source heat pump products are available in a several models, which can be used in water loop, ground water, and ground loop systems.

AQUAZONE PRODUCT GUIDE

50 SERIES	TYPE SIZE (tons)	APPLICATION
50RHC,RVC Horizontal/Vertical	Standard Efficiency 1/2-5	Efficient, low cost alternative for retrofit or new boiler/tower systems.
50RHR,RVR Horizontal/Vertical	High Efficiency 1/ ₂ -5	Efficient, adaptable unit for new boiler/tower, ground water, or ground loop systems.
50RHS,RVS Horizontal/Vertical	Premium Efficiency 1/ ₂ -6	Premium, ultra efficient unit for new boiler/tower, ground water, or ground loop systems
50HQ,VQ Horizontal/Vertical	Large Capacity 6 ¹ / ₂ -25	Designed to handle large zoned areas for all applications.
50KQ	Console 1/2-11/2	Attractive design for finished interior, under-window installations.
50RTG	Rooftop 3-20	Economical solution for IAQ problems and tempering ventilation air.
50RWS	Water-to-Water 3-10	Used to pre-heat or cool air and can be used as a stand-alone or supplemental boiler/chiller in most hydronic heating applications. Also conditions process fluids, lubricants and refrigerants.

Water loop system

Water loop (or boiler/tower) system applications typically include a number of units plumbed to a common piping system. For optimal performance, this system should be designed between 2.25 and 3 gpm per ton of cooling capacity. The system is comprised of highly efficient packaged reverse cycle heat pump units interconnected by a water loop. The water circuit serves as both a sink and source for heat absorption and rejection and is designed for entering water temperatures between 60 F and 90 F. Within this temperature range, units can heat or cool as required from the same water source. Transferring heat from warm to cold spaces in the building conserves energy rather than creating new heat.

Refer to the **Carrier Water Source Heat Pump System Design Guide** for assistance with the design of water loop systems. The guide includes a practical approach for the latest and most current design recommendations including:

- Product application including horizontal, vertical, console, rooftop, and water-to-water applications.
- Ventilation methods and system design including energy recovery.
- Acoustical considerations for different product types.
- Addressing IAQ (indoor air quality) issues such as condensate removal and humidity control.
- Air Distribution Design including diffuser selection/ layout and ductwork design.
- Hydronic System Design including pipe sizing/layout and boiler/tower sizing.



- Control Configurations such as stand alone, DDC, DCV, and VVT®.
- WSHP Efficiency/Operational Cost Comparison charts.
- System applications such as a system without a boiler, variable pumping, and VAV for interior use.

Ground water systems

To utilize Aquazone units in ground water applications, extended range should be specified. This will provide factory-installed insulation on the coaxial coil to prevent condensate from dripping when entering-water temperatures are below 60 F. The standard copper coaxial coil on the Aquazone units may not be suitable for certain water conditions. Refer to the Water Conditioning section for proper coaxial coil material selection.

Surface water system — This system is typically located near a lake or pond. In this application, the loop can be submerged in a series of coils beneath the water surface. The number of coils required depends on system load and design. This application requires minimum piping and excavation.

Open loop system — This system is used where ground water is plentiful. In this application, ground water is pumped through supply piping from the well to the building. The water is then pumped back into the ground through a discharge well as it leaves the building. An additional heat exchanger is usually installed between the building water piping system and the ground water piping system. This design limits the amount of piping and excavation required.

Aquazone units are provided with a standard TXV and are rated to extremely low temperatures to self-adjust the refrigeration circuit, therefore water regulating valves are not required on open loop systems. To conserve water on this type of system, a slow opening/closing solenoid valve is recommended.

Ground loop systems

There are many commonly specified designs for ground loop applications. Typical designs include vertical loops and horizontal loops. In some applications, water is piped from the ground or lake directly to the water source heat pump. Piping is limited to the amount of pipe required to get the water from the source to the unit.

NOTE: When utilizing Aquazone water source heat pumps in ground loop systems, refer to design considerations in the ground water system section.

Horizontal ground loop — This system is used when adequate space is available and trenching can be easily accomplished. A series of parallel pipes are laid out in trenches 3 to 6 feet below the ground surface and then backfilled. Often multiple pipes are used to maximize the heat transfer capability of each trench. The amount of pipe and the size of the ground loop field are based on ground conditions, heating, and cooling requirements of the application and system design.



Vertical ground loop — This system is used in vertical borehole applications. This design is well suited for retrofit applications where there are space limitations or where landscaping is already complete and minimum disruption of the site is desired. The vertical ground loop system contains a single loop of pipe inserted into a hole. The hole is back-filled and grouted after the pipe is inserted. The completed loop is concealed below ground. The number of loops required depends on ground conditions, heating and cooling requirements, and the depth of each hole.

Hybrid systems — In some applications, it may be beneficial to incorporate a cooling tower into the ground loop system to reduce the overall cost. A Hybrid System discards excess heat into the air and increases the cooling performance of the ground loop.

Water conditioning

In some applications, maintaining proper water quality may require the use of higher corrosion protection for the water-to-refrigerant heat exchanger. Water quality varies from location to location and is unique for each job. Water characteristics such as pH value, alkalinity, hardness, and specific conductance are of importance when considering any WSHP application. Water typically includes impurities and hardness that must be removed. The required treatment will depend on the water quality as well as type of system. Water problems fall into three main categories:

- Scale formation caused by hard water reduces the heat transfer rate and increases the water pressure drop through the heat exchanger. As water is heated, minerals and salts are precipitated from a solution and deposited on the inside surface of the pipe or tube.
- Corrosion is caused by absorption of gases from the air coupled with water on exposed metal. Corrosion is also common in salt-water areas.
- Organic growths such as algae can reduce the heat transfer rate by forming an insulating coating on the inside tube surface. Algae can also promote corrosion by pitting.

NOTE: In most commercial water loop applications, Aquazone™ WSHP units use a copper water-to-refrigerant heat exchanger. Units can also be equipped with a cupronickel heat exchanger for applications where water is outside the standard contaminant limits for a copper heat exchanger.

WATER QUALITY GUIDELINES

CONDITION	ACCEPT	ABLE LEVEL	
рН	7 to 9 range for copper Coin the 5 to 9 range.	upro-nickel may be u	used
Total Hardness	Calcium and magnesium of exceed 20 grains per gallo	carbonate should no on (350 ppm).	ot
Iron Oxides	Less than 1 ppm.		
Iron Bacteria	No level allowable.		
Corrosion*		Max Allowable Level	Coaxial Metal
	Ammonia, Ammonium Hydroxide	0 5 ppm	Cu
	Ammonium Chloride, Ammonium Nitrate	0 5 ppm	Cu
	Ammonium Sulfate	0 5 ppm	Cu
	Chlorine/Chlorides Hydrogen Sulfide†	0 5 ppm None Allowable	CuNi —
Brackish	Use Cupro-nickel heat exc of calcium or sodium chlo are present. (Seawater is	ride are greater thar	n 125 ppm

*If the concentration of these corrosives exceeds the maximum allowable level, then the potential for serious corrosion problems exists

†Sulfides in the water quickly oxidize when exposed to air, requiring that no agitation occur as the sample is taken Unless tested immediately at the site, the sample will require stabilization with a few drops of one Molar zinc acetate solution, allowing accurate sulfide determination up to 24 hours after sampling A low pH and high alkalinity cause system problems, even when both values are within ranges shown The term pH refers to the acidity, basicity, or neutrality of the water supply. Below 7 0, the water is considered to be acidic. Above 7 0, water is considered to be basic Neutral water contains a pH of 7 0.

NOTE: To convert ppm to grains per gallon, divide by 17 Hardness in mg/l is equivalent to ppm.

Solenoid valves

In applications using variable flow pumping, solenoid valves can be field installed and operated from the control board in the Aquazone WSHP unit.

Freeze protection

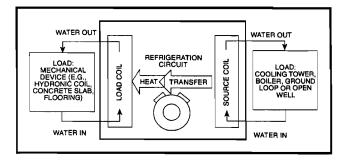
Applications where systems are exposed to outdoor temperatures below freezing (32 F) must be protected from freezing. The most common method of protecting water systems from freezing is adding glycol concentrations into the water. Design care should used when selecting both the type and concentrations of glycol utilized due to the following:

- Equipment and performance may suffer with high concentrations of glycol and other antifreeze solutions.
- Loss of piping pressure may increase greatly, resulting in higher pumping costs.
- Higher viscosity of the mixture may cause excess corrosion and wear on the entire system.
- Acidity of the water may be greatly increased, promoting corrosion.
- Glycol promotes galvanic corrosion in systems of dissimilar metals. The result is corrosion of one metal by the other, causing leaks.

Application data (cont)

Source vs. load heat exchanger

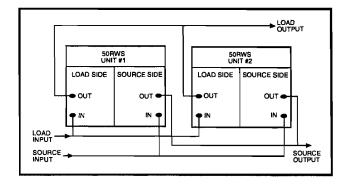
Both the load and source heat exchangers are water-to-refrigerant heat exchangers. The water for the source heat exchanger is supplied from a ground loop, open loop (well water), or water loop (boiler/tower) system. Heat from the refrigeration circuit is exchanged between the load and source heat exchangers. The water for the load heat exchanger can be used in many applications to provide chilled or hot water for air handling units, fan coils, hydronic baseboards, radiant in-slab piping, or swimming pools.



Parallel operation

Multiple units can be piped in a parallel operation to satisfy heating and/or cooling loads that cannot be accomplished from a single 50RWS water-to-water unit. This arrangement provides additional capacity combinations beyond the largest 50RWS unit offered.

Cycling one or more of the units on or off will provide capacity control through staging of multiple unit combinations. In a parallel operation, the total pressure drop through the load heat exchanger of multiple units is the same as the drop through a single unit.



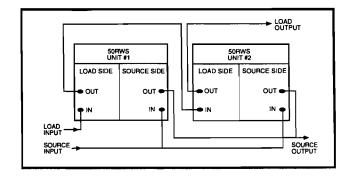


Series operation

Multiple units can be piped in a series type operation to satisfy lower cooling leaving water temperature.

In a series operation, the leaving load water temperature of the first unit becomes the load entering water temperature of the second unit. This arrangement provides an additional decrease in water temperature beyond the capability of a single unit. For example, a typical drop of 10 F to 15 F can be accomplished with one 50RWS unit. When 2 or more units are piped in series, the water temperature drop ranges between 20 F and 25 F. Capacity control is provided by cycling one or more of the units on or off to provide staging of the leaving water temperature from the units.

When the load coils are piped in series, the total water pressure drop through the load heat exchanger of the units should include both units. This is a consideration when sizing the overall system, since an increase in pump horse-power may be required.



Tempering ventilation air in air handlers

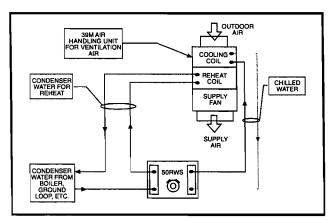
The load heat exchanger in a water-to-water unit provides chilled water during the cooling season and hot water during the heating season. The source heat exchanger is used to provide warm water for ventilation air reheat during the cooling season. In the heating season, the source heat exchanger uses heat from building exhaust to efficiently produce hot water for heating ventilation air in the air-handling unit. The cooling and heating systems can be either piped together for tempering ventilation air as part of an overall integrated system with water-to-water units, or implemented separately depending on the particular design requirements for the ventilation air system.

NOTE: Depending on the system hydronic design, circulation pumps may be required for the source and load of the water-to-water heat pumps in both heating and cooling season operations.



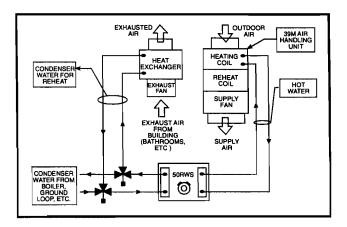
Cooling season

On the load side of the 50RWS unit, chilled water is circulated to the air-handling unit where it cools and dehumidifies ventilation air. The water absorbs heat from the ventilation air and returns back to the 50RWS unit where the heat is removed via the refrigeration circuit and then transferred to the source heat exchanger. Heated water from the source heat exchanger is used to reheat air in the ventilation unit. The heat is then absorbed from the water by the air in the reheat coil and if necessary is returned to the cooling tower, boiler or ground loop for further heat rejection.



Heating season

Building exhaust heat is used by the water-to-water unit for hot water generation. On the load side of the heat exchanger, hot water is circulated to the air-handling unit for heating ventilation air. As the heat from the water is released to the air, the water is circulated back to the 50RWS unit. On the source side of the unit, water is circulated through the heat recovery coil, picks up heat from the exhaust airstream, and then circulates to the 50RWS unit. A pair of control valves is required to maximize the process of extracting the heat from the exhaust. Control valves on the source heat exchanger supply and return water from the main water loop to minimize (or possibly eliminate) the need for additional heat injection by system boilers.



Hydronic heating/cooling system with storage tank

In some cooling or heating applications, the addition of a storage tank may be necessary. The tank allows hot or chilled water temperatures to fluctuate, allowing the waterto-water heat pump to operate more consistently.

In heating applications, this prevents equipment short cycling and to allow different flow rates through the water-to-water unit rather than through the hydronic heating delivery system.

A storage tank is also required for cooling applications if the water-to-water unit is 20% larger than the cooling load and/or multiple fan coil units in the same application.

NOTE: In cooling applications where only one fan coil is utilized, water-to-water units may be able to operate without a storage tank.

The size of the storage tank should be based upon the primary use of the application. For heating, storage tanks should be sized at one U.S. gallon per 1,000 Btuh of heating capacity at the maximum entering source water temperature and the minimum entering load water temperature. For cooling, storage tanks should be sized at one U.S. gallon per 1,000 Btuh of cooling capacity at the minimum entering source water temperature and the maximum entering load water temperature. The selection of the storage tank should be based upon the larger of the heating or cooling calculations.

NOTE: When the water-to-water units do not have sufficient capacity to handle the required heating load, supplementary heating such as electric heat or a boiler may be required.

Application data (cont)

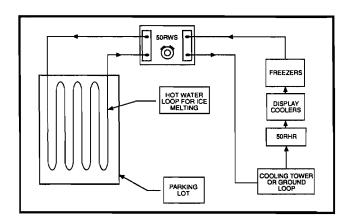


Snow melting systems use water-to-water heat pumps to melt snow and ice. The water-to-water heat pumps circulate hot water through a piping loop in a slab to melt ice and snow. This system is especially energy efficient when coupled with a geothermal ground loop for heat addition/rejection. The size of the water-to-water heat pumps is based on the amount of heat needed to melt the snow across the surface.

NOTE: Consult the ASHRAE HVAC Applications Handbook for slab piping design and temperature requirements.

The 50RWS units can be configured with a field-supplied control system for ice and snow melting. In commercial applications where fast ice removal is required, keeping the slab at a stationary temperature just below the freezing point and then gradually increasing the hot water temperature may reduce melting time.

NOTE: To prevent thermal expansion of the slab due to extreme temperature differences, hot water temperature should be slowly increased.





50RWS036-120 UNIT OPERATING TEMPERATURES

SOURCE COIL	COOLING (F)	HEATING (F)
MIN. ENTERING LIQUID	50	20
NORMAL ENTERING WATER	85	60
MAX ENTERING WATER	110	70
LOAD COIL		
MIN. ENTERING WATER	50	60
NORMAL ENTERING WATER	60	100
MAX ENTERING WATER	90	120

WATER TEMPERATURE CHANGE (F) THROUGH HEAT EXCHANGER

WATER FLOW RATE (GPM)	RISE (F) (Cooling)	DROP (F) (Heating)
FOR CLOSED LOOP: GROUND SOURCE OR COOLER/ BOILER SYSTEMS AT 3 GPM/TON	9-12	4-8
FOR OPEN LOOP: GROUND WATER SYSTEMS AT 1.5 GPM/TON	20-26	10-17

COAX WATER PRESSURE DROP

SOURCE COIL

UNIT	GPM	PRESSURE DROP (psi)				
50RWS		30 F	50 F	70 F	90 F	
036	5.0	4.2	2.6	2.3	1.8	
	7.0	5.8	4.1	4.1	3.1	
	9.0	8.4	6.0	5.5	4.9	
060	7.5	3.1	2.2	1.9	1.5	
	11.3	5.0	4.0	3.6	3.1	
	15.0	7.4	6.1	5.5	5.0	
120	15.0	4.3	3.1	2.7	2.1	
	22.6	7.0	5.6	5.0	4.3	
	30.0	10.3	8.5	7.7	7.0	

LOAD COIL

UNIT	GPM	PRESSURE DROP (psi)				
50RWS		50 F	70 F	90 F		
036	5.0	2.3	1.6	1.3		
	7.0	4.1	2.9	2.6		
	9.0	5.3	4.6	4.3		
060	7.5	1.9	1.4	1.1		
	11.3	3.4	2.9	2.2		
	15.0	5.6	4.6	3.9		
120	15.0	2.6	2.0	1.6		
	22.6	4.8	3.9	3.1		
	30.0	7.8	6.4	5.3		

Electrical data



UNIT 50RWS	VOLTAGE (V-Ph-Hz)	VOLTAGE RANGE MIN/MAX	COMPRESSOR			TOTAL	NCA	MOCP*
			RLA	LRA	QTY	FLA	MCA	MOCP
036	208/230-1-60	197/254	15.0	73.0	1	15.0	18.8	30
	265-1-60	239/292	14.3	71.0	1	14.3	17.9	30
	208/230-3-60	187/254	10.7	63.0	1	10.7	13.4	20
	460-3-60	414/506	5.0	31.0	1	5.0	6.3	15
	208/230-1-60	197/254	28.0	169.0	1	28.0	35.0	60
000	208/230-3-60	187/254	19.3	123.0	1	19.3	24.1	40
060	460-3-60	414/506	7.5	49.5	1	7.5	9.4	15
	575-3-60	518/633	6.4	40.0	1	6.4	8.0	15
120	208/230-1-60	197/254	28.0	169.0	2	56.0	63.0	90
	208/230-3-60	187/254	19.3	123.0	2	38.6	43.4	60
	460-3-60	414/506	7.5	49.5	2	15.0	16.9	20
	575-3-60	518/633	6.4	40.0	2	12.8	14.4	20

LEGEND

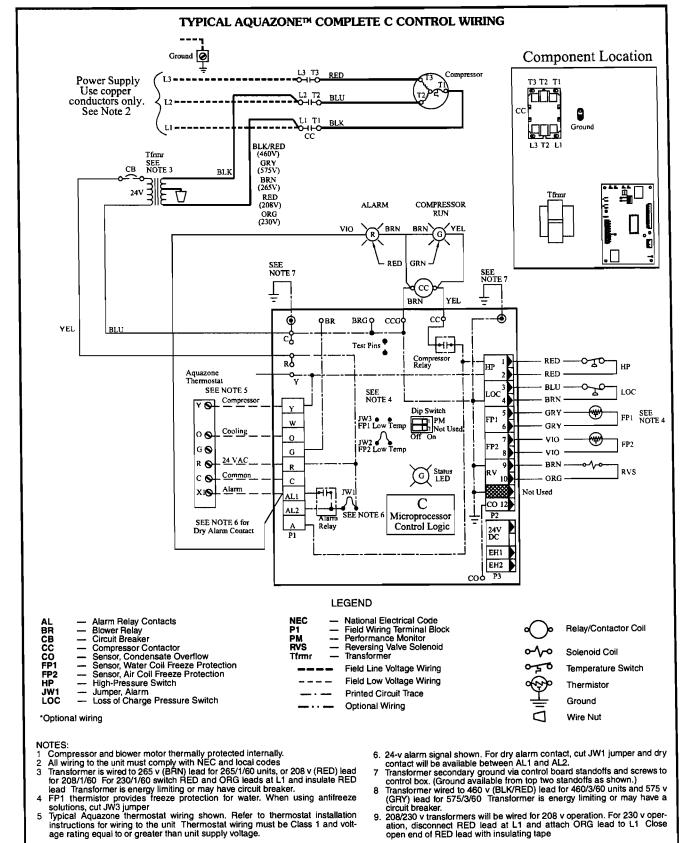
FLA — Full Load Amps
HACR — Heating, Air Conditioning, and Refrigeration
LRA — Locked Rotor Amps
MCA — Minimum Circuit Amps
MOCP — Minimum Overcurrent Protection
RLA — Rated Load Amps



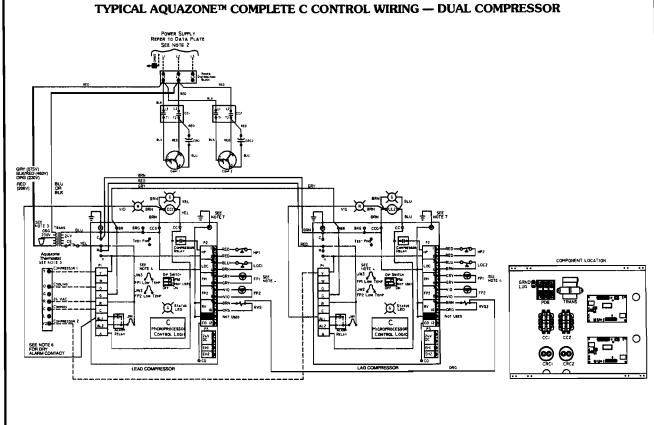
^{*}Time-delay fuse or HACR circuit breaker.

Typical wiring schematics









LEGEND

Alarm Relay Contacts Blower Relay AL BR Circuit Breaker CB Compressor Contactor
 Sensor, Condensate Overflow
 Sensor, Water Coil Freeze Protection
 Sensor, Air Coil Freeze Protection
 High-Pressure Switch
 Jumper Alarm FP1 FP2 HP

- Jumper, Alarm JW1

*Optional wiring.

Loss of Charge Pressure Switch National Electrical Code LOC NEC Field Wiring Terminal Block

PM — RVS — TRANS — Performance Monitor Reversing Valve Solenoid

Transformer

Field Line Voltage Wiring Field Low Voltage Wiring **Printed Circuit Trace**

Optional Wiring

Relay/Contactor Coil

Solenoid Coil



Temperature Switch



Thermistor

Ground

Wire Nut

NOTES:

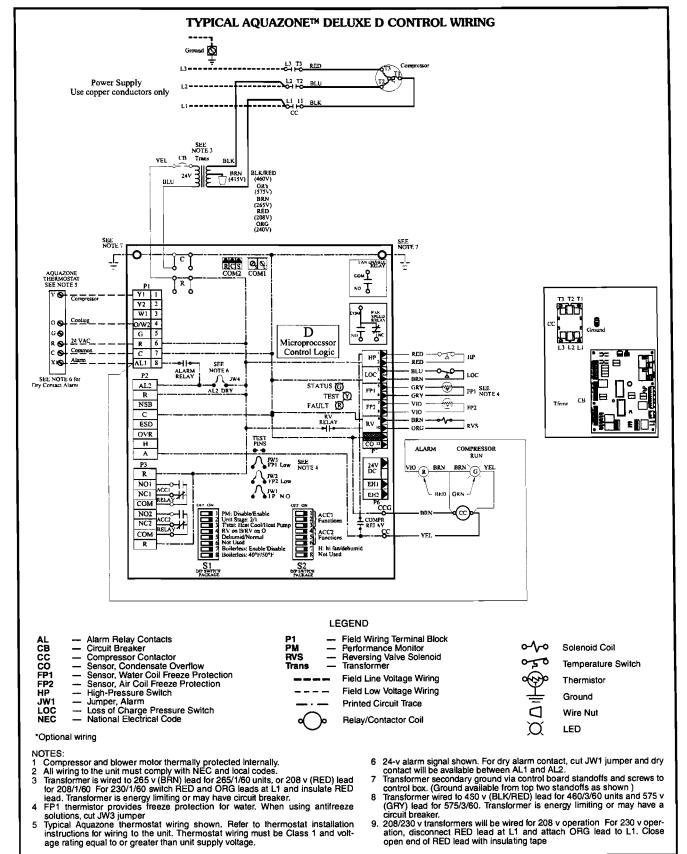
- Compressor and blower motor thermally protected internally.
 All wiring to the unit must comply with NEC and local codes.
 Transformer is wired to 265 v (BRN) lead for 265/1/60 units, or 208 v (RED) lead for 208/1/60. For 230/1/60 switch RED and ORG leads at L1 and insulate RED lead. Transformer is energy limiting or may have circuit breaker.
- FP1 thermistor provides freeze protection for water. When using antifreeze solutions, cut JW3 jumper.
 Typical Aquazone thermostat wiring shown. Refer to thermostat installation instructions for wiring to the unit. Thermostat wiring must be Class 1 and voltage rating equal to or greater than unit supply voltage.
- 24-v alarm signal shown. For dry alarm contact, cut JW1 jumper and dry contact will be available between AL1 and AL2.
 Transformer secondary ground via control board standoffs and screws to control box. (Ground available from top two standoffs as shown.)
- as snown.)

 Transformer wired to 460 v (BLK/RED) lead for 460/3/60 units and 575 v (GRY) lead for 575/3/60. Transformer is energy limiting or may have a circuit breaker.

 208/230 v transformers will be wired for 208 v operation. For 230 v operation, disconnect RED lead at L1 and attach ORG
- lead to L1. Close open end of RED lead with insulating tape.

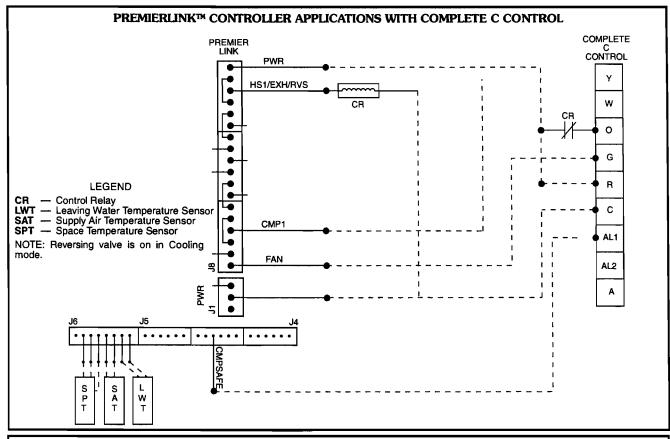
Typical wiring schematics (cont)

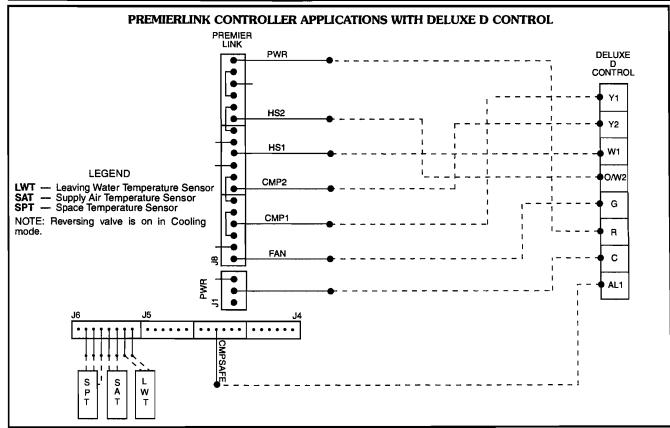




Typical control wiring

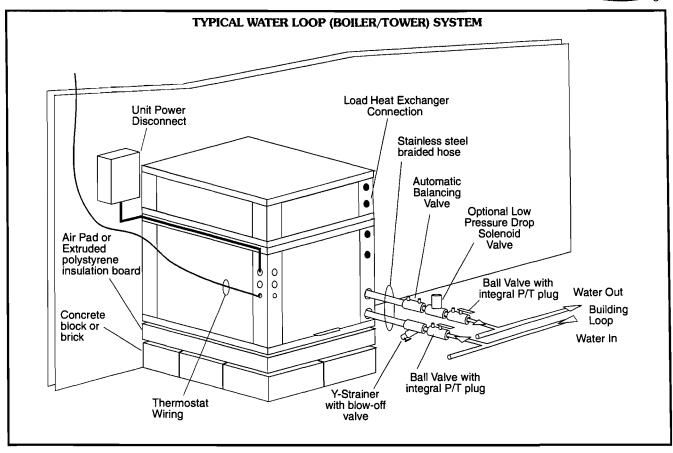


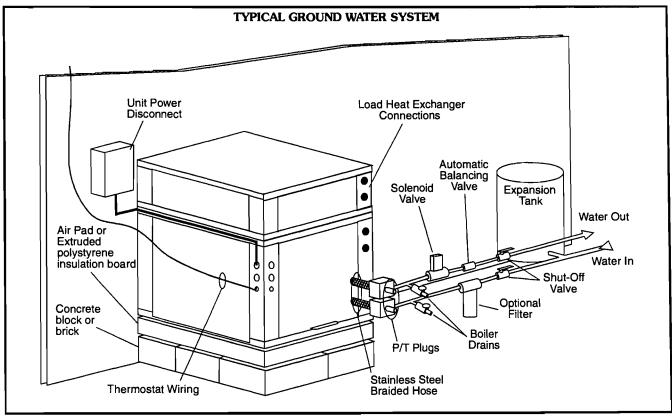




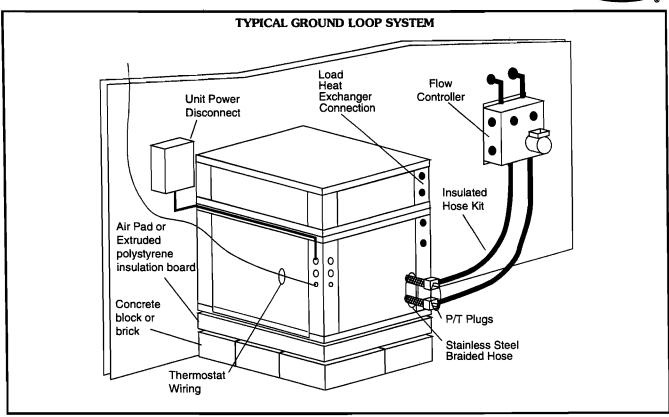
Typical piping and wiring











Guide specifications — 50RWS036,060,120



Commercial Water-to-Water Source Heat Pump Units

HVAC Guide Specifications

Size Range: 29,000 to 91,800 Btuh Cooling Capacity Carrier Model Number: 50RWS, Size 036, 060, 120

Part 1 — General

1.01 SYSTEM DESCRIPTION

- A. Heat pump units designed to operate with 20 to 110 F water temperature. Units shall consist of high efficiency scroll compressor(s) and shall have single or dual independent refrigeration circuits.
- B. Units shall be individually packaged with wooden skid covered with protective corner posts and plastic stretch wrapping for maximum protection.

1.02 QUALITY ASSURANCE

- A Basic unit shall be rated and certified in accordance with ARI/ISO/ASHRAE Standards.
- B. Units shall have insulation and adhesive which meet NFPA (National Fire Protection Agency) 90A requirements for flame spread and smoke generation, and assembled units shall be UL and UL, Canada certified.
- C. Units shall be factory tested under normal operating conditions at nominal water flow rates to assure proper operation of all components and safety devices.

Part 2 — Product

2.01 EQUIPMENT

A. Heat Pump Assembly:

Factory-tested and assembled single-piece water source heat pump units shall be factory wired, charged with non-CFC R-22, contain refrigerant-to-water heat exchanger, 4-way reversing valve, compressor, metering device, and all internal controls and safety devices.

B. Unit Cabinet:

- Unit shall be constructed of heavy gauge galvanized sheet metal with removable service panels.
- 2. Unit shall have separate entrances for high- and low-voltage electrical supplies.
- All interior surfaces shall be lined with 1/2-in. thick, 11/2 lb/cu ft. density acoustic type fiberglass insulation. All fiberglass shall be coated and all edges shall be tucked under flanges.

C. Compressors:

Unit shall have heat pump duty, scroll compressor(s) with internal and external isolation.

D. Heat Exchangers:

 Refrigerant-to-water heat exchanger shall be steel/copper tube-in-tube type rated for 450 psig refrigerant, 450 psig water-side pressures. Optional steel/cupronickel refrigerant-to-water heat exchanger shall be used for open loop applications, or where water quality cannot be maintained as specified by manufacturer.

E. Refrigerant Components:

- Refrigeration circuit components shall include liquid line service valve, suction line service valve, reversing valve, a full charge of compressor oil, and a holding charge of refrigerant.
- 2. Thermostatic expansion valve shall be provided for refrigerant metering.

F. Solid-State Controls:

Two light-emitting diodes (LEDs) shall be externally mounted to indicate compressor ON status and unit fault modes.

G. Controls and Safeties:

- Safety devices on all units shall include lowpressure sensor, high-pressure switch and low water temperature sensor.
- Standard Complete C electronic control system(s) on all units shall interface with a heat pump (Y, O) wall thermostat (mechanical or electronic). The control system shall have the following features:
 - Anti-short cycle time delay on compressor operation; time delay shall be 5 minutes minimum.
 - b. Random start on power-up.
 - c. Low voltage protection.
 - d. High voltage protection.
 - e. Condensate overflow shutdown.
 - f. Unit shutdown on low refrigerant pressures.
 - g. Unit shutdown on high or low water temperature (selectable for antifreeze solutions).
 - h. Option to reset unit at thermostat or disconnect. Fault type shall be retained in memory if reset at thermostat.
 - Automatic intelligent reset. Unit shall automatically restart 5 minutes after shutdown if the fault has cleared. Should a fault occur 3 times sequentially, then lockout will occur.
 - j. Ability to defeat time delays for servicing.
 - k. Light-emitting diode (LED) to indicate high pressure, low pressure, improper voltage, water coil freeze protection, air coil freeze protection, condensate overflow, and control status.
 - Unit Performance Monitor to indicate inefficient operating conditions prior to unit lockout.
 - m. Remote fault type indication at thermostat
 - n. Single harness connection for all safety devices.
 - o. Selectable 24-v or pilot duty dry contact alarm output.



- p. 24-v output to cycle a motorized water valve with compressor contactor.
- Optional Deluxe D electronic control shall have all the features of the Complete C control, with the following additional features:
 - a. A removable thermostat connector.
 - b. Random start on return from night setback.
 - Minimized reversing value operation for extended life and quiet operation.
 - Night setback control from low temperature thermostat, with 2-hour override initiated by a momentary signal from the thermostat.
 - e. Dry contact night setback output for digital night setback thermostats.
 - Ability to work with heat/cool (Y, W) thermostats.
 - g. Ability to work with heat pump thermostats using O or B reversing valve control.
 - h. Single grounded wire to initiate night setback or emergency shutdown.
 - Boilerless system control can switch automatically to electric heat at low loop water temperature.
 - Control board shall allow up to 3 units to be operated from one thermostat without any auxiliary controls.
 - k. A relay to operate an external damper. The control to be such that the damper will not open until 30 minutes after the unit comes back from Unoccupied mode.
 - Fan speed selection at thermostat.
 - m. A relay to restart a central pump or control a 24-v motorized water valve.
 - Intelligent fan speed selection based upon thermostat demand and/or dehumidistat signal.
- 4. Carrier PremierLink™ Controller:

This control will function with CCN and ComfortVIEW™ software. It shall also be compatible with ComfortLink™ controllers. It shall be ASHRAE 62-99 compliant and Internet ready. It shall accept a CO₂ sensor in the conditioned space and be Demand Control Ventilation (DCV) ready. The communication rate must be 38.4K or faster. It shall include an integrated economizer controller.

H. Electrical

- A control box shall be located within the unit compressor compartment and shall contain a 50 VA transformer, 24 volt activated, 2 or 3 pole compressor contactor, terminal block for thermostat wiring and solid-state controller for complete unit operation. Electro-mechanical operation WILL NOT be accepted.
- 2. Units shall be name-plated for use with time delay fuses or HACR circuit breakers.

- Unit controls shall be 24 volt and provide heating or cooling as required by the remote thermostat.
- Sound Attenuation (Mute) Package:
 Consists of attenuation material applied to cabinet to reduce noise.
- J. Field-Installed Accessories:
 - 1. Thermostat Controls:
 - a. Programmable multi-stage thermostat with 7-day clock, holiday scheduling, large backlit display and remote sensor capability.
 - Programmable 7-Day Light-Activated Thermostat offers occupied comfort settings with lights on, unoccupied energy savings with lights off.
 - c. Programmable 7-Day Flush-Mount Thermostat offers locking cover plate with tamper proof screws, flush to wall mount, dual point with adjustable deadband, O or B terminal, and optional remote sensor.
 - d. Programmable 5-Day Thermostat offers 2 stage heat, 2 stage cool, auto changeover, 5-minute built-in compressor protection, locking cover included.
 - e. Non-programmable Thermostat with 2 heat stages, 2 cool stages, auto changeover, 5-minute built-in compressor protection, locking cover included.
 - Fire-Rated Hoses kits with a fixed MPT on one end and a swivel with an adapter on the other end. Hose kits can be either stainless steel or galvanized.
 - 3. Ball Valves (Brass Body) for shutoff and balancing water flow. Available with memory, memory stop, and pressure temperature ports.
 - Y Strainers (Bronze Body) "Y" type configuration with a brass cap. Maximum operating pressure rating of 450 psi. Strainer screen made of stainless steel.
 - Solenoid Valves (Brass Body) provides slow operation for quiet system application.
 - 6. Hose Kit Assemblies includes a ported ball valve with pressure temperature (P/T) plug ports, flexible stainless steel hose with swivel and nipple. Return hose includes a ball valve, preset measure flow (gpm) with two P/T ports, flexible stainless steel hose with a swivel and nipple.
 - Remote Sensor for wall or duct mounted applications.
 - PremierLink™ accessories include air temperature sensors, CO₂ sensors, communicating room sensors and linkage thermostats.

1.4) Trane

1.4.1) WXWA Series

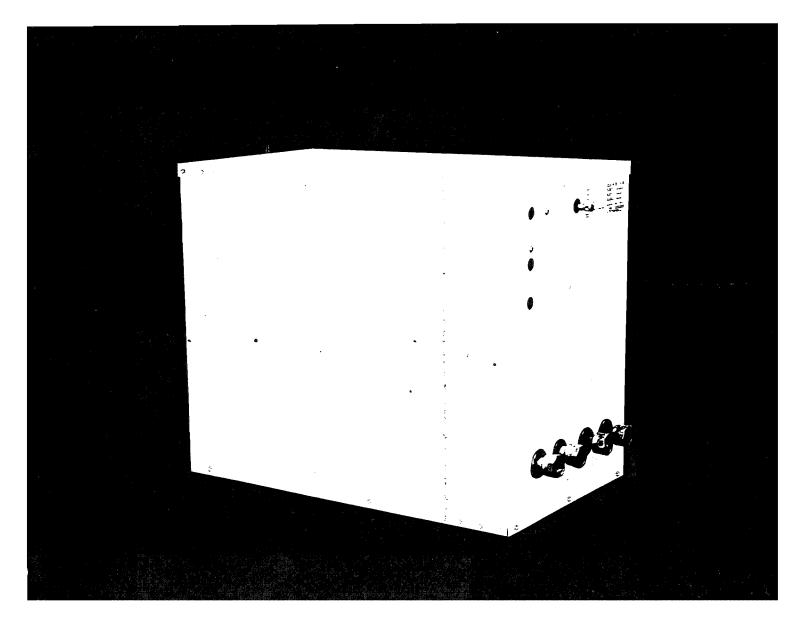


WSHP-D-6 November 1994

First Printing

Water Source Heat Pump

Water-To-Water Model WXWA





Dependable Design

Sound

Quiet operation is achieved through design. All units have thermal/ acoustical insulated cabinets to attenuate compressor noise. Compressors are internally isolated to reduce vibration noise.

Compressor

The high efficiency hermetic compressor helps assure quiet, reliable and efficient operation.

Filter Drier

This unit is also equipped with a filter drier to dehydrate and clean the system, adding to the life of the unit.

Heat Exchanger

The exclusive refrigerant to liquid heat exchanger is a helical coil and shell design. The heat exchanger serves as a flooded evaporator/accumulator in the heating mode and a receiver in the cooling mode.

Expansion Valve

All units are equipped with a balanced port, bidirectional thermal expansion valve. The valve precisely meters the refrigerant flow through the circuit. No check valves are required.

Safety

This unit was designed with safety and maximum protection in mind. High and low pressure cutouts are included to protect the compressor. A freezestat is included to protect the unit from unusually cold waterflow or no waterflow conditions. The lockout relay will shut the entire unit off if there is a problem.

Features and Benefits

Easy Installation

Loop Pump(s)

Loop pump(s) are 115/60/1, six amps maximum, field connected to the pump relay.

Easy Serviceability and Maintenance

Access Panels

The unit has a service door and the top is removable for access to all components.

Transformer

The unit is supplied with a 40 VA transformer.

Control Box

The control box is amply sized to facilitate any troubleshooting or service work that might be required.

Service Ports

High and low side service ports are external to the unit. This simplifies accessing refrigerant pressures and saves service time.

System Benefits

The ground source heat pump system consists of:

- the water source heat pump
- the ground heat exchanger made of high density thermoplastic pipe (guaranteed 25 years or more by many manufacturers)
- a low wattage circulating pump

In the heating mode, the closed loop heat exchanger absorbs heat from the earth (typically 50 to 70 F) and is compressed by the heat pump to a higher temperature. An antifreeze solution may be added to the ground loop heat exchanger to enhance the heating operation. In the cooling mode, the heat pump extracts heat and moisture from the air and rejects the heat to the cooler ground.

Due to constant moderate earth temperatures, the system is typically twice as efficient as an air-to-air heat pump and three times that of high efficiency gas or resistance heat.

Moderate earth temperatures translate into highest comfort levels.

The self-contained unit is entirely within your home, much like a refrigerator, avoiding outside weather extremes, field refrigerant connections, and a noisy, unsightly outdoor air conditioning unit.



Model Number Description

Ground Source Residential Water-Te-Water Upflow Heat Pump

WX W A 026 1 0 B 1 1,2 3 4 5,6,7 8 9 10 11

Digit 1 and 2 - Product Type

WX = Ground Source Residential Heat Pump Without Desuperheater

Digit 3 — Product Configuration W ≈ Water-To-Water

Digit 4 — Development Sequence Current Development

Digit 5, 6 & 7 — Unit Nominal Capacity

026 = 22.6 MBh 035 = 36.4 MBh 041 = 40.0 MBh 051 = 49.5 MBh 061 = 60.0 MBh Digit 8 — Voltage (Volts/Hz/Phase)

1 = 208-230/60/1 — 40 VA Transformer

Digit 9 — Unit Arrangement 0 = Water-To-Water Arrangement

Digit 10 — Design Sequence Current Design

Digit 11 — Heat Exchanger

1 = Copper Heat Exchanger w/35 F Freezestat

2 = 90/10 Cupronickel Heat Exchanger w/35 F Freezestat

3 = Copper Heat Exchanger w/Low Temp. (20 F) Freezestat

4 = Cupronickel Heat Exchanger w/Low Temp. (20 F) Freezestat



Application Considerations

The Heat Pump

The WXWA is a heating and cooling hydronic fluid water-to-water heat pump which is capable of producing fluids up to 130 F or chilled fluid temperatures down to 25 F. The extended operating temperature range offers great opportunities in residential, commercial and industrial applications. Following are some of the typical applications of the water-to-water unit: radiant slab heating, space heating/cooling with fan coils, snow melting, high volume water heating, swimming pool or spa heating and fish farms.

The WXWA has two hydronic sides. To differentiate between the two we define the "source" or sink side as where we extract or reject heat. The load side supplies the terminal devices.

Earth Coupled Applications

The earth provides a constant, unchanging source of energy. This energy can be used as either an energy source or energy sink. It is possible by burying polyethylene or polybutylene pipe within the earth to achieve considerable energy improvements over other systems.

This is because the fluid temperatures tend to be more favorable for earth coupled systems. Thus the equipment operates at lower discharge pressures and uses less kw. Energy efficiency levels (EER) as high as 20 have been demonstrated. The other advantage is the elimination of outdoor condensing units.

The technology has recently advanced to the point where many electric utilities and rural electric cooperatives are offering incentives for the installation of earth coupled systems. These are offered because of savings to the utility which they can return to their customers due to favorable electric load with very low peak demand.

The earth coupled loop can be installed either horizontally or vertically. Vertical loops require less overall land area to reject/sink the necessary energy from the building. The cost to drill a vertical borehole in the southwestern portion of the United States has steadily reduced with experience. This cost will vary from region to region, depending on the familiarity of the local driller with the technology and soil conditions at the jobsite.

The system provides other benefits. It is environmentally sound. There are no known hazards to the environment. The loop is made of material that is chemically inert and, therefore, is nonpolluting. Small, packaged heat pumps contain a relatively small refrigerant charge, and the likelihood of leakage is less than with field assembled equipment. The heat pumps use HCFC-22, which has a relatively low ozone depletion potential. Because it does not require a heat adder (typically fossil fuel), there are no NO2 emissions. Emissions from the power plant are reduced because less electric power is consumed. Therefore, the system offers advantages not seen by other central furnace or heat pump systems.

Ground Water Applications

Where an existing or proposed well can provide an ample supply of suitable quality water, open ground water systems may be very efficient. However, there are several potential risks that need to be evaluated.

- Even if plenty of water is available, there needs to be an acceptable way to dispose of it after it has passed through the heat pump. A three-ton heat pump is apt to use one million gallons of water per year, and it may be necessary to install a recharge well to return the water to the aquifer. In some soils, this might be difficult to do.
- Water quality must also be acceptable, with minimal suspended solids, and it must be non-corrosive to copper or brass. See Table A-1 below for specifications. Use 90/10 cupronickel heat exchanger if salty or brackish water is to be used.

Water regulating valve assemblies are available to control waterflow from well water or similar open loop systems. For a heat pump, two water regulating valves connected in parallel with each other are required. One is direct acting and will function during cooling operation. The other is reverse acting and functions during heating operation.

Table A-1

SCALING	
Calcium and magnesium salts (hardness)	Less than 350 ppm
fron oxide	Low
CORROSION	
ph	7-10
Hydrogen Sulfide	Less than 50 ppm
Carbon dioxide	Less than 75 ppm
Chloride	Less than 600 ppm
Total dissolved solids	Less than 1500 ppm
BIOLOGICAL GROWTH	
Iron Bacteria	Low
SUSPENDED SOLIDS	Low



General Data

Table G-1 — Physical Data

MODEL: WXWA		026	035	041	051	061
COMPRESSOR	TYPE	Hermetic	Hermetic	Hermetic	Hermetic	Hermetic
	VOLTS - PHASE	208-230/1/60	208-230/1/60	208-230/1/60	208-230/1/60	208-230/1/60
	COMPR. FLA	12.9	17.6	21.2	23.7	30.5
ELECTRICAL	COMPR. LRA	54	88	108	116	165
	TOTAL FLA	24.9	29.6	33.2	35.7	42.5
	MIN. CIRCUIT AMP.*	28.1	34	38.5	41.6	50.1
	MAX FUSE SIZE	40	50	50	60	60
APPROXIMATE	UNIT	160	215	215	265	295
WEIGHT LBS	SHIPPING	170	225	25 5	275	305
R-22	LBS.	3.5	3.75	4 .	4.25	4.5
Heat Exchanger		C-200	C-250	C-400	C-500	C-600

Notes:

Units do not have intregral fusing. If fusing is required must be furnished by others.

Check liquid to refrigerant exchanger pressure drop chart for design pressure drop (deta P).

* Includes 12 Amps for water pump(s) (1/2 HP Max).

Table G-2 — Specifications

Unit	Source	Coo	ling	Hea	ting
Size	and Load	LOAD E	WT 45 F	LOAD EV	VT 100 F
WXWA	GPM / FT. HD.	MBH	EER	MBH	COP
026	7 / 16.2	16.9	11.9	23.6	3.2
035	8 / 18.1	24.8	13.0	33.2	3.4
041	10.8 / 9.2	29.4	12.6	39.8	3.4
051	12 / 12.3	34.1	13.2	45.9	3.3
061	14 / 19	41.7	12.0	58.0	3.2

Notes:

1) Source EWT at 55 F.

2) Select unit based upon extended specifications at lowest or highest expected source and load EWT.

Legend

ELT Entering Load Temperature - F
EST Entering Source Temperature - F

Cooling Capacity - MBTUH

TC Cooling Capacity - MBTUH
KW Total Kilowatts Input (KW = 1000 watts)
EER Energy Efficiency Ratio (cooling)

COP Coefficient of Performance (heating)

HC Heating Capacity - MBTUH

HR Heat Rejected to Water - MBTUH

Heat Extracted from Water - MBTUH



Table P-1 — WXWA 026 Cooling Performance

	· · · ·	LOAD		7.0 GPM	- 5.09 PSI			5.5 GPM -	3.14 PSI			4.0 GPM	- 1.66 PSI	
ELT	EST	GPM -	TC	KW	HR	EER	TC	KW	HR	EER	TC	KW	HR	EER
		7.0	10.5	1.23	14.7	8.5	10.1	1.25	14.8	81	9.8	1.27	14.1	7.7
	55	5.5	10.2	1.19	14.2	8.6	9.8	1.21	13.9	8.1	9.4	1.23	13.6	7.6
	_	4.0	9.8	1.15	13.8	8.5	9.5	1.17	13.5	8.1	9.1	1.19	13.2	7 .7
		7.0	9.3	1.45	14.3	6.4	8.9	1.48	14.0	6.0	8.5	1.50	13.7	5.7
25	75	5.5	9.0	1.41	13.8	6.4	8.6	1.43	13.5	6.0	8.3	1.45	13.2	5.7
		4.0	8.7	1.36	13.4	6.4	8.4	1.38	13.1	6.1	8.0	1.40	12.8	5.7
		7.0	8.1	1.68	13.8	48	7.7	1.70	13.5	4.5	7.3	1.73	13.2	4.2
	95	55	7.8	1.62	13.4	4.8	7.5	1.65	13.1	4.6	7.1	1.67	12.8	4.3
		4.0	7.6	1.57	12.9	4.8	7.2	1.59	12.7	4.5	6.9	1.62	12.4	4.3
		7.0	16.9	1.42	21.8	11.9	164	1.45	21.3	11.3	15.8	1.47	20.9	10.8
	55	5.5	16.4	1.38	211	119	15.9	1.40	20.6	11.4	153	1.42	20.2	10.8
		4.0	15.8	1.33	20.4	11.9	15.3	1.35	20.0	11.3	14.8	1.38	19.5	10.7
		7.0	15.4	1.68	21.1	92	14.8	1.71	20.7	87	143	1.74	20.2	8.2
45	75	5.5	14.9	1.63	20.4	91	14.4	1.65	20.0	8.7	138	1.68	19.6	8.2
		4.0	14.4	1.57	19.8	9.2	13.9	1.60	19.3	8.7	13.4	1.62	18.9	8.3
	-	7.0	13.8	1.94	20.5	7.1	13.3	1.97	20.0	6.8	12.8	2.00	19.6	6.4
	95	5.5	13.4	1.88	19.8	71	12.9	1.91	19.4	68	12.3	1.94	19.0	6.3
		4.0	13.0	1.81	19.1	7.2	12.4	1.84	18.7	6.7	11.9	1.87	18.3	6.4
		7.0	23.3	1.62	28.9	144	22.6	1.65	28 2	13.7	219	1.67	27.6	13.1
	55	5.5	22.6	1.57	27.9	144	219	1.59	27.3	13.8	21.2	1.62	26.7	13.1
		4.0	21.8	1.51	27.0	14.4	21.2	1.54	26.4	13.8	20.5	1.56	25.8	13.1
		70	21.5	1.91	28.0	11.3	20.8	1.94	27 4	107	201	1.97	26.8	10.2
65	75	55	20.8	1.85	27.1	11.2	20.1	1.88	26.5	10.7	194	1.91	25.9	10.2
		4.0	20.1	1.79	26.2	11.2	19.4	1.82	25.6	10.7	18.8	1.85	25.1	10.2
		7.0	19.6	2.20	27.1	8.9	189	2.24	26.5	8.4	18.2	2.27	25.9	8.0
	95	55	19.0	2.13	26 2	8.9	18.3	2.17	25.7	8.4	176	2.20	25.1	8.0
		4.0	18.3	2.06	25.4	8.9	17.7	2.10	24.8	8.4	17.0	2.13	24.3	8.0

Table P-2 — WXWA 026 Heating Performance

		LOAD		7.0 GPM	- 5.09 PSI			5.5 GPM -	3.14 PSI			4.0 GPM	- 1.66 PSI	
ELT	EST	GPM -	HC	KW	HE	COP	HC	KW	HE	COP .	HC	KW	HE	COP
		7.0	14.2	1.51	90	276	13.7	1.46	8.7	2.75	132	1.41	8.4	2.74
	25	5.5	13.9	1.53	8.6	2.66	13.4	1.48	8.3	2.65	130	1.43	8.1	2.66
		4.0	13.6	1.56	8.2	2.55	13.1	1.51	8.0	2.54	12.7	1.46	7.7	2.55
		7.0	21.0	1.75	15.0	3.52	20.3	1.69	14.5	3.52	196	1 63	14.0	3.52
80	45	5.5	20.5	1.77	14.5	3.39	19.9	1.72	14.0	3.39	192	1.66	13.5	3.39
		4.0	20.1	1.80	13.9	3.27	19.4	1.74	13.5	3.27	18 .8	1.69	13.0	3.26
		70	27.8	1.98	21.0	4.11	26 9	1.92	20.3	4.11	26.0	1 86	196	4.10
	65	55	27.2	2.02	20.3	3.95	26.3	1.95	19.6	3.95	254	1.89	19.0	3 94
		4.0	26.6	2.05	19.6	3.80	25.7	1.98	19.0	3.80	24.9	1.92	18.3	3.80
		7.0	13.7	1.73	7.8	2.32	13.3	1.68	7.6 7.2	2.32	12.8	1.62	7.3	2.32
	25	5.5	13.4	1.76	7.4	2.23	13.0	1.70	7,2	2.24	12.6	1.65	6.9	2.24
		4.0	13.1	1.79	7.0	2.14	12.7	1.73	6.8	2.15	12.3	1.67	6.6	2.16
		7.0	20.3	2.00	13.5	2.97	19.6	1.94	13.0	2.96	19.0	1.88	12.6	2.96
100	45	5.5	19.9	2.04	12.9	2.86	19.2	1.98	12,5	2.84	18.6	1.91	12.1	2.85
		4.0	19.4	2.07	12.4	2.75	18.8	2.00	12.0	2.75	18.2	1.94	11.6	2.75
		7.0	26.9	2.28	19.1	3.46	26 0	2.20	18.5	3.46	25.2	2.13	17.9	3.47
	65	5.5	26.3	2.31	18.4	3.34	25.5	2.24	17,8	3.34	24.6	2.17	17.2	3.32
		4.0	25.7	2.35	17.7	3.20	24.9	2.27	17.1	3.21	24.1	2.20	16.6	3.21
		7.0	13.3	1.95	66	2.00	12.8	1.89	6.4	1.98	12.4	1.83	62	1.99
	25	5.5	13.0	1.98	6.2	1.92	12.6	1.92	6.0	1.92	12.1	1.86	5.8	1.91
		4.0	12.7	2.02	5.8	1.84	12.3	1.95	5.6	1.85	11.9	1.89	5.4	1.84
		70	196	2.26	119	2 54	190	2.19	11.5	2.54	18.4	2.12	11.1	2.54
120	45	5.5	19.2	2.30	11.4	2 45	186	2.22	11.0	2 45	180	2.15	106	2 45
		4.0	18.8	2.33	10.8	2.36	18.2	2.26	10.5	2.36	17.6	2.18	10.1	2.37
		7.0	26.0	2.57	172	2.96	25 2	2.49	16,7	2 97	24.3	2.40	161	2.97
	65	5.5	25.4	2.61	16.5	2 85	246	2 53	16.0	2.85	238	2.44	15.5	2.86
		4.0	24.9	2.65	15.8	2.75	24.1	2.57	15.3	2.75	23.3	2.48	14.8	2.75

Notes:

¹⁾ To convert PSI to feet of head multiply by 2.31
2) Interpolation between points is allowed

Table P-3 — WXWA 035 Cooling Performance

		LOAD	1	0.0 GPM	12.12 PS	1		3.0 GPM -	7.76 PSI			6.0 GPM -	4.3E PSI	
ELT	EST	GPM	TC	KW	HR	EER	TC	KW	HR	EER	TC	KW	÷R	EER
		100	162	1 66	21.8	9.8	15.9	1 68	216	9.5	15.6	1.71	Z* 4	9.1
	55	8.0	15.8	1.62	21.4	9.8	15.5	1.65	21.2	9.4	15.2	1.67	2"0	9.1
		6.0	15.5	1. <u>5</u> 9	20.9	9.8	15.2	1.61	20.7	9.4	14.9	1.64	225	9.1
		100	143	1.96	209	7.3	14.0	1 99	20 7	7.0	136	2 01	22.5	6.8
25	75	80	14.0	1.92	20.5	7.3	13.7	1.95	20.3	7.0	13.3	1.97	2_1	68
		6.0	13.7	1.88	20.1	7.3	13.4	1.91	19.9	7.0	13.1	1.93	15.7	6.8
		10.0	12.4	2.26	20.1	5.5	12.1	2.29	19.9	5.3	11.7	2.32	13.7	5.0
	95	8.0	12.1	2.21	19.7	5.5	11.8	2.24	19.5	5.3	11.5	2.28	15.3	5.0
		6.0	11.9	2.17	19.3	5.5	11.6	2.20	19.1	5.3	11.3	2.23	129	5.1
		10.0	25.8	1.92	32.3	13.4	25.3	1.95	32.0	13.0	24.9	1.98	31.7	12.6
	55	8.0	25.2	1.88	31.7	13.4	24.8	1.91	31.3	13.0	24.4	1.94	37.0	12.6
		6.0	24.7	1.84	31.0	13.4	24.3	1.87	30.7	13.0	23.9	1.90	35.4	12.6
		10.0	23.3	2.26	31.0	10.3	22.8	2.30	30.7	9.9	22.4	2.33	314	9.6
45	75	8.0	22.8	2.22	30.4	10.3	22.4	2.25	30.1	10.0	22.0	2.29	23-8	9.6
		6.0	22.3	2.17	29.8	10.3	21.9	2.21	29,5	9.9	21.5	2.24	25.2	9.6
		10.0	20.8	2.61	29.7	8.0	20.4	2.65	29.4	7.7	19.9	2.69	29.1	7.4
	95	80	20.4	2.56	29.1	8.0	20 .0	2.60	28.8	7.7	19.5	2.64	25.5	7.4
		6.0	20.0	2.51	28.5	<u>8.0</u>	19.5	2.54	28.2	7.7	19.1	2.57	27.9	7.4
		100	35 3	2 18	42.8	16.2	34.8	2. 21	42.4	15.8	343	2 25	21.9	15.2
	5 5	80	34.6	2.14	41.9	16.2	34.1	2.17	41.5	15.7	33.6	2.20	4: 1	153
		6.0	33.9	2.09	41.1	16.2	33.4	2.12	40.7	15.8	32.9	2.16	41.2	15.2
		100	32.3	2.57	41.1	12.6	31.7	2.61	40.7	12.2	31.2	2.65	40.2	11.8
65	75	80	31.6	2.52	40.2	12.5	31.1	2.56	39.8	12.2	30.6	2.60	35.4	11.8
	-	6.0	31.0	2.47	39.4	12.6	30.5	2.51	39.0	12.2	29.9	2.54	32.6	11.8
		100	29.2	2.97	39.3	9.8	28.7	3.01	39.0	9.5	28.1	3.06	35.6	9.2
	95	8.0	28.6	2.91	38.6	9.8	28.1	2.95	38.2	9.5	27.6	3.00	37.8	9.2
	55 45 75 95 55 65 75 95	6.0	28.1	2.85	37.8	9.9	27.5	2.89	37.4	9.5	27.0	2.93	37.0	9.2

Table P-4 — WXWA 035 Heating Performance

		LOAD	1	0.0 GPM -	- 12.12 PS	Si		8.0 GPM -	7.76 PSI			6.0 GPM	4.36 PSI	
ELT	EST	GPM	HC	KW	HE	COP	HC	KW	HE	COP	HC	KW	ΗE	COP
		10.0	20.7	2.03	13.8	2.99	20.3	1.99	13.5	2.99	19.9	1.95	:32	2.99
	25	80	20.5	2.06	13.5	2.92	20.1	2.02	13.2	2.92	19.7	1.98	:29	2.92
		6.0	20.3	2.09	13.2	2.85	19.9	2.05	12.9	2.84	19.5	2.01	2.6	2.84
		10.0	30.7	2.35	22.7	3.83	30.1	2.30	22.2	3.83	29.5	2.26	21.7	3 82
80	45	8.0	30 4	2.39	22.2	3.73	29.8	2.34	21.8	3.73	29.2	2.29	21.3	3.74
		6.0	30.1	2.42	21.8	3.64	29.5	2.37	21.4	3.65	28.9	2.33	20.9	3.63
		10.0	40.6	2.67	31.5	4.46	39.8	2.62	30.9	4.45	39.0	2.57	30.3	4.45
	65	80	40.2	2.71	31.0	4.35	39.4	2.66	30.4	4.34	38.6	2.60	29.7	4.35
		6.0	39.8	2.75	30.4	4.24	39.0	2.70	29.8	_ 4.23	38.2	2.64	29.2	4.24
		100	19.8	2.33	11.9	2.49	19.4	2.28	11.7	2.49	19.1	2.24	11.4	2.50
	25	8.0	19.6	2.37	11.6	2.42	19.3	2.32	11.3	2.44	18.9	2.27	31.1	2.44
		6.0	19.4	2.40	11.3	2.37	19.1	2.35	11.0	2.38	18.7	2.30	10.8	2.38
		100	29 4	2 70	20.2	3.19	28.8	2.64	19.8	3.20	28.2	2.59	19.4	3.19
100	45	8.0	29.1	2.74	19.7	3.11	28.5	2.68	19.3	3.12	27.9	2 63	19.0	3.11
		6.0	28.8	2.78	19.3	3.04	28.2	2.72	19.9	3.04	27.6	2.67	18.5	3.03
		10.0	3 8.9	3.07	28.5	371	38.1	3.00	27.9	3.72	37 4	2.94	27.3	3.73
	65	8.0	38.5	3.11	27.9	3.63	37.8	3.05	27.3	3.63	37.0	2 99	25.8	3 63
		6.0	38.1	3.16	27.4	3.53	37.4	3.09	26.8	3.55	36.6	3.03	26.3	3.54
		10.0	19.0	2.63	10.0	2.12	18 .6	2.58	9.8	2.11	18.2	2.52	9.6	2.12
	25	8.0	18.8	2.67	9.7	2.06	18.4	2.62	9.5	2.06	18.0	2.56	9.3	2.06
		6.0	18.6	2.71	9.4	2.01	18.2	2.65	9.2	2.01	17.8	2.60	9.0	2.01
		10.0	28.1	3.04	17.7	2.71	27.5	2.98	17.3	2.70	27.0	2.92	17.0	2.71
120	45	8.0	27.8	3.09	17.3	2.64	27.2	3.03	16.9	2.63	26.7	2.97	16.6	2.63
		6.0	27.5	3.14	16.8	2.57	27.0	3.07	16.5	2.58	26.4	3.01	16.1	2.57
		10.0	37.2	3.46	25.4	3.15	36.5	3.39	24.9	3.15	35.7	3.32	244	3.15
	65	8.0	36.8	3.51	24.8	3.07	36.1	3.44	24.3	3.07	35.4	3.37	23.9	3.08
		6.0	36.5	3.56	24.3	3.00	35.7	3.49	23.8	3.00	35.0	3.42	23.3	3.00

¹⁾ To convert PSI to feet of head multiply by 2.31
2) Interpolation between points is allowed

Table P-5 — WXWA 041 Cooling Performance

	_	LOAD		12.0 GPM	- 4.99 PSI			9.5 GPM -	3.13 PSI	•		7.0 GPM	- 1.70 PSI	
ELT	EST	GPM	TC	KW	HR	EER	TC	KW	HR	EER	TC	KW	HR	EER
		12.0	18.8	2.02	25.6	93	18.4	2.05	25.4	9.0	18.0	2 08	25.1	8.7
	55	9.5	18.3	2.00	25.1	9.2	17.9	2.03	24.8	8.8	17.6	2.06	24.6	8.5
		7 <u>.0</u>	17.8	1.98	24.6	9.0	17.5	2.01	24.3	8.7	17.1	2.04	24.1	8.4
		12.0	16.6	2.37	24.7	7.0	16.2	2.40	24.4	6.8	15.8	2.44	24.2	65
25	75	9.5	16.2	2 34	242	6.9	15.8	2.38	23.9	6.6	154	2.42	23.7	6.4
		7.0	15.7	2.32	23.6	6.8	15.4	2.35	23.4	6.6	15.0	2.39	23.2	6.3
		12.0	14.4	2.72	23.7	5.3	140	2.76	23.5	5.1	13.6	2 80	23.2	4.9
	95	95	14.0	2.69	23 2	52	13.6	2.73	23.0	5.0	133	2.77	22.7	48
		7.0	13.6	2.66	22.7	5.1	13.3	2.70	22.5	4.9	12.9	2.74	22.2	4.7
		12.0	30 0	2 34	38 0	12.8	295	2.37	37 6	12.5	28.9	2.41	37 2	12.0
	55	9.5	293	2.31	37.2	12.7	28.8	2.35	36.8	12.3	28.3	2.39	36 4	118
		7.0	28. <u>6</u>	2.29	36.4	12.5	28.1	2.32	36.0	12.1	27.6	2.36	35.6	11.7
		12.0	27 2	2.74	36 5	99	26.6	2 78	32.1	96	26.1	2.83	358	9.2
45	75	9.5	26.5	2.71	35.8	98	26.0	2.76	35.4	9.4	25 5	2.80	35.0	9.1
		7.0	25.8	2.68	35.0	9.6	25.3	2.73	34.6	9.3	24.8	2.77	34.3	9.0
		12.0	24.4	3.15	35.1	78	23.8	3.20	34.7	7.4	23.3	3.24	34.4	7.2
	95	9.5	23.7	3.11	344	7.6	23.2	3.16	34.0	7.3	22.7	3.21	33.6	7 1
		7.0	23.1	3.08	33.6	7.5	22.6	3,13	33.3	7.2	22.1	3.18	32.9	7.0
		12.0	41.2	2.66	503	155	40.5	270	498	15.0	39.9	2.74	49 2	146
	55	9.5	40 3	2.63	49.2	15.3	39.6	2 67	48 7	148	39 0	2 71	48.2	144
		7.0	39.3	2.60	48.2	15.1	38.7	2.64	47.7	14.7	38.0	2.68	47.2	14.2
		120	37.7	3 12	48 4	12.1	37 1	3.16	47.9	11.7	36 4	3.21	47.4	113
65	75	95	368	3.08	47 4	12.0	36.2	3 13	46.9	116	35 5	3 18	46 4	11.2
		7.0	36.0	3.05	46.4	11.8	35.3	3.10	45.9	11.4	34.7	3.15	45.4	11.0
		12.0	343	3.58	46 5	96	33.6	3.63	46.0	9.3	32.9	3.69	45.5	89
	95	9.5	33.4	3.54	45 5	94	32.8	3 59	450	9.1	32.1	3 65	44 6	88
	55 45 75 95 55 65 75	7.0	32.6	3.50	44.5	9.3	31.9	3.56	44.1	9.0	31.3	3.61	43.6	8.7

Table P-6 — WXWA 041 Heating Performance

		LOAD		12.0 GPM	- 4.99 PSI			9.5 GPM -	- 3.13 PSI			7.0 GPM	- 1.70 PSI	
ELT	EST	GPM _	HC	KW	HE	COP	HC	KW	HE	COP	HC	KW	HE	COP
		12.0	24.4	2.46	16.1	2.91	23.9	2 43	156	2.88	23.4	2.40	15.2	2.86
	25	9.5	24.2	2.49	15.7	2.85	23.7	2 47	153	2.81	23.2	2.44	14.8	2.79
		7.0	23.9	2.53	15.3	2.77	23.4	2.51	14.9	2.73	22.9	2.48	14.5	2.71
		12.0	36.2	2.84	26.5	3.73	35.4	2.81	25.8	3 69	347	2.78	25 2	3 66
80	45	9.5	35.8	2.89	25.9	3.63	3 5.0	2.86	253	3.59	34.3	2.83	247	3 55
		7.0	35.4	2.93	25.4	3.54	34.7	2.90	24.8	3.51	33.9	2.87	24.1	3.46
		12.0	47 9	3.23	369	4 35	46.9	3 20	360	4.29	45 9	3 16	35.1	4 26
	65	9.5	47.4	3.28	36.2	4 23	48.4	3 25	35.3	4.18	45 4	3.21	34.5	4.14
		7.0	46.9	3.33	35.5	4.13	45.5	3.30	34.7	4.08	44.9	3.26	33.8	4.04
		12.0	23.5	2.80	13.9	2.46	23.0	2.78	13.5	2.42	22.5	2.75	13.1	2.40
:	25	9.5	23.2	2.85	13.5	2.39	22.7	2.82	13.1	2.36	22.2	2.79	12.7	2.33
		7.0	23.0	2.89	13.1	2.33	22.5	2.86	12.7	2.31	22.0	2.83	12.4	2.28
		12.0	34.7	3.25	23.7	3.13	34.0	3.21	23.0	3.10	33.3	3.18	22.4	3.07
100	45	9.5	34.4	3.30	23.1	3.05	33.7	3.26	22.5	3.03	32.9	3.23	21.9	2.98
		7.0	34.0	3.35	22.6	2.97	33.3	3.31	22.0	2.95	32.6	3.28	21.4	2.91
		12.0	46.0	3.69	33 4	3.65	45.0	3.65	32.6	3.61	44.1	3.61	31.8	3 58
	65	9.5	45.5	3.75	32.7	3 56	44.5	3.71	31.9	3.52	43.6	3.67	31.1	3 48
		7.0	45.0	3.81	32.1	3.46	44.1	3.77	31.3	3.43	43.2	3.73	30.5	3.39
		120	22.5	3.15	11.7	2.09	22 .0	3.12	11.4	2.07	21.6	3.09	110	2 05
	25	9.5	22.3	3 20	11.3	2 04	21.8	3.17	11.0	2.01	21.3	3.14	106	1.99
		7.0	22.0	3.25	10.9	1.98	21.5	3.22	10.6	1.97	21.1	3.18	10.2	1.94
		120	33 3	3.65	208	2 67	32.6	3 61	203	2.65	31.9	3 58	197	2 61
120	45	95	32 9	3.71	20.3	2 6 0	32.3	3 67	197	2.58	316	3 63	19 2	2 55
		7.0	32.6	3.77	19.8	2.53	31.9	3. 7 3	19.2	2.51	31.2	3.69	18.7	2.48
		120	44 1	4 15	29 9	3 11	43.2	4.11	2 9 2	3.08	42.3	406	28 4	3 0 5
	65	95	436	4.21	293	3 03	42.7	4 17	285	3.00	418	4 13	27 7	2 97
	25	7.0	43.2	4.28	28.6	2.96	42.3	4.23	27.8	2.93	41.4	4.19	27.1	2.90

Notes:
1) To convert PSI to feet of head multiply by 2 31
2) Interpolation between points is allowed

Table P-7 — WXWA 051 Cooling Performance

		LOAD		15.0 GPM	- 8.33 PSI		1	2.0 GPM -	- 5.33 PSI	•		9.0 GPM	- 3.00 PSI	
ELT	EST	GPM	TC	KW	HR	EER	TC	KW	HR	EER	TC	KW	HR	EER
		15	23.1	2.26	30.8	10.2	22.4	2.30	30.2	9.7	21.7	2.33	29.6	9.3
	55	12	22.1	2.19	29.6	10.1	21.4	2.23	29.0	9.6	20.7	2.26	28.4	9.2
		9	21.1	2.13	28.4	9.9	20.4	2.16	27.8	9.4	19.8	2.19	27.2	9.0
		15	20.3	2.77	29.7	73	19.6	2.81	29.1	7.0	18.8	2.85	28.6	6.6
25	75	12	19.4	2.68	28.6	7.2	18.7	2.72	28.0	6.9	18.0	2.76	27 4	6.5
		9	18.5	2.60	27.4	7.1	17.8	2.64	26.8	6.7	17.1	2.68	26.3	6.4
		15	17.5	3.27	28.6	5.4	16.8	3.32	28.1	5.1	16.0	3.37	27.5	4.8
	95	12	16.7	3.17	27.5	5.3	16.0	3.22	27.0	5.0	15.3	3.27	26.4	4.7
		9	15.9	3.07	26.4	5.2	15.2	<u>3.</u> 12	25.8	4.9	14.5	3.17	25.3	4.6
		15	36.7	2.62	45.6	14.0	35.7	2.66	44.7	13.4	34.6	2.70	43.8	12.8
	55	12	35.2	2.54	43.8	13.9	34.1	2.58	42.9	13.2	33.1	2.62	42.1	12.6
		9	33.6	2.46	42.0	13.7	32.6	2,50	41.2	13.0	31.7	2.54	40.3	12.5
		15	33.1	3.20	44.0	10.3	32.1	3.25	43.1	9.9	31.0	3.30	42.3	9.4
45	75	12	31.7	3.11	42.3	10.2	30.7	3.15	41.4	9.8	29.7	3.20	40.6	9.3
		9	30.2	3.01	40.5	10.0	29.3	3.05	39.7	9.6	28.3	3.10	38.9	9.1
		15	29.5	3.79	42.4	7.8	28.5	3.84	41.6	7.4	27.4	3.90	40.7	7.0
	95	12	28.2	3.67	40.7	7.7	27.2	3.73	39.9	7.3	26.2	3.78	39.1	6.9
		9	26.9	3.56	39.0	7.6	25.9	3.61	38.2	7.2	25.0	3.66	37.5	² 6.8
		15	50.3	2.98	60.5	169	48.9	3.02	59.2	16.2	47.6	3.06	58.0	15.6
	55	12	48.2	2.89	58.0	167	46.9	2.93	56.9	16.0	456	2.97	557	15.4
		9	46.1	2.80	55.6	16.5	44.8	2.84	54.5	15.8	43.6	2.88	53.4	15.1
		15	45.9	3.64	58.3	12.6	445	3.69	57.1	12.1	43.2	3.75	56.0	11.5
6 5	75	12	43.9	3.53	56.0	12.4	42.6	3.58	54.9	11.9	41.3	3.64	53.7	11.4
		99	42.0	3.42	53.6	12.3	40.7	3.47	52.6	11.7	39.5	3.52	51.5	11.2
		15	41.5	4.30	56.2	9.7	40.2	4.37	55.1	9.2	38.8	4.43	53.9	8.8
	95	12	39.7	4.17	53.9	9.5	38.4	4.23	52.8	9.1	37.1	4.30	51.8	8.6
		9	37.9	4.04	51.7	9.4	36.6	4.10	50.6	8.9	35.4	4.16	49.6	8.5

Table P-8 — WXWA 051 Heating Performance

•		LOAD		15.0 GPM	- 8.33 PS		1	2.0 GPM -	- 5.33 PSI			9.0 GPM	- 3.00 PSI	
ELT	EST	GPM	HC	KW	HE	COP	нс	KW	HE	COP	нс	KW	HE	COP
		15.0	29.5	2.89	19.6	2.99	28.3	2.80	18.7	2.96	27.1	2.72	17.8	2.92
	25	12.0	28.9	2.93	18.9	2.89	27.7	2.85	18.0	2.85	26.6	2.76	17.2	2.82
		9.0	28.3	2.98	18.1	2.78	27.2	2.86	17.3	2.79	26.0	2.80	16.5	2.72
		15.0	43.6	3.35	32.2	3.81	41.9	3.25	30.8	3.78	40.1	3.15	29.4	3.73
80	45	12.0	42.8	3.40	31.2	3.69	41.0	3.30	29.8	3.64	39 .3	3.19	28.4	3.61
		9.0	41.9	3.45	30.1	3.56	40.2	3.34	28.8	3.53	38.5	3.24	27.5	3.48
		15.0	57. 8	3.80	448	4.46	55.5	3.69	42.9	4.41	53.2	3.58	41.0	4.35
	65	12.0	56.6	3.86	43.4	4.30	54.4	3.75	41.6	4.25	52.1	3.63	39.7	4.21
		9.0	55.5	3.92	42.1	4.15	53.3	3.80	40.3	4.11	51.0	3.68	38.5	4.06
		15.0	28.4	3.40	16.8	2.45	27.2	3.29	16.0	2.42	26.1	3.19	15.2	2.40
	25	12.0	27.8	3.45	16.1	2.36	26.7	3.34	15.3	2.34	25.6	3.24	14.5	2.32
		9.0	27.2	3.50	15.3	2.28	26.2	3.39	14.6	2.26	25.1	3.29	13.8	2.24
		15.0	42.0	3.93	28.6	3.13	40.3	3.81	27.3	3.10	38.6	3.70	26.0	3.06
100	45	12.0	41.2	3.99	27 6	3.03	39.5	3.87	26.3	2.99	37.9	3.75	25.1	2.96
		9.0	40.3	4.05	26.5	2.92	38.7	3.93	25.3	2.89	37.1	3.81	24.1	2.85
		15.0	55.6	4.47	40 4	3.64	53.4	4.33	38.6	3.61	51.2	4.20	36.9	3.57
	65	12.0	54.5	4.53	39 1	3.53	52.3	4.40	37.3	3.48	50.2	4.26	35.6	3.45
		9.0	53.4	4.60	37.7	3.40	51.3	4.46	36.0	3.37	49.1	4.33	34.4	3.32
		15.0	27.3	3.90	14.0	2.05	26.2	3.78	13.3	2.03	25.1	3.67	12.6	2.00
	25	12.0	26.7	3.96	13.2	1.98	25.7	3.84	12.6	1.96	24.6	3.72	11.9	1.94
		9.0	26.2	4.02	12.5	1.91	25.1	3.90_	11.9	1.89	24.1	3.77	11.2	.1.87
		15.0	40.4	4.51	25.0	2.62	38.8	4.38	23.8	2.60	37.2	4.24	22.7	2.57
120	45	12.0	39.6	4.58	23.9	2.53	38.0	4.44	22.8	2.51	36. 4	4.31	21.7	2.47
		9.0	38.8	4.65	22.9	2.44	37.2	4.51	21.8	2.42	35.7	4.37	20.8	2.39
		15.0	53.5	5.13	36.0	3 06	51.4	4.98	34.4	3.02	49.2	4.82	32.8	2.99
	65	12.0	52.4	5.21	34.7	2.95	50.3	5.05	33.1	2.92	48.2	4.89	31.5	2.89
		9.0	51.4	5.28	33.3	2.85	49.3	5.13	31.8	2.82	47.3	4.97	<u>30.</u> 3	2.79

Notes:

¹⁾ To convert PSI to feet of head multiply by 2.31
2) Interpolation between points is allowed

Table P-9 — WXWA 061 Cooling Performance

		LOAD	1	8.0 GPM	- 15.62 PS	SI	14	1.0 GPM -	10.06 PSI			10.0 GPM	- 5.58 PSI	
ELT	EST	GPM	TC	KW	HR	EER	TC	KW	HR	EER	TC	KW	HR	EER
		180	27.1	2.89	37.0	9.4	25.7	2.93	35.7	8.8	24.3	2.98	34.5	8.2
	55	14.0	26.3	2.86	36.1	9.2	25.0	2.90	34.9	8.6	23.6	2.95	33.7	8.0
		10 <u>.0</u>	25.7	2.83	35,3	9.1	24.3	2.87	34.1	<u>8.5</u>	23.0	2.91	32.9	7.9
		180	24.1	3.41	35.7	7.1	22.8	3.46	34.6	6.6	21.4	3.52	33.4	6.1
25	75	14.0	23.5	3.37	35.0	7.0	22.1	3.43	33.8	6.5	20.7	3.48	32.6	60
		10.0	22.9	3.33	34.2	6.9	21.5	3.39	33.1	6.4	20.2	3.45	31.9	5.9
		18.0	21.2	3.93	34.6	54	19. 9	4.00	33.5	5.0	18.5	4.06	32.4	46
	95	140	20.7	3.89	33.9	5.3	19.3	3.96	32.8	4.9	17.9	4.01	31.6	4.5
		10. <u>0</u>	20.0	3.84	33.1	5.2	18.7	3.91	32.1	4.8	17.4	3.98	30.9	4.4
		18.0	43.2	3.34	546	12.9	41.2	3.40	52.8	12.1	39 3	3.45	51.1	11 4
	55	14.0	42.2	3.31	53 5	127	40.2	3 36	51.7	12.0	38 2	3 42	49.9	11.2
		10.0	41.1	3.27	52.3	12.6	39.2	3.32	50.5	11.8	37.2	3.38	48.8	11.0
		180	39.6	3.95	53.0	10.6	37.5	4.01	51.2	94	35.5	4 08	49.4	87
45	75	14.0	38.5	3.91	51.8	∕ વૈંક)	36.6	3.97	50.1	9.2	346	4.03	48.4	8.6
		10.0	37.4	3.86	50.6	9.7	35.6	3.93	49.0	9.1	33.7	3.99	47.3	8.5
		18.0	35.8	4.55	51.3	7.9	33.9	4.63	49.7	7.3	31.8	4.70	47.9	6.8
	95	140	34.8	4.50	50.2	7.7	32.9	4 57	48.5	72	31.0	4.65	46.8	67
		10.0	33.9	4.45	49.1	7.6	31.9	4.53	47.4	7.1	30.1	4.60	45.8	6.5
		18.0	594	3.80	72.4	15.6	56.8	3 86	70.0	14.7	54.2	3.93	67.6	138
	55	14.0	58.0	3.75	708	154	55.4	3 82	68.4	14.5	52.9	3.88	66.1	13.6
		10.0	56.5	3.72	69.2	15.2	54.0	3.77	66.9	14.3	51.5	3.84	64.6	13.4
		18.0	54.9	4 49	70.2	12.2	52.3	4 56	67.9	115	497	463	65.5	107
65	75	140	535	4 44	686	12 0	51.0	451	66.3	113	48.4	4 58	64.1	106
		10.0	52.1	4.39	67.1	11.9	49.6	4.46	64.8	11.1	47.2	4.54	62.7	10.4
		180	50.4	5.17	68 0	9.7	47.8	5.26	65.7	9.1	45.3	5.35	63.5	8.5
	95	140	49.0	5.11	66.5	9.6	46.5	5.20	64.3	8.9	44 0	5.29	62.0	83
		10.0	47.7	5.06	64.9	9.4	45.3	5.14	62.8	8.8	42.8	5.23	60.7	8.2

Table P-10 — WXWA 061 Heating Performance

		LOAD	1	8.0 GPM	- 15.62 PS	i	14	4.0 GPM -	10.06 PSI			10.0 GPM - 5.58 PSI			
ELT	EST	GPM	нс	KW	HE	COP	НC	KW _	HE	COP.	√ HC	KW	HE	COP	
		180	35.5	3.54	23.4	2.94	347	3 50	22.8	2.91	34.0	3.46	22.1	2.87	
	25	14.0	34.4	3.60	22.1	2 80	33.6	3 56	21.4	2.76	32.8	3.52	20.8	2.73	
		10.0	33.2	3.66	20.7	2.66	32.4	3.62	20.1	2.63	31.7	3.58	19.4	2.59	
		180	526	4.10	38.6	3.76	51.4	4 05	37.6	3.72	50.3	4.00	36.6	3.68	
80	45	14.0	50.9	4.17	36.6	3.58	49.7	4.12	35 6	3.53	48.5	4.07	346	3 49	
		10.0	49.1	4.24	34.7	3.40	48.0	4.19	33.7	3.36	46.9	4.14	32.8	3.32	
		18.0	69.7	4.66	53.8	4.38	68.1	4 60	52.4	434	66 6	4 55	51.0	4.28	
	65	14.0	67.4	4.74	51.2	4 17	658	4 68	498	4.12	644	4 63	486	4 07	
		10.0	65.0	4.82	48.6	3 .9 6	63.6	4.76	47.4	3.92	. 62.1	4.71	46.1	3.87	
		18.0	34.4	4.06	20.5	2.48	33.7	4.01	20.0	2.46	32.9	3.98	19.3	2.43	
	25	14.0	33.3	4.13	19.2	2. 3 6	32.5	4.08	18.6	2.33	31.7	4.03	18.0	2.31	
		10.0	32.1	4.20	17.8	2.24	31.4	4.15	17.2	2.22	30.7	4.10	16.7	2.19	
		18.0	51.0	4.70	34.9	3.18	49.8	4 65	33.9	3.14	48.6	4.60	32.9	3.10	
100	45	14.0	49.2	4.78	32.9	3.02	48.2	473	32.0	2.98	47.0	4.67	31.1	2.95	
		10.0	47.6	4.86	31.0	2.87	46.5	4.81	30.1	2.84	45.5	4.75	29.3	2.81	
		180	67.5	5.35	49.2	3.70	65.9	5.29	47.9	3 65	64.5	5.23	46.6	3.61	
	65	14.0	65.2	5.43	467	3.52	63.8	5.38	45.4	3.48	62.3	5.32	44.2	3 44	
		10.0	62.9	5.52	44.1	3.34	61.6	5.46	42.9	3.30	60.1	5.40	41.7	3.26	
		18.0	33 3	4.58	17.7	2 13	32.5	4.54	17.0	2 10	31.7	4.48	16.5	2.08	
	25	140	32 1	4.66	16.2	2.02	31.5	4 61	15.7	2 00	30.7	4.55	151	1.97	
		10.0	31.1	4.74	14.9	1.92	30.4	4.68	14.4	1.90	29.6	4.63	13.8	1.87	
		18 .0	49 2	5.31	31.1	272	48.2	5 25	30.2	2.69	47.1	5.19	29 4	2 66	
120	45	140	47 6	5.39	29.2	2.5€	46.5	5.34	28.3	2 55	45 5	5.28	27.4	2 52	
		10.0	45.9	5.48	27.2	2.4€	45.0	5.42	26.5	2.43	43.9	5.37	25.6	2.40	
		18 0	65 2	6.03	44.7	3 17	63.8	5. 96	43 4	3 13	62.3	5. 9 0	42.2	3 10	
	65	140	63 1	6 13	42.2	3 02	61.7	606	41.0	2 98	60.2	5.99	398	2.94	
		10.0	60.9	6.23	39.6	2.8 6	59.5	6.17	38.5	2.83	58.2	6.09	37.4	2.80	

Notes

¹⁾ To convert PSI to feet of head multiply by 2.31

²⁾ Interpolation between points is allowed

1.4.2) WPWD Series





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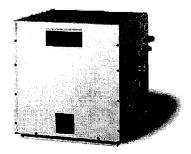
Water-Source Heat Pumps - Water to Water Unit 024-072 (WPWD)

Features & Benefits

Text Information

General Data

Cooling & Heating Performance Data 024-072



Refer to Trane Publications:

- Product Catalog (WSHP-DS-6)
- Installation/Owner/Maintenance (WSHP-IOM-4) (0.47 MB)

Emergency Cooling

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		Physic	cal Data - W	PWD 024-07	2		
Model	: WPWD	024	036	042	048	060	072
	Width of cabinet (in)	23	23	23	23	23	23
Unit Size	Width of cabinet and connections (in)	24.8	24.8	24.8	24.8	24.8	24.8
	Height (in)	24.3	24.3	24.3	24.3	24.3	24.3
	Depth (in)	23.3	23.3	23.3	23.3	23.3	23.3
Compre	ssor Type	Scroll	Scroll	Scroll	Scroll	Scroll	Scroll
R-22 Refrigerant (lbs)		3.25	3.375	3.50	4.00	4.25	4.25
Approxin With c	Approximate Weight With crate (lbs)		183	203	214	244	277

WPWD 024-0	WPWD 024-072 Specifications												
Model: WPWD	024	036	042	048	060	072							
Source and Load GPM	4.0	6.0	7.0	7.50	10	10							
Source and Load Ft. Hd.	1.4	3.2	4.4	5.0	9.2	9.2							
Cooling Load EWT 45 F (MBH)	18.24	26.74	31.3	35.55	45.98	51.01							
Cooling Load EWT 45 F (EER)	15.0	15.7	15.7	15.4	15.5	14.9							
Heating Load EWT 100 F (MBH)	25.38	33.34	39.69	42.87	57.15	67.47							
Heating Load EWT 100 F (COP)	3.64	3.62	3.7	3.45	3.62	3.62							

WPWD Size 024-072 Features and Benefits

General

The water source heat pump Model WPWD (water-to-water) offers a range of capacities from two tons to six tons. All units are housed in one standard compact cabinet.

Cabinet

The cabinet, which allows easy access for installation and service, is constructed of heavy gauge metal. The cabinet finish is produced by a corrosion resistant electrostatic powder paint coating in the color "soft dove". The top half of the diagonal cabinet is removable for access to the internal components by removing two screws. Insulation To reduce condensation and compressor noise, the cabinets are insulated with 1/2-inch thick, neoprene backed, acoustical fiberglass insulation.

Compressor

The Model WPWD contains a highefficiency scroll compressor for reliable and efficient operation. The scroll compressor's unique design lends itself to having one of the lowest sound levels in the industry. The compressor is internally isolated and placed on a stiff base plate designed to further reduce vibration noise. As an added benefit, the WPWD cabinet includes full length channel stiffeners underneath the unit.

Heat Exchanger

The water to refrigerant heat exchangers are made of stainless steel brazed plate. This design provides a larger amount of surface area for heat exchange between the water and the refrigerant.

Piping

All low-side copper tubing in the refrigeration circuit is insulated to prevent condensation at low entering liquid temperatures.

Filter Drier

A filter drier is provided in each unit for dehydration and cleaning of the refrigeration circuit. This feature adds to the unit life.

Expansion Valve

As standard, Trane provides a balanced port thermal expansion valve. This valve precisely meters the refrigerant flow through the circuitry to achieve the desired heating or cooling over a wide range of fluid temperatures.

Water Connections

All water connections feature one-inch brass swivel connectors. Because the connectors are swivel, a back-up wrench is not necessary when tightening.

Low Pressure Switch

The low pressure switch prevents compressor operation under low charge or in excessive loss of charge situations. This device is set to activate at refrigerant pressures of 35 psig when a 35 F low temperature detection thermostat is applied. An optional 7 psig pressure switch is available when using a 20 F temperature low temperature detection thermostat.

High Pressure Switch

For internal overload protection, Trane provides a high pressure switch. This deenergizes the compressor when discharge pressure become excessive.

Low Temperature Detection Thermostat

The low water temperature detection thermostat is provided to protect the water-to-refrigerant heat exchanger from freezing. This device prevents compressor operation if leaving water temperature is below 35 F. An optional 20 F

temperature thermostat may be applied for low water temperatures where an appropriate antifreeze solution is used.

Lockout Relay

When the safety controls are activated to prevent compressor short cycling, the lockout relay (circuit) can be reset at the thermostat, or by cycling power to the unit.

Thermostat Hookup

Low voltage and high voltage knockouts are provided in the top half of the unit. All control wiring to the unit should be 24 volt.

Desuperheater Option

The desuperheater option is a heat recovery system packaged within the water-to-water unit. This option captures heat energy from the heat pump for considerable cost savings all year. Since it is active in either operating mode, it can provide hot water at a reduced cost while in heating or virtually free hot water while in cooling.

1.5)	Comfort Systen	a Colutions I	no (CSSI)	Sorios
1.3)	Comfort System	i Solutions II	ic. (CSSI) - (Series

CSSI

Specifications

General

Fluid Heat Pump shall be COMPAX mechanical modules, with capacities and efficiency levels as per the equipment schedule.

Cabinet

Cabinet shall be 18ga. galvanized satin coat steel with a baked powder-coat finish. Heavy gauge base with an integral welded steel "tree" shall support the major components to withstand shipping and handling. Cabinet shall be internally insulated for improved thermal and acoustic performance. All cabinet panels shall be removable for service access to all internal components.

Compressor

Compressor shall be fully hermetic high efficiency, high pressure shell design with inherently balanced quad design. Compressor shall not be rotation dependant. Compressor shall be designed for low temperature operation without the need for a crankcase heater.

Heat Exchangers

Refrigerant to fluid heat exchangers shall be Atlantis tube-in-shell type with minimum passage sizes of .50 inches in the shortest direction. Circuiting shall be arranged in a counterflow heat transfer configuration on both evaporator and condenser in any mode. Heat exchangers shall be designed for pressures of 375 psi on the refrigerant side, and 125 psi on the water side.

Refrigerant Circuit

Refrigerant circuit shall be constructed in accordance with design regulations for R22 refrigerant. Circuit shall include in addition to the basic components, a sight glass balanced port thermal expansion valve(s), and a filter dryer. Safety devices shall include a high pressure cutout and a loss of charge cutout. Reversing units shall incorporate a high quality four way reversing valve with leakage less than one percent, and shall incorporate two balanced port thermal expansion valves, each tuned for the heat exchanger they serve. Completed circuit shall be pressure tested for leaks, fully evacuated, and factory charged to the prescribed amount. Operation test on the complete unit shall include a 30 minute run in test during which time performance characteristics shall be recorded.

Contro/

INTELACON microprocessor based control system and all controlled components shall operate on 24 volt AC power. Controller shall provide anti-recycle protection, intelligent lockout protection of low pressure, high pressure, and freeze-up. Built-in temperature control for both heating and cooling modes with internal or external change over capabilities shall be incorporated. A five segment alpha-numerical LED display shall provide menu selection of operating and override parameters as well as indication of operational problems. Communication capabilities shall be available through RS485 protocols. (Special order)

Options

- · Reverse cycle operation
- 90/10 Cupronickel heat exchangers
- · Law temp option for geo-exchange



Quick Selection Tables

Formulas:

 $\Delta T = Capacity / 500 GPM$

 $EWT = LWT - \Delta T$

COP = Heating Capacity / 3.413 / Watts

EER = Cooling Capacity / Watts

Enter Table at the desired "Supply Water Temperature" (LA/T, Leaving Water Temperature from the Compax Mechanical Module) Heating selection is made from the vertical column and cooling selection from horizontal row. Capacity will be dependent on the LWT (Leaving water temperature) on the opposite side of the Compax Mechanical Module and the selected GPM. High GPM will yield a low ΔT versus low GPM yields a higher ΔT .

Use the above formula's to calculate non-tabular data.

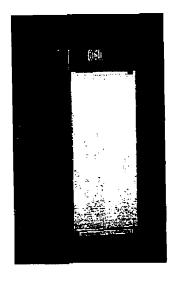
Compax mechanical Modules are available in two configurations

CMS – Non-reversing, heating on one side (top) cooling on the other (bottom water connections). The Compax moves heat from the bottom circuit to the top circuit.

CMM – Reversing, Load side (top) is Hot Water or Chilled water that can be supplied to the occupied space. The Source side (bottom water connections) is where heat is rejected or absorbed (condenser loop, WSHP loop, Geo-exchange, or the Mother Loop, a source of water between 25°F – 110°F).

Consult Factory for applications outside the chart.

Model CMM/CMS 045



INTELACON Electronic Control System:

- · Built-in temperature controller
- Menu driven control and setpoint adjustment
- Alpha numerical LED display for temperature, mode and trouble indication
- Intelligent lockout circuit for compressor protection
- R\$485 communication link (Special order)

Refrigeration Components

CSSI

- · Sight glass, filter dryer and Schrader ports
- Balanced port thermal expansion valves
- High pressure cutout
- Loss of Charge cutout
- Freeze protection



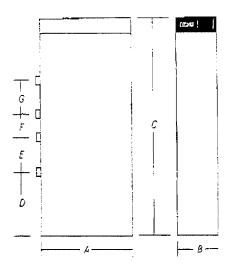
Heat Exchangers

- Atlantis compact design
- Counterflow heat transfer configuration
- · Refrigerant storage capability
- ½" Tube-in-shell

Compressor

- · Non-CFC refrigerant
- New high efficiency design
- · Low noise level

Dimensional Data





Model	A	В	С	D	E	F	G
CMM 045	24	12	34	4	8	6	8
CMS 045	24	12	34	4	В	6	8

All dimensions in inches. Weight Model 045 = 250 lbs. Pipa connections rear panel, T' union provided.

Performance Data

Nominal capacity at 49 F/99 F Leaving Water Temperature

Mechanical

		Heating	Coolina				Common Data					
Model	Reversible	Capacity	Capacity	KW! Input	COP	EER	Nominal	Pressure		Maximum		
		MBH	MBH	III	,		GPM	Drop (ft)	208-230/1	208-230/3	460/3	575/3
CMM 045	Yes	4E.3	39.0	2.7	5.3	14 1	7	8	35	20	15	
CMS 045	No	50.3	47.0	2.7	5.4	15 2	7	8	35	20	15	- :

Electrical

						Electri	cal Data	1.27						
Modei		208-230 1/60	**		206-230/3/60		1	480/3/60			<i>575/3/</i> 60			
	FLA	Ampacity	LRA	FLA	Ampacity	LRA	FLA	Ampacity	LRA	FLA	Ampacity	LRA		
CMM 045	165	20.5	97 6	10.8	13.5	73 4	5 5	6.6	37 7		_			
CMS 045	16.5	20 6	97.6	10.8	13.5	73 4	5.5	6.6	<i>37</i> . <i>7</i>	: -	_	_		

Due to Compan's anguing research and technological improvements mechanical module specifications and ratings are subject to change without notification

CSSI

Performance Data

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CMS 045

Water-to-Water Heat Pump Unit

Cooling and Heating capacities in BTU's per Hour. EER at 45°F/100°F LWT's 14.1 COP at 45°F/100°F LWT's 5.1

Correction Factor for CMM 045

Cooling x 0.95

Heating x 0.96

Watts x 1 00

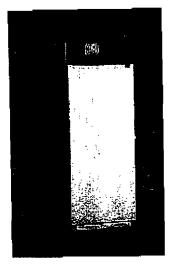
LWT F	25°	30 °	35°	40°	45⁼	5 0 °	<i>55</i> °
	Cooling	33435	37074	40912	44946	49176	53599
20°	Heating	40999	44785	48734	52845	57174	61540
	: vYatts	2216	2259	2292	2314	2326	2327
	27916	31236	34753	38467	42376	46477	50771
90°	35901	39478	43218	47120	51181	55400	59773
	2340	2415	2480	2535	2580	2614	2638
	25736	28925	32309	35887	39658	43621	47775
1 0 ∂*	34243	37764	41447	45290	19291	53448	57760
	2493	2590	2677	2755	2822	2879	2926
	23502	26546	29783	33213	36834	40647	44648
110	32451	35903	39517	43289	47219	51305	<i>55544</i>
	2622	2742	2852	2952	3043	312 3	3192
	21260	24144	27219	30487	33945	37593	41431
120°	30573	33944	37474	41164	45011	49012	53168
	2729	2871	3005	3128	3242	3346	3439
	19055	21763	24662	27751	31031	34501	38160
130-	28659	319 3 2	35366	38959	42709	46614	50674
	2814	2980	3136	3284	3422	3549	36 66
	16938	19452	22156	25050	2813€	31412	34877
140°	26757	29918	33239	36720	40359	44154	48104
	2877	3067	3247	3419	3581	3734	3875

Pressure Drops

Flow Rate gpm	Ft wg
6	5.8
8	10.2
10	7 <i>6</i> 0
12	23.0



September 1998



INTELACON Electronic Control System:

- Built-in temperature controller
- Menu driven control and setpoint adjustment
- Alpha numerical LED display for temperature mode and trouble indication
- Intelligent lockout circuit for compressor protection
- RS485 communication link (Special order)

Refrigeration Components

- Sight glass, filter dryer and Schrader ports
- Balanced port thermal expansion valves
- · High pressure cutout
- Loss of Charge cutout
- Freeze protection



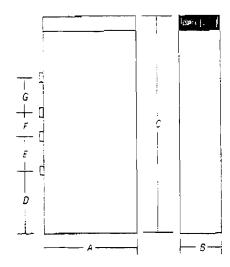
Heat Exchangers

- Atlantis compact design
- Counterflow heat transfer configuration
- Refrigerant storage capability
- ½" Tuba-เก-shell

Compressor

- Non-CFC refrigerant
- New high efficiency design
- Low noise level

Dimensional Data





Model	Α	В	С	D	E	F	G
CMM 075	24	12	34	4	12	3	12
CMS 075	24	12	34	4	12	3	12

All dimensions in Inches Weight Model 075 - 400 lbs. Pipe connections rear panel, 1' union provided.

Performance Data

Nominal capacity at 45 F/95 F Leaving Water Temperature

Mechanical

		Heating	acity Capacity						Common Data				
Mode!	Reversible	Capacity		KW Input	COP	EER	Nominal	Pressure	Maximum Fuse		use Size	e Size	
	1	MBH "					ĢPM	Drop (ft)	208-235/1	208-230/3	460/3	<i>575</i> .3	
CMM 075	Yes	74 0	60.1	4.0	5 4	750	10	26	50	30	15	15	
CMS 076	No	76.Q	62.6	4.0	55	15 5	10	26	50	30	15	15	

Electrical

			- Electrical Data												
Mod≘!		208-230/1/60	ю 1		208-230/3/80		480/3/60				575/3/80				
	FLA	Ampacity	LRA	FLA	Ampacity	LRA	FLA	Ampacity	LRA	FLA	Ampacity	LRA			
CMM 075	225	28 1	155	14.3	. 179	108	7	8.8	60	5.7	7.1	48.4			
CMS 075	22.5	28.1	155	14 3	17.8	108	7	8.8	60	5.7	7.1	48 4			

Due to Compax's engoing research and technological improvements mechanical module specifications and ratings are subject to change without notification.

CMS 075

Water-to-Water Heat Pump Unit

Cooling and Heating capacities in BTU's per Hour.

EER at 45° F/100° F LWT's 14.4

COP at 45° F/100° F LWT'S 5.2

Correction Factor for CMM 075

Cooling x 0 95

Heating x 0.97

Watts x 1 00

LWT°F	25°	<i>30</i> °	<i>35</i> °	40°	45	50⁵	55°
	Cooling	51729	56986	62471	68170	740-69	80158
80°	Heating	63141	68539	74122	79878	85795	91862
	V.Vatts	3344	3385	3414	3431	3436	3429
	43518	48398	53511	58844	64383	70116	76030
90°	55805	60957	65291	71793	77453	83258	89199
	3600	3680	3744	3794	3829	74069 85795 3436 70116	3858
	40560	45311	50266	55434	60800	£6352	72078

_	1 4140	7437	7740	4002	4441	7051	· 4/4J
	34972	39370	43976	48777	<i>53760</i>	<u> 58913</u>	64226
120	49871	54930	60117	65420	70829	75334	81926
	4365	4559	4729	4876	5001	<i>5104</i>	5186
	32044	36260	40676	45278	50054	54991	60080
130°	47552	52 6 01	577 5 9	63014	68357	73778	79267
_	4544	4783	5905	5197	5363	5504	5622
	28856	32883	37099	41493	46052	50764	55618
140°	44813	49865	55005	60223	65510	70856	76251
	4675	4976	5246	5488	5701	5887	6046

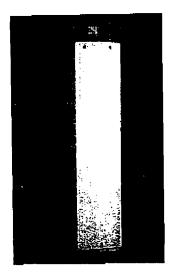
Pressure Drops

Flow Rate gpm	Ft wg
6	9.0
8 .	16.0
10	25.0
12.	36.0



September 1998

Model CMM/CMS 135



INTELACON Electronic Control System.

- Built-in temperature controller
- Menu driven control and setpoint adjustment
- Alpha numerical LED display for temperature, mode and trouble indication
- Intelligent lockeut circuit for compressor protection
- RS485 communication link (Special order)

Refrigeration Components

- Sight glass, filter dryer and Schrader ports
- Balanced port thermal expansion valves
- High pressure cutout
- Loss of Charge cutout
- Freeze protection



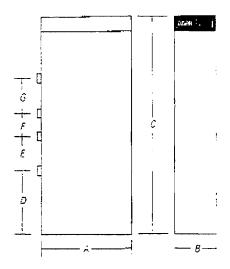
Heat Exchangers

- Atlantis compact design
- Counterflow heat transfer configuration
- Refrigerant storage capability
- 1/2" Tube-in-shell

Compressor

- Non-CFC refrigerant
- New high efficiency design
- Low noise level

Dimensional Data





Model	А	В	C	D	E	F	G
CMM 135	32	13	58	241/2	101/2	51/2	10 /2
CMS 135	32	13	58	241/2	101/2	51/2	10%

All dimensions in inches. Weight Model 135 = 535 lbs. Pipe connections rear panel, 1½" union provided.

Performance Data

Nominal capacity at 49 F/99 F Leaving Water Temperature

Mechanical

		Heating	Coolina	60.00					Comm	on Data		
Model	Reversible	Capacity	Capacity	inout Inout	COP	EER	Nominal	Pressure		Maximum	Fuse Size	1,000,000
1		МВН	MBH	пары			GPM	Drop (ft)	208-236/1	208-230/3	460/3	575/3
CMM 135	Yes	130.0	107.9	7.2	5 3	15.0	18	17	<u></u>	60	30	25
CMS 135	No	135.7	117.2	2.2	<i>Ş.5</i>	15 4	18	17	_	60	30	25

Electrical

				. •		Electric	cai Data				. •	
Madei		208-230/1/60	Ī	7	202-230/3/60			480/3/60			575/3/60	
Ī	FLA	Ampacity	LRA	FLA	Ampacity	LRA	FLA	Ampacity	LRA	FLA	Ampacity	LRA
CMM 135	_			28.3	35 4	205	14.4	180	194	17.4	74.3	78.4
CMS 135		-		22.3	35.4	205	74 4	18.0	104	11.4	14.3	78.4

Due to Compar's origining research and technological improvements mechanical module specifications and ratings are subject to change without notification

CMS 135

Water-to-Water Heat Pump Unit

Cooling and Heating capacities in BTU's per Hour

EER at 45° F/100° F LWT's 14.4

COP at 45° F/100° F LWT's 5.2

Correction Factor for CMM 135

Cooling x 0 97

Heating x 0.96

Watts x 1 00

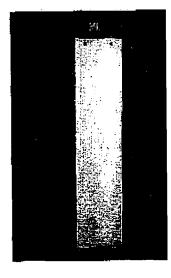
LWT°F	25°	30°	35	40°	45°	50°	55°
	Cooling	91356	100113	109299	118926	129004	139541
80°	Heating	11 28 68	121940	131356	141120	151234	151697
i	Watts	5303	6395	6463	6503	6573	6492
	78700	86872	95468	104500	113975	123913	134312
90°	100600	109324	118399	127826	13 76 07	147745	158239
	6417	55,78	6719	6834	6923	6983	7011
	7 <u>3815</u>	81746	90110	98920	108185	117914	128110
100°	97005	105663	114681	1240662	133806	143915	154388
	6795	7008	7199	7367	7507	7618	7698
	68654	76265	84323	92838	101821	111280	12122
110°	93381	101910	110811	120086	129735	139762	15016
	7245	7514	7761	7984	8179	8345	8479
	63513	70719	78388	86532	95158	104276	11389
120	897.57	98088	106808	115916	125412	135296	14556
	7689	8019	8327	8609	8864	9029	9281
	58695	65401	72593	80279	88468	97167	10638
130°	86 165	94227	102694	111568	120847	130529	14061.
	8049	8446	8820	9168	9487	9775	10030
	54521	60623	67235	74368	82028	90223	98956
140°	82646	90358	98499	107066	116058	125472	13530
	8241	8712	9150	9580	9971	10328	10650

Pressure Drops

Flow Rate gpm	Ft wg
10	5.0
15	.17.3
20	20.0
24	28.8



September 1998



INTELACON Electronic Control System:

- Built-in temperature controller
- Menu driven control and setpoint adjustment
- Alpha numerical LED display for temperature, mode and trouble indication
- Intelligent lockout circuit for compressor protection
- R\$485 communication link (Special order)

Refrigeration Components

- Sight glass, filter dryer and Schrader ports
- Balanced port thermal expansion valves
- High pressure cutout
- Loss of Charge cutout
- Freeze protection



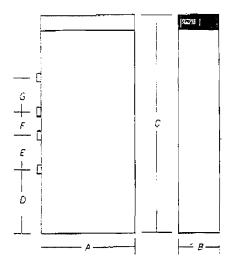
Heat Exchangers

- · Atlantis compact design
- Counterflow heat transfer configuration
- Refrigerant storage capability
- 1/2" Tube-in-shell

Compressor

- · Non-CFC refrigerant
- New high efficiency design
- · Low noise level

Dimensional Data





Model	Α	В	С	D	E	F	G
CMM 150	32	13	58	241/2	10%	51/2	101/2
CMS 150	32	13	58	241/2	10%	51⁄≥	101/2

All dimensions in inches, Weight Model 150 = 535 lbs, Pipe connections rear panel, 1%" union provided.

Performance Data

Vominal capacity at 49 F/95 F Leaving Water Temperature

Mechanical

	1	Hesting	Cooling	2/14/						on Data		
Madel	Reversible	Capacity	Capacity	KW Input	COP	EER	Nominal					
		MBH	MBH				GPM	Drop (ft)	208-230/1	208-230/3	460/3	575/3
CMM 150	Yes	161. 8	131.2	8.8	5.4	149	23	12		75	<i>35</i>	30
CMS 150	No	166.8	136.7	₹8	5.5	15 4	23	. 12	-	75	35	30

Electrical

					44	Electri	cal Data	44				
Mode!		208-230/1/60			208-230/3/60	A=		480/3760			575/3/60 -	The Art of
	FLA	Ampacity	LRA	FLA	Ampacity	LRA	FLA	Ampacity	LRA	FLA	Ampacity	LRA
CMM 150		· _		34.5	43 1	239	17.0	21.3	179	15.2	19.0	111
CMS 150		<u>-</u> `		34.5	43-1	239	17.0	27.3	119	15.2	19.0	111

Due to Compax's ongoing research and technological improvements mechanical module specifications and ratings are subject to change without notification.

CMS 150

Water-to-Water Heat Pump Unit

Cooling and Heating capacities in BTU's per Hour EER at 45° F/100° F LWT'S 14.5 COP at 45°F/100°F LWT's 5.3

Correction Factor for CMM 150: Cooling x 0.96

Heating x 0.97

Watts x 1.00

LWT°F	25°	30 ⁻	3 <i>5</i> °	40°	45	50°	<i>55</i> °
	Cooling	111075	122074	133693	145942	158832	172370
80°	Heating	135664	147442	159787	172698	186169	200195
	Watts	7204	7433	7646	7839	8010	8152
	95693	105892	116682	128076	140987	152725	165998
90°	121318	132430	144084	156279	169012	182281	195082
	7508	7 <i>776</i>	8029	8263	8475	8660	8814
	89726	99675	110200	121317	1330 39	145376	158338
10 0 -	117191	128194	139712	151746	164294	177353	19092
	8047	8356	8647	8916	9158	9369	9547
	83195	92829	103029	113810	125186	137169	14976
110°	112450	123326	134693	146551	15 8 899	171736	18506
	<i>8572</i>	8936	9277	9593	<i>98</i> 78	10128	7034
	76505	85757	95566	105947	11691E	128483	14066
120°	107466	118194	129388	141050	153160	165778	17884
	9071	9504	9910	10285	10626	10927	11187
	7,0070	78865	88208	98119	108611	119698	13139
1 30 °	102611	113164	124160	135602	147490	159826	17261
_	9534	10050	10534	10982	11392	71757	1207
	64315	72569	81368	90729	100688	111201	12233
140°	98261	108608	119376	130568	142187	154234	16671
	9946	10559	11136	11673	12165	12609	1300

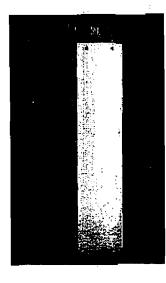
Pressure Drops

Flow Rate gpm	Ft wg
15	5.0
20	8.9
25	13.9
30	20.0



September 1998

Model CMM/CMS 175

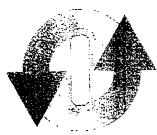


INTELACON Electronic Control System:

- Built-in temperature controller
- Menu driven control and setpoint adjustment
- Alpha numerical LED display for temperature, mode and trouble indication
- Intelligent lockout circuit for compressor protection
- RS485 communication link (Special order)

Refrigeration Components

- Sight glass, filter dryer and Schrader ports
- Balanced port thermal expansion valves
- High pressure cutout
- · Loss of Charge cutout
- Freeze protection



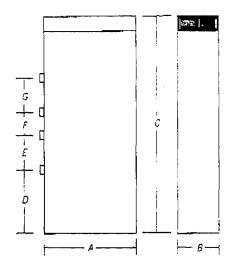
Heat Exchangers

- Atlantis compact design
- Counterflow heat transfer configuration
- Refrigerant storage capability
- 1/2" Tube-in-shell

Compressor

- Non-CFC refrigerent
- · New high efficiency design
- · Low noise level

Dimensional Data





Model	A	В	С	D	E	F	G
CMM 175	32	13	58	241/2	101/2	51/2	101/2
CMS 175	32	13	58	241/2	101/2	51/2	101/2

All dimensions in inches. Weight Model 175 = 545lbs. Pipe connections rest panel, 1½" union provided.

Performance Data

Nominal capacity at 45 F/95 F Leaving Water Temperature

Mechanica/

			Heating Cooling				Common Data					
Modei	Reversible	Capacity	Capacity	KW Input	COP	EER	Nominal	Pressure		Maximum	Fuse Size	
		MBH	MBH"	, riput	_		GPM	Drop (ft)	208-230/1	208-230/3	460/3	575/3
CMM 175	Yes	186.5	152.4	10.5	52	14.5	26	15	_	90	45	35
CMS 175	No	192.3	157.1	10.3	5.5	152	26	15	-	90	45	35

Electrical

	Electrical Data											
Model		208-230/1/60	2		208-230/3/60		1:	480/3/60			575/3/60	
	FLA	Ampacity	LRA	FLA	Ampacity	LRA	Fi.A	Ampacity	LRA	FLA	Ampacity	LRA
CMM 175			_	41.0	51 <u>3</u>	269	20 7	25 9	1 3 5	17.2	21.5	111
CMS 175		_		41.0	51.3	269	20 7	25.9	135	17.2	21.5	111

Due to Compay's ongoing research and technological improvements mechanical module specifications and ratings are subject to change without notification

CMS 175

Water-to-Water Heat Pump Unit

Cooling and Heating capacities in BTU's per Hour EER at 45° F/100° F LWT's 14.2 COP at 45° F/100° F LWT's 5;

Correction Factor for CMM 175: Cooling x 0 97

Heating x 0.97

Watts x 1 02

LWT°F	25°	<i>30</i> °	35 ⁻	40°	45-	50°	55℃
	Cooling	128409	141155	154672	169009	184173	220190
80°	Heating	156904	170297	184400	199247	214869	231290
	.√atts	8349	8538	8708	8860	8994	9112
	110759	122268	134492	147470	161238	175823	191249
90°	141379	153729	166716	180384	194772	209915	225840
	8972	9218	9442	9644	9826	9989	10135
	104276	115319	127051	139514	152747	166780	18164
100	137460	149537	162216	175545	189568	204323	21984.
	9723	70126	10303	10557	10789	11000	11192
	97213	107819	119085	131059	143780	157285	17160
110°	132508	144508	156974	170058	183807	198264	21346
	10371	10750	11101	11427	11728	12007	1226
	89833	100026	110850	122355	134586	147582	15137
120°	127006	138826	151173	164104	177669	191915	20687
	10892	11368	11815	12232	12623	12989	13332
	82402	92203	102605	113661	125419	137923	15120
1 <i>30</i> F	120845	132677	144998	157866	171336	185455	20026
	11264	11 8 59	12421	12952	13453	13927	14375
	75191	84620	94617	105241	116541	128564	14135
140°	114308	126248	138634	151528	164989	179068	19381
	11461	12197	12897	13562	. 14195	14797	15377

Pressure Drops

Flow Rate gpm	Ft wg
15	5. <i>0</i>
20	8.9
25	13.9
30	<i>20.0</i>



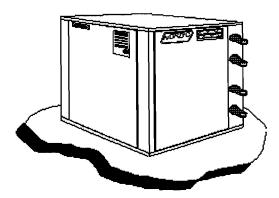
1.6) Maritime Geothermal Ltd. - W Series



Maritime Geothermal Ltd.

Manufacturers of NORDIC® geothermal heat pumps 📥

W-Series Units - Hot Water Output



W-series units are designed to produce large quantities of hot water. Units can be installed on either open well systems or on closed loop systems. Available with domestic hot water desuperheaters and as either heating only or as heating/cooling systems. Very popular for use with concrete **in-floor heating systems**, swimming pool heating, or any other application where large quantities of hot water are required.

Performance Specifications

	MODEL	GPM	HEATING CAPACITY					
	MODEL	GFM	BTU	WATTS	COP	Amps		
Entering Water Temp. 50 deg F.	W-45-W	a	43.000	2316	38	15.7		
	W-55-W	8	53,000	4196	3.7	20.2		
	W465-W	10	62,000	5048	36	24.6		
Entering Water Temp. 32 deg F	VV-45-VV	8	35,100	3024	3.4	15.1		
	V/+35+V/V	90	44/100	39/15	33	19.5		
	W-65-W	12	52,200	4779	3.2	23.8		

Specifications subject to change without notice.

Heating performance will increase with higher water flow rates and ℓ ar EWT.



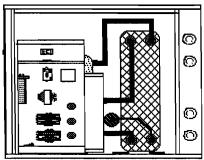
Typical Piping for hot water heating.

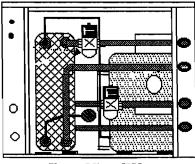


Infloor heating possible plumbing layout.

W3 - Series - Hot Water Output

Ultra High Efficiency Liquid-to-Water Heat Pumps





Back View W3

Front View W3

The dual compressors (1) HP & (2) HP can be operated to give 3 stages of capacity at an ultra high efficiency rate. These units can be equipped with either 316 Stainless Steel brazed plate exchangers or high efficiency copper / cupro-nickel coaxial style exchangers depending on the application. The heat exchangers are sized for maximum output therefore when running on the first or second stage the exchangers

are vastly oversized for the compressor capacity yielding the highest suction and lowest discharge pressure possible. COP's range from 3.1 to 4.5 depending on the water inlet and outlet conditions.

Three stage Performance Specifications

	MODEL	0.0.10		HEATING	CAPACITY	
	MODEL	€ 6 IGPM	BTU	WATTS	COP	Amps
Entering Water	/V3-45	Hegh	42,568	2928	98	78
Temp. 50 deg.F.		Medium	29,797	2046	4.2	11 2
SD deg.i .		is a	17,878	1228	4.8	*,
Entering	W3-45	High	31,772	2615	3.09	14.9
Water Temp.		Medium	22,240	1831	3.4	10.4
32 deg F		Low	13,344	1098	3.71	63

Specifications subject to change without natice 230v / 1 / 60

Hoating performance will increase with higher water flow rates and f

Drawing

Cabinet and Piping dimensions for "W" and "W3" series liquid-to-water heat pumps

Home Products Case Studies Photo Gallery

1.7) Hydron Module - WW Series



Water to Water Units

Home | Company | Request Info | Contact Us

For product information, select item from drop-down list and click the View button.

General and Technical Information



Water to Water WW23 thru WW120 (2 thru 10 ton):

- Water to Water Condensing Units
- Built-in Reversing Valve for Chiller Applications
- 6 thru 10 Ton are Stagable
- Will Produce Hot Water for Floor Heat or Fan Coil
- Will Produce Chilled Water for Summer Cooling with Hydronic Fan Coils Shown
- Domestic Water Heating Option
- High Heating Out-Put
- All Panels Removable for Easy Service





Water to Water Single Compressor

Rated in accordance with ARI 330

Based on 32° entering water temperature in heating mode and 77° entering water temperature in cooling mode. (Includes Pump Penalties)

Model #	GPM	BTU/hr Heating	СОР	BTU/hr Cooling	EER
CS-WW23 (2.0 Ton)	6.0	19,400	3.0	20,100	13.1
CS-WW34 (3.0 Ton)	9.0	28,300	3.0	29,600	14.0
CS-WW46 (4.0 Ton)	12.0	37,000	3.1	40,000	13.8
CS-WW61 (5.0 Ton)	14.0	51,200	3.0	53,100	13.6
CS-WW70 (6.0 Ton)	16.0	56,300	3.0	58,200	13.2

Water to Water Dual Compressor									
CS-WW72 (6.0 Ton)	18.0	56,600	3.0	61,400	15.0				
CS-WW96 (8.0 Ton)	24.0	74,000	3.1	82,800	15.0				
CS-WW120 (10.0 Ton)	28.0	102,400	3.0	110,000	15.0				

Water to water data is based on 110° entering load temperature in heating mode and 50° entering load temperature in cooling mode.



Hydron Module, LLC, Mitchell, South Dakota

Home | Company | Request Into | Contact Us | Energy Dynamics Website
General & Technical Information | Single Speed Upflow & Downflow | Single Speed Horizontal

Dual Compressor Upflow & Side Discharge | Water to Water Units

Air to Water - Hydronic Fan Coils | Split System Units

ECM Blower Motors | Accessories & Hydron Pump Module

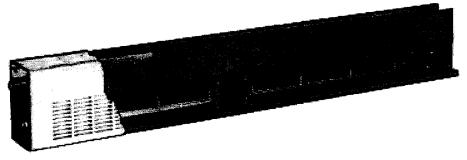
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2.0) Manufacturers of Tangential Fan Coils

2.1) Rosemex - LOW FLOW Baseboard

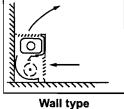


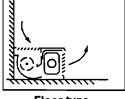
LOW-FLOW

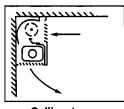


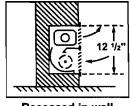
APPLICATION: Rosemex low-flow forced-air fin tube radiation is designed primarily for use in large window areas where high heat loses occurs. Two standard unit sizes 48" and 96" are available with 50 1/2" and 98" enclosures for individual installation. Smooth finish slip joint cabinets are also available for wall to wall installation.

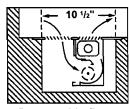
Several different arrangements are available. Some standard basic arrangements are ceiling mounted, floor mounted, recessed in wall and recessed in floor. Special free standing and custom built cabinets are also available. Three types of element piping arrangements are possible.











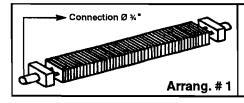
wan type

Floor type

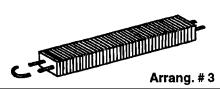
Ceiling type

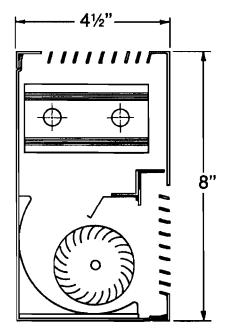
Recessed in wall

Recessed in floor









CABINET: Cabinet and all accessories are manufactured of 16 ga. cold rolled steel, and coated with rust proof tan primer finish.

ELEMENT: Copper aluminium heating elements are manufactured of 2 row \emptyset $\frac{1}{2}$ seamless copper tubes permanently bonded to aluminium fins.

MOTOR: Motors are shaded pole type, tapped wound, two speed with built in thermal overload protection for 115/1/60. Permanently lubricated for a minimum of 20,000 hours of operation.

FANS: Two aluminium tangential blowers are directly connected to a double extended motor shaft. Statically and dynamically balanced forquiet vibration free operation.

CONTROLS: Two speed motor switch with "OFF" position is mounted behind an access door on all floor and wall models. Optional line voltage thermostats can also be mounted by the factory.

CAPACITY DATA FOR LOW-FLOW ON MOTOR & FAN

1				мото)R			AIR INLET EMP. 65°F — 18.3°C			18.3°C	WATER INLET TEMPERATURE				PRESSURE	
NODEL	R.P.M.	MOTOR	FAN	VOLTAGE	H.P.	WATT	AMP	CFM	L/SEC.	OUTLE	T TEMP.	TEME		20'F — 1		FEET	_
L	n.r.m.	TIP	QTY	TOLINGE		WALL	Cmt.	VI IM	:	°F	*C	мвн	KW	USGPM	L/SEC.	WATER	KPA
LF-175	1100	1	2	120/1 60	1/12	60	0.6	175	82.5	109	43.7	8.3	2.43	0.83	0.05	0.29	2.00
LF-250	1500	1	2	120-1 60	1,12	60	0.6	250	118.0	101	38.3	9.8	2 87	0.98	0.06	0.35	2.42
LF-350	1100	2	4	120:1 60	2 x 1/12	2 x 60	12	350	165.0	109	43.7	16.6	4.86	1.66	0.10	1.60	11.00
LF-500	1500	2	4	120:1:60	2 x 1/12	2 x 60	12	500	236.0	101	38.3	19.6	5 74	1.96	0.12	1.98	13.65

CAPACITY: Capacity of Low-Flow units are given on table no 1 at 200° F water inlet temperature, 20° F temperature drop and 65° F entering air temperature. For capacity at different entering water or air temperature conditions, use following formula.

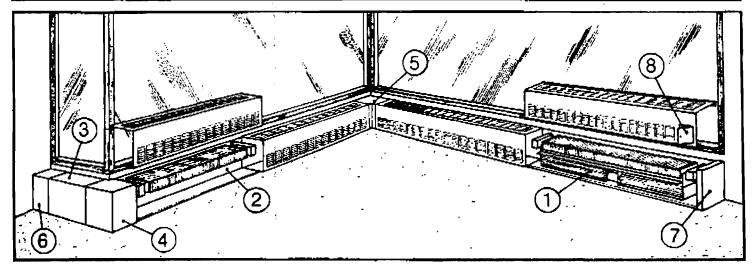
New capacity BTUH = $\frac{\text{New}_{\text{water}} \quad \text{F}_{\text{new air}} \quad \text{F}_{\text{a}}}{135}$ x capacity show in table BTUH

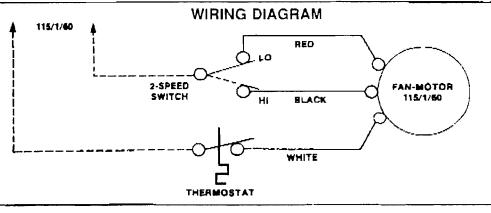
BASEBOARD APPLICATION: Low flow unit can also be used as baseboard heater without motor-blower assembly. See table no. 2 for capacity.

TABLE 2

CAPACITY DATA FOR LOW-FLOW WITHOUT MOTOR & FAN

STEAM)	ENT. AIR 65° F	— 18.3° C			CAPACITY AT	AVERAGE	WATER TEM	PERATUR	E	
1 PSI	6.9 KPA	WATER FLO	W RATE	200° F	93.3° C	190° F	87.8° C	180° F	82.2° C	170° F	76.7° C
BTU/HR. FT.	WATT/M.	U.S. G.P.M.	L/SEC.	BTU/HR.FT.	WATT/M	BTU/HR.FT.	WATT/M	BTU/HR.FT.	WATT/M	BTU/HR.FT.	WATT/M
1070	1028	1	0 063	920	884	835	803	738	709	653	628
1128	1083	4	0.253	970	932	880	846	778	748	668	661





- 1 LOW-FLOW c/w MOTOR & FAN
- 2 LOW-FLOW WITHOUT MOTOR & FAN
- 3 DUMMY CABINET
- 4 OUTSIDE CORNER
- 5 INSIDE CORNER
- 6 JOINER PIECE
- 7 END PIECE
- 8 CABINET C/W ACCESS DOOR

2.2) MINIB - In floor Model KT-1

Czech Floor FAN-COILs Manufacturer Catalogue Home Order Contact Prices Portfolio without blower Control Information with blower Warranty Modular Accessorries Pressure drop 1 2 3 4 1 2

MINIB COIL - KT-1

with a 12V tangential blower / mit 12V Tangentialventilator

CHARACTERISTIC

- the narrowest type, the der engste Typ width is only 184 mm
- dry interiors heating
- noise level approximately 34 dB

CHARAKTERISTIK

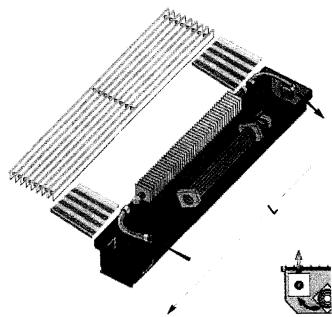
- Breite nur 184 mm
- Ausheizung trockener Umgebungen
- Laufgeräusch ungefähr 34 dB

DIMENSIONS

- total width
- construction height with the bottom insulation
- lengths

MASSE

- Gesamtbreite 184 mm
- Bauhöhe mit Bodenisolierung 128 mm
- då ka 1000 ÷ 2500 mm



USAGE

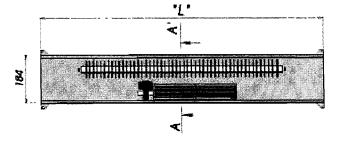
The convector COIL-KT-1 is a fast reacting heating

element that belongs to the lower output range of MINIB convectors with a 12 V blower. The convectors COIL-KT-1 should be used for the space heating of interiors with a lower heating demand in those cases where it is necessary to provide for long strip of convectors bellow the windows.

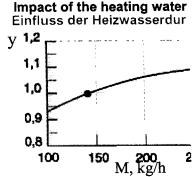
ANWENDUNG

Der Konvektor COIL - KT-1 ist ein schnell reagie Heizkörper, der die niedrigere Leistungsserie der Konvektoren mit 12 V-Ventilator bildet. Wir emp Konvektoren COIL - KT-1 zur Ausheizung von I mit niedrigeren Wärmeansprüchen in den Fällen z verwenden, wo es nötig ist, einen langen Streifen Konvektoren unter den Fenstern zu bilden.

Front view / Anriss



Cross section Querschnitt A-A' 125 160 184



°C		t _A °C			t _A °C	
	15	20	22	15	20	22
		1000			2000	
0	488	450	433	1464	1350	1299
0	408	366	350	1224	1098	1050
0	245	206	190	735	618	570
		1500			2500	
0	976	900	866	1952	1800	1732
0	816	732	700	1632	1464	1400
0	490	412	380	980	824	760

Temperature equation / Wärmegleichung:

$$Q = \psi Q_N \left(\frac{t_w \cdot t_A}{60}\right)^{m=1.13}$$
 (1)

where/wo: m=1.13 Temperature exponent / Warmeexponent

t_{wa}

QN

Temperature exponent / Wärmeexponent Mean temperature of the heating water, air, "C mittlere Heizwasser, Heizluftlemperatur, "C Nominal heat transfer rate for the Nennwärmeleistung für Temperaturunterschied \$\to \tau \tau = 80 - 20 = 60 \cdot \text{C}, \text{ W}

The coefficient of the water flow rate, se the diagram \(\text{Koeffizient des Wasserdurchflusses, s. die graphische Darste for an unknown flow rate select \(\text{W} = 1 \) für unbekannten Wasserdurchfluss wählen Sie \(\text{W} = 1 \)

Mass flow rate of water / Massenwasserdurchfluss, kg/h Heat transfer rate for other temperatures, W Warmeleistung für andere Temperaturen, W

example/Beispiel:

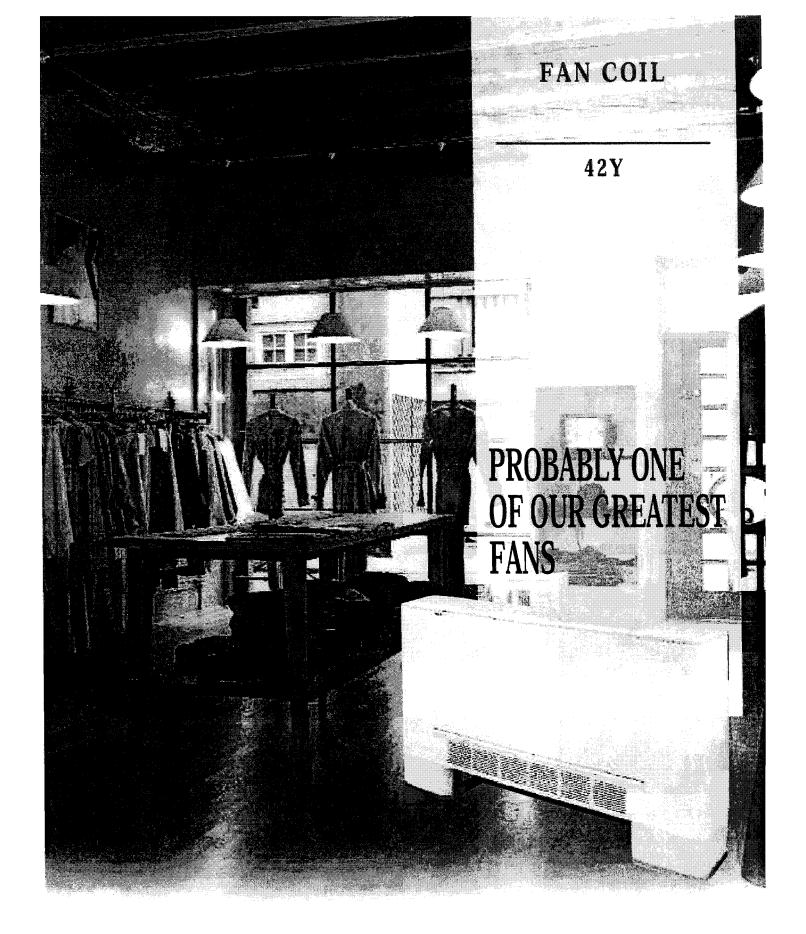
given/Vorgaben: L = 1.5m, t_w = 70 °C, t_A = 15 °C

for/für:

L = 1.5m -> $Q_N = 900 \text{ W}$ $Q = \psi Q_N \left(\frac{t_v \cdot t_h}{60}\right)^{1.13} = 1 \times 900 \left(\frac{70.15}{60}\right)^{1.13} = 811$ offaus (1):

Home	Catalogue	Order	Contact	Prices	Portfolio

2.3) Carrier - Fan Coil 42Y





A NEW FAN COIL FROM THE WORLD'S NUMBER ONE

In the world of air-conditioning, no one has more experience or more expertise than Carrier. Years of research and development, together with sensitivity to customer needs, have made Carrier the number one name in this market. What's more, Carrier actively participates in the Eurovent certification programme. Eurovent is a totally independent body which scientifically validates the performance claims made for units supplied by participating companies: the new 42Y comes with the benefit of Eurovent certification.

CARRIER QUALITY, FLEXIBILITY AND POWER

The new 42Y Fan Coil combines a range of features and improvements inspired by customer feedback. These make the new unit better looking on the outside and more efficient on the inside, with a virtually noiseless tangential fan and a powerful new

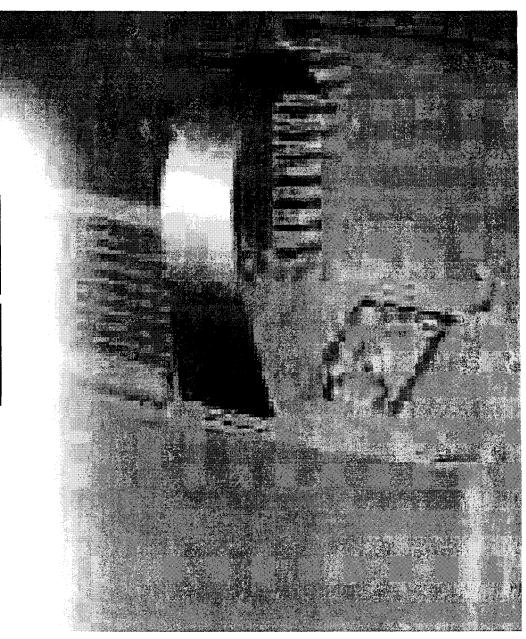
centrifugal fan in support. Overall it represents a small but significant upgrade in the Carrier fan coil family, with a new grille, new hinges and a more stylish cabinet design. The control system is now located inside, under the hinges, for better protection.

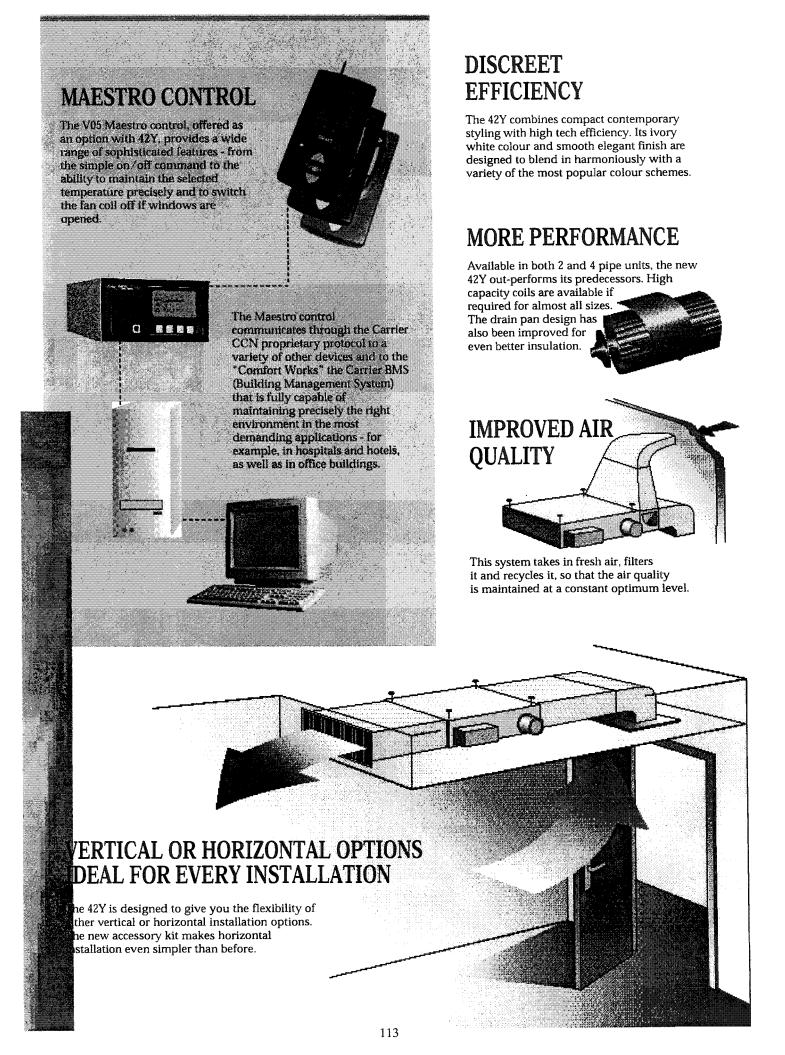
8000 VERSIONS DIRECT FROM THE FACTORY





The new 42Y is available in no fewer than 8000 different variations capable of satisfying virtually any conceivable need from a small villa to a massive public building. However many units are involved, in an "intelligent building" all can be controlled from a single point.







THE EASY WAY TO DECIDE PRECISELY WHAT YOU NEED

The more complicated the building, the more comparative information you need to help you make the right choice. That's why we have developed new software designed to answer every relevant "What if ...?" question.

You can see this information on screen and print-out hard copy for side by side comparisons and product selection.

TECHNICAL DATA

A2Y		01	02	03	04	05	06	07	08	10	12
> Total coding capacity	KAN .	1.13	1.55	2.03	2.55	3.30	4.28	5.20	5.59	6.22	8.00
Sensible cooling capacity	W	0.92	1.28	1.62	2.06	2.69	3.50	4.07	4.51	498	6.72
➤ Water flow (cooling)	.Vh	200	265	350	440	635	735	890	960	1070	1370
► Water pressure gloop (cooling)	(Pa	12	18	8	13	., 11	16	. 22	29	18	18
➤ Heating capacity	:W	147	2.10	2.52	310	4.12	6.00	7,20	7.50	8.25	10.80
► Electric heaters L/H	W	510/-	510/1020	750/1500	1150	/2300	1750	/3500	2000	74000	2300/4600-
Fantype		-			TANGENTIAL			Ţ.	ŧ	CENTRIFLICAL	
➤ Air flow I/m/h (*)	l/s	44/53/69	46/72/95	52/84/113	65/106/142	77/129/171	114/184/239	126/201/259	176/274/310	168/262/324	202/389/17
► Power input (*)	W	21	26	32	38	45	68	74	121	139	187
Sound power level 1/m/h (*)	dB(A)	20/28/32	26/32/40	25/29/36	25/36/41	34/43/45	34/45/48	34/45/48	35/47/50	40/47/52	43/51/59
Sound pressure level 1/m/h (*)	dB(A)	28/36/40	28/40/48	33/37/44	33/44/49	42/51/63	42/53/56	42/51/57	47/55/58.	46/55/60	\$1/59/67
► Unit with carbinat - His Loc D.	mm	543/7	91/220	-	543/991722)— <u>—</u>	\$43/11	91/220	543/1	391/220	543/1591/220
► Weight	kg .	- 1			19		2	7		15	41
Caled units: Dimensions H x L x	O mm	538/5	83/220	-	538/783/22) >	538/9	37/220	538/1	183/220	538/1383/220
► Weight	kg	13			15		2		100	29	36
► Power Supply	V-ph-H	z 🔫 ⋍				23	-1-50-				-

The above data refer to Eurovent Conditions. Cooling conditions: 27°C Dry bulb/19°C Wet bulb air temperature: 7°C/12°C entering and leaving water temperature at high fan speed. Heating conditions: 20°C air temperature, entering water temperature: 50°C, same water flow rate as in cooling condition test at high fan speed Sound pressure is measured in a 100 m² room with 0.5 sec reverberation time Centrifugal fan is available in sizes 01 to 07 with concealed units only.

(*) Data refers to units with tangential fan from size 01 to 07 and centrifugal fan from 08 to 12







Order No. 18135 - 06/99 Supersedes order No. New Manufacturer reserves the right to change any product specifications without notice. Printed in France on Elemental Chlorine Free Paper.



2.4) Myson - CSU Series

COU teen inio

MYSON.

CSU Fan Convector Technical Information

CSU Fan Convectors... available in three sizes to meet a range of service requirements. Each wall mounted unit connects to a conventional hydronic heating system with connections either through the wall or through the floor. The two-speed fan provides gentle air circulation with rapid room heat up. Optional legs are available for mounting on the floor.



ISO 9002 Certified . . . ISO 9002 certification means building quality products that will last for years.

Reliable efficiency... CSU's advanced heat exchanger design delivers 100% of its BTU output promised, keeping the space comfortable with less wear and cycling. Heat output is available from 5,319 to 16,947 BTU/hr, replacing 11 to 36 feet of conventional baseboard and installing in a fraction of the time. For rapid heat up, an additional 50% is available on the boost fan setting. The 5-year warranty on the heat exchanger and 3-year warranty on the fan motor assure you that MYSON builds in reliability.

MYSO	ON CS	SUFAN	CONVEC	TOR-	- BTU/	HR HI	EATO	UTPU	T - EN	TERI	NGAI	R (a 6:	5°I
	FLOW RATE gpm ¹	FAN SPEED	AIR DELIVERY CFM	110**	120**	130**	140	150	160	170	180	190	200
CSU- 10M	3.0	Low	62	1190	1954	2529	3165	3823	4481	5319	5973	6609	724
		Boost	99	2437	3226	4173	5195	6040	6852	7763	8659	9500	1034
CSU- 15M	3.0	Low	66	1524	2484	3452	4418	5385	6352	7317	8282	9240	1019
		Boost	91	1928	3886	4994	6102	7203	8715	10331	11947	14000	1505
CSU- 23M	3.0	Low	92	2018	3461	4687	5751	6983	8260	9518	10813	12262	1377
		Boost	129	4400	6481	8573	10665	12750	14838	16947	19027	21000	2323

¹Note: Correction factor for 1.0 gpm, multiply by 0.87 **For output at these water temperatures, optional 107° low temperature cutoff required.

CS	CSU FAN CONVECTOR DIMENSIONS								
MODEL #	Wide	Deep	High						
CSU- 10M	21 3/8"	4 23/32"	13 1/4" (optional legs +2 9/16")						
CSU-		4							

COU teen inio

1L	15M	29 1/8" 	23/32"	13 1/4" (optional legs +2 9/16")
	CSU- 23M	41 17/32"	4 23/32"	13 1/4" (optional legs +2 9/16")

CSU Fan Convector Specifications

Fan Unit . . . A highly efficient tangential fan extends the full width of the heat exchanger, giving extremely quiet, trouble-free operation. All units have aluminum fans, sealed motor bearings, and permanently lubricated porous bronze sleeve fan bearings.

Controls . . . Units have a two-speed Boost/Low fan switch and built-in thermostat. All models have low-limit thermostats which close on rise at 129°F and reopen at 109° F (\pm 7°F). Optional low temperature cutoff is available.

Heat Exchanger... Fin tube heat exchanger is a manifold design with copper tube water conduits expanded to create firm contact with the surrounding aluminum fins. Special air turbulator design maximizes the rate of heat transfer. All units are hydraulically tested to 300 psi.

Construction . . . The chassis is manufactured from zinc-coated steel with advanced epoxy/polyester baked on finish.

Water Connections... Supply and return are 1/2" sweat connections at the upper left. An air vent is provided in the upper left corner of the unit, underneath the cover. No special key is needed.

Electrical Connections... Wiring connections are supplied through the lower right side of each unit. Motors are 110V, 60Hz.



<u>Towel Warmers | Radiators | Fan Convectors | Water Heaters | Shower Rails | Valves Home | Contact Us | About MYSON | What's New | What's Happening | Area Reps | Site Map /csobj></u>

g Panels

3.1)	Hydronic	Alternatives -	Radiant	Panel	Baseboard
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RadiantPanel Baseboard

Design and Installation Guide

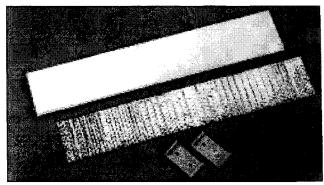
August 2001

Introduction

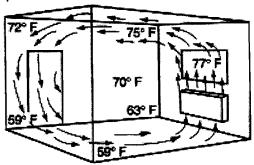
RadiantPanel Baseboard is one of the most advanced concept in perimeter hot water heating. Extending only one inch from the wall, Radiantpanel gives the appearance of typical mop board type molding.

Traditional heating systems have always limited one's freedom of choice in creating the home environment, requiring a sacrifice in comfort, efficiency, and design. With superior comfort, energy efficiency and complete freedom of interior design, the *RadiantPanel Baseboard* system opens up a world of new possibilities.

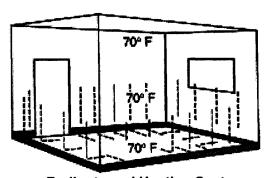
RadiantPanel eliminates the localized heating provided from conventional baseboard, radiator, and forced air systems by using what is called the "Heat Enclosure Principle". Warming a room from its perimeter. RadiantPanel maintains a consistent room temperature throughout, minimizing air turbulence (drafts) and dust circulation, while protecting the air humidity. In addition, radiant heat by nature is energy efficient because it delivers higher levels of comfort at lower thermostat settings. With these advantages the expensive and wasted "Heat Blanket" that accumulates at the ceiling and the "Dried Out" stuffy air associated with traditional heating systems are greatly reduced allowing for an altogether higher comfort level, improved energy conservation and a healthier living environment. Optional manifold and control packages offer room by room zoning, weather responsive operation and the ability to customize a heating system to fit everyone's unique needs.



Radiantpanel is a copper lined aluminum heating panel. Lengths are available from 1 1/2' through 8 1/2' in 6" increments. Each panel comes complete with brass quick connect fittings designed to receive 3/8" PEX tubing, mounting brackets and reflective insulation foil. **Radiantpanel** is available in a standard white (RAL 9010) powerder-coated finish.



Typical baseboard or forced air system



Radiantpanel Heating System

Technical Data

Material. Copper lined aluminum

Fittings: Brass

Recommended Operating Temp: 180°F
Maximum Operating Pressure: 50 PSI

Weight Per Foot: 1.34 lbs

Water Content Per Foot: .018 gal.

<u>Height:</u> 5.14"

Depth (Front to Back): 925"

Design Guidelines

Step 1: Determining Your Heating Requirements

The initial step in your heating system design is to determine the individual area heating requirements. Our in-house sales engineers and local representatives can assist you with your entire system design. This will assure you that the maximum comfort levels and energy savings potential of your specific system are achieved.

Conventional heat loss calculations (e.g. I=B=R) should not be utilized for radiant heating design. If they are used then the result will be an oversized system. An ASHRAE or Manual J heat loss calculation or equivalent is the only proper way to design a modern heating system. Appropriate U or R values and the closest air exchange rate should be selected. After these calculation have been performed, then the system can be laid out.

Step 2: Required Amount of Baseboard

The heat loss of any given area must be replaced with the heat output from the baseboard radiation. **Table A** shows the BTU/hour output for *RadiantPanel Baseboard* at various average water temperatures.

Table A: BTU/h Per liner foot

Average Water	BTU / hr @ .07
Temperature F	GPM Flow Rate
200	245
190	225
180	205
170	176
160	151
150	115
140	104
130	92
120	72

A system should always be designed for the lowest possible water temperature necessary to offset the heat loss. The more baseboard you install, the lower the water temperature your system will require. This will assure maximum energy savings and comfort levels. As a rule you save 1% of fuel for every 3 degrees you lower the water temperature.

Room Heat Loss
BTU Output (@°F)

Necessary Footage

Step 3: Baseboard and Component Calculation

With the footage of baseboard calculated in step 2 you can now lay out the required baseboards and components.

Table B shows the correct *RadiantPanel* sizes for walls from 2'6" through 18' in length. As a rule of thumb, leave at least 6" from the ends, corners and between joining panels for the tubing connections. This space will be covered using our 12" or 60" snapon cover plates. (eg. A 12' wall would require 10'6" of *RadiantPanel Baseboard*- 1 - 5' panel, 1 - 5'6" panel, 2 - end caps, and 3 - 12" snap-on covers.) After the total number of panels have been established, the following components can be determined:

- Manifold Size: Dependent upon zoning requirements. Larger rooms may require more then one manifold loop.
- *(Note) In general, no more than 60 feet of baseboard, with 60 feet of supply and 60 feet of return PEX tubing should be run for any single zone / loop.
- 3/8" PEX Tubing: Total length for all supply and return lines. We recommend only using PEX-A or PEX-C type tubing, or a composite layered pipe witch is made up of PEX Aluminum PEX.
- Cover Plates: You will need a cover plate at every end cap, both sides of a corner piece, and at every joint between 2 panels. We offer 12" snap-on cover plates as a standard, and we also have a 60" cover plate which can be used as a blank baseboard run, or custom cut for spaces longer then 12".
- End Caps and Corners: We have left and right hand end caps as well as inside and outside 90deg corner trims. For other angles of corners, you can custom make a joint using either the 12" or 60" snap-on covers. The amount of end caps and corner trims will depend on your room layout.

Table B:

Length of Wall	Panel Size
32" - 37"	1 1/2' 2'
36" • 43" 44" - 49"	2 1/2'
50" - 55" 56" - 61" 62" - 67"	3 1/2)
68" - 73"	4 1/2' 5'
74" - 79" 80" - 85"	5 1/2'
86" - 91" 92" - 97" 98" - 103"	6' 6 1/2' 7'
104"4109"	7.1/2'
110" - 115" 116" - 125"	8 1/2"
126" - 132" 133" - 137" 138" - 145"	4·1/2' & 4·1/2' 4·1/2' & 5' 5' & 5'
146" - 151" 152" - 157"	5' & 5 1/2' 5 1/2' & 5 1/2'
158" - 163" 164" - 169"	5 1/2" & 6'
170" - 175" 176" - 181"	6' 8 6' 6' 8 6 1/2' 6 1/2' 8 6 1/2'
182" - 187" "188" - 193" 194" - 199"	6 1/2' & 7' 7' & 7' 7' & 7 1/2''
200% 205" 206% 211" 212" - 217"	7 1/2! & 7 1/2! 7 1/2' & 8' 8' & 8'

- Zone valves: If desired, equal to the amount of manifold loops / zones. Typically zone control are available in 5 or 10 zone modules. You will need a thermostat for each zone you plan to have. (Note: A thermostat can generally control up to 3 powerheads as 1 zone)
- Circulator Pumps: Generally you only need 1 circulator for your RadiantPanel system. It should be sized based on the required flow rate and pressure drop of your system. (See Step 4). There are many ways of piping a hydronic heating system, including using separate circulator for each zone. Though we feel you only need 1 circulator, there is no right or wrong in this area. Please consult your local heating professional.

Step 4: Flow Rates and Pressure Drop

Typically, the maximum RadiantPanel zone (consisting of 60 feet of baseboard and 120 feet of 3/8" PEX pipe) requires 0.7 GPM of flow at 15.3 feet of head. A Grundfos UP15-42F circulator or equivalent will handle most normal requirements. You may also calculate the required flow and pressure drop (feet of head) for your system as follows:

First, calculate the system's flow rate by dividing the total BTU/hr output of your baseboard system by 500 times the design delta T (differential between the supply and return temperature) of your system. A design delta T of 35°F is considered optimum.

Next, using the largest single zone the pressure drop resistance must be calculated. This consists of the internal resistance of the RadiantPanel baseboard and PEX tubing, along with the connection resistance of the RadiantPanel fittings. Utilizing the flow rate formula above, calculate the necessary GPM for this zone.

Table C shows the pressure drops in feet of head (FOH) for flow rates of 0.1 - 2.0 GPM. Reading across from the calculated required GPM will give the pressure drop for 3/8" PEX tubing (per ft.), RadiantPanel Baseboard (per ft.), and connection resistance of RadiantPanel fittings (per panel). The total pressure drop can now be calculated.

Table C: Pressure Drops

Flow	3/8" PEX	RadiantPanel	Connections (per panel)
(GPM)	(perfoot)	(per foot)	
2	0024	.0022	0142
	0076	.0067	0429
	(0)59 (0)272	0128	2 .0822 - 1303 - 1862
.6	0894 0650 0734	0290 .0388 .0496	.2492
7 8 9	0917 1138	.0496 .0614 .0742	.3949 .4768
10	1387	.0878	.5644
11	1625	.1023	.6573
12	1905	.1175	.7556
13	2217	1336	.8588
14	2508	1504	.9669
15	2847	1680	1.0798
16	3215	1868	21.1972
17	3558	2052	1.3192
18	3951	2249	1.4455
1:9	.4375	.2452	1.5761
2.0	.4767	.2662	1.7109

PDR = (length 3/8" PEX x PD) + (length Radiantpanel x PD) + (# of panels x PD) FOH

In order to properly size the circulator, choose one that can produce the total system flow that is needed while maintaining the highest single loop's head pressure or PDR. It's ok to size the circulator slightly above your highest PDR, but over-sizing can lead to problems in your system including noise, metal fatigue, and the unnecessary consumption of electricity.

System Control

Distribution Manifold

A distribution manifold provides the flexibility necessary to design and tailor the optimum heating system for any given project. Manifolds incorporate individual zone shut off, balancing, air vents, and purge valve into solid brass supply and return headers. Optional zone valves and room thermostats allow for individual zone control (often on a room by room basis) and are easily installed or removed at any time without disassembly of the system.

Mixing Valves and Reset Controls

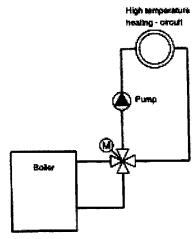
We recommend using a mixing valve reset control with constant circulation for maximum comfort and the best economy of operation. A mixing valve is the only way to accurately deliver the precise water temperature to the *RadiantPanel Baseboard* system. This minimizes the expansion and contraction that occurs with a conventional demand circulation hot water system.

There are two different kinds of mixing valve reset controls available, indoor and outdoor. With an indoor reset control, you will set the desired room temperature, and the control will adjust the delivery water temperature at the mixing valve, so the system maintains the proper room temperature. This type of control is limited to small areas. A mixing valve reset control can be either electronic or non-electric. An electronic outdoor reset control has a sensor that mounts on the exterior of the house to record outdoor air temperature.

The electronics then regulate the temperature of the water deliverd to the *RadiantPanel Baseboard* by adjusting the mixing valve. The introduction of an interior room sensor in the worst case room completes this type of system. It is by far the best way to manage a heating system of any fashion. No peaks and valleys in your room temperature setpoints. Consistent temperatures day after day, with a reduced energy bills to boot.

This control strategy will suit our **RadiantPanels** as well as all other forms of high temperature radiation. So mixing and matching our products with others is not out of the question.

We do not reccomend demand circulation type systems for RadiantPanel
Baseboard! Expansion problems and associated noise problems can be a nuisance. We highly reccomend the above mentioned an below detailed control strategy.

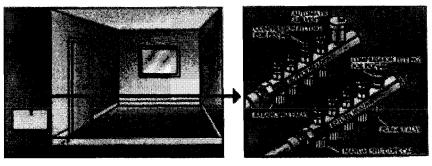


4-way mixing valve layout for use with mixing valve reset controls.

Installation Guidelines

Step 1: Manifold Location

The distribution manifold should be located and installed first. Ideally this should be installed in the boiler or mechanical room. However, for larger installations a central or remote location should be considered. This will allow for shorter lengths of PEX tubing to be utilized for the supply and return runs to each zone.



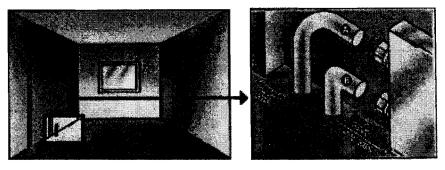
Picture A

Step 2: Rough in of PEX Tubing

 $\bf A$. Identify the supply and return points, as well as jumps at doorways or openings. In almost every case the top pipe $\bf \underline{A}$ will be the supply and the bottom pipe $\bf \underline{B}$ will be the return. (See picture B)

B. With a 9/16' bit, drill holes for the PEX tubing on a slight angle toward where the RadiantPanel will be mounted. By drilling at an angle, it will make it easier to connect the PEX tubing to the RadiantPanel (note the measurements in picture B showing proper clearances). * Important- as Pex is roughed through the floor, sleeve or make allowances so the tubing does not rub against the wood. This will prevent expansion noise at the exiting point. Also Note-bend supports <u>must</u> be used at the supply and return connections when changing a direction of 90 degrees.

C. Run all pipe leaving approximately 12" coming up from the floor for connection to the RadiantPanel. *

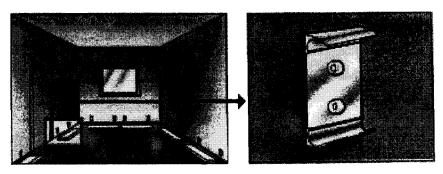


Picture B

Step 3: Laying out and attaching the panels

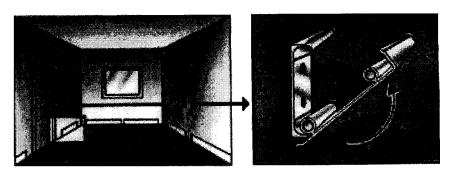
C. Lay the *RadiantPanel Baseboard* out on the floor according to the plan. A pre-cut piece of reflective insulation is included with each panel and should be stapled in place on the wall where the *RadiantPanel Baseboard* is to be installed.

Two mounting brackets will be necessary per panel and should be securely fastened into a stud near the end of each panel. For the proper height, rest the bracket on a 3/4" spacer or a separate bracket laid flat on the floor. If a panel is installed on a wall which is not plumb, it may be necessary to shim out the bracket so that the panel can move freely during the natural expansion and contraction of the heating system.



Picture C

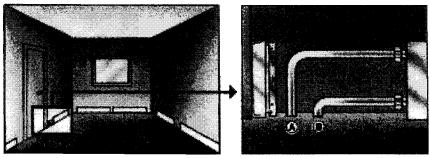
D. Snap the panels onto the brackets as shown. The return pipe will be placed into the bottom cradle of the bracket. Push the panel up and towards the wall until the supply pipe "snaps" into place on the top portion of the bracket. When properly installed the *RadiantPanel Baseboard* should not be in contact with the floor or wall at any point.



Picture D

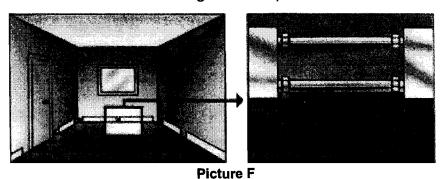
Step 4: Connecting the PEX

A. The PEX piping may now be installed. Slide the nut and ferrule over the pipe and push the pipe onto the barbed post of the panel fitting. Make sure that the pipe is properly seated on the post prior to tightening. Using two wrenches, tighten the nut and ferrule over the Pex tubing <u>being careful not to over tighten</u>.

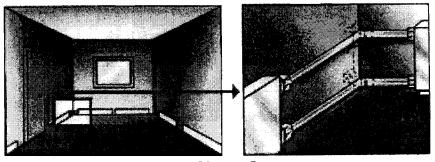


Picture E

B. When joining two or more panels on a single wall, measure and cut both lengths of pipe together to assure equal length and correct fit between panels. There should be a minimum of 4 - 6" of tubing between panels. Install the bottom tube first.



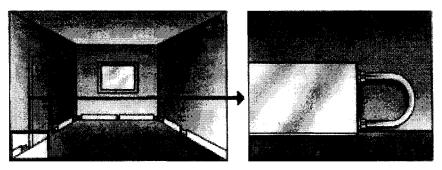
- **C**. For inside and outside corners use the following procedures:
- 1. Cut an oversize piece of pipe and install the tube bend support.
- 2. Hold pipe over the panel, mark and cut the ends, leaving a minimum of 6" between the panel and corner.
 - 3. Cut a second piece of pipe the same size
 - 4. Install the bottom piece first



Picture G

D. At the end of each heating loop, form a "U" bend with approximately 12" - 15" of PEX tubing. Connect one end to the supply and one end to the return. Form the "U" bend in your hands before installing, being careful not to kink the tubing. Any kinks in the tubing will restrict the flow and cause a possible weak spot in the tubing.

*Note: Once the system is operational, all fittings should be checked and re-tightened before any trim pieces are installed



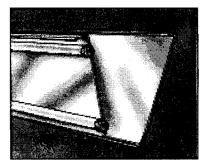
Picture H

Step 5: Filling the System

Fill each zone/loop one at a time and bleed accordingly to make sure that all the air is removed. Re-check all fittings. Once you have thourghly inspected the system and have determined that no leaks exist you can proceed to Step 6.

Step 6: Installing Trim Pieces

All end caps and corners can be installed at this time by fastening them to the wall. Cover plates will be used to conceal the pipe and fittings between pieces and at the ends of each panel. The cover plate will attach to a corner or end cap on one side and overlap the panel on the other side. It will also act as a splice between two pieces of panel on a wall. Before installing the cover plate, remove the protective layer on the double face tape that you will find on the end caps and corners. To mount the cover plates attach the bottom first by hooking it under the panel, end cap, and corners then swing the top upwards over the panel, snapping it into place. Press firmly against the tape to lock into place.



Picture I

Step 7: Enjoy

Congratulations on the installation of your new *RadiantPanel Baseboard* heating system. If you like you may now add any wood trim that may be needed to match the remaining baseboard / mop board in the room. (i.e.- cove / crown molding, 1/4 round, etc.) If you like, paint the baseboard to match the trim or color of your room. Remember though, that Latex paint is an insulator and reduces the output of the baseboard 5-7%. If you have to desire to paint your baseboard, a powder coat is best, but if this is not possible, a good alkyd enamel oil based paint will have the least impact on the heating ability of your *RadiantPanel Baseboard*.

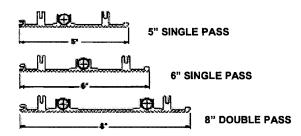
You can now place your furniture around the room as you normally would. There are is need to leave a space in front of the panels as you would with a conventional convective type finned baseboard as we are not concerned with air movement. Maintenance of the panels should only involve cleaning the exterior of the panel with a mild solution as needed. (Do not use an abrasive type cleaner.)

We thank you for your purchase and are sure that you will enjoy the comfort and efficiency of your *RadiantPanel Baseboard* system for years to come. If you have any questions on the installation or operation of your system, please contact your local contractor, supplier or our office.

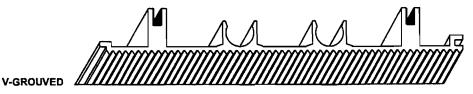
3.2) Rosemex - Linear Ceiling Radiant Panels



EXTRUDED SECTIONS



Rosemex linear Radiant Panels are constructed from the aluminum extrusions shown. Any 1 inch incremental panel width from 5 to 36" wide can be constructed from a combination of 5", 6" or 8" radiant extrusions. Panel lengths can be provided to suit perimeter planning modules up to 8 ft. long. For additionnal custom extruded sections, contact Rosemex.



PERIMETER HEATING PERFORMANCE

MEAN WATER						PANEL	ANEL WIDTH						
TEMPERATURE ° F	6" 1 TUBE	8" 2 Tubes	10" 2 Tubes	12" 2 TUBES	15" 3 TUBES	16" 4 TUBES	18" 3 TUBES	18" 4 TUBES	20" 4 TUBES	24" 4 TUBES	30" 5 TUBES	36" 6 TUBES	
120	47	61	65	70	82	90	97	118	130	146	155	200	
125	56	72	76	84	104	.108	117	137	159	172	185	235	
130	65	82	91	100	117	126	136	155	177	196	214	267	
135	72	92	110	113	137	144	156	175	194	220	243	300	
140	81	102	117	127	158	163	175	194	208	245	273	334	
145	89	113	130	142	176	180	193	212	227	270	302	368	
150	96	122	145	157	193	200	213	231	247	294	332	401	
155	105	132	157	172	211	218	233	250	267	319	362	434	
160	114	142	172	185	228	236	252	263	286	343	390	469	
165	121	153	185	200	245	254	272	287	306	367	420	503	
170	130	163	199	214	264	273	291	306	325	393	450	535	
175	137	173	212	228	281	290	310	325	344	417	480	569	
180	144	184	225	243	299	310	329	344	365	442	509	603	
185	153	193	239	258	316	328	348	353	384	467	538	636	
190	162	203	253	272	334	346	369	382	403	491	568	669	
195	. 170	214	267	287	351	365	388	401	423	516	598	703	
200	177	223	280	301	369	383	407	419	442	540	627	737	
205	187	233	294	315	387	401	426	438	453	565	657	770	
210	195	242	307	328	400	420	445	458	482	589	686	804	
215	203	255	321	343	422	438	465	475	501	619	715	837	
220	211	265	335	359	439	458	485	495	520	638	745	872	

* Heating perfromance shown in BTUH / Linear foot of panel.

^{*} Outputs for panel widths not shown may be interpolated from above table. Performance based on 70°F. Air temperature, 67°F AUST with natural convention. One inch thick three quarter pound density fiberglass insulation was placed on the reverse side of the panels. Select the most economical panel width which will satisfy the heat loss by adjusting the Average Water Temperature (AWT).

		(C)							

ROOM AIR TEMPERATURE	. I	STUH/S	QUARE	FOOT 0	F PANE	L.	ROOM AIR TEMPERATURE		TUH/S	UARE	FOOT O	F PANE	L '
MINUS MWT	A	В	C	D	E	F	MINUS MWT	A	В	C	D	E	F
10	17	21	28	35	38	40	20	35	40	46	52	55	57
. 11	19	23	30	37	40	42	21	37	42	48	54	57	58
12	21	25	31	38	41	43	22	39	43	50	56	59	60
13	22	27	33	40	43	45	23	40	45	52	58	61	62
14	24	28	35	42	45	47	24	42	47	53	59	62	63
15	26	30	38	44	47	48	25	44	49	55	61	64	65
16	28	32	39	45	48	50	26	46	51	56	63	66	67
1.7	30	34	41	47	50	52	27	48	53	58	64	67	68
18	31	36	43	49	52	53	28	49	55	60	65	69	72
19	33	38	45	50	54	55							

CONDITION:

- A. Interior room.
- B. No glass exterior wall in sun or fully shaded glass and wall.
- C. 25% clear glass exterior wall in sun.
- D. 50% clear glass exterior wall in sun.
- E. 75% clear glass exterior wall in sun.
- F. 100% clear glass exterior wall in sun.



PRESSURE DROP (IMPERIAL)

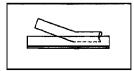
GPM/ TUBE	FT./ 100								
0.05	0.01	0.65	1.47	1.25	4.93	1.85	10.18	2.45	17.12
0.10	0.05	0.70	1.69	1.30	5.30	1.90	10.70	2.50	17.77
0.15	0.10	0.75	1.92	1.35	5.68	1.95	11.22	2.55	18.44
0.20	0.17	0.80	2.16	1.40	6.08	2.00	11.76	2.60	19.11
0.25	0.25	0.85	2.42	1.45	6.49	2.05	12.31	2.65	19.80
0.30	0.35	0.90	2.68	1.50	6.91	2.10	12.87	2.70	20.49
0.35	0.47	0.95	2.97	1.55	7.34	2.15	13.45	2.75	21.20
0.40	0.60	1.00	3.26	1.60	7.78	2.20	14.03	2.80	21.92
0.45	0.74	1.05	3.57	1.65	8.24	2.25	14.63	2.85	22.65
0.50	0.91	1.10	3.89	1.70	8.71	2.30	15.23	2.90	23.99
0.55	1.08	1.15	4.23	1.75	9.19	2.35	15.85	2.95	24.14
0.60	1.27	1.20	4.57	1.80	9.68	2.40	16.48	3.00	24.90

- WPD in height of water column per length of panel tubing for a given flow rate.
- To ensure air removal at start-up, desigh flow rates below 0.5 USGPM are not recommended.
- For Rosemex 360-loop add 18" to tubing length.
- Pressure drop in Rosemex return bends may be ignore.
- Adjust flow for glycol solutions compensating for specific heat and specific gravity.

TUBING CONNECTORS

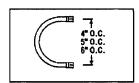
Rosemex supplies a variety of interconnects to accommodate most situations. All interconnects are presized to fit panel tubing without fittings.

PIPING COMPONENTS



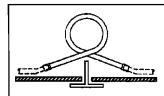
Typical connection for supply, return and trimmed panels (Provided by other)

Size panel tubing to accept type L or M 1/2 O.D. soft copper tubing. Slip into panel tubing elevated to the connected position. Typical soldered joint.



Rosemex Return Bends.

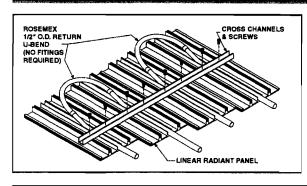
Install, and solder in place, factory supplied Rosemex return bends as illustrated. No fitting required.



Rosemex 360-loop

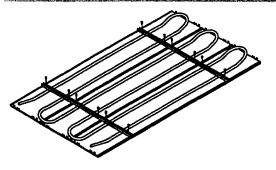
Install, and solder in place. 360loops ends are sized to accept panel tubes with no fitting.

PANNEL ASSEMBLY ON SITE



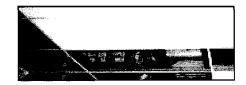
- Put together the number of section of 5", 6", or 8" needed.
- Screw cross channels at the position desired as illustrated.
- Install, and solder in place U-bends.

PANNEL PRE-ASSEMBLED 2' X 4' ONLY



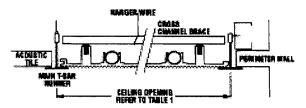
Simple installation and maintenance free :

Pre-assembled panel are manufactured to suit ceiling grids with a standard 24" x 48".

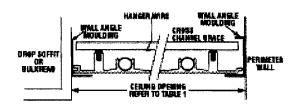




LINEAR CEILING PANELS SUSPENSION DETAILS



This detail compensates for an uneven outer wall or perimeter obstructions and permits a better view factor of the glass by the panel.



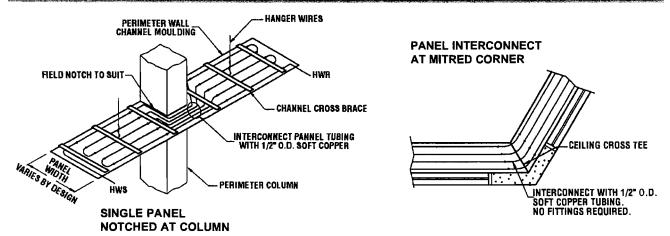
Typical window pocket installation where panel is higher than ceiling. Channel moulding on one side and angle wall moulding on the other. Similarly, this detail may be used for a drop soffit where panel is lower than balance of ceiling.

TABLE 1

LINEAR PANEL CEILING OPENING SCHEDULE

NOMINAL PANEL WIDTH (inches)	CEILING OPENING: add dimension below to nominal width (inches)
Less than 15"	1/4
15" to 19"	3/16
20" to 24"	1/8
25 to 29	1/1 6
30" to 36"	0

LINEAR PANELS AT PERIMETER OBSTRUCTIONS





Products

MECAR METAL INC.

1560, Marie-Victorin blvd Saint-Bruno (Quebec) J3V 6B9

Tel.: (450) 653-1002 Fax: (450) 653-3464

http://www.rosemex.com

3.3) Sterling

3.3.1) Linear Radiant Panels



DESCRIPTION

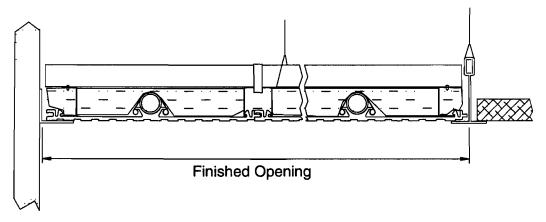
Linear panels are an extruded aluminum radiant heating strip that provides exceptionally high heat transfer. Linear panels are available in virtually any width and length up to a maximum of 16'.

This product, while offering an up-to-date visual appearance, is suitable for both ceiling or wall mounting. Linear panels are also available with a range of mounting accessories providing flexible setup.

ADVANTAGES

The system being flexible is easily designed into any heating scheme with few constraints. Installation is straightforward and, as found through independent tests, the heat output of linear panels is equal to or better than other radiant heating products.

RADIANT PANEL WIDTHS & FINISHED OPENINGS



Panel Widt	h ^{in.}	6	8-1/4	10	12	15	16-1/8	17-3/4	19-7/8	23-3/4	29-5/8	35-1/2
	(mm)	(154)	(208)	(256)	(304)	(383)	(410)	(454)	(506)	(604)	(754)	(902)
Finished	In.	6-1/4	8-1/2	10-1/4	12-1/4	15-1/4	16-3/8	18-1/8	20-1/8	24	29-7/8	35-3/4
Opening	(mm)	(160)	(214)	(262)	(310)	(389)	(416)	(460)	(512)	(610)	(760)	(908)

NOTE: Finished openings do not include angle thickness.

General Specifications

MATERIAL SPECIFICATION

Standard linear panels have a castellated face plate. The extrusions combine outstanding aesthetic quality with excellent design flexibility as individual sections can be fastened together to form panels of virtually any width. A smooth surface extrusion is available as an option in 6" wide increments only.

The aluminum sections incorporate a tube saddle channel as an integral part of the profile. The tubing is seated into this channel and held in direct thermal contact with the extrusion. A nonhardening heat paste between the tubing and the aluminum face plate ensures even heat distribution to the active face providing overall thermal efficiency.

The individual panel sections are tongue-and-groove to provide a clean joint longitudinally. They are held together using a special clipping system.

DIMENSIONS AND WEIGHT

Linear panel assemblies can be provided in multiple lengths of up to 16 feet and widths in multiples of 5", 6", 8" up to 36". For wider panels, consult Sterling. An operating weight of 2 lb/ft² should be used when calculating the requirements for clamping and suspension components.

MATERIALS OF CONSTRUCTION

Pipework: 5/8" O.D. tubing

Panels: Extruded aluminum sections with castellated design

Panel joint clips: Cadmium or zinc-plated steel springs
Panel suspension clips: Cadmium or zinc-plated steel springs.
Pipework clips: Cadmium or zinc-plated steel springs.

Support channel: Extruded aluminum 1-1/2" x 3/4" x 1/8" thick.

Paint finish: Electrostatic acrylic powder paint applied with a minimum of 2 to 2.5 mils. Tested to ASTM

D3359 crosshatch adhesion test.

Suspension system: Standard t-bar or drywall installation. The panels can be suspended with or without a frame

for custom applications.

Insulation: As per consultant's specifications, usually a minimum of 1" thick foil backed batt insulation.



Panel Outputs

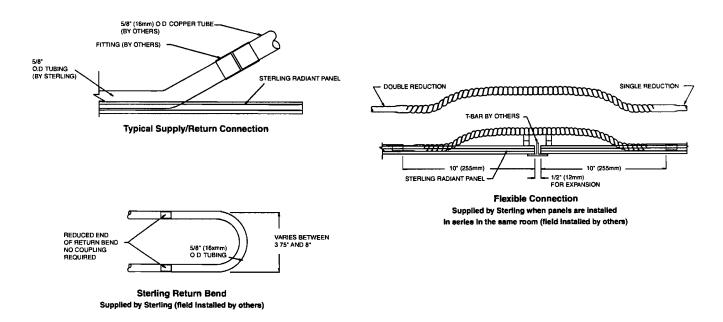
						Passes			_		
Mean Water	1	2	2	2	3	4	3	4	4	5	6
Temp.					Panel	widths In.	(mm)				
°F (°C)	6	8	10	12	15	16	18	20	24	30	36
	(154)	(208)	(256)	(304)	(383)	(410)	(454)	(506)	(604)	(754)	(902)
120	54	63	_	78	_	94	109	_	163	196	224
(48.9)	(52)	(61)		(75)		(90)	(105)		(157)	(188)	(215)
125 (51.7)	62 (60)	73 (70)	_	93 (89)		111 (107)	128 (123)	_	188 (181)	226 (217)	258 (248)
130	71	85		106		129	148		213	256	292
(54.4)	(68)	(82)	_	(102)		(124)	(142)	_	(205)	(246)	(281)
135	79	94		121		147	166		238	285	327
(57.2)	(76)	(90)	_	(116)		(141)	(160)	_	(229)	(274)	(314)
140	87	104	125	134	160	165	186	227	263	315	361
(60.0)	(84)	(100)	(120)	(129)	(154)	(159)	(179)	(218)	(253)	(303)	(347)
145	96	114	137	149	178	185	205	245	288	345	394
(62.8)	(92)	(110)	(132)	(143)	(171)	(175)	(197)	(236)	(277)	(332)	(379)
150 (65.6)	104 (100)	124 (119)	151 (145)	162 (156)	196 (188)	202 (194)	225 (216)	264 (254)	313 (301)	375 (361)	428 (412)
155	112	134	163	177	212	219	246	282	338	406	463
(68.3)	(108)	(129)	(157)	(170)	(204)	(211)	(234)	(271)	(325)	(390)	(445)
160	121	145	177	190	230	238	263	301	363	436	497
(71.1)	(116)	(139)	(170)	(183)	(221)	(229)	(253)	(289)	(349)	(419)	(478)
165	129	154	189	205	248	255	282	320	389	466	531
(73.9)	(124)	(148)	(182)	(197)	(238)	(245)	(271)	(308)	(373)	(448)	(511)
170	137	164	203	218	265	276	302	340	413	495 (476)	565 (543)
<u>(76.7)</u> 175	(132)	(158)	(195)	(210)	(255)	(264)	(290)	(327)	(397)	(476)	(543)
(79.4)	146 (140)	175 (168)	215 (207)	233 (224)	281 (270)	292 (281)	320 (308)	360 (346)	438 (421)	525 (505)	599 (576)
180	154	186	229	246	301	312	340	380	463	555	633
(82.2)	(148)	(179)	(220)	(237)	(289)	(300)	(327)	(365)	(445)	(534)	(609)
185	162	197	241	261	316	329	359	404	488	586	668
(85.5)	(156)	(189)	(232)	(251)	(304)	(316)	(345)	(388)	(469)	(563)	(642)
190	171	207	255	275	334	348	379	427	513	615	702
(87.8)	(164)	(199)	(245)	(264)	(321)	(335)	(364)	(411)	(493)	(591)	(675)
195 (90.6)	179 (172)	216 (208)	267 (257)	289 (278)	353 (339)	365 (351)	397 (382)	452 (435)	538 (517)	645 (620)	736 (708)
200	187	226	281	303	369	384	417	471	563	675	771
(93.3)	(180)	(217)	(270)	(291)	(355)	(369)	(401)	(453)	(541)	(649)	(741)
205	195	236	293	317	387	401	436	490	588	705	805
(96.1)	(188)	(227)	(282)	(305)	(372)	(386)	(419)	(471)	(565)	(678)	(774)
210	204	248	307	330	405	420	456	509	613	735	839
(98.9)	(196)	(238)	(295)	(318)	(389)	(404)	(438)	(489)	(589)	(707)	(807)
215	212	258	319	345	422	439	474	527	638	764 (705)	874 (840)
(101.7)	(204)	(248)	(307)	(332)	(406)	(422)	(456)	(507)	(613)	(735)	(840)

NOTE: Outputs expressed in BTUH/Lineal foot (watts/linear meter) of panel and are based on 70°F (21°C) room temperature. Any panel width can be constructed by combining 5", 6" and 8" extrusions up to 36" width. Consult Sterling for wider width requirements Table for ethylene and propylene 50/50 glycol also available upon request.



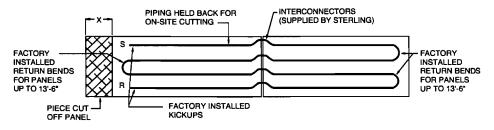
Piping & General Installation

COPPER CONNECTION DETAILS

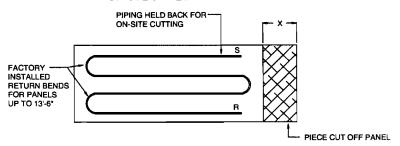


CUTTING INSTRUCTIONS

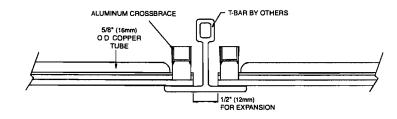
MULTI-PANEL INSTALLATION

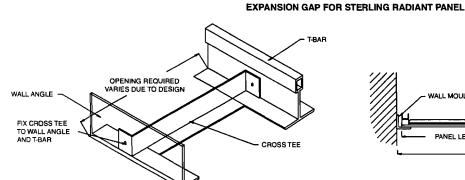


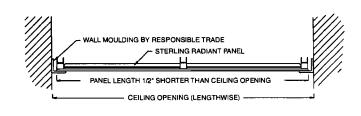
SINGLE PANEL INSTALLATION



LINEAR PANEL EXPANSION DETAILS



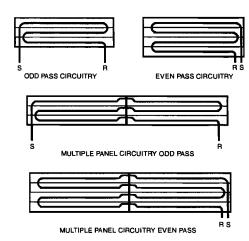




INSTALLATION OF CROSS TEE BETWEEN PANEL ENDS

WALL TO WALL INSTALLATION DETAIL

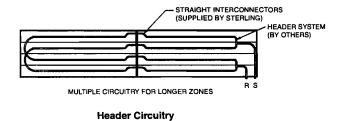
LINEAR CIRCUITRY & PRESSURE DROPS



Single panel length to max. of 16 feet. Pressure Prop for Sterling's 5/8" O.D. tubing

Pressure Drop for Sterling	's 5/8" U.D. tubing	
Flow Rate GPM (L/s)	Press. Drop per 100 ft. (per 10 m)	
0.5 (0.032)	0.5' (0.050 m)	
1.0 (0.063)	2' (0.203 m)	
2.0 (0.126)	7' (0.711 m)	
2.5 (0.157)	10' (1.020 m)	
3.0 (0.189)	14' (1.422 m)	

INTERCONNECTOR PRESSURE DROPS



Sterling Straight Interconnectors Pressure Drop

Press. Drop psi.		
0.0505		
0.168		
0.559		
0.823		
1.130		

3.3.2) Modular Radiant Panels



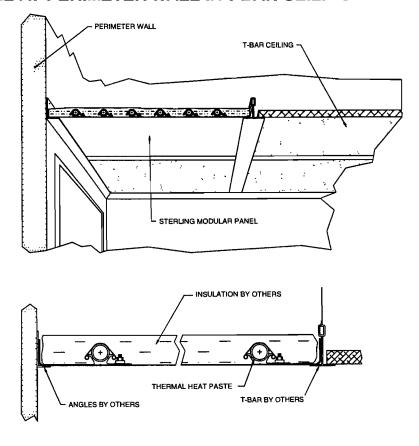
DESCRIPTION

Modular radiant panels are an easily installed type of radiant heating panel. The modular panel is typically supported by an exposed grid acoustic ceiling system. Modular panels are manufactured to suit either metric or imperial ceiling grids with standard or tegular edges. Modular panels supported by an acoustic ceiling grid system are often silkscreened to simulate adjacent acoustic tiles. However, panels in gyproc ceilings are provided in a standard white finish. Panels can be provided with aluminum or steel frames for recess or surface mounting in areas other than acoustic ceiling grids. The panel combines a serpentine copper coil mechanically attached to either an aluminum or steel tray. The active or radiating surface of the panel can also be perforated for reduced sound or noise transmission when used in a total ceiling arrangement.

ADVANTAGES

The modular format of the panel allows for zone or spot heating in an integrated building system. Panels are easily removed if dividing walls are moved and relocated.

MODULAR PANEL AT PERIMETER WALL IN T-BAR CEILING



Modular Radiant Panel

General Specifications

MATERIAL SPECIFICATION

Modular radiant panels are a system of standard sized radiant panels which can be integrated into a suspended ceiling to provide overhead radiant heating.

The system can be used with hot water at various temperatures; insulation blankets with a heat reflecting foil backing are utilized to maintain heating efficiency.

The panels are fabricated from either 18 gauge aluminum sheet or 24 gauge steel sheet to which a heating coil is mechanically fastened. Thermal contact between the coil and panel is maintained by an aluminum heat saddle fastened with welded aluminum or steel studs and with heat transfer paste applied between the panel and the saddle. The coil is clipped to the heat saddle using cadmium plated steel clips where heat transfer paste is used at the interface between the aluminum heat saddle and tubing.

DIMENSIONS AND WEIGHT

Modular panels are available in the following sizes:

Imperial: 24" x 24", 24" x 48". Consult Sterling for other available sizes (i.e. 48" x 48" & 24" x 60").

Metric: 600 mm x 600 mm, 600 mm x 1200 mm.

The working weight for the aluminum panels is approximately 1.5 lb/ft². The working weight for the steel panels is approximately 2.2 lb/ft².

MATERIALS OF CONSTRUCTION

Pipework: Each panel has its own serpentine pipe coil of 5/8" O.D. tubing.

Panels: 0.040" aluminum or 0.027" steel sheet with standard square edges or tegular edge detail.

Paint finish: Standard finish is off-white or optional silk-screen printed to simulate adjacent acoustic ceiling tiles.

Contact stripes: Aluminum heat saddle bolted to the back of the panel using steel or aluminum studs which are

welded to the panel with heat transfer paste applied between the two surfaces before assembly.

Insulation: As specified by consultant's specification, usually a minimum of 1" thick foil back batt insulation.



Panel Outputs

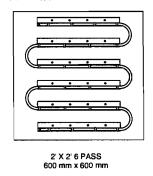
Maan Water Town	•	Pas		_
Mean Water Temp.	<u> </u>	6	<u>5</u>	5
(°C)			ions - Ft. (mm)	
()	2 x 2	2 x 4	2 x 2	2 x 4
100	(600 x 600)	(600 x 1200)	(600 x 600)	(600 x 1200)
120 (48.9)	320 (94)	640 (188)	270 (79)	540 (158)
125	380	760	290	580
(51.7)	(111)	(222)	(85)	(170)
130	440	880	320	640
(54.4)	(129)	(258)	(94)	(188)
135	470	940	350	700
(57.2)	(138)	(276)	(103)	(206)
140	500	1000	380	760
(60.0)	(147)	(294)	(111)	(222)
145	540	1080	410	820
(62.8°)	(158)	(316)	(120)	(240)
150 (65.6)	580 (170)	1160	440	880
	(170)	(340)	(129)	(258)
155 (68.3)	620 (182)	1240 (364)	480 (141)	960 (282)
160	660	1320	520	1040
(71.1)	(194)	(388)	(152)	(304)
165	700	1400	560	1120
(73.9)	(205)	(410)	(164)	(328)
170	740	1480	600	1200
(76.7)	(217)	(434)	(176)	(352)
175	780	1560	640	1280
(79.4)	(229)	(458)	(188)	(376)
180	840	1680	680	1360
(82.2)	(24.6)	(492)	(199)	(398)
185 (85.5)	880 (258)	1760 (516)	720 (211)	1420 (422)
190 (87.8)	920 (270)	1840 (540)	770 (226)	1540 (452)
195	980	1960	820	1640
(90.6)	(287)	(574)	(240)	(480)
200	1040	2080	870	1740
(93.3)	(305)	(610)	(255)	(510)
205	1100	2200	925	1850
(96.1)	(323)	(646)	(271)	(542)
210	1160	2320	960	1920
(98.9)	(340)	(680)	(281)	(562)

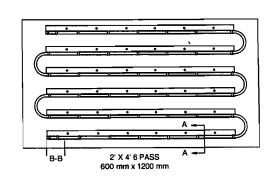
NOTE: Outputs expressed in BTUH (Watts) per panel and are based on 70°F (21° C) room temperature. Table for ethylene and propylene 50/50 glycol also available upon request.

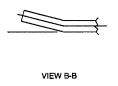
Modular Radiant Panel

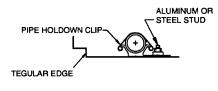
Piping & General Installation Drawings

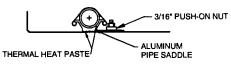
6 PASS PANELS





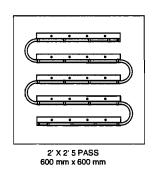


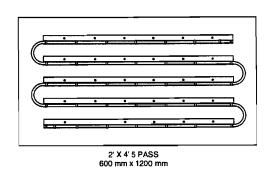


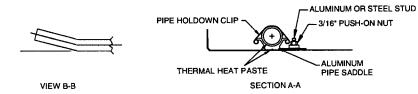


SECTION A-A

5 PASS PANELS

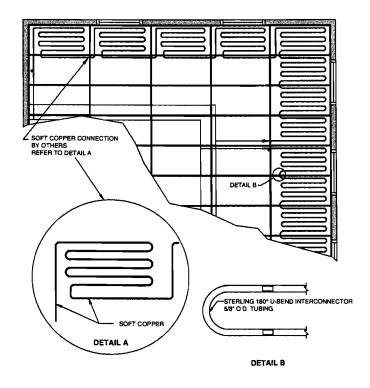








PIPING DETAILS

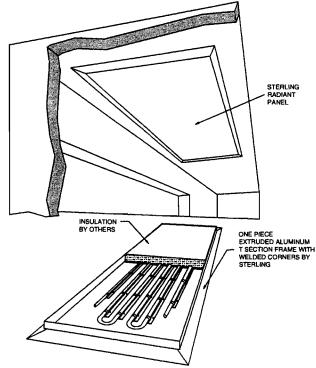


SUPPLY/RETURN CONNECTION & EXPANSION DETAILS

Hot Water Supply at Outside Wall SOFT COPPER BY OTHERS 1/4" FOR EXPANSION FACE OF OUTSIDE WALL RADIANT PANEL ANGLE MOLDING BY OTHERS OPENING IS REQUIRED FOR MODULAR DESIGN 24" X 48" T-BAR Expansion Gap Detail

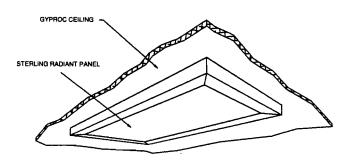
Modular Radiant Panel

FRAMED MODULAR PANEL IN GYPROC CEILING

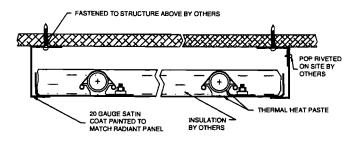


NOTE: IF SPACE ABOVE PANEL IS NOT ACCESSIBLE, REMOTE ACCESS PANEL IS REQUIRED FOR PANEL CONNECTION

SURFACE MOUNTED MODULAR PANEL



NOTE: PIPING CONNECTION ALSO POSSIBLE THROUGH SIDE OF PANEL



M8

3.4) Siebe Comfort Systems - Model RCU-166





Siebe Comfort Systems

Specification Data

RCU 166 Radiant Panels

Product Information

RCU-166 radiant panels are high capacity elements that provide maximum heat absorption and convective cooling capabilities as a result of the unique patented shape. The radiant panel design is fully compliant with the severe norms for low room air velocity (DIN 1946 part 2/SIA).

RCU-166 cooling elements are applied in a wide variety of commercial, institutional, educational, and industrial buildings.

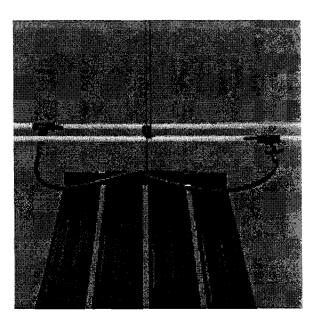
Benefits

- Energy efficient cooling
- Draft free environment
- Reproducible, highly efficient heat transfer using REDEC® Technology
- Low water pressure resistance
- No clogging
- Air tight operation with thick-walled copper meanders
- Low ceiling installation height
- Low noise operation
- Highest Possible Human ComfortSM



RCU-166 heat conducting profiles

Extruded aluminum profiles collect the energy absorbed from the room and conduct it to the flanks of the copper tubing. The unique airfoil design increases the natural convection airflow to increase air circulation without the use of fans. RCU-166 are produced as a standard black anodized profile. The profiles may be painted any color to match architectural requirements.



Accessories:

Room Thermostat Control Valve Condensation-High Limit Flexible Hose w/Push-on Couplings

The cooling capacities need to be adjusted for the height of the ceiling by multiplying the capacity in the chart by the following correction factors.

Ceiling Height Correction Factor:

Height fl		8.3 ft	O	2.0.16	10.8 ft
Factor	1.015	1.000	0.970	0.926	0.886

The influence of the ceiling coverage in % on the cooling capacities is to be adjusted by multiplying the capacity in the chart by the following correction factors.

Ceiling Coverage Correction Factor:

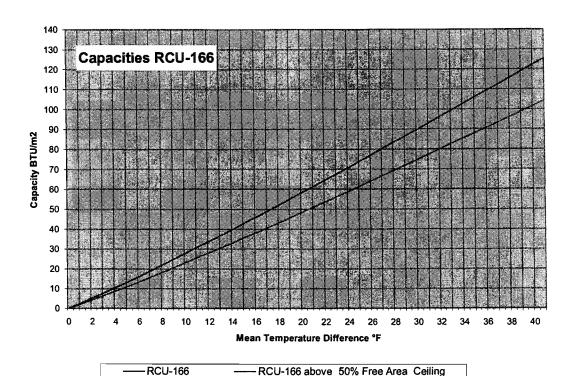
20%	30%	40%	50%	60%	70%	80%	90%
1.022	1.000	0.973	0.942	0.906	0.867	0.824	0.778

07.08.99 Page 1 An Invensys Company





Siebe Comfort Systems



Cooling Capacity Specifications (DIN Standard 4715-1)

Note

 ΔT = °F temperature difference between the space and the average panel temperature.

Mounting Options

Standard: The RCU-166 is mounted against an open plenum ceiling using hanger elements. Option: The RCU-166 may be mounted above ceilings with at least 50% free area at a reduced capacity as shown above. Examples are open wooden lattice structures, "stretch" type metallic ceilings, and acoustical baffle elements used in airport concourses.

Part Number Table

Number pes.	Part Number	Description	Size mm
	RCU4-LLLL-0525	Module with 4 profiles	x 0525
	RCU6-LLLL-0795	Module with 6 profiles	x 0795
	RCU8-LLLL-1065	Module with 8 profiles	x 1065
	RCUA-LLLL-1335	Module with 10 profiles	x 1335

All Module Lengths must be ordered in mm. 1 inch = 25.4 mm or 1 mm = 0.03937 inches. The Minimum and Maximum Length of the Modules is 1000 and 2500mm (3.3 and 8.2 ft). All non-Standard Lengths must be coordinated with the factory.

07.08.99 Page 2 An Invensys Company

All specifications are nominal and may change as design improvements are introduced. Siebe Comfort Systems shall not be liable for damages resulting from misapplication or misuse of its products.

4.0) Manufacturers of Heat Recovery Ventilators

4.1) Fantech - VER Series

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Commercial Products

Heat Recovery Ventilators

Energy Recovery Ventilator

Residential Products

hodoci ina ovenia

Heat Recovery Ventilators | Energy Recovery Ventilators | Air Exchangers | Filtration | In-Line Fans

Energy Recovery Ventilators

SER SERIES Overview

SER 1504 Specsheet

SER 1505-R

Specsheet

SER 2004 Specsheet

SER 2005-R

Specsheet

SER 3005-R

Specsheet

VER SERIES Overview

VER 1405-R

Specsheet

VER 1404 Specsheet

VER 2004 Specsheet

VER 2005-R

Specsheet

FINDER





Required CFM volume

Select the CFM

Select, only if you know Series (option)

The second secon

VER SERIES
Energy Recovery Ventilator

At the heart of Fantech VER Series of ERVs is a specially designed enthalpic core that exchanges both heat and moisture, maximizing energy performance. During the heating season, the Fantech enthalpic core recovers some of the moisture that's exhausted to the outdoors and transfers the heat and moisture to the incoming fresh air. This helps in maintaining a comfortable humidity level within the home, avoiding static electricity, sore throats and other discomforts caused by air is too dry. During the air-conditioning season, the Fantech enthalpic core helps to keep excess moisture out of the home by extracting it from the incoming fresh air and transferring it to the exhaust air. Since less energy is required to lower the temperature of dry air comapred to moist air, an Fantech ERV can reduce the load on the air conditioner and save you money. Double the performance from the Fantech VER Series of VRVs.



Home - Abou

- High performance, low maintenance, reliability without compromise
- Exclusive "FANTECH" electroni control board
- No wasted heat, no crosscontamination
- Superior motors
- · Choice of defrost mode

Performance & Specifications:	VER 1404	<u>VER 1405 R</u>	VER 2004	<u>VER 2005 R</u>
Recirculation	n/a	Standard	n/a	Standard
Airflow Capacity L/s (cfm)				
High speed	66 L/s (140 cfm)	66 L/s (140 cfm)	94 L/s (200 cfm)	94 L/s (200 cfm)
Med. speed	33 L/s (70 cfm)	33 L/s (70 cfm)	47 L/s (100 cfm)	47 L/s (100 cfm)
Low speed	19 L/s (40 cfm)	19 L/s (40 cfm)	33 L/s (70 cfm)	33 L/s (70 cfm)
Heating at 0°C (+32°F):				
Net Air Flow L/s (cfm)	32 L/s (68 cfm)	32 L/s (68 cfm)	47 L/s (100 cfm)	47 L/s (100 cfm)
Sensible Recovery Efficiency	66%	66%	68%	68%
Net Moisture Transfer	61%	61%	62%	62%
Coolingat 35°C (+95°F):				
Net Air Flow L/s (cfm)	32 L/s (68 cfm)	32 L/s (68 cfm)	61 L/s (129 cfm)	61 L/s (129 cfm)
Total Recovery Efficiency	49%	49%	44%	44%
Dimensions mm (inch):				
Length	604 mm (23.75")	604 mm (23.75")	711 mm (23.75")	711 mm (23.75"
Depth	438 mm (17.25")	438 mm (17.25")	438 mm (17.25")	438 mm (17.25"
Height	413 mm (16.25")	413 mm (16.25")	521 mm (20.5")	521 mm (20.5")
Electrical Requirements:				

Heat Recovery Ventilators Energy Recovery Ventilator

Residential Products

Heat Recovery Ventilators | Energy Recovery Ventilators | Air Exchangers | Wall Controls _Filtration | In-Line Fans

Energy Recovery Ventilators

SER SERIES Overview

SER 1504 Specsheet

SER 1505-R

Specsheet

SER 2004 Specsheet

SER 2005-R

Specsheet

SER 3005-R

Specsheet

VER SERIES Overview

VER 1405-R

Specsheet

VER 1404 Specsheet

VER 2004 Specsheet

VER 2005-R Specsheet

FINDER





Required CFM volume

Select the CFM

Select, only if you know

Series (option)



VER 1404



Features Air Flow Capacity

66 L/s (140 cfm) @ High Speed,33 L/s (70 cfm) @ Medium Speed, 19 L/s (40 cfm) @ Low Speed,

Heating @ 0°C (+32°F)

Net Air Flow - 32 L/s (68 cfm), Sensible Recovery Efficiency - 66%, Net Moisture Transfer - 0.61,

Cooling @ 35°C (+95°F)

Net Air Flow - 32 L/s (68 cfm), Total Recovery

Efficiency - 49%,

Electrical Requirements

Volts - 120V, Amperage - 1.3A

Dimensions

Length - 604mm (23.75inches), Depth - 438mm (17.25 inches), Height - 413mm (16.25inches),

Your best solution

is a ENERGY RECOVERY VENTILATOR! An ERV will exhaust indoor air pollutants and excess humidity to the outdoors, while at the same time capture heat from the outgoing stale air and use it to preheat the incoming fresh air.

Intermittent Mode The system is always on call and operates at high speed when activated by any of our wall controls.

Continuous Mode The energy recovery ventilator (ERV) constantly exchanges the air at the rate you select, either at low or medium speed, and switches to high speed on demand returning to the preset level when the demand is satisfied. Continuous mode is recommended, since pollutants are slowly but constantly being generated in your house.

Recirculation Mode Only FANTECH VER R models have this unique feature. Recirculation is activated without introducing household odors from the kitchen or bathroom into the home environment. The HRV will exchange the air at the selected speed on demand returning to the preset level when the demand is satisfied. This feature is available year round using the 3MR or 5MR Intellitek Multi-function Control.

Intellitek digital controls

Contemporary, Low Rofile, Slim Line Design, to ensure optimum ventilation performance and provide maximum comfort and savings! The Fantech family of Intellitek Multi-function Wall Controls have been developed to function with the Fantech Series of SHR/VHR Heat Recovery Ventilators (HRVs) & SER/VER Energy Recovery Ventilators (ERVs). State-of-the-art features include a highly accurate adjustable digital

dehumidistat control designed to continually ² ⁰¹ ³ monitor humidity in the home along with a variety of "Next Generation" soft touch control keypad ventilation functions.

Intellitek Digital Multi-function Wall Controls

Mechanical Dehumidistat

ELECTRONIC CONTROL BOARD

The entire FANTECH Series of Energy Recover Ventilators are equipped with a "new" high tech state of the art electronic control board designed to operate with the FANTECH "Next Generation" Multi-function Wall Controls. This control board has several unique features including a diagnostic LED and a furnace interlock which allows the ventilator to tap into an existing forced air system and trigger the furnace blower motor to turn on and off on demand.

NO WASTED HEAT, NO CROSS-CONTAMINATION

At the heart of the FANTECH VER Series of ERVs is a specially designed enthalpic core that exchanges both heat and moisture, maximizing energy performance. During the heating season, the FANTECH enthalpic core recovers some of the moisture that's exhausted to the outdoors and transfers the heat and moisture to the incoming fresh air. This helps in maintaining a comfortable humidity level within the home, avoiding static electricity, sore throats and other discomforts caused by air that is too dry. During the airconditioning season, the FANTECH enthalpic core helps to keep excess moisture out of the home by extracting it from the incoming fresh air and transfering it to the exhaust air. Since less energy is required to lower the temperature of dry air comapred to moist air, an FANTECH ERV can reduce the load on the air conditioner and save you money. Double the performance from the FANTECH VER Series of ERVs.

SUPERIOR MOTORS

Another advantage of the FANTECH Series of Heat Recovery Ventilators is our exclusive use of German manufactured factory-balanced EBM motors. Vibration is reduced to a minimum providing quiet operation and added home comfort. Permanently lubricated sealed bearings guarantee long life and maintenance-free operation.

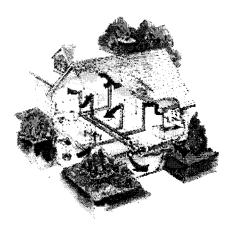
CHOICE OF DEFROST MODE

The FANTECH VER models of ERVs feature an automatic timed "shutdown" defrost that activates when the temperature of the incoming fresh outdoor air is below –5°C. The FANTECH VER R models of ERVs have a unique defrost sequence. The defrost mechanism uses a damper to temporarily block the incoming fresh air stream allowing the warm air from the house to circulate through the ERV. The defrost mode is activated without introducing household odors from the kitchen or bathroom into the home environment. The VER and VER R models return to normal operation after the automatic defrost cycle.

4.2) LifeBreath



Information



maximum amount of heat to incoming air. Nothing does as good a job as aluminum -- don't settle for plastic!

Lifebreath Residential HRVs

Model No.	PSHAX	185MAX	200 MAX	MAXTOP	1060008	SOODCS
Airflow Wg (Pa)	CFM(L/S)	CFM(L/S)	GFM(US)	CFM(US)	CFM(L/S)	CFM(L/6
.1 (25 PA)		169 (80)	232 (109)	A CONTRACTOR OF THE PARTY OF	208 (86)	d 285 (125
.2 (50 PA)		161 (76)	223 (105)	188 (89)	191 (90)	4 260 (123
.3 (75 PA)		150 (71)	E (51 (62))	178 (84)	162 (86)	250 (118
4 (100 PA)		130 (61)		165 (78)	167 (72)	H 235 (111
.5 (126 PA)		56 (26)	169 (69)	149 (71)	155 (73)	220 (104
ffectiveness .	80%	83%	81%	81%	88%	90%
Pefrost Type	Recirculati	Recirculate	Rediroulate	Recirculate	Damper	Damper
)imensions						
ixWxD(in.)	24 Settle Settle	10031046.78		25.5/22.5/28.5	Santa Santa Santa	10x40x14,75
(mm)	SZZDATTOWICO	The state of the s	distribution of	and the second second second second	632,00000	and the second

Options: All above units are capable of operating via remote low voltage centrals. Check shop drawings and accessories for details. Nutsech reserves the right to make changes without prior notification.

4.3) Summeraire - Model SHRV40SD



SPECIFICATIONS HEAT RECOVERY VENTILATORS PERFORMANCE RATINGS

MODEL: SHRV40SD

12% Supply - 0% Exhaust

VENTILATION PERFORMANCE

Options Installed: Defrost		EXT. STATIC NET SUPPL PRESSURE AIR FLOW		NET SUPPLY		GROSS AIR FLOW			
Internal	PRE			FLOW	SUPPLY		EXHAUST		
Dehumidistat	Pa	in. wg	L/S	CFM	ĽS	CFM	L∕S	CEM	
Electrical: 120 V - 2.0 Amp	25	0.1	40	84	41	87	43	9:	
Exhaust Air Transfer Ratio:	50	0.2	34	71	35	74	39	83	
0.04 @ ,04 in. Wg 0.04 @ 0.2 in wg.	75	0.3	27	57	28	59	34	72	
0.04 @ 100 Pa - 0.04 @ 50 Pa Low Temp. Reduction Factor:	100	0.4	17	37	18	38	24	51	

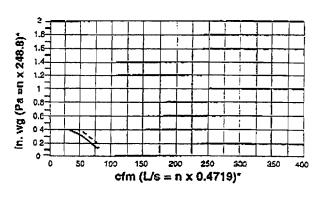
Low Temp. Imbalance Factor: 0.90

ENERGY PERFORMANCE

SUPPL TEMPERAT C°		-	•	IET FLOW CFM	POWER CONSUMED WATTS	SENSIBLE RECOVERY EFFICIENCY	APPARENT SENSIBLE EFFECTIVENESS	LATENT RECOVERY/ MOISTURE TRANSFER	
HEATING	0	+32	17	36	58	69	93	0.05	
	C	+32	25	38	68	74	86	0.08	
	0	+32	32	68	117	72	85	0.08	
	-25	-13	33	70	122	59	79	0.04	
	-25	-13							

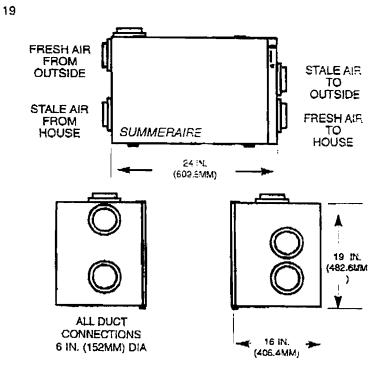
TOTAL RECOVERY EFFICIENCY

CODLING +35 +95 35 95 118 +35 +95



—— Net Supply —+— Net Exhaust





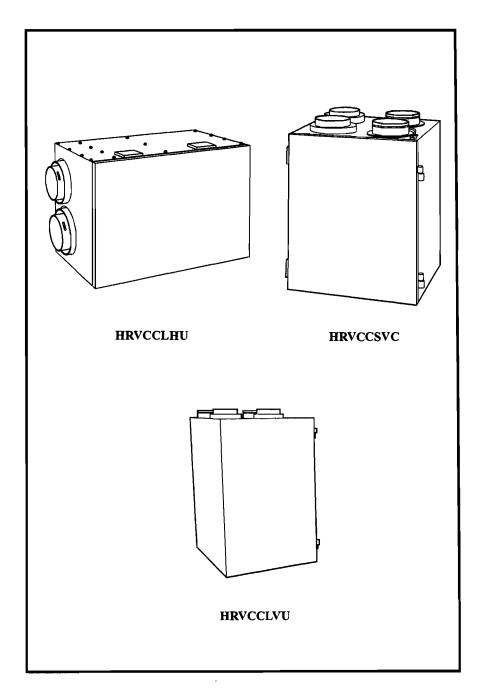
4.4) Carrier



Product Data

HRVCCLHU HRVCCSVC HRVCCLVU

Heat Recovery Ventilators



The Heat Recovery Ventilation (HRV) system offered by Carrier is the finest unit on the market today. The HRVC provides efficient and cost-effective heat recovery during the heating season when needed most.

As temperatures drop below 23°F (-5°C), indoor air is recirculated periodically through the heat exchanger core to prevent frost from forming. Competitors' methods of supplementary electric defrost waste energy. Unlike rotary wheel heat exchangers which mix air streams, these cross flow or counterflow heat exchangers ensure that there is no mixing of the stale air stream with the fresh outdoor air stream.

A filter installed on the incoming outdoor air stream removes large airborne particles from the intake air stream before they enter the heat exchanger and reduces the maintenance required.

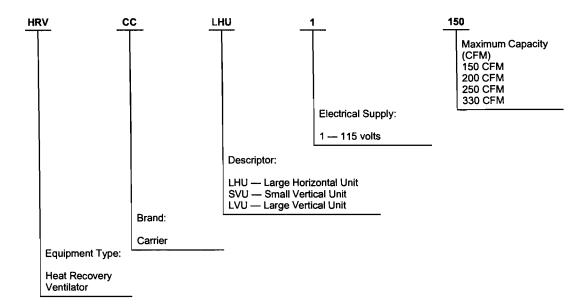
The units' acoustically engineered design makes them the quietest on the market and ensures that comfort is felt, not heard.

Unlatching 2 suitcase style latches allows easy removal of the filters and core for cleaning.

FEATURES

- · Energy saving defrost cycle
- Cross flow, counterflow heat exchangers
- Two filters on incoming outdoor air stream to protect the HRV core
- · Acoustical design
- · No-tools maintenance
- Polypropylene heat exchanger core

Model number nomenclature



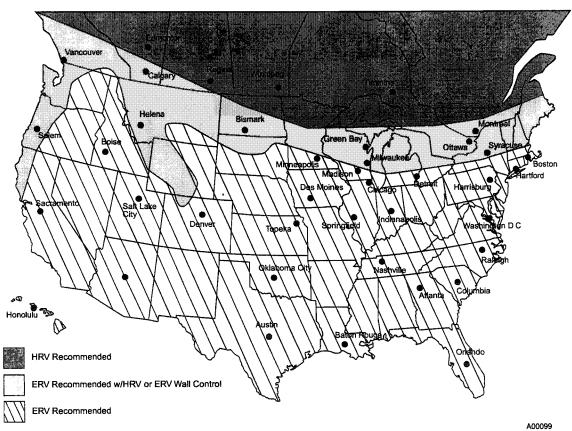






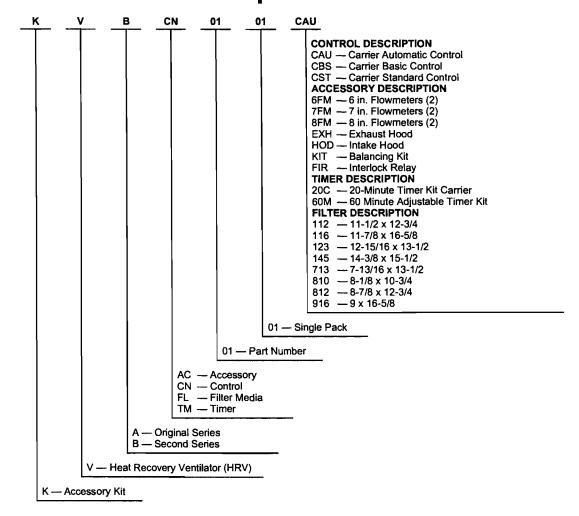


Climate Map for Energy and Heat Recovery Ventilators



2

Controls and accessories part no. nomenclature



Accessories

Kit Number	Description	Where Used
KVBCN0101CBS	Basic HRV Control	Used with all HRVs
KVBCN0101CST	Standard HRV Control	Used with all HRVs
KVBCN0101CAU	Automatic HRV Control	HRVCLSVU, HRVCCLVU
KVAAC0101FIR	Interlock Relay	When combining an HRV with a Furnace or Fan Coil
KVATM010120C	20 Minute Push Button Timer	Used with all HRVs when 20 minute manual operation is required
KVATM010160M	60 Minute Timer	Used with all HRVs, time is adjustable between 10 and 60 minutes
KVAAC0101HOD	Exterior Intake and Exhaust Hood	2 Required
KVAAC0101KIT	Start up Balancing Kit	Start up Balancing Kit, includes (2) 6 in. Flow Meter Collars & Magnehelic Gage
KVAAC01016FM	6 in. Flow Meter Collar	At start up, when 6 in. duct work is connected to HRV
KVAAC01017FM	7 in. Flow Meter Collar	At start up, when 7 in. duct work is connected to HRV
KVAAC01018FM	8 in. Flow Meter Collar	At start up, when 8 in. duct work is connected to HRV
KVAFK0101150	Internal Filter	Used with HRVCCLHU 1150 Unit 11 3/4 x 12 7/8 x 3/4 (2)
KVAFK0201200	Internal Filter	Used with HRVCCLHU 1250 Unit 11 3/4 x 16 3/4 x 3/4 (2)
KVAFL0101713	Internal Filter	Used with HRVCCSVU 1150 Unit 7 13/16 x 13 1/2 (2)
KVAFL0101123	Internal Filter	Used with HRVCCSVU 1200 Unit 12 15/16 x 13 1/2 (2)
KVAFL0101123	Internal Filter	Used with HRVCCLVU 1200 Unit 12 15/16 x 13 1/2 (2)
KVAFL0101145	Internal Filter	Used with HRVCCLVU 1200 Unit 14 3/8 x 15 1/2
KVAFL0101810	Internal Filter	Used with HRVCCLVU 1330 Unit 8 1/8 x 10 3/4 (1)
KVAFL0101145	Internal Filter	Used with HRVCCLVU 1330 Unit 14 3/8 x 15 1/2 (1)
KVAFL0101810	Internal Filter	Used with HRVCCLVU 1200 Unit 8 1/8 x 10 3/4 (1)

Control features

Basic Control: Allows the user to manually set fan speed to low or high as required to maximize comfort.

Standard Control: Offers automatic dehumidistat control and the option to select continuous or intermittent fan operation. Setting the wall control to low will activate the continuous mode.

Automatic Control: In addition to the features found with standard control, this package offers a recirculation mode. These controls may only be used to operate stand-alone units with the defrost option which enables the recirculation feature.

CONTROL DESCRIPTION	FAN SPEED CONTROL	DEHUMIDISTAT CONTROL	CONTINUOUS MODE*	INTERMITTENT MODE*	CIRCULATION MODE†
Basic	Yes	No	Yes	No	No
Standard	Yes	Yes	Yes	Yes	No
Automatic‡	Yes	Yes	Yes	Yes	Yes

^{*} Air exchange with outside.

Control description and usage

Fan Speed Control — Enables user to modulate fan speed from low to high air exchange with outside.

Dehumidistat Control — Allows the user to select the relative humidity level at which the unit would change fan speed for dehumidification in the winter months.

Continuous Mode — If the relative humidity inside the building is lower than selected, air exchange occurs with the outside at low speed. If the relative humidity inside the house is higher than selected, air exchange occurs with the outside at high speed. Ensures continuous air exchange for constant air quality.

Intermittent Mode — If the relative humidity inside the building is lower than selected, no air exchange occurs and the system turns off. If the relative humidity inside the house is higher than selected, air exchange occurs with the outside at high speed. Ensures minimum air exchange level when the building is unoccupied to minimize operating costs.

Circulation Mode — If the relative humidity inside the building is lower than selected, the ambient air would be circulated and filtered at high speed. If the relative humidity inside the house is higher than selected, air exchange would occur with the outside at high speed. Ensures continuous movement and filtration of air for maximum comfort. Available with automatic control only.

Automatic defrost cycle features

All models offer a non-electric defrost cycle feature which prevents frost and ice buildup within the heat recovery core. When the outside air temperature falls below 23°F (-5°C) it is electronically sensed and the dampers close the outside air ports. This allows warm indoor air to recirculate within the heat recovery core. The frequency of this cycle increases as the outside air temperature decreases.

	23°F TO -5°F	(-5°C TO -15°C)	4°F TO -17°F (-1	5.6°C TO _27.3°C)	BELOW -1	B°F (-27.8°C)
MODEL	DEFROST*	EXCHANGE†	DEFROST*	EXCHANGE†	DEFROST*	EXCHANGE†
HRVCCLHU	6 Minutes	60 Minutes	6 Minutes	32 Minutes	6 Minutes	34 Minutes
HRVCCSVU	6 Minutes	60 Minutes	6 Minutes	32 Minutes	6 Minutes	20 Minutes
HRVCCLVU	6 Minutes	60 Minutes	6 Minutes	32 Minutes	6 Minutes	20 Minutes

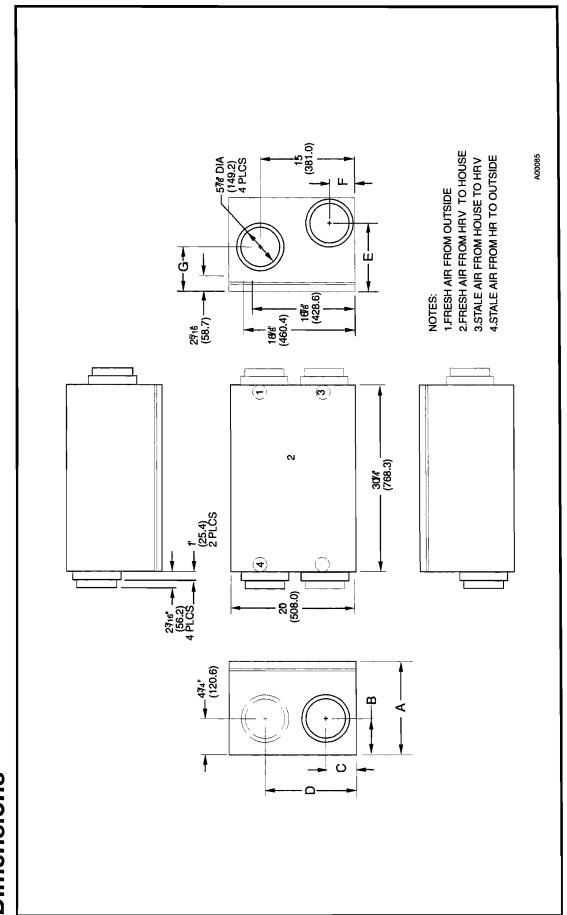
^{*} All defrost times are in the standard mode (as shipped)

[†] No air exchange with outside

[#] Use only on units with defrost

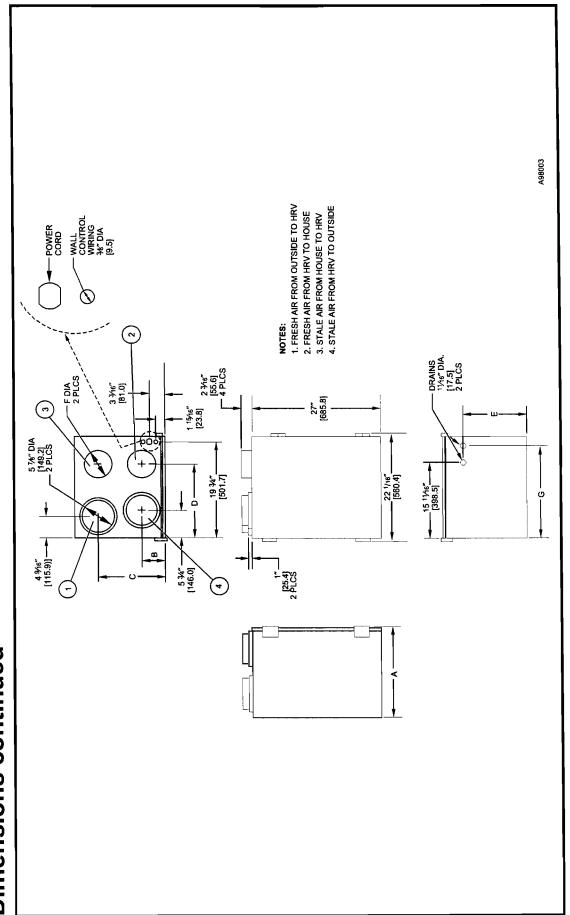
[†] Time between defrost when within specified temperature range

Dimensions



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DEL NO.	Ë	E	ï.	mm	ë	mm	Ë	e e	ï.	mm	in.	mm	in.	шш
CLHUMSO	15-1/8	384.2	4-1/16	104	9-2/8	143.3	14-1/2	368.9	10-3/8	288.9	4-3/8	111.3	7-3/4	196.9
CLHU4250	19	483	5-13/16	147.7	5-1/16	128.1	14-1/2	368.9	11-3/16	283.9	4-3/8	111.3	10-1/16	255.6

[®] Dimensions continued



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A98001 WALL CONTROL WIRING 36" DIA [9.5] --- POWER CORD 1. FRESH AIR FROM OUTSIDE TO HRV 2. FRESH AIR FROM HRV TO HOUSE 3. STALE AIR FROM HOUSE TO HRV 4. STALE AIR FROM HRV TO OUTSIDE 7 1/8" --[181.0] 41″ [1041.4] --- 22 36" ---[568.3] NOTES: 1 12 34" [323.9] 4 34" [120.6] 2 3/6" [55.6] 2 PLCS .DRAIN 11/6"DIA. [17.5] 2 PLCS 6 ¹⁵⁄16″ **→** [176.2] 5 13/16" [147.6] $\widehat{\mathbb{C}}$ 1" [25.4] 2 PLCS-7 3/16" [182.6] 23 15/16" ---- [608.0] 17 %16″ [446.9] 18 5⁄16″ [465.1] 19 1/16" [484.2] 8 3/16" [208.0] 43" (1092.2) 8 1/8" DIA [206.4] 2 PLCS— 5 76" DIA-[148.2] 2 PLCS (2) 4 **Dimensions continued** -24 1/16" [611.2]

HRVCCLVU1200 or HRVCCLVU1330

Physical data

MODEL DESCRIPTION	CONVEN	ITIONAL	СОМ	PACT		HIGH EFFICIENCY	1
Model No.	HRVCCVHU1150	HRVCCVHU1260	HRVCCSVC1150	HRVCCSVC1200	HRVCCLVU1150	HRVCCLVU1200	HRVCCLVU1330
Port Locations	Sides	Sides	Тор	Тор	Тор	Тор	Тор
Core Type	Polypropylene Cross Flow	Polypropylene Cross Flow	Polypropylene Cross Flow	Polypropylene Cross Flow	Polypropylene Cross Flow	Polypropylene Counterflow	Polypropylene Counterflow
Weight — Ib (kg)	65 (29.5)	73 (33.2)	60 (27)	80 (36.3)	80 (36 3)	120 (54 5)	120 (54 5)
Shipping Weight — Ib (kg)	75 (34)	83 (37.6)	75 (34)	89 (40.4)	89 (40.4)	143 (64 9)	143 (64.9)
Shipping Dimensions (in.) Height Width Depth	23 1/16 36 1/16 17 13/16	22 15/16 35 1/16 22 5/16	31.5 23.25 26.00	31 5 23.25 26.00	31.5 23.25 26 00	47 5 26 0 26 0	47 5 26 0 26 0

Performance data

MODEL DESCRIPTION	CONVE	ITIONAL	COM	PACT	ı	HIGH EFFICIENCY	Υ
Model No.	HRVCCLHU1150	HRVCCLHU1250	HRVCCSVC1150	HRVCCSVC1200	HRVCCLVU1150	HRVCCLVU1200	HRVCCLVU1330
Capacity CFM @ 0.5 0.3ESP (in. wc)	130168	191–210	106–150	177–211	123–141	189–209	300–334
Efficiency (Sensible) — percent 32°F (0°C) -13°F (-25°C)	65 65	65 60	69 60	77 67	81 69	84 72	80 74
Efficiency (Latent) — percent @ all temperatures	0	0	0	0	0	0	0
Heat Core Exchange Area — cu ft (cu m)	120 3.4	166 4 7	90 8 4	144 13.3	144 13 3	210 19.5	210 19 5

Electrical data

	CONVEN	TIONAL	COM	PACT	i	HIGH EFFICIENC	7
Model	HRVCCLHU1150	HRVCCLHU1250	HRVCCSVC1150	HRVCCSVC1200	HRVCCLVU1150	HRVCCLVU1200	HRVCCLVU1330
Voltage	120	120	120	120	120	120	120
Max Power — watts	150	218	115	195	115	250	500
Max Amps	1 4	19	1.2	18	1.2	22	5 4

Methods to size HRV's

METHOD 1

1. Calculate cu ft of occupied space.

2. Multiply by recommended air changes per hr (AC/h).

3. Divide by 60 minutes per hr to convert to CFM.

EXAMPLE: 2000 sq ft with 8 ft ceiling 0.35 air changes per hr (AC/h)

(2000 sq ft x 8 ft ceiling x 0.35 AC/h) / 60 min/h = 93.3 CFM

METHOD 2

1. Multiply number of people times 15 CFM/person.

2. Multiply number of bath rooms 20 CFM/each.

3. Add 25 CFM for kitchen.

EXAMPLE: 2 people 2 baths

l kitchen

 $(2 \times 15) + (2 \times 20) + 25 = 95 \text{ CFM}$

Additional heating and cooling load charts

Although the ventilators process the outside air before it enters the home, additional heating and cooling loads need to be considered.

Heating load BTU

Outside			Heat Load (B	tuh) @ Inside Desi	gn Temp 72°F		
Temp °F	HRVCCLHU1150	HRVCCSVC1250	HRVCCSVC1150	HRVCCSVC1200	HRVCCLVU1150	HRVCCLVU1200	HRVCCLVU1330
25	4,688	8,165	6,970	7,690	5,500	6,650	9,990
-20	4,446	7,744	6,470	7,090	5,030	6,070	9,310
−15	4,598	8,008	5,990	6,520	4,590	5,510	8,650
-10	4,334	7,547	5,520	5,970	4,160	4,970	8,000
-5	4,069	7,087	5,070	5,440	3,750	4,470	7,380
0	3,805	6,627	4,550	4,840	3,300	3,910	6,640
5	3,541	6,167	4,130	4,360	2,940	3,470	6,060
10	3,502	6,100	3,730	3,900	2,600	3,050	5,500
15	3,220	5,608	3,290	3,400	2,240	2,600	4,870
20	2,938	5,116	2,930	3,000	1,940	2,240	4,350
25	2,950	5,138	2,580	2,610	1,670	1,910	3,850
30	2,636	4,591	2,240	2,250	1,410	1,600	3,370
35	2,322	4,045	1,900	1,880	1,160	1,300	2,870
40	2,009	3,498	1,600	1,560	940	1,040	2,430

The heating load chart shows the heating loads in Btuh for a range of winter design temperatures for each model of ventilator.

EXAMPLE: The heating design temperature for Milwaukee, WI is -4°F. At -5°F, the additional heating load of the HRVCCLHU1250 is 8417 Btuh. This additional load should be taken into consideration when sizing the heating equipment.

Cooling load BTU

Outside		Cooling L	oad (Btuh) @ Insid	e Design Temp 75°	F and 50% Relative	Humidity	
Enthalpy Btu/lb	HRVCCLHU1150	HRVCCLHU1250	HRVCCSVC1150	HRVCCSVC1200	HRVCCLVU1150	HRVCCLVU1200	HRVCCLVU1330
30	670	1,071	780	990	770	990	1,390
31	1,090	1,741	1,300	1,650	1,290	1,650	2,310
32	1,509	2,411	1,820	2,310	1,800	2,310	3,240
33	1,928	3,080	2,340	2,970	2,310	2,970	4,170
34	2,347	3,750	2,860	3,630	2,830	3,630	5,090
35	2,766	4,419	3,380	4,290	3,340	4,290	6,020
36	3,185	5,089	3,910	4,950	3,860	4,950	6,940
37	3,604	5,759	4,430	5,610	4,370	5,610	7,870
38	4,023	6,428	4,950	6,270	4,890	6,270	8,790
39	4,442	7,098	5,470	6,930	5,400	6,930	9,720
40	4,861	7,767	5,990	7,590	5,910	7,590	10,650
41	5,280	8,437	6,510	8,250	6,430	8,250	11,570
42	5,699	9,107	7,030	8,910	6,940	8,910	12,500

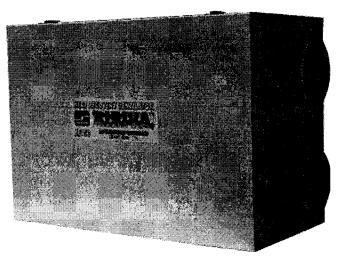
The cooling load chart shows loads in Btuh as well. To use the cooling load chart, first find the design enthalpy from a psychrometric chart using the design dry bulb and wet bulb temperatures. (See psychrometric chart on p. 11.) The cooling load can then be found for a range of enthalpies for each ventilator.

EXAMPLE: The cooling design dry bulb temperature for Milwaukee, WI is 87°F and the average wet bulb at that temperature is 73°F. On the psychrometric chart the enthalpy is about 37.7 Btu/lb of dry air which will round up to 38 Btu/lb of dry air. In the left column, at 38 Btu/lb the HRVCCLHU1250 would have an additional cooling load of 6428 Btuh. This additional load should be taken into account when sizing the air cooling equipment.

4.5) Airiva - Model HE100 and HE150



CLICK HERE FOR A PRINTABLE VERSION OF THIS PAGE INSTALLATION INSTRUCTIONS



Model HE100 and Model HE150 You need fresh air and you want to save energy doll

Modern homes are constructed practically air tight. Older homes have been sealed tighter over the years by the windows, door seals and caulking. Preventing the loss of indoor air also means that we do not get enough fresh home. Stale air causes problems:

- Our health suffers because we are exposed to dangerous fumes and gases from building materials furnishings, houshold cleaners, etc. Some components of these pollutants are referred to as VOC'
- Radon gas may build up in your home, causing serious health risks.
- The home and its contents, including clothing, will not smell fresh.
- Allergens are not cleared from your home.
- Humidity will build up causing mold, mildew and damage to your health, the home structure and co
- Your heating appliances may not operate efficiently due to lack of fresh air.

The Airiva Heat Revovery Ventilators deliver fresh air and exhaust stale air

The temperature of the incoming fresh air will be improved by traveling through thousands of channels in the heat exchanger core of the Airiva.

So, it will not cost you as many energy dollars to make that air a comfortable temperature.

- In the winter, the heated stale air being exhausted will transfer warmth to the fresh air coming in.
- In the summer, cooled stale air being exhausted will transfer cooling to the fresh air coming in.

Recommendations from Government and Health Agencies are for 6 complete air exchanges per day for a home occupied by a family of four.

The following table gives the number of air exchanges at airflows in cubic feet per minute (CFM) for various size homes in square feet.

Airflow		Square feet of the home								
	1500	2000	2500	3000	3500	4000				
150 CFM	20.0	15.0	12.0	10.0	8.6	7.5				
140 CFM	18.6	14.0	11.2	9.3	8.0	7.0				
130 CFM	17.3	13.0	10.4	8.6	7.4	6.5				
120 CFM	15.8	12.0	9.6	7.9	6.8	6.0				
110 CFM	14.6	11.0	8.8	7.3	6.3	5.5				
100 CFM	13.3	10.0	8.0	6.6	5.7	5.0				
90 CFM	12.0	9.0	7.2	6.0	5.1	4.5				
80 CFM	10.6	8.0	6.4	5.3	4.6	4.0				

To reduce the number of air exchanges in smaller homes, the Airiva must be operated using a timer s

HE100

HE150

For instance, at an airflow of 120 CFM in a 2000 square feet home, 24 hour operation would give 12 air exchanges per day

The desired 6 air exchanges per day require 12 hours of operation per day

We suggest operating the Airiva during the coolest hours of the day in the summertime and during the warmest hours of the day during the wintertime

Dimensions:		31"x19.5"x14"	31"x19.
Weight:		76 Lbs.	70 Lbs.
120 Volt AC 60 Hz	Startup Amps	1.7 A	1.7 A
	Running draw	100 Watt	100 Wat
Airflow capacity (nominal)	High speed:	130 CFM	150 CF
	Typical installation (1)	100 CFM	120 CF
	Low speed:	80 CFM	90 CFM
Heat recovery efficiency	High speed:	73.5%	63.5%
	Typical installation (1)	82.2%	72 5%
	Low speed:	86.0%	79.1%
Heat exchanger core:		91 Square feet	72 Squ
		6370 Channels	5040 C
Pressure drop over core:		0.08" W.K.	0.05" W

Performance and Specifications

Internal balance within:	0.01" W.K.	0.01" W
Temperature stabilization:	< 5 Minutes	< 5 Min

⁽¹⁾ Typical installation with 25 feet of 6" diameter metal duct and 4 - 90° elbows for each the stale air and fresh air paths

MODEL	L Efficiency in percent vs Airflow in CFM *									
	150	140	130	120	110	100	90	80	70	
HE100			73.5	76.5	79.5	82.2	84.5	86.0	87.5	
HE150	63.5	66.3	69.5	72.5	74.7	76.9	79.1	81.2	83.0	

 Percentages shown are the averages of multiple measurements, including variati internal air leakage, air density fluctuations, airflow variations, outside and inside temperature changes as in an actual operating environment.

Other features:

- Dual speed balanced fans. Class B, Thermally Protected motors.
- Corrosion proof Polypropelene core. Flame rating UL 94HB.
- Automatic electronic frost protection. User adjustable.
- Condensate drain fiting for 3/8" hose. (hose not included).
- Replaceable 12" x 12" air filter.
- Safety interlock switch.
- Plug into a grounded 110-120 Volt AC outlet. (2)

Installation hardware is not included.

Manufacturer reserves the right to change the product specifications without notice.

AIRIVA™ FAQ PAGE

INSTALLATION INSTRUCTIONS

Home Products Specs Components Buy Shipping About News Contacts FAQ Catalog Index

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⁽²⁾ Power may be supplied to the Airiva using a humidistat, pollution detector, radon detector or timer These devices are not included

4.6) Eco Air



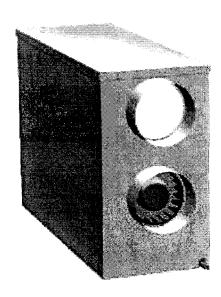
ECO AIR Heat Recovery Ventilators



The energy efficient solution for fresh air ventilation.

You will need the Adobe Acrobat Reader to view the brochure





ECO AIR HEAT RECOVERY VENTILATOR - 70 I/s to 500 I/s

"ECO VENT" TM COOLROOM VENTILATOR

Heat Recovery Ventilator
 Product Range

 Click here for more information about Eco Vent

A range of small and lightweight Heat Recovery Ventilators incorporating a patented air-to-air counterflow heat exchanger.

Energy from the exhaust air is reclaimed and fresh air enters at near room temperature. An energy efficient solution for the introduction of fresh air Eco Vent for Coolroom Ventilation - the fresh approach for cold storage profits.

Eco Vent introduces fresh air into coolrooms at minimal cost to keep produce fresh and moist. Storage life is increased with the removal of ethylene gas.

Fresh Air Ventilator

The ideal solution to the high cost of introducing fresh air into HVAC systems. Eco Air Fresh Air Heat Reclaim Ventilators.

The Fresh Air Issue

All over the world, Standards for Ventilation of Buildings are requiring higher volumes of fresh air be introduced into HVAC systems. This is due to the common practice of having tightly sealed, highly insulated buildings, which do not "breath". The increased amount of fresh air makes the traditional A/C unit oversized, expensive and costly to run. How can we introduce sufficient fresh air, without severely impacting HVAC equipment size or running costs?

The Eco Air Environment

Eco Air Fresh Air Heat Reclaim Ventilators (HRV) will supply fresh air at near room temperature, by

reclaiming the energy of exhausted room air. Plant capacity can be as much as 15 - 20% smaller than a similar installation which does not use Eco Air Fresh Air Heat Reclaim Ventilators. That means energy cost savings of up to 20%.

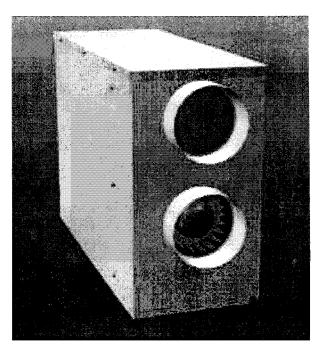
Eco Air - The Investment

Eco Air Fresh Air Heat Reclaim Ventilators will be paid for by the reduced plant size and savings in energy costs. In some applications, such as hotel rooms, Eco Air units can also be used for combined toilet exhaust and fresh air supply, which alleviates the need for additional separate and costly toilet exhaust systems.

Eco Air - The Savings

Due to the use of the patented counter flow heat exchanger, Eco Air Fresh Air Heat Reclaim Ventilators are significantly smaller, lighter and lower in cost than products using cross-flow or parallel-flow heat exchangers. With a much lower

pressure drop through the unit, Eco Air Fresh Air Heat Reclaim ventilators also have smaller fans, which use less energy. By choosing Eco Air, there will be savings in space, capital and installation costs, as well as ongoing energy costs.





coolrooms	commercial toilets	medical clinics
Bedrooms, living rooms, hotel rooms, toilets,	Boardrooms, hotel rooms, domestic homes, indoor pools, laboratories,	Offices, homes, schools bars, restaurants, shops hospitals, nursing homes
15kg	17kg	30kg
700	700	700
240	280	530
500	500	500
75	110	260
80	120	280
HRV80	HRV120	HRV280
	88 75 500 240 700 15kg Bedrooms, living rooms,	88 120 75 110 500 500 240 280 700 700 15kg 17kg Bedrooms, Boardrooms, hotel rooms, living rooms, domestic homes, hotel rooms, tollets, indoor pools, laboratories,

Eco Air Counterflow Heat Reclaim Ventilator

Heat Exchanger Efficiency

- Eco Air Counterflow Heat Exchanger is more efficient than conventional cross flow heat exchangers.
- Eco Air Heat Exchanger allows 3 times the air flow of competitive units for the same static pressure with efficiencies of up to 70%.
- Tested to Ashrae 84-1991 by NATA Certified Vipac Engineers and Scientists.

Construction

Patented heat exchanger core made from continuous aluminium plates, guaranteed for 5 years. Pre-painted zinc coated steel cabinet.

Easy Installation and maintenance

Compact size, light weight, low profile and minimum maintenance.

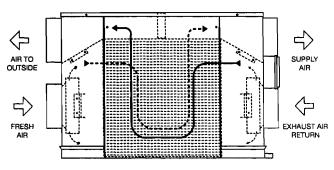
Australian designed and manufactured.



Featured in the Australian Technology Showcase - an international compaign promoting the best of Australia's technology.



Government initiative to promote and foster energy efficient technologies to reduce the level of greenhouse gas emissions.



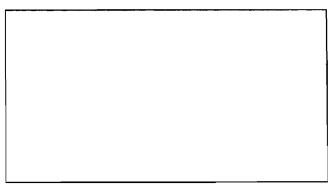
TYPICAL STANDARD HRV UNIT



For more information

Telephone + 61 2 9526 2133 Fax + 61 2 9540 3495 56 Bay Road, Taren Point NSW 2229 Australia Email sales@eco-air.com.au

Or visit our website www.eco-air.com.au



Specialist suppliers of energy efficient indoor air quality solutions

5.0) Manufacturers of Tangential Wheels

5.1) Eucania



eucania

small tangential wheels



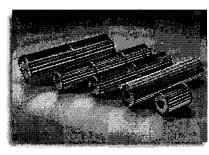
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Small Size Tangential Wheels

Typically used in:

- electronic air cleaners
- small heaters
- air conditioning units
- hand dryers
- · wood stove blowers
- gas stove blowers

Performance of our 2 1/4" diam. at 2600 rpm

Available Wheel Lengths (inches)

_																
	Inches	3.31	3 86	4.19	4 38	5.13	7 13	8.13	8 50	9.13	10 00	11.19	12 19	14.00	15 31	17.88
	CFM (max.)	43	51	55	57	67	94	106	111	119	134	150	163	188	210	245
	HP (max.)	0.012	0.012	0.012	0.012	0.012	0.015	0.016	0.017	0.018	0.019	0.019	0.020	0.020	0.021	0.022

Values are extrapolated from 2 1/4" x 5 1/8", 2 1/4" x 10" and 2 1/4" x 15 5/16" wheel tests using Fan Laws. Tests were performed according to **AMCA Standard 210-85.**

It is the responsibility of the Original Equipment Manufacturer to test and evaluate this product in the application and determine suitability of the design and perfomance of the product for the specific application.

Other standard wheel sizes available:

60mm x 10 3/8" 60mm x 9.5" 80mm x 11.25"

For other sizes please contact us.

Unitined Fage 1 01 2





small tangential wheels

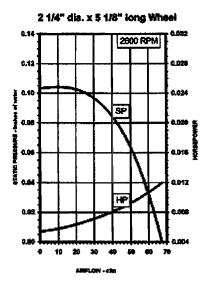


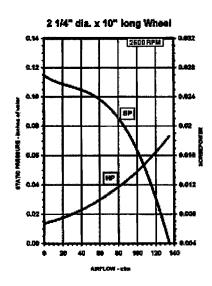
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Performance Curves

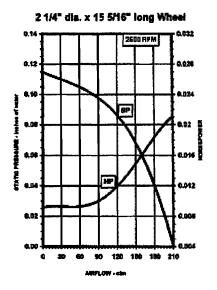
Viewing Tips: Scroll down for cross section.

Click on graph for large version





Unidica Fage 2 01 2

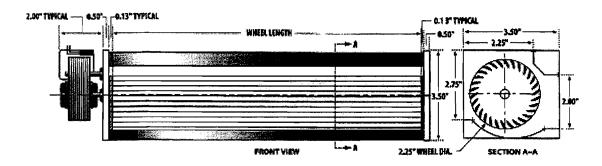


Tests were performed according to AMCA Standard 210-85.

It is the responsibility of the Original Equipment Manufacturer to test and evaluate this product in the application and determine suitability of the design and perfomance of the product for the specific application.

To request more information go to "How to Inquire"

Custom Graphs available in minutes, please contact us.



Related Information

Selection of Optimum Wheel diameter, length and running speed

Eucania International Inc.

Tel: 514-631-1669 Fax: 514-631-0867

Send us email at la@eucania.com

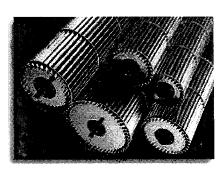


eucania

large tangential wheels



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Large Size Tangential Wheels

Typically used in:

- large institutional and commercial heat pumps
- laser machines
- air curtains
- air conditioners
- mini split air conditioners

CFM of Large Tangentials at zero static and 1050 RPM

		Available Wheel Lengths (in.)								
Wheel Dia. (in.)	13 00	17.7	20 00	20 5	23.2	2" :	32.11	38.0	11.2	
4.00	295	402	454	465	525	618	726	862	933	
4.50	408	556	627	643	726	854	1003	1191	1291	
5.00	559	762	860	882	996	1172	1376	1634	1770	
5.50	744	1014	1145	1174	1326	1560	1832	2175	2356	
6.00	789	1076	1214	1244	1406	1654	1942	2306	2498	
8.00	1870	2549	2877	2949	3332	3921	4604	5467	5922	

CFM of Large Tangentials at zero static and 1625 RPM

		Available Wheel Lengths (in)								
Wheel Dia. (in.)	13 00	124	20.00	20,50	23)) = {	14141	(8.10)	41 '	
4.00	456	622	702	720	813	956	1123	1334	1445	
4.50	631	860	970	995	1124	1322	1553	1844	1997	
5.00	865	1179	1331	1365	1542	1814	2130	2529	2740	
5.50	1152	1570	1772	1816	2052	2414	2835	3367	3647	
6.00	1221	1 6 65	1879	1926	2176	2560	3006	3570	3866	
8.00	2201	3000	3385	3470	3920	4613	5417	6432	6967	

Values are extrapolated from 4" x 27.25", 5" x 27.25" and 6" x27.25" wheel tests using Fan Laws. Tests were performed according to AMCA Standard 210-85.

It is the responsibility of the Original Equipment Manufacturer to test and evaluate this product in the application and determine suitability of the design and perfomance of the product for the specific application.

Standard wheel diameters available: 4", 4 1/2", 5", 5 1/2", 6", and 8". Other diameters and lengths are available. To request more information go to "How to Inquire"

Related Information

■ Large Tangential Wheel Performance Curves

MATERIA NA MATERIA CONTROL INC. OF CONTROL INC. OF CONTROL OF CONT

- Large Tangential Wheel Cross Sections
- How to select the optimum wheel diameter, length and running speed



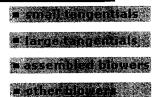
eucania

large tangential wheels



🗆 about eucania

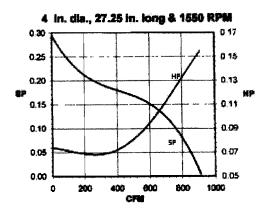
□ products

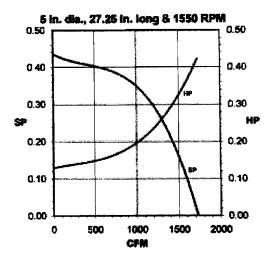


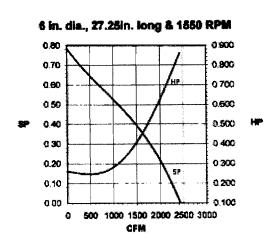
news

- □ your questions
- □ how to inquire
- □ links

Performance Curves







Undited Fage 2 of 2

Tests were performed according to AMCA Standard 210-85.

It is the responsibility of the Original Equipment Manufacturer to test and evaluate this product in the application and determine suitability of the design and perfomance of the product for the specific application.

Standard wheel diameters available: 4", 4 1/2", 5", 5 1/2", 6", and 8".

Other diameters and lengths are available.

Custom Graphs: Available in minutes, please contact us. To request more information go to "How to Inquire"

Related Information

- Large Size Tangential Wheel Cross Sections
- Selection of Optimum Wheel diameter, length and running speed

Eucania International Inc.

Tel: 514-631-1669 Fax: 514-631-0867

Send us email at la@eucania.com

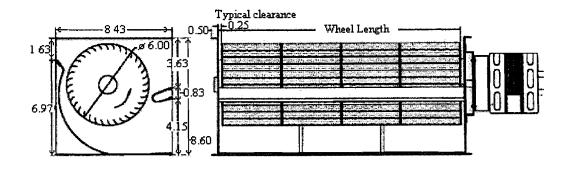
Uniqueu rage 1 01 2

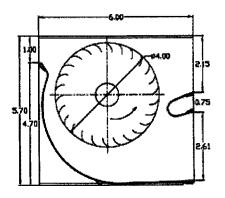


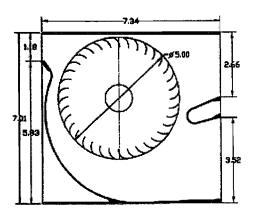
eucania large tangential wheels



Cross Sections









eucania

Fully Assembled Blowers



🗆 about eucania

products

- small tangentials
- large tangentials
- assembled blowers
- other blowers
- □ news
- □ your questions
- □ how to inquire
- □ representation
- □ links



Fully Assembled Blowers

Fully Assembled

Blowers:

Most wheels can also be supplied as part of a fully assembled blower, including housing and motor

Related Information

- Small Size Tangential Wheel Specifications
- Large Size Tangential Wheel Specifications
- How to select the optimum wheel diameter, length and running speed

Eucania International Inc.

Tel: 514-631-1669 Fax: 514-631-0867

Send us email at la@eucania.com



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eucania

family of products



small tanuentials

large tangentials

assembl**ed blow**ers

other blippers.

How to: *

Select the optimum wheel diameter, wheel length and running speed to provide the desired CFM for your system

1.) For specified wheel dimensions, a change in speed will optimize your system:

$$N_{\text{new}} = N_{\text{old}} \times \left(\frac{\text{CFM }_{\text{new}}}{\text{CFM old}} \right)$$

Resulting in: $HP_{new} = HP_{old} \times \left(\frac{N_{new}}{N_{old}}\right)^3$

$$SP_{new} = SP_{old} \times \left(\frac{N_{new}}{N_{old}}\right)^2$$

 If the static pressure is acceptable, wheel length can be optimized (while other conditions remain constant):

$$L_{\text{new}} = L_{\text{old}} \times \left(\frac{\text{CFM }_{\text{new}}}{\text{CFM old}}\right)$$

Resulting in:

$$H_{new}^p = H_{old}^p \times \left(\frac{new}{old} \right)$$

3.) If the static pressure is not acceptable, wheel diameter must be resized using:

$$SP_{new} = SP_{old} \times \left(\frac{D \text{ new}}{D \text{ old}}\right)^2$$

Resulting in:

$$CFM_{new} = CFM_{old} \times \left(\frac{D_{new}}{D_{old}}\right)^3$$

$$HP_{new} = HP_{old} \times \left(\frac{D_{new}}{D_{old}}\right)^5$$

Key ₩

Where:

N = Speed (Revolutions per minute) CFM = Volume

(Cubic Tect per minute)

HP = Horsepower SP = Static Pressure

(inches of water)

L = Wheel Length (inches)

D = Wheel Diameter (inches)

Key *

Where:

N = Speed

(Revolutions per minute)

CFM = Volume

(Cubic | Leet per minute) HP = Horsepower

SP = Static Pressure

(inches of water)

L = Wheel Length

(inches)

D = Wheel Diameter

(inches)

5.2) Kyung Jin Blower CO. Ltd.

CIOSS FIOW Fall rage 1 01 2





AC-060 SERIES



1) It is very quiet and suitable for producing quantity of air volume.

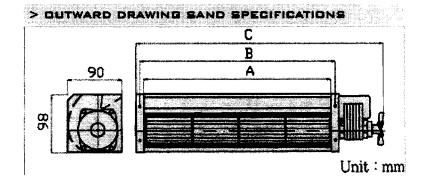
Clear at a title 1 2- 14

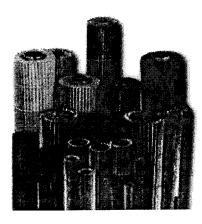
2) Impellers may be produced form ABS synthetic resin product which is nonmetal materials with strong anti-corrosion and resistant against high temparature besides aluminium.

3) Cross flow fan and cross impellers are applied to air curtain, film driers, fain coil units and suitable for air conditioners and cooling heating machinery for home and office etc.

HEME

ii





Bross Flow Impellers

DIMENSIONS

No.	Model No.	Wheel DIA (øD)	Wheel Width	Natural Gifts
1	ACA-060-000	ø60	260.340 420	A5052P
2	ACA-088-000	ø88	224.332 442.550	A5052P
3	ACA-097-000	ø97	220.294.367 439	ABS
4	ACA-120-000	ø120	277 412 541.680	A5052P
5	ACA-150-000	ø150	300 400.500 600	ABS
6	ACA-150-000	ø150	350 400.500.550	A5052P

5.3) AirVac



Konstruktion

Tysta tvärströmsfläktar för ex.vis datakylning, torkskåp, luftrenare, kontorsmaskiner etc.. TG45: Fläkthus i aluminiumprofil och gavlar i plast. Försedda med motorer 230V/50Hz och fläkthjul i aluminium. Avsedda för horisontell montering (vertikal på begäran). Isolationskl. F. Självsmörjande glidlager (standard) eller kullager på begäran, Luttemp. -30 till +40°C. SCD: Fläkthus i stålplåt med fläkthjul i aluminium. Borstlösa DC-motorer med kul- eller glidlager. Drifttemp. -40 till +60°C

Construction

Low noise cross flow blowers for dryers, electronic cooling, aircleaners, officemachines etc.. TG45: Housing in aluminium-profile with impeller in aluminium. Shaded pole motors with selflubricating sleevebearings (standard) or ball bearings. Insulational. F. For horizontal application (vertical on request). For air transp. -30 to +40°C.

SCD: Housing in steelsheet with impeller in aluminium. DC brushless motors with sleeve- or ballbearings. Operating temp. -40 to +60°C.



TEKNISKA DATA

AC 230V/50Hz

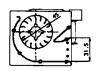
TYP	Effekt IN	Kurva Nr.	Varvtal	
type	Iriput W	curve no.	r/min	
TG45/1-60.15	13	1	2600	
TG45/1-100.15	14	2	2300	
TG45/1-120.15	15	3	2200	
TG45/1-150.15	19	4	2100	
TG45/1-180.15	24	5	2000	
TG45/1-200.20	20	6	2300	
TG45/1-240.20	22	7	2100	
TG45/1-300.20	24	8	1900	
TG45/1-360,20	27	9	1700	

150

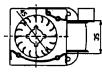
Motor Side Right(R) or Left (L), Speed-HH, H, M, L, LL

100 Portata Air Delivery

Profil TG45/1



Profil TG45/2

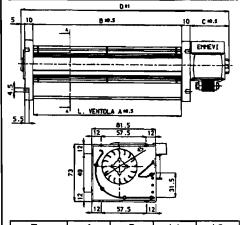


45/1-360,20 45/1-360,20	27 9	1700	No.
Pa	Pa		
90	90		

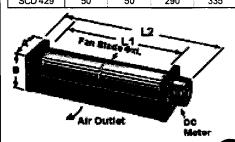
0 50 100 150 200 250 300_{m3/h}

Mått mm

Sorlek	Α	В	C	D
Size	mm	mm	mm	mm
60.15	60	62	47,5	134,5
100.15	100	102	47,5	174,5
120.15	120	122	47,5	194,5
150.15	150	152	47,5	224,5
180.15	180	182	47,5	254,5
200.20	200	202	52,5	279,5
240.20	240	242	52,5	319,5
300.20	300	302	52,5	379,5
360.20	360	362	52,5	439,5



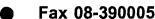
Тур	Α	В	L1	L2
Size	mm	mm	mm	mm
SCD 308	44,5	41	87	123
SCD 315	50	50	150	195
SCD 319	50	50	190	235
SCD 329	50	50	290	335
Ŧ.		В	1.4	L2
Тур	L A	D	_ L!	LZ
Size	. A пт	mm	mm	mm
	50		mm 90	
Size SCD 409 SCD 415		mm		mm
Size SCD 409	50	mm 50	90	mm 135



DC 5, 12, 24, 38 and 48V.

Тур	Fläkthjul	Volt	Max. luft	Max. tryck	Ljudnivå	Bearing
Туре	Type Side Ø x L		VDC m3/min mmVi		dB (A)	sieeve/ball
SCD 308L	Ø30x77	5, 12, 24	0.43~0.20	1.9~1.0	34~28	S/B
SCD 315	Ø30X150	12, 24, 38, 48	0.82~0,28	1.9~1.0	35~29	S/B
SCD 319	Ø30X190	12, 24, 38, 48	1.1-0.43	2.0-1.1	38~28	S/B
SCD 329	Ø30×290	12, 24, 38, 48	1.50~0.79	2.0~1.2	39~30	S/B
SCD 409	Ø40X90	12, 24, 38, 48	0.85~0.70	2.5~1.8	38~34	S/B
SCD 415	Ø40X150	12, 24, 38, 48	1.20~1.00	2.6~2.0	39~35	S/B
SCD 419	Ø40X190	12, 24, 38, 48	1.50~1.20	2.6~2.0	40~36	S/B
SCD 429	Ø40X290	12, 24, 38, 48	2.20~1.80	2.6~2.0	42~38	S/B

Tel. 08-390010



Bearing-Ball or Sleeve



Konstruktion

Tysta tvärströmsfläktar för ex.vis datakylning, torkskåp, luftrenare, kontorsmaskiner etc.. Fläkthus i förzinkad stålplåt utan punktsvetsar (alt. gavlar i plast med hus i alu.profil). Försedda med skärmpolsmotorer och fläkthjul i aluminium. Fläktarna avsedda för horisontell montering (vertikal på begäran). Isolationskl. B. Självsmörjande glidlager (standard) eller kullager på begäran. Omgivningstemp. -30 till +40°C.

Construction

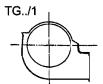
Low noise cross flow blowers for dryers, electronic cooling, aircleaners, officemachines etc. Housing in galvanized steelsheet with impeller in aluminium. Shaded pole motors with self-lubricating sleevebearings (standard) or ball bearings. Insulational. B. For horizontal application (vertical on request).

Operating temp. -30 to +40°C.



TEKNISKA DATA

TYP	Effekt IN	Kurva Nr.
type	Input W	curve no.
TG 60/1-60,15	12	1
TG 60/1-90/15	13	2
TG 60/1-120.15	14	3
TG 60/1-120/20	23	4
TG 60/1-180.15	16	5
TG 60/1-180.20	27	6
TG 60/1-180.30	31	7
TG 60/1-240.20	18	8
TG 60/1-240.30	34	9
TG 60/1-270.20	19	10
TG 60/1-270.30	39	11
TG 60/1-300.20	19	12
TG 60/1-300.30	39	13
TG 60/1-330.20	22	14
TG 60/1-330.30	31 "	15
TG 60/1-360.20	20	16
TG 60/1-360.30	37	17
TG 60/1-420.30	37	18
TG 60/1-480.30	45	19



TG../2

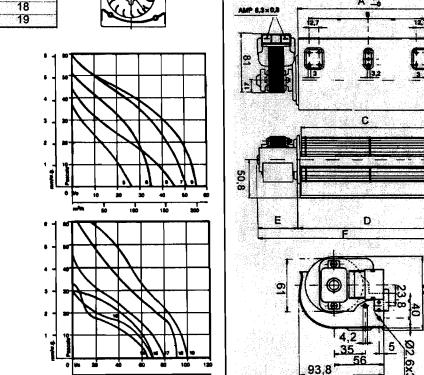


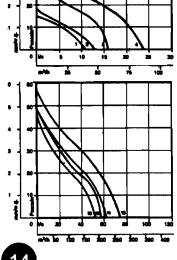
TG../3



Mått mm

Storlek	Α	В	С	ם	ш	F
Size	mm	mm	mm	mm	mm	mm
60.15	64	-	60	75	48	123
90/15	94	69	90	105	48	153
120.15	124	94	120	135	48	188
120/20	124	94	120	135	53	148
180.15	184	154	180	195	48	238
180.20	184	154	180	195	53	248
180.30	184	154	180	195	63	258
240.20	244	212	240	255	53	308
240.30	244	212	240	255	63	318
270.20	274	244	270	285	53	338
270 30	274	244	270	285	63	348
300.20	304	272	300	325	53	368
300.30	304	272	300	325	63	378
330.20	334	302	330	345	53	398
330.30	334	302	330	345	63	408
360.20	364	334	360	375	53	428
360.30	364	334	360	375	63	438
420.30	424	394	420	435	63	498
480.30	484	454	480	495	63	558





Tel. 08-390010

Fax 08-390005



Konstruktion

Tvärströmsfläktar för ex.vis kylning, luftridåer, luftrenare, etc.. Fläkthus i strängdragen aluminium med gavlar i plast. Försedda med skärmpolsmotorer och fläkthjul i aluminium. Fläktarna avsedda för horisontell montering (vertikal på begäran). Motorer i 2- eller 4-poligt utförande. Isolationskl. B eller F. Självsmörjande kullager. Lufttemp. -30°C till +130°C.

Construction

Low noise cross flow blowers for dryers, electronic cooling, aircleaners, officemachines etc.. Housing and impeller in aluminium. 2- or 4-pole shaded pole motors with self-lubricating ball bearings.

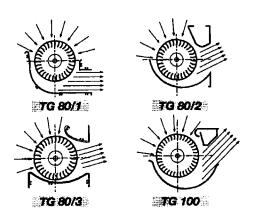
Insulation class B. For horizontal application (vertical on request). For air transp. -30 to +130°C.



TEKNISKA DATA

TYP	Varv/min	Flöde	Varv/min	Flöde
type	R/Min	m3/h	R/Min	m3/h
TGA 80/1-180	1400	180	2800	285
TGA 80/1-240	1400	235	2800	380
TGA 80/1-270	1400	270	2800	430
TGA 80/1-300	1400	295	2800	475
TGA 80/1-330	1400	325	2800	520
TGA 80/1-360	1400	355	2800	570
TGA 80/1-405	1400	400	2800	640
TGA 80/1-420	1400	415	2800	665
TGA 80/1-480	1400	475	2800	760
TGA 80/1-505	1400	500	2800	800
TGA 80/1-540	1400	535	2800	
TGA 80/1-605	1400	600	2800	

TYP	Varv/min	Flöde	Varv/min	Flöde
type	R/Min	m3/h	R/Min	m3/h
TGA 100-180	1400	365	2800	585
TGA 100-360	1400	730	2800	1165
TGA 100-405	1400	820	2800	1310
TGA 100-420	1400	850	2800	1360
TGA 100-455	1400	920	2800	1475
TGA 100-480	1400	970	2800	1555
TGA 100-505	1400	1025	2800	1635
TGA 100-540	1400	1095	2800	· · · · · · · · · · · · · · · · · · ·
TGA 100-570	1400	1155	2800	
TGA 100-605	1400	1225	2800	

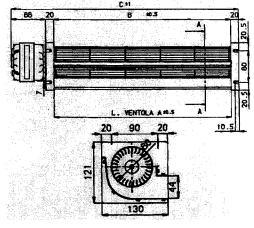


Mått mm

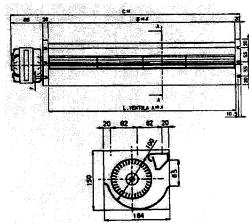
TG 80		
A	В	С
mm	mm	mm
180	180	308
360	360	488
405	405	533
420	420	548
455	455	583
480	480	608
505	505	633
540	540	668
570	570	698
605	605	733
		

TG 100)	
A	В	C
mm	mm	mm
180	180	308
240	240	368
270	270	398
300	300	428
330	330	458
360	360	488
405	405	533
420	420	548
480	480	608
505	505	633
540	540	668
605	605	733

TG 80



TG 100



Tel. 08-390010 ●

Fax 08-390005

5.4) MA-VIB

Ventilatori tangenziali

Cross-flow blowers

Ventilateurs tangentiels

Querstromgebläse

Ventilatori tangenziali con motori a poli schermati, 230V - 50Hz, 2 poli; ventole in alluminio a pale riportate e coclee in lamiera zincata

Temperature d'esercizio da -30°C a +50°C Voltaggi speciali su richiesta

Cross flow fans with shaded pole motors, 230V-50Hz 2pole, high efficiency aluminium impellers (tablock construction) and galvanized steel housings

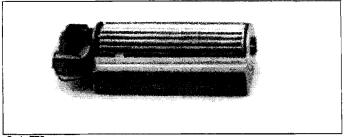
Working temperatures from -30°C up to +50°C Special voltages on request

Ventilateurs tangentiels avec moteurs "shaded pole", 230V - 50Hz, 2 pôles, turbines en aluminium et volutes en acier galvanisé

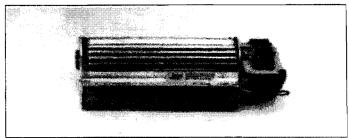
Temperatures d'emploi entre -30°C et +50°C Autres voltages sur demande

Spaltpolmotoren Questromgebläse 230V - 50Hz, 2polig, Gehäuse aus galvanisiertem Stahl und Flügel aus Aluminium

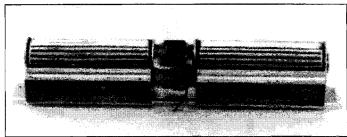
Betriebstemperaturen von -30°C bis +50°C Andere Spannungen und Frequenzen auf Anfrage



Serie ETS



Serie ETD



Serie ETC

Serie Range Série Model	Motore Motor Moteur Motor	Coclea sinistra Left side Housing Volute gauche Linksgehäuse	Cocla destra Right side Housing Volute droite rechtsgehäuse	Bacinella Plate plateau Tropfwanne		
				+ + +		
ETS						
ETD	14.20 A. W.		**************************************			
ETC						

MA-VIB S.P.A.

I - 20065 Inzago - Mi - Italy

TEL. ++39. 02.9547403 r.a. - FAX ++39.02.9549825 - Internet : http://www.mavib.com

Server-Catalogo.xi- 07/99 Pag.27



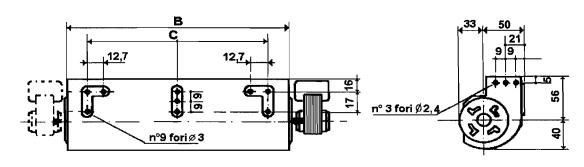
Cross flow blowers single wheel

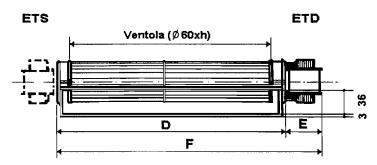
Ventilateurs tangentiels simple turbine

Einfach

Questromgebläse

Ventilatori tangenziali semplici





Serie ETD - ETS - 230V - 50/60Hz - marce CE classe B , in accordo a EN.60335.1

Codice 3	송	충 Dati elettrici			Dimensioni					
	sto	W.in.	A.	RPM	В	С	D	Ē	F	Diam. x h
ETD(S) 6090.15		21	0,18	2300	94	64,5	110	48	158	60 x 90
ETD(S) 60120.15		23	0,19	2050	124	94	140	48	188	60 x 120
ETD(S) 60180.15		24	0,2	1800	184	154	200	48	248	60 x 180
ETD(S) 60180.20	*	29	0,23	2100	184	154	200	53	253	60 x 180
ETD(S) 60240.30		47	0,38	2100	244	212	260	63	323	60 x 240
ETD(S) 60300.30		50	0,41	1500	304	272	320	63	383	60 x 300
ETD(S) 60420.30		51	0,41	1300	424	394	440	63	503	60 x 420

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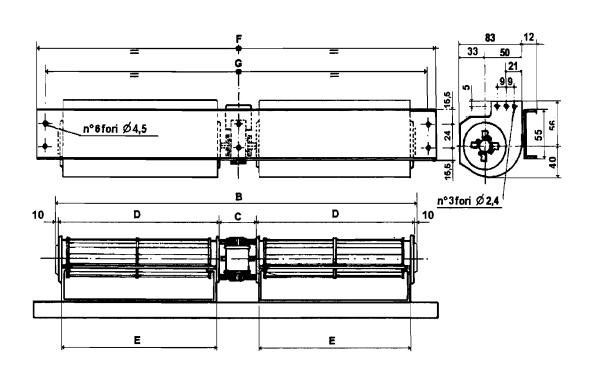
Ventilatori tangenziali doppi

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Serie ETC - 230V - 50/60Hz - marcati C classe B , in accordo a EN.60335.1

Codice story	농	D	ati elettri	ci			Dime	nsioni			Ventoia
	sto	W.in.	A.	RPM	В	С	D	E	F	G	Diam. x h
ETC 6090.20		29	0,32	2100	249	49	100	94	287	277	60 × 90
ETC 60120.20		32	0,35	1200	309	49	130	124	347	337	60 x 120
ETC 60180.20		33	0,36	900	429	49	190	184	490	476	60 x 180
ETC 60180.30	*	49	0,39	1700	439	59	190	184	490	476	60 x 180
ETC 60240.30		51	0,41	1300	559	59	250	244	587	577	60 x 240
ETC 60300.40		-	-	-	689	69	310	304	715	697	60 x 3 00

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Performance

curves

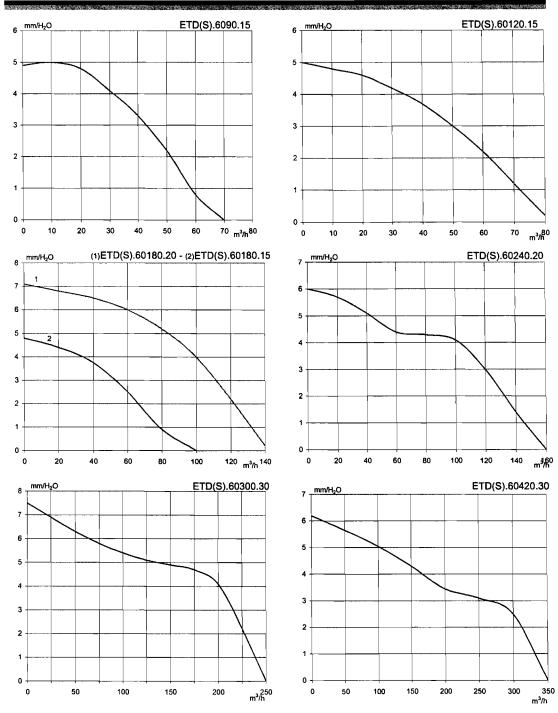
Courbes

de débit

Luftleistungskenn-

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Curve di portata



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5.6) ebm-ZIEHL

rage i of i





148 to 353 mm impeller.

75 to 155 m3/h @ free air.

Q range

Aluminium housing and impeller.

12, 24v DC.

Catalogue

Papst

Typical Application

Electronic cooling.

rage 1 of 1





180 degree air flow

350 to 1180 mm impeller.

QK range

440 to 3100 m3/h @ free air.

Galvanised sheet steel / aluminium housing

Aluminium impeller.

2 and 4 pole speeds.

Single and three phase. DC possible.



Catalogue DL 6.1



Typical Application

Electronic cooling.

Air curtain.

ragerori tang-range-qr



90 degree air flow



QR range

380 to 720 mm impeller.

680 to 1320 m3/h @ free air.

Galvanised sheet steel / aluminium housing

Aluminium impeller.

2 and 4 pole speeds.

Single and three phase. DC possible.

Catalogue DL 6.1



Don't forget

Typical

Electronic cooling.

Application

Air curtain.



rage 1 01 1



380 or 419 mm impeller.



320 m3/h @ free air.

Aluminium sheet / plastic housing.

19" range

Aluminium impeller.

2 pole speed.

Single phase. DC possible.



Catalogue DL 6.1



Typical Application

Electronic cooling.

Air curtain.

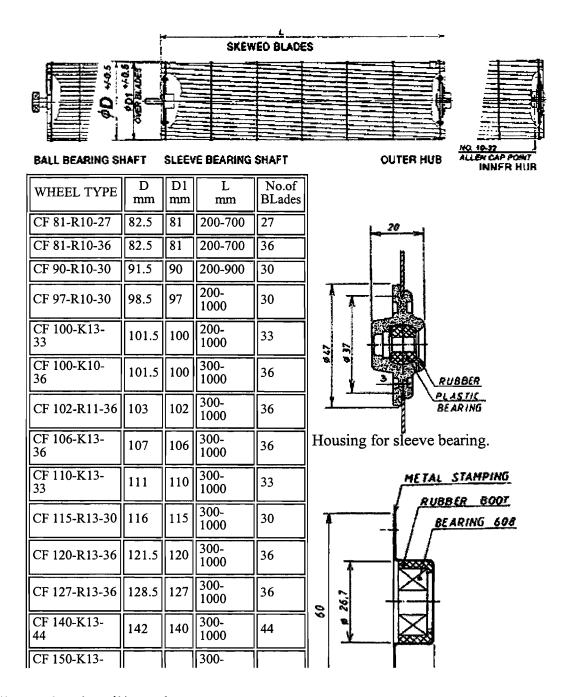
5.7) Shevah Blowers Ltd.



<u>CROSSFLOW</u> WHEELS & FAN BLADES

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CROSSFLOW WHEELS with straight or twisted blades. Length and diameter of wheels - according to the customer's specification. We supply wheels with shafts for sleeve bearings and wheels with ball bearings.



36	152	150	1000	³⁶	1 - 1
CF 150-K13- 44	152	150	300- 1000	44	Housing for ball bearing.
CF 175-R18-54	178	175	300- 1000	54	
CF 200-R18-44	203	200	300- 1000	44	

6.0) Case Studies

CASE NO.1

SHERP Ref# CO1076

HOUSING MANAGEMENT: Scarborough Heights

Co-op Homes

Contact: Mr. Patrick MacLeod, Manager

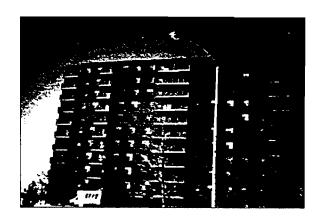
LOCATION: 90 Burrows Hall Blvd., Scarborough

CONSULTANT: Enerplan

Contact: Mr. Mike Doiron

CONTRACTOR: Malfar Mechanical Inc.

Contact: Mr. Peter Li



CASE DESCRIPTION

Housing type: 11 storey apartment

Occupancy type: Family Number of units: 108

Scope of construction work:

- install pounds gas through existing gas line and extend to and regulate to inch gas;
- convert space heating load to natural gas;
- install two boilers in rooftop mechanical room;
- install vertical fan coil systems in each unit;
- disconnect electric baseboard heaters in each suite.

Status of construction as of January 18, 1994: complete

Planned time for construction: Aug 93-Dec 93
Actual time for construction: Aug 93-Jan 94

Planned construction cost per dwelling unit: \$3,934.26 (\$424,900 for 108 units)

Actual construction cost per dwelling unit: \$3,800.61 (\$410,466 for 108 units)

Equipment rental coal per dwelling unit: \$297.80 per month for boilers (no previous rental charges)

Space heating and DHW electrical energy consumption before retrofit: \$25,553 per year for building

Gas purchases for space heating and DHW after retrofit: \$10,061 per year for building

Estimated net savings per year: \$11,918 for building

Simple Payback: 34 44 years

Continued from Case No. 1

RETROFIT SYSTEM DESCRIPTION

System type: Two gas boilers with fan coil distribution system

Boiler type: Two medium efficiency (84%) Teledyne-Laars 'Mighty Therm' model #HH1010, made in USA. Each has an output of 848 kBTU, a design temperature of 140 degrees F and 135 US Gal expansion tanks.

Piping materials: Lead free solder and insulation

Thermostat type and function: Regular type with three way valve control.

Location of boilers: Roof top mechanical room

Forced air system: Climatic Vertical Fan Coil Unit, Model# EL-4, made in Ontario

Location of air ducts: At ceiling level

Position of supply air grilles: Approximately one foot below ceiling level.

Venting: Power

VISUAL EVALUATION OF COMPLETED CONSTRUCTION

Work appeared neat and thorough.

COMMENTS AND SUGGESTIONS FROM PARTICIPANTS

Householders: Householders were initially informed at members meeting of the duration of construction and the level of intrusion to be expected. The consultant used a mock-up and explained how the system would function and cited better air circulation as a benefit. The residents who attended the meetings considered themselves very well informed. The householders like the energy conversion and describe the new system as noisier but has the benefit of producing air that is less dry. The quantity of heat was unchanged but more than sufficient.

The quality of the construction work was considered very good. However to reduce the impact of construction, it was suggested that work not be done floor by floor but instead have all units of the same type done together. The addition of an on site supervisor was suggested as a means to co-ordinate the various sub-contractors.

Manager: Initially contacted by the MOH, the manager was kept well informed before and during construction by the consultant. The number of trades involved and the frequency of visits by the various contractors did come as a surprise. The manager believes there may be a possibility of improving the construction schedule; however, this seems unlikely given the nature of the work, and it would not significantly reduce the level of disturbance that the tenants experienced. Overall, the construction was of good quality and financially necessary as the old system was wasteful and inefficient.

Contractor: No implementation difficulties were cited and believes no further cost reductions were possible.

Consultant: The construction contract included a provision that tenants be given 48 hours notice prior to entry.

Continued from Case No. 1

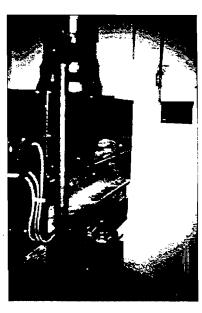
ESTIMATED JOB CREATION

Through manufacture of equipment: 216 hours

Through construction: 380 hours (primary contractor) 5,170 hours (estimate of subcontractors)

Through consultants: 360 hours





CASE NO.2

SHERP Ref# CO1144

HOUSING MANAGEMENT: Mimico Co-op Homes Inc.

Contacts: Ms. Anne Ward-Murphy

LOCATION: 1 Summerhill Rd., Etobicoke

CONSULTANT: Enerplan **Contact:** Mr. Mike Doiron

CONTRACTOR: Maifar Mechanical Inc.

Contact: Mr. Peter Li



Housing type: 14 storey apartment

Occupancy: Family
Number of units: 156



install pounds gas through existing gas line to the roof top and regulate back down to inch gas;

convert space heating load to natural gas;

· install two boilers in the roof top mechanical room;

· install hydronic baseboard system in each unit and corridors;

remove the existing electric baseboard heaters in suites and corridors.

Status of construction as of February 16, 1994: Apartments will be completed near the end of March 1994.

Planned time for construction: Aug 93-Dec 93
Actual time for construction: Aug 93-Mar 94

Planned construction cost per dwelling unit: \$4,474.36 (\$698,000 for 156 units)

Actual construction cost per dwelling unit: \$4,221.15 (\$658,500 for 156 units)

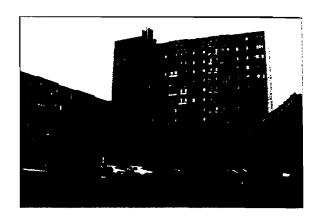
Equipment rental cost per dwelling unit: \$2.85 per unit per month

Space heating consumption before retrofit: \$38.72 per unit per month

Gas purchases for space heating and DHW after retrofit: \$10.51 per unit per month

Estimated net savings per year: \$304.49 (47,500 for 156 units)

Simple Payback: 13.86 years



Continued from Case No. 2

RETROFIT SYSTEM DESCRIPTION

System type: Two central boilers with hydronic baseboard space heating.

Boiler type: Two high efficiency (85%) Patterson Kelly 'Thermific' model N-1900C, made in USA. Each has an output of 1,615 kBTU and is equipped with 125 US Gal. expansion tanks and a Marathon Electric model VN213TTDR8062BN 150 Gal. per minute, water pump made in USA. The boilers are rental units.

Piping Materials: Type 'L' copper with lead free solder and foam insulation.

Loop layout: One loop, reverse return.

Radiator type: Hydronic baseboard type with pipe under radiator cover and wall fin type convectors. Made in the USA by Embassy Industries.

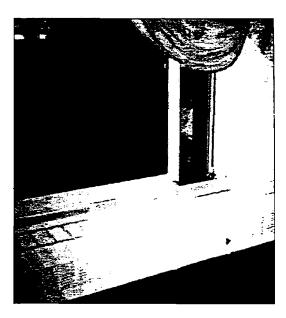
Thermostat type and function: Regular with two-way valve control made by Danfoss model RA 200.

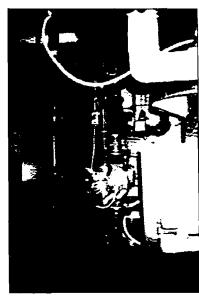
Location of boiler: Roof top mechanical room.

Venting: Power

VISUAL EVALUATION OF COMPLETED CONSTRUCTION

The hydronic baseboards are located in the same place as the removed electric baseboards. At time of site visit the boxing and finishing of the water pipes was incomplete. Using the completed work in the corridors as an indication, the suites should have a high quality finish. Compared to vertical fan coil units, which were an option at this site, little loss of space will be experienced.





Continued from Case No. 2

COMMENTS AND SUGGESTIONS FROM PARTICIPANTS

Householders: The Co-op members were split when asked about whether they felt themselves informed enough prior to the retrofit construction. There was a delay in the members approving the retrofit as quorum was not present at the first two meetings the subject was introduced and votes by proxy are not allowed. Most thought they had ample notice of work within suites however as many are out of the building during the day there were security concerns. The householders are satisfied with the quality of the retrofit and the conduct of the contractors. Approximately half of the respondents reported the need for extra touch up work to be done after the renovations have been completed.

Manager: The manager was informed of the availability of funding by the MOH and approached by various consultants. The short window of opportunity to access SHERP funding was less than desirable as there was insufficient time to carefully study tenders and negotiate with members of the co-operative. It was recommended that a non-stakeholder such as the MOH provide an initial information program rather than the consultants. The extra time may increase the level of acceptance amongst co-op members and thus reduce the burden on the staff.

The retrofit of the apartments followed the retrofit of 19 townhouses belonging to Mimico Co-op (SHERP# CO1110). With knowledge of this project the Manager and the Co-op owners board distributed a questionnaire to all members. Results from the survey were used to create a very detailed information package for the members.

Based on the retrofit of the townhouses and the work performed so far within the apartment building, the quality of the construction work has been excellent and the manager had high praise for the contractors. During construction the level of disruption was described as high and it was felt that the consultants should spend more time on site to better co-ordinate the work. As a result of the survey, most problems have been smoothed over and a good working relationship exists between all parties.

Consultant: The consultant's construction contract provided for the required 48 hours notice prior to entry of an apartment. The consultant mentioned difficulties in explaining the operation of the system to householders and getting them to appreciate the requirement for the project schedule to be flexible.

Contractor: The contractor noted that making the members accept the idea of the retrofit and understand that the level of disruption would be low during construction was somewhat problematic. The decision to use hydronic baseboard heaters was based on the tight budget.

ESTIMATED JOB CREATION

Through manufacture of equipment: 546 hours

Through construction: 1,000 hours (primary contractor) 8,880 hours (estimate of subcontractors)

Through consultants: 720 hours

CASE NO.5

SHERP Ref# CO1150

HOUSING MANAGEMENT: Peel Regional Housing

Authority

Contact(s):

Ms. Eleanor MacDonald, Property Manager Mr. Herbert Dellamarre, Maintenance Manager

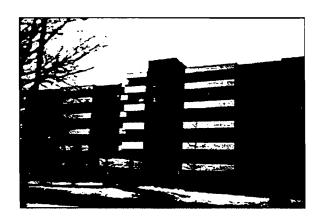
Ms. Margaret Woodcox, Custodian

LOCATION: 3020 Queen Frederica Dr., Mississauga

CONSULTANT: Day MacDonald Behn Inc.

Contact: Mr. Barry Day, Principal

CONTRACTOR: James Johnston Mechanical **Contact:** Mr. James Johnston, Principal



CASE DESCRIPTION

Housing type: 6 storey apartment

Occupancy: Seniors
Number of units: 114
Scope of construction work:

construction of a boiler room at grade;

· new gas service installed; replace electric domestic boilers with gas boilers;

installation of hydronic baseboard heaters in all apartment units.

Status of construction as of 16 Feb, 1994: portions complete

Planned time for construction: Sep 93-15 Jan 94 Actual time for construction: Oct 93-11 Feb 94

Planned construction cost per dwelling unit: \$3,357.02 (\$382,700 for 114 units)

Actual construction cost per dwelling unit: \$3,243.07 (\$369,710 for 114 units)

Equipment rental cost per dwelling unit: None (\$.79 per unit per month previously)

Space heating and DHW electrical energy consumption before retrofit: \$42.30 per unit per month

Gas purchases for space heating and DHW after retrofit: \$28.16 per unit per month

Estimated net savings per year: \$347.36 (\$39,599.28 for 114 units)

Simple Payback: 9.34 years

Continued from Case No. 5

RETROFIT SYSTEM DESCRIPTION

System type: Central boilers with heat exchangers for DHW and hydronic baseboard radiators for space heating.

Boiler type: Seven boilers by Viessmann, 5 modules model #AR270, made in Waterloo, Ontario, 2 modules model #AR230 each with 160-325 litre expansion tanks and an output of 230 kBTU.

Loop layout: Multiple loops in ground floor ceiling (feeding up and down). **Radiator type:** Slant fin baseboard - pipe within radiator cover on exterior wall

Thermostat type and function: Honeywell regular thermostat

Location of boiler: Ground floor

Venting: Direct venting

VISUAL EVALUATION OF COMPLETED CONSTRUCTION

Work appears to be thorough and clean. The hydronic baseboard heaters were located on the exterior walls in the living room and bedrooms. The electric baseboard heaters were removed.

COMMENTS AND SUGGESTIONS FROM PARTICIPANTS

Householders: The residents did attend at least one meeting, received many notices and overall, were satisfied with the amount and content of the information received. Very little disturbance was reported during the construction phase though one resident, who was not at any meetings, was offended by the use of a video camera in her bedroom during a pre-construction evaluation. Those persons who have heat provided by the new system are very happy with the steady heat, better circulation and the fact that the air feels less dry. Many agree with the intent of the SHERP program but wish some financial savings would be seen by the residents.

Custodian: The acting custodian believed that the quality of the work was satisfactory. There were no problems with the previous system therefore the retrofit was only necessary for financial reasons. It was noticed that the level of disturbance experienced by the residents was related to their age and/or level of mobility.

Manager: The addition of the boiler at the rear of the building has spoiled the view of the apartments above and beside. The adjacent apartment no longer receives the same amount of sunlight. See also Case #3 (Streetsville OH2).

Contractor: Did not respond to the survey or follow up telephone calls.

Consultant: The only problems experienced were a one month delay in obtaining the building permit from the City of Mississauga and meeting the many needs of the tenants when working within suites.

Continued from Case No. 5

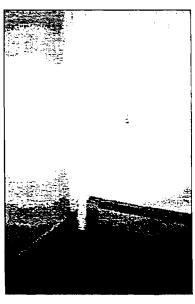
ESTIMATED JOB CREATION

Through manufacture of equipment: 491 hours

Through construction: 5,080 hours (primary & subcontractors)

Through consultants: 475 hours





CASE NO.3

SHERP Ref # CO1148

HOUSING MANAGEMENT: Peel Regional Housing

Authority

Streetsville OH2Contact(s):

Ms. Eleanor MacDonald, Property Manager Mr. Herb Delamarre, Maintenance Manager

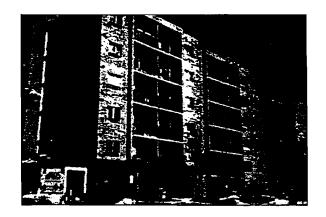
Mr. Al Sutton, Custodian

LOCATION: 4 Caroline St., Mississauga
CONSULTANT: M.V. Shore and Associates

Contact: Mr. Thomas Lau

CONTRACTOR: Malfar Mechanical Inc.

Contact: Mr. Peter Li



CASE DESCRIPTION

Housing type: 6 storey apartment building with basement

Occupancy: Seniors

Number of units: 60

Scope of construction work:

- installation of central heating plant system including rental boilers;
- conversion of DHW heating system with hydronic heating via heat exchangers;
- install space heating distribution piping system;
- · install hydronic vertical fan coils in suites;
- · install duct work;
- install and wire heating plant control system;
- extend gas piping system;
- cutting, patching, drywall enclosure, floor and wall drilling, boiler room renovation;
- · install new lighting reflectors for existing light fixtures, change to energy efficient light bulbs;
- install new chimney for the new boilers.

Status of construction as of February 15, 1994: 95% complete

Planned time for construction: Aug 93-Dec 93
Actual time for construction: Oct 93-Feb 94

Planned construction cost per dwelling unit: \$4,241.67 (\$254,500 for 60 units)

Actual construction cost per dwelling unit: \$4,316.67 (\$259,000 for 60 units).

Equipment rental cost per dwelling unit: \$24.68 per unit per month

Space heating and DHW electrical energy consumption before retrofit: \$42.27 per unit per month

Gas purchases for space heating and DHW after retrofit:: \$15.03 per unit per month

Estimated net savings per year: \$30.71 (\$1,842.89 for 60 units)

Simple Payback: 140.56 years

Continued from Case No. 3

RETROFIT SYSTEM DESCRIPTION

System type: Central boilers with heat exchangers for DHW and vertical fan coil units for space heating.

Boiler type: Two Teledyne-Laars, Model #HH1200, made in USA, high efficiency (85%) hydronic space heating boilers with an output of 1 MBTU each at a design water temperature of 180 degrees F. Each boiler is fitted with a 200 gallon expansion tank.

Piping: Black steel Schedule 40, type 'M' copper piping in fan coil risers, insulation and lead free solder. Pattern is a one loop reverse return positioned on the ground floor ceiling, feeding up and down.

Fan Coil Unit: Climatic Vertical Fan Coil Unit, Model# EL-4, made in Ontario. One per dwelling unit, located in the corner of the bedroom adjacent to the living room. Air grilles one foot above floor and ducts at the ceiling level.

Other Equipment: Three-way valves, stainless steel plate type heat exchangers

Thermostat type and function: Packaged with fan coil unit

Location of boiler: Ground floor boiler room

Venting: Power venting

VISUAL EVALUATION OF COMPLETED CONSTRUCTION

The finish and detail of the duct work and drywall enclosures enabled the new units to blend in well with the surroundings.

COMMENTS AND SUGGESTIONS FROM PARTICIPANTS

Householders: Householders were kept informed through weekly meetings and frequent notices. The locating of the heating units and thermostats in the bedrooms rather than in the living rooms is a huge concern to a great majority of the residents. Though not operating yet, it is perceived that heat in the bedroom will be excessive and living rooms will be cool. Residents prefer cooler bedrooms and warm living rooms and often sleep with the bedroom window partially open. Concerns about too much heat and not enough air exchange in bedrooms are of such great concern that one resident interviewed, who has a variety of medical problems that are heat sensitive, is considering moving out of the building.

During construction the noise from drilling was very disruptive and the moving of furniture was difficult for some. Older and less mobile residents were affected the most. There is a widely held misconception that the retrofit involves gas lines in each unit when in fact pipes carry hot water only. One respondent described some other residents as being 'terrorized'. Poor communications with tenants was cited for this misunderstanding. Residents of apartments that end with the number _01 complain about the stainless steel chimney reflecting sunlight and heat inside the apartment. Persons living above the furnace room want the possibility of sound insulation be explored.

At this time the overall impression is that the residents were happy with the previous heating system and feel the retrofit was not necessary and will reduce their comfort level.

Superintendent: The live in custodian was informed in the same manner as the other residents. As the custodian lives on site he had to deal with many complaints, most of which relate to the loss of space within apartments, the noise of the fan coil unit and the level of disruption. Though the quality of the work was rated as excellent and the workers very helpful, the need to do the SHERP conversion at all could not be seen and was certainly not worth the "disastrous" level of disruption it caused.

Continued from Case No. 3

Manager: Great efforts were made to compress work schedule and reduce impact on tenants; however, construction was very disruptive due to multiple visits over an extended period of time. Specific complaints brought to the manager's attention by tenants were: the noise from drilling, the seemingly constant moving of furniture and the fact that installing fan coils results in a permanent loss of space in an already small apartment.

It was suggested that changing the time of year for construction to the summer would lessen the level of disturbance as the seniors would have more reasons and opportunities to leave the building when construction was taking place. Summer construction would also eliminate the need temporary auxiliary heaters (portable electric) during switch over period.

Overall, the work was of good quality, the contractors were exceptionally considerate of the seniors and the contracting firm was responsive to input from the Manager. In this case, the retrofit, though part of a noble program, was not considered necessary as tenants and housing projects will not reap the benefits of any direct savings. Some mechanism to mitigate the additional stress on the tenants is required.

Consultant: The consultant made provisions to lessen tenant disruption during construction. Problems noted during construction included having all parties agree on the location of the fan coil units within the suites and the routing of the exhaust flue.

Contractor: The contractor noted that the residents were reluctant to accept the new system. The contractor found the location of the fan coil unit and the power venting problematic. If the project were to be repeated on an even tighter budget the contractor would consider deleting the DHW system.

ESTIMATED JOB CREATION

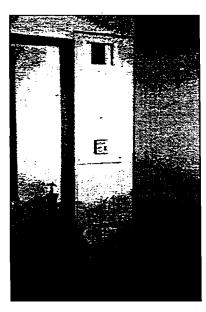
Through manufacture of equipment: 120 hours

Through construction: 380 hours (primary contractor)

3,182 hours (estimate of subcontractors)

Through consultants: 350 hours





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ELECTRIC TO Natural Gas Conversions

CASE NO.4

SHERP Ref# CO1149

HOUSING MANAGEMENT: Peel Regional Housing-

Mapleview

Contact(s):

Ms. Eleanor MacDonald, Property Manager Mr. Herb Delamarre, Maintenance Manager

Mrs. Joyce MacDonald, Custodian

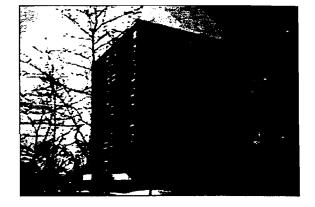
LOCATION: 1 Maple Avenue, Brampton

CONSULTANT: M.V. Shore and Associates

Contact: Mr. Thomas Lau

CONTRACTOR: Malfar Mechanical Inc

Contact: Mr. Peter Li



CASE DESCRIPTION

Housing type: 11 storey apartment

Occupancy: Seniors

Number of units: 101

Scope of construction work:

- upgrade gas capacity to serve the new boilers;
- · install energy management control panel;
- install new boilers and water piping for space heating;
- · install vertical fan coil units in each suite;
- · install new reflectors for the existing lighting system;
- install new heat exchanger for the DHW system;
- · install new power venting for the boilers;
- · install new gas dryers;
- disconnect the existing electric baseboard heaters in suites.

Continued from Case No. 4

Status of construction as of Feb 16, 1994: complete

Planned time for construction: Aug 93-Dec 93 Actual time for construction: Oct 93-Jan 94

Planned construction cost per dwelling unit: \$4,396.04 (\$444,000 for 101 units).

Actual construction cost per dwelling unit:

\$3,337.70 (\$337,108 for 101 units without rebate) \$2,954.00 (298,387 for 101 units with rebate)

Equipment rental cost per dwelling unit:

\$11.49 per unit per month (no previous rental)

Space heating and DHW electrical energy consumption before retrofit: \$48.56 per unit per month

Gas purchases for space heating and DHW after retrofit:: \$15.65 per unit per month

Estimated net savings per year: \$257.12 (\$25,969.60 for 101 units)

Simple Payback: 11.49 years (with rebate)

RETROFIT SYSTEM DESCRIPTION

System type: Gas boilers with fan coil distribution system

Boiler type: High efficiency (85%) Teledyne Laars Gas Boilers, Model #HH1825,made in USA, each with an output of 1.5 MBTU. Each boiler has 200 gallon expansion tanks. The design water temperature of the system is 200 degrees.

Piping Materials: Lead free solder and insulation

Loop layout:: One reverse return loop positioned in ground floor ceiling, feeding up & down

Thermostat type and function: Regular the three way valve control

Location of boiler: Ground floor

Forced air system: Climatic Vertical Fan Coil Unit Model# EL-4, made in Ontario.

Location of air ducts: At ceiling level

Position of grilles: Supply grilles one foot below ceiling and air grilles one foot above the floor.

Venting: Power venting

VISUAL EVALUATION OF COMPLETED CONSTRUCTION

Work appeared to be neat and thorough. The fan coil units were very compact and took very little space in the bedrooms of the apartment units.

Continued from Case No. 4

COMMENTS AND SUGGESTIONS FROM PARTICIPANTS

Householders: Even though meetings were held and frequent notices distributed the residents did not feel they were very well informed. One resident mentioned not going to a meeting because it was held in a lounge that is used as a smoking area. The contracting team left excellent impressions and were described as tidy, polite and quick. The X-ray examination that involved the upper three floors was exceptionally bothersome. A few felt that the housing authority showed a lack of concern for the very elderly and infirm.

Residents at this location were unhappy with the placement of the heating units in the bedrooms instead of the living areas. There is a preference for cooler bedrooms and warmer living rooms.

It was suggested by many that the work would be best done in the spring and summer so that more reasons and opportunities to leave the building would be present. The possibility of having the housing authority organize day trips to escape the construction was brought up by one resident.

Custodian: The superintendent found the meetings productive, the mock up and drawings were also helpful. It was felt that most people, except for those on the 11th floor, were not overly disrupted. Doing the construction in the spring would lessen the disturbance. Although the electrical system performed well, the new system will save money.

Manager: In order to X-ray concrete floor prior to coring, three floors of the building had to be vacated. This was very disturbing as the residents are senior citizens. See also Case # 3 (Streetsville OH2).

Consultant: The consultant noted some difficulty with the location of the fan coil unit within the suites. The location of the boiler plant was also a difficulty.

Contractor: The contractor indicated problems with the power venting routing and the location of the fan coil units. It was also observed that the tenants were very reluctant in their acceptance of the new system.

ESTIMATED JOB CREATION

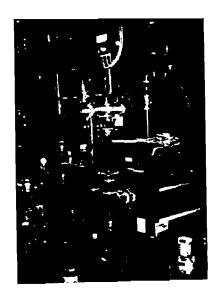
Through manufacture of equipment: 202 hours

Through construction: 480 hours (primary contractor)

4,580 hours (estimate of subcontractors)

Through consultants: 450 hours





CASE NO. 2

HOUSING MANAGEMENT: Peel Regional Housing

Authority (OHC)

Contact Bruno Irachi, Housing Manager **LOCATION:** 4 Caroline St., Streetsville

CONSULTANT: M. V. Shore

Contact: Tom Lau, Project Manager

CONTRACTOR: none; feasibility study only

CASE DESCRIPTION

(Based on recommendations in feasibility study done by M. V. Shore)

Housing type: 6-storey apartment building, basement

Occupancy: seniors

Number of units: 60

Metering: bulk, landlord pays Scope of construction work:

- installation of central heating plant system including rental boilers
- · conversion of DHW heating system with hydronic heating via heat exchangers
- · install space heating distribution piping system
- install hydronic vertical fan coils in suites
- install duct work
- install and wire heating plant control system
- · extend gas piping system
- cutting, patching, drywall enclosure, floor and wall drilling, boiler room renovation

Planned time for construction: 14 weeks
Actual time for construction: not planned

Planned construction cost per dwelling unit: \$3,422 (\$205,345 over 60 units, including \$25,145 design fees

paid to consultant); does not include installation cost of rental equipment

Actual construction cost per dwelling unit: no construction done

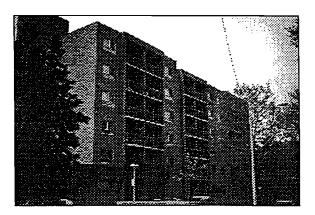
Rental cost per dwelling unit: estimated \$14.33/month (2 boilers @ \$430 over 60 units); no previous rental

Space Heating and DHW Electrical Energy Consumption Before Retrofit: 13,087 kWh/year per dwelling unit

Gas Purchases for Space Heating and DHW After Retrofit: 1,574 m3/year per dwelling unit

Estimated Net Savings per Year: \$433 per dwelling unit (takes into account rental fees)

Simple Payback: 7.9 years (compare payback of 7.3 years calculated by consultant)



RETROFIT SYSTEM DESCRIPTION

(based on recommendations in feasibility study done by M. V. Shore)

System type: central boilers with heat exchangers for DHW and fan coil units for space heating

Boiler type: mid-efficiency, power vented boiler (e.g. Patterson Kelly Thermific gas-fired boiler, model # N-1200, made in U.S.A.) with output approximately 1000 MBH, 2 boilers for entire building. Boilers are to be rented from Consumers Gas.

Piping Materials: black steel Schedule 40, type 'M' copper piping in fan coil risers, insulation **Fan Coil Unit:** one per dwelling unit, located at the corner of the bedroom adjacent to living room

Other equipment: three-way valves, stainless steel plate type heat exchangers

Thermostat type and function: packaged with fan coil Location of boilers: boiler room on ground floor

Venting: power venting

VISUAL EVALUATION OF COMPLETED CONSTRUCTION

no construction done

COMMENTS AND SUGGESTIONS FROM PARTICIPANTS

Consultant: in feasibility study, performed cost-benefit analysis to compare vertical fan coil heating system to hydronic baseboard system. Study recommended vertical fan coil system because of lower construction costs, better comfort factor, less interference during construction and minor costs for operation and maintenance.

ESTIMATED JOB CREATION

Through manufacture of equipment: 12 Ontario person-days; 14 other person-days

Through construction: no construction done, no estimates available

Through consultants: 50 person-days

7.0) Books and Abstracts

CBS Newsletter Summer 1995 pg. 5

Energy and Ventilation Research in Highrise Apartments: The Chelsea Public Housing Study

More than 30 million Americans live in multifamily housing. A disproportionate number of them are poor, renters, minority, single parents, and children. While buildings with five or more units account for only 9% of residential energy end-use in the United States, the energy burden(i.e., the percent of household income spent for energy(is several times higher for these households than for single-family households. Historically, multifamily buildings have been the most neglected building sector for retrofit activity in utility and federal programs, but the last ten years have seen impressive advances in improving the energy efficiency of these buildings.



Figure 1. The Margolis Apartments in Chelsea, Massachusetts, was designed in 1973 and is typical of high-rise construction from that period. This USHUD project is the site of ventilation and infiltration measurements to improve comfort and energy performance.

A new book, *Improving Energy Efficiency in Apartment Buildings*, by John DeCicco, Rick Diamond, Sandy Nolden, and Tom Wilson, funded by the <u>U.S. Department of Energy</u> and the Energy Foundation and to be published by the <u>American Council for an Energy Efficient Economy</u> in early 1996, documents much of this work. It is the result of collaboration by practitioners and researchers active in multifamily retrofit research. One area that continues to block retrofit efforts has been our lack of understanding of how ventilation and infiltration occurs in these buildings. Unlike single-family buildings, where our knowledge of ventilation and infiltration has benefited from such tools as blower doors and tracer gas measurement, the more complex configurations of multifamily buildings challenge our ability to measure and model the air flows and their resulting energy costs.

We have been working for the past two years at the Margolis Apartments (Figure 1), the

site of a collaborative venture among DOE, HUD, the Boston Edison Company, and the Chelsea Housing Authority, to demonstrate energy-efficient retrofits of public housing as part of a utility DSM Program.

We made a series of visits to the building in which we performed ventilation and air-leakage measurements using tracer gases and blower doors to determine the performance of the energy-saving retrofits and to determine if adequate levels of ventilation for air quality were being met throughout the building. Following these measurements, we modeled the air flows in this building using the computer simulation program COMIS, which allowed us to understand the complex air flows under different weather conditions.

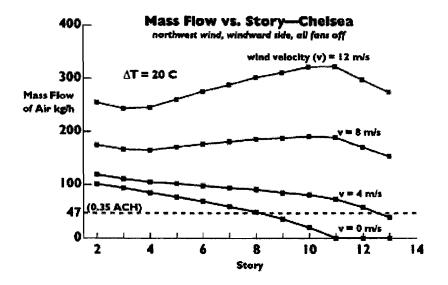


Figure 2. A simulation of the air flows in the Margolis Apartments under different wind speeds. The model shows that even apartments on the windward side of the building are not receiving sufficient outside air (according to ASHRAE Standard 62, see dashed line) during periods of low windspeed.

Our findings to date illuminate the asymmetric nature of the air flows in highrise buildings. Depending on the side of the building and the height above the ground, the unit may be under- or overventilated (Figure 2). We have also been studying the relative importance of the stair towers and elevator shafts and how they interact with both the mechanical and natural ventilation in the building. One disturbing finding is that the designed mechanical ventilation often performs poorly, both in exacting a greater energy penalty and in not providing adequate ventilation.

We plan to continue our study of ventilation in highrises by looking at additional buildings and making recomendations for both retrofits and new construction. One goal of this research is to develop protocols and guidelines for measuring and improving ventilation as efficiently as possible.

--Rick Diamond, Helmut Feustel, and Darryl Dickerhoff



Rick Diamond Indoor Environment Program (510) 486-4459; (510) 486-6658 fax Sherman, M.H., H.E. Feustel, and D.J. Dickerhoff, "Description of a System for feasuring Interzonal Air Flows Using Multiple Tracer Gasses," In Proceedings of AXI Symposium of the International Centre for Heat and Mass Transfer (ICHMT), Dubrovnik, Yugoslavia:1989, pp. 781-790. LBL-26538. On-line PDF version

Sherman, M.H., "Uncertainty in Air Flow Calculations Using Tracer Gas Measurements," Building and Environment 24 347-354, 1989. LBL-25415.On-line PDF version

Go to top of page Multifamily Buildings

Diamond, R.C., J.A. McAllister, L.I. Rainer, and R.L Ritschard, "Handbook for Performing Energy Retrofits for HUD-Owned Multifamily Properties," U.S. Department of Housing and Urban Development under the DOE-HUD Initiative, 1991.

Diamond, R.C., J.A. McAllister, L.I. Rainer, and R.L. Ritschard, "Multifamily Energy Audit for HUD-Insuted Multifamily Properties," US Department of Housing and Urban Development under the DOE-HUD Initiative, 1991.

Diamond, R.C., J.A. McAllister, H.E. Feustel, C. Patullo, and T. Buckley, "Affordable Housing Through Energy Efficiency: The Northgate Story," In Proceedings, Thermal 'erformance of the Exterior Envelopes of Buildings V, Atlanta, GA:ASHRAE, 1992, pp. 668-674. LBL-32167.

Diamond, R., Goldman, C., Modera, M., Rothkopf, M., Sherman, M., Vine, E., "Building Energy Retrofit Research: Multifamily Sector Multiyear Plan - FY 1986-FY 1991" Lawrence Berkeley Laboratory, 1985. LBL-20165.

Diamond, R.C., Modera, M.P., Feustel, H.E., "Ventilation and Occupant Behavior in Two Apartment Buildings" Proceedings of 7th AIVC Conference: Occupant Interactions with Ventilation Systems 6.1-6.8: 1986. LBL-21862.

Harrje, D.T., R.N. Dietz, M.H. Sherman, D.L. Bohac, T.W. D'Ottavio, and D.J. Dickerhoff, "Tracer Gas Measurement Systems Compared in a Multifamily Building." In Air Change Rate and Airtightness in Buildings, ed. M.H. Sherman, Philadelphia: ASTM, 1990, pp. 5-20.

Modera, M.P., J.T. Brunsell, and R.C. Diamond, "Improving Diagnostics and Energy Analysis for Multi-Family Buildings: A Case Study," In Proceedings, Thermal Performance of the Exterior Envelopes of Buildings III, SP 49, Atlanta, GA:ASHRAE, 1986, pp. 689-706.

Modera, M.P., "Jacket and Stack Losses from Multifamily Boilers," In Proceedings of the 1988 ACEEE Summer Study on Energy Efficiency in Buildings, Vol. 2, Washington, DC:ACEEE, 1988, pp. 2.148-2.154. LBL-25414.

Palmiter, L. and M.H. Sherman, "Measured Airflows in Multifamily Buildings." In Special Technical Publications, Airflow Performance American Society for Testing &



Consumer Energy Information: EREC Reference Briefs

Energy Efficiency in Multifamily Dwellings: Reading List

The following is a list of articles and publications provide information on energy efficiency in public and private multifamily dwellings. To find the publications listed, contact the source or publisher as indicated. Libraries may be able to obtain books and reports through their interlibrary loan system. This list does not cover all available information on this subject, nor is the mention of any publication, product, service, or organization to be considered a recommendation or endorsement.

Besides the publications listed below, the following are additional sources of information on energy efficiency in public housing:

Public Housing Energy Conservation Clearinghouse

Phone: (866) 275-6228 (toll-free)

Fax: (406) 494-2905

Email: info@phaenergy.org

World Wide Web: www.phaenergy.org

The Public Housing Energy Conservation Clearinghouse (PHECC) assists public housing authorities manage utility operations and reduce utility costs. Contact the PHECC for details on information and services available.

Rebuild America U.S. Department of Energy 1000 Independence Avenue, SW Washington, DC 20585

World Wide Web: www.eren.doe.gov/buildings/rebuild/

Rebuild America is a program that focuses on energy solutions as community solutions. Rebuild America "partners" with small towns, large metropolitan areas and Native American tribes, creating a large network of peers. Rebuild America supports communities with access to DOE Regional Offices, state energy offices, national laboratories, utilities, colleges and universities, and nonprofit agencies.

Articles

"The Best Boiler and Water Heating Retrofits," M. Lobenstein and M. Hewett, *Home Energy*, (12:5) pp. 27-33, September/October 1995.

"Controlling Recirculation Loop Heat Losses," M. Lobenstein, *Home Energy*, (10:1) pp. 9-13, January/February 1993.

Designing Better Multifamily Programs," J. Hammarlund, *Home Energy*, (8:1) pp. 40-41, January/February 1991.

"DSM Example: All-Electric Multifamily Housing," *Home Energy*, (8:1) p. 35, January/February 1991.

"Energy and Ventilation Research in High-Rise Apartments: The Chelsea Public Housing Study," R. Diamond, Center for Building Science News, (2:2) p. 5, Summer 1995.

"Energy Savings in New, Low-Rise Multifamily Buildings Due to Energy Efficient Building Practices," B. Tonn, *Energy Systems & Policy (ENE)*, (14:2) pp. 85-111, April/June 1990.

"Making Low Income Housing Affordable: The Northgate Retrofits," C. Patullo, *Home Energy*, (10:2) pp. 13-16, March/April 1993.

"Nyland CoHousing Community," B. Thayer, *Solar Today*, (8:5) pp. 29-32, September/October 1994.

"Once Heated, Twice Used," D. Bohac, *Home Energy*, (9:4) pp. 14-19, July/August 1992.

"Profiles of Multifamily Weatherization Projects: A Tale of Five Cities," L. Kinney, T. Wilson, and M. MacDonald, *Home Energy*, (12:5) pp. 55-60, September/October 1995.

Reports and Proceedings

Unless otherwise indicated, all reports are available from the National Technical Information Service (NTIS) (See Source List below).

ASHRAE Standard 90.2-1993: Energy Efficient Design of New Low-Rise Residential Buildings, American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE), 1993. Available from ASHRAE, 1791 Tullie Circle NE, Atlanta, GA 30329; Phone: (800) 527-4723 or (404) 636-8400; Fax: (404) 321-5478; Email: ashrae.org; World Wide Web: www.ashrae.org. 107 pp., \$84.00. This document contains the latest energy-efficiency standard and calculation methodology for single and multifamily residential buildings.

Attacking Energy Waste in Public and Publicly Assisted Housing in New York State, Citizens Conservation Corp. and New York State Energy Research and Development Authority, 1994. 115 pp., \$41.00, NTIS Order No. PB96-195177I.

"Choosing the Right Replacement Boiler in Low-to-Moderate Income Multifamily Buildings—An Update of Current Practice and Research," J. Katakis, L. Wharton, and W. Goldmann, *Demand and Load Shape: ACEEE 1992 Summer Study on Energy Efficiency in Buildings* (Vol. 2), pp. 2.117-26, 1992. Available from the American Council for an Energy Efficient Economy (ACEEE) (see Source List below). 10 volume set, \$160.00.

Cutting Energy Costs in Multi-Family Housing: Practical Case Studies for the Builder and Developer, W. Whiddon, 1986. 197 pp., \$51.00, NTIS Order No. DE87002469. This book is based on an evaluation of nine existing and three proposed multi-family projects across the United States.

"Domestic Hot Water Loads, System Sizing and Selection for Multifamily Loads," F. Goldner and D. Price, *Demand Load Shapes, Proceedings: ACEEE 1994 Summer Study on Energy Efficiency in Buildings* (Vol. 2), pp. 2.105-16, 1994. Available from ACEEE (see Source List below). 10 volume set, \$180.00.

"Energy Conservation in Multifamily Housing: Review and Recommendations for Retrofit Programs," J. Decicco, R. Diamond, S. Morgan, et al., *Program Design, Proceedings: ACEEE 1994 Summer Study on Energy Efficiency in Buildings* (Vol. 10), pp. 10.21-33, 1994. Available from ACEEE (see Source List below). 10 volume set, \$180.00.

This report consolidates the data from the demonstration projects and formulates overall conclusions and recommendations. The data is taken from individual project reports, which are prepared and issued by others.

The conclusions and recommendations of this report are based on consideration of the individual project reports but are not bound by these conclusions. The reports, prepared by the regional consultants should be reviewed for additional specific information. A list of the individual project reports follows:

Summary Reference List; SHERP Fuel Substitution Demonstration Project Reports



- Electric to Natural Gas Conversions, Ontario Social Housing 1992-1994
 Consumers Gas Inc; prepared by IBI Group
- 2. Middleton Way Gas Conversion: Performance Evaluation Consumers Gas Inc.; Prepared by Project Dynamics Ltd.
- 3. Stroud Low Rise Space Heating; Conversion Demonstration Consumers Gas Inc.; Prepared by Project Dynamics Ltd.
- SHERP, Fuel Substitution Project Report Centra Gas Ontario Inc; prepared by Centra Gas
- 5. SHERP; Fuel Substitution Project Report
 Union Gas Limited; prepared by David A. Maclean and Associates
- A Techno-Economic assessment of Natural Gas Technologies for Retrofit Installations in Non-Profit Multi-Family Buildings.
 Ontario Ministry of the Environment and Energy; Prepared by Engineering Interface Ltd.
- 7. Energy Cost Saving Study; Ontario Housing Corporation Fuel Conversion Project; Prepared by J. Wm. Andrews, September 1992



- 8. Social Housing Energy Retrofit Program (S.H.E.R.P.); Electric To Natural Gas Fuel Conversions; Demonstration Projects 1992/93; Ontario Ministry of the Environment and Energy; Prepared by J. Wm. Andrews
- 9. Retrofit Summary Report; Fuel Substitution Project; 104 Charles St., Dryden (OH-2) Centra Gas Ontario Inc., Prepared by J. Wm. Andrews, February 1995

SHERP1992/94 Page 8



Conversion from electric baseboard heating to gas fired heating in single family houses

Source: SGC-Report 085(In Swedish), December 1997

Mikael NŠslund

Electric baseboard heaters are used in approximately 500000 Swedish single family houses. Gas fired heating systems are shown as conversion alternatives. Experiences from earlier conversions and studies are shown. A starting-point for this work is that the building structure is not changed, i.e. no insulation is added or windows improved. Among six suggested heating systems, two are recommended. These are a common hydronic system with a boiler and a heating system comprising two or three gas radiators and keeping the electric baseboard heaters as backup. The first system can be used in all houses while the second system requires an open floor layout.

The electricity reduction due to the conversion will be 50-70% of the total electric consumption depending on whether or not the hot tap water production is included in the conversion. Gas radiators give a smaller electricity reduction because the baseboard heaters are used to prevent cold regions around the windows. The investment cost for the hydronic system is approximately SEK 70000 (including connection to the gas grid). There are no experiences from conversion to gas radiators in Sweden. Therefore, the conversion cost can not be estimated. The annual heating cost is reduced by SEK 2000-3000 at an annual net heat demand of 11000 kWh and SEK 2800-4700 at 22000 kWh. Condensing boilers seem to be profitable even at low heat demands because the heating system can be designed for maximum efficiency. Gas radiators today have lower efficiencies than boilers. The annual space heating cost is reduced by SEK 2 000-2 700 at 11 000 kWh and SEK 2 500-4 000 at 22 000 kWh provided that the radiator design is improved.

The amount of electricity replaced and the gas radiator efficiency is important hut also the electricity tariff after the conversion. A flat tariff, same rate at all times, is necessary to obtain an acceptable economy for the cases studied.

Visit the SGC homepage

asp:00 11 29 /member/library/sgc/sgc085e htm

Conversion of electrically heated motel to geothermal energy

ABSTRACT:

Outlines the feasibility design efforts for retrofitting an existing 40-unit motel from propane and electric heating to a geothermal supply. The motel is located in the south-central portion of Colorado at an elevation of 6,900 ft (2,100 m). A geothermal resource of 150 deg F (65 deg C) at a depth of 2, 200ft (610 m) is available for the conversion. The equipment and installation costs for the geothermal conversion are approx. 110,000 dollars, assuming a geothermal supply temperature of 150 deg F (65 deg C). By providing all space heating and hot water needs from a geothermal supply the potential annual electrical savings are 21,000 dollars. The actual payback period is dependent on the site specific characteristics of the geothermal resource.

AUTHOR: Garing K L.Coury G E.

CITATION: ASHRAE Trans. 1980, Vol.86, Part 1, 747-754, 3 tabs, 3 figs.

KEYWORDS: year 1980, space heating, space heating, hotels, modernising, USA, hot water supply,

propane, geothermal energy, swimming pools

A comparison of energy consumption and electric demand of earth-coupled heat pumps and electric resistance baseboard heaters in a residential multifamily application

ABSTRACT:

A demonstration project was conducted to explore the potential for energy conservation and demand reduction of converting electric resistance heating to earth-coupled heat pumps (ECHPs) at a 550-unit, garden apartment complex in upstate New York. The demonstration involved three apartments in each of three buildings. Earth-coupled heat pumps were installed in one building, the other two buildings retained electrical resistance baseboard heating and conventional air-conditioning systems. Energy consumption data for heating and cooling were collected at 15-min intervals for approximately one year, then analysed. The energy consumption and electric demand for heating an apartment with an ECHP were approximately one-third as much as for electric resistance heating. However, cooling data were too scattered to establish meaningful trends because tenants were inconsistent in using air conditioning, therefore no cooling comparisons could be made.

AUTHOR: Rizzuto J

CITATION: ASHRAE Trans. 1994, vol.100, part 1, paper number NO-94-26-4. 1597-1603, 9 figs,

5 tabs

KEYWORDS: year 1994, comparing, energy consumption, soil heat pumps, heat pumps, energy

conservation, electric heaters, resistance, dwellings,

Heat recovery ventilators in multifamily residences in the arctic

ABSTRACT:

Heat recovery ventilators (HRVs) have been utilised in the design of new residential units in Kotzebue, Alaska. This project will provide 50 new residential units for US Public Health Service health care professionals who will be working in a new hospital in Kotzebue. Kotzebue is located just north of the Arctic Circle on the coast of the Arctic Ocean. The ASHRAE 99% design winter condition is -38degF. The prolonged and severe winter conditions warrant construction designed to limit infiltration to the minimum that current construction techniques will allow. Consequently, adequate ventilation can be best ensured by mechanical ventilation provisions. Individual HRVs are provided to ensure compliance with ASHRAE Standard 62-1989. The residential units are heated by a hydronic baseboard fin-tube system. The HRVs provide supply air to the occupiable areas and obtain the exhaust air from the kitchen and bathroom(s).

AUTHOR: Ninomura P T., Bhargava R.

CITATION: ASHRAE Trans. 1995, Vol.101, Part 2, Paper number SD-95-9-1, 961-966, 5 figs.,

refs.

KEYWORDS: year 1995, heat recovery, ventilators, domestic, flats, service life, costs, winter, arctic

regions, energy conservation, payback period, ventilation, USA, air infiltration,

An evaluation of thermal comfort and energy consumption for a surface-mounted ceiling radiant panel heating system

ABSTRACT:

A surface-mounted, ceiling radiant heating system, an air-to-air heat pump system, and a monitoring data-acquisition system were installed in an occupied research home. Information on thermal comfort and energy consumption for alternating operation of the two heating systems was collected for approximately half of a heating season. This allowed a comparison of the radiant system and the more conventional air-to-air heat pump system. Data on energy consumption from a zoned electric baseboard heating system previously installed in the same house were available for comparison.

AUTHOR: Yost P A., Barbour C E., Watson R.

CITATION: ASHRAE Trans. 1995, Vol.101, Part 1, Paper number CH-95-19-3, 1221-1235, 4 figs., 4 tabs.. refs.

KEYWORDS: year 1995, calculating, thermal comfort, energy consumption, ceiling heating, radiant panels, radiant heating, performance, energy conservation, comparing, air air heat pumps,

Energy allocation equipment for HVAC systems - a practical guide to its use and limitations

ABSTRACT:

Notes that guidelines are being drafted by ASHRAE GPC-8P for the performance and installation of energy allocation equipment for heating, ventilation and air conditioning (HVAC) systems. Highlights practical experience with the installation of energy allocation equipment in HVAC systems in more than 300 multi-family buildings in the USA. The HVAC systems considered include hydronic baseboard, central fan coil with a single-speed fan, and central system fan coil with a multiple speed fan. Discusses allocation accuracy limitations related to HVAC maintenance and allocation equipment installation. Provides examples.

AUTHOR: Freischlag R L.

CITATION: ASHRAE Trans., 1993, vol.99, part 1, paper number CH-93-6-2, 880-887, 3 figs, 3

refs.

KEYWORDS: year 1993, regulations, USA, meters, costs, heating, ventilation, air conditioning, equipment, metering, accuracy, installing, flats, fan coil units, heating, skirting heating, heat meters

8.0) Caneta Report

Heat Pump Retrofit Guidelines for MURB Sector

HEAT PUMP RETROFIT GUIDELINES FOR THE MURB SECTOR

Final Report

Prepared for: Retail Customer Relations

Ontario Hydro Services Company

Eatons Centre

Suite 700, 250 Yonge Street

P.O. Box 7 Toronto, Ontario

M5B 2L7

Att: R.D. McKellar, P.Eng.

Senior Account Executive

Business Markets, Products and Services

Prepared by: Caneta Research Inc.

7145 West Credit Avenue Suite 102, Building 2 Mississauga, Ontario

L5N 6J7

Reviewed by: Wayne Ruhnke

Project Leader, EE Comm/Res

Ontario Power Generation Technologies

October 1999

SUMMARY

The MURB sector in Ontario is estimated to have almost 1,000 buildings (250,000 ft²) with about 120 million square feet of floor space, in excess of ten years of age, with electric baseboard heating. This project investigated both suitable heat pump equipment for retrofit to these buildings and Guidelines were developed to identify further opportunities in the sector.

The technical potential customer electricity savings are estimated to be \$19,619,000 per year. The retrofits to achieve those savings are estimated to involve a capital outlay of approximately \$150,000,000.

There are a wide range of through-the-wall, package terminal and mini-split heat pumps available from fourteen manufacturers for the retrofit market. Further work is required to explore more optimal control of electric baseboard heaters when used in conjunction with these heat pump units.

The Guidelines should be developed into a window-based screening software program which Custom Solution's staff could use to assess MURB opportunities. The software could also be marketed to other utility service companies in Canada and the United States.

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APPENDIX A

Apartment Heating and Cooling Energy Use and Peak Loads – Toronto, Ottawa, Windsor

APPENDIX B

Heat Pump Energy Savings – Base Conditions – Toronto, Ottawa, Windsor

APPENDIX C

Life-Cycle Cost Analysis of Heat Pump Performance – Toronto, Ottawa, Windsor

APPENDIX D (Separately Bound)

Heat Pump Equipment for MURB Retrofit

APPENDIX E (Separately Bound)

Supplementary Results

1. CONCLUSIONS

The MURB sector is estimated to have almost 1000 buildings (> 50,000 ft²) with about 120 million square feet of floor space, in excess of ten years of age, with electric baseboard heating with potential for heat pump retrofit. About 70 of these buildings are estimated to have had terminal air-conditioning units that can be replaced with either PTHPs or through-the-wall heat pumps. The remainder, in 1987, either had no air-conditioning or tenant owned window air-conditioners – prime candidates for heat pump retrofit. The technical potential customer electricity savings are conservatively estimated to be \$19,619,000 per year. Assuming a payback period of 7.5 years, this represents a capital outlay of approximately \$150,000,000.

There are fourteen manufacturers of PTHPs, through-the-wall heat pumps and mini-split heat pumps with a range of performance and application capabilities. This project resulted in the preparation of a 395 page product manual containing all the information necessary for Custom Solutions to evaluate and implement projects in this sector.

Further follow-up would be required to work with terminal type, mini-split and specialty indoor unit manufacturers such as First Company, to explore the options available to integrate control (or more optimally control) electric baseboard heaters in these units.

Life-cycle analysis of the heat pump options revealed a number of attractive retrofit cases. Paybacks are often well under ten years for individual apartment sizes and orientations. The PTAC with gas-fired furnace was found to have comparatively long payback periods suggesting that it is not a competitive threat to electric heat pump retrofits at this time.

The Guidelines can be used to estimate energy savings with one particular type of heat pump make or type or a variety of types in a given building or complex of buildings. The Guidelines result in more accurate sizing of heat pump units which allow for capital savings without sacrificing comfort. Economics of any heat pump retrofit can be readily estimated using the Guidelines. An example on a Toronto apartment complex demonstrated potential energy savings of \$114,000; by better sizing with the model \$245,000 was reduced from the replacement cost.

The total business opportunity (in terms of capital outlay) was estimated to be \$150,000,000, suggesting MURBs be included as a portfolio.

2. RECOMMENDATIONS

The Guidelines can be developed into a window-based (VISUAL BASIC) screening software program which will make the Guidelines application more user friendly than the hard-copy version. The important information from the equipment manual could be included within the program as well. Such a development would provide Custom Solutions with a unique tool for use within its own sales territory and with further development, potentially a lucrative package to market to other utility services companies in Canada and the United States.

A subsequent phase should involve discussions with heat pump and control manufacturers to investigate further the technical barriers and options to better integrating the control of electric baseboards with these heat pumps and to estimate the costs of the control options for retrofit.

Similar Guidelines could be developed for other building sectors where opportunities exist for heat pump or other HVAC retrofits.

3. INTRODUCTION

The Forest Laneway investigation revealed the performance shortcomings of existing heat pump units intended for retrofit to existing MURB buildings. These shortcomings included limited operating range due to inability to defrost and dispose of condensate under winter operating conditions and difficulty to use in conjunction with existing electric baseboard electric heaters.

The objective of this phase of the investigation was to identify suitable heat pump equipment for MURB retrofit and to develop a retrofit guide for staff to use in identifying future opportunities.

The scope of the work included:

- quantifying the electric heating/cooling equipment demographics in the existing MURB sector in the Greater Toronto area;
- identifying the heat pump retrofit options and other (gas) alternatives suitable for replacing existing terminal cooling units;
- sourcing available heat pump equipment and assembling into a directory with information on benefits, and features, performance specifications, physical dimensions and other information;
- predict heating and cooling loads, energy cost savings for each situation, retrofit options/ alternatives and estimate life-cycle owner economics for the applicable heat pump configurations.

4. PROCESS/METHODOLGY

The market data was identified from a number of somewhat dated reports but the best available. The Guidelines for MURB retrofit were based on simulation results for a typical MURB model building using the building energy analysis program DOE 2.1E. Heat pump modelling was undertaken using a bin method procedure developed by Caneta Research Inc. The life cycle cost analysis involved the use of a spreadsheet developed for this purpose by Caneta Research Inc. for NRCan's Commercial Building Incentive Program Guidelines. Equipment costs were sourced from MEANs. The equipment product information was obtained from manufacturers and distributors of heat pump equipment via the internet and telephone.

5. RESULTS

5.1 ELECTRIC HEATING/COOLING EQUIPMENT DEMOGRAPHICS

This investigation was to quantify the electric heating/cooling equipment demographics in the existing MURB sector in both the Greater Toronto area and other major centres in Ontario. This would allow for an estimate of the potential retrofit market for terminal and mini-split heat pumps.

5.1.1 Estimate of MURB Floor Space

In its 1990 Commercial Sector End-Use Forecast, Ontario Hydro [1] estimated that there was 839 million square feet of floor space in the multi-unit residential sector in Ontario. Marbek Resource Consultants [2] estimated that within the city of Toronto alone there was 107 million square feet of floor space in the multi-unit residential sector. The latter was split between social housing (16%) and private apartments (84%).

Another source [3] estimated there were 5578 multi-unit residential buildings in Ontario with greater than 50,000 ft². The floor area of these buildings was reported as 666 million square feet. This represents the majority of the floor space in this sector in Ontario – about 80% of the estimate from [1] and will be used in the assumptions.

5.1.2 Estimate of the Potential Retrofit/Replacement Market for Terminal Heat Pumps

A study in 1987 by Market Facts of Canada Ltd. for Ontario Hydro [4] identified that 50% of a 427 multi-residential building sample was air-conditioned. Of these buildings, 65% had tenant owned equipment. These were assumed to be window air-conditioners. Another 23% were classed as central air-conditioning systems. The remainder (12%) were said to be individual air-conditioning units owned by the building. The latter are assumed to be either PTAC or through-the-wall air-conditioners, the primary product of interest from a retrofitting standpoint.

If we assume that this same penetration applies across the entire multi-unit residential building sector in Ontario, there are estimated to be about 335 buildings (each with greater than 50,000 square feet) totalling 40 million square feet of floor space with terminal type air-conditioning.

The next step is to estimate how many of these buildings have electric resistance heating. Marbek [2] estimated there was a 20% penetration of electric heating in the apartment sector in Toronto in post-1970 buildings. Market Facts [4] found that 18% of the buildings in their survey were electrically heated with baseboards.

If one uses the Marbek [2] estimate of 20% penetration and applies it to the estimated number of buildings with terminal type air-conditioning, the estimated potential market for heat pump retrofit into electric baseboard heated MURBs in Ontario is 67 buildings (>50,000 ft²) with a estimated floor space of 8 million square feet.

5.1.3 Estimate of the Potential Retrofit Add-on Market for Heat Pumps in the MURB

Sector

It is technically possible that heat pumps could be retrofitted into all MURB buildings with electric resistance heating. Some of these may have tenant owned window air-conditioners or no air-conditioning at present. From section 5.1.2, electric baseboard heating is used in 20% of all buildings in the sector. This represents 1115 buildings in Ontario with over 50,000 ft². Of these buildings, subtract those that have central air-conditioning systems – 128. That leaves a technical potential of 982 buildings ($> 50,000 \text{ ft}^2$) or 117 million square feet of floor space with electric baseboard heating that have either no air-conditioning, terminal air-conditioners or tenant owned window air-conditioners and would be candidates for one of the heat pump retrofit options analysed here.

5.1.4 Estimate of Energy Savings for Heat Pump Retrofit in the MURB Sector

The opportunity for heat pump retrofit can be expressed in terms of potential customer electricity dollar savings. Assuming an average suite area of 820 ft²; that the average heating/cooling savings in the 67 buildings from Section 5.1.2 is 2500 kWh and the heating only savings from Section 5.1.3 is 1925 kWh, savings can be estimated as follows:

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Total savings = [(2500)(9756) + (1925)(132,926)] \times .07
= $19,619,000 per year
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This is based on packaged terminal heat pump (> 25°F) performance. Mini-split heat pump savings would be much larger.

5.2 RETROFIT OPTIONS/ALTERNATIVES FOR TERMINAL COOLING UNITS

There are a number of terminal type configurations (heating/cooling) used in existing MURB buildings. The configurations of interest include:

- electric baseboards with through-the-wall air-conditioners,
- electric baseboards with package terminal air-conditioners (PTAC),
- electric baseboards with window air-conditioners.

The heat pump retrofit add-on options and competing alternatives (gas) for these configurations include the following:

- a through-the-wall heat pump to replace an aging through-the-wall air-conditioner;
- a modern package terminal heat pump to replace an aging package terminal air-conditioner;

- a mini-split or ductless heat pump to use in any of the existing configurations;
- an electric cooling, direct vent gas furnace package terminal unit from Suburban to replace an existing PTAC or through-the-wall air-conditioner;
- a mini-split or ductless heat pump employing a natural gas burner (similar to kool-fire) in the outdoor unit (Sanyo) to use in any of the existing configurations.

Indoor distribution systems used with the heat pump retrofit options and competing alternatives include:

- **ducted** in the case of some PTHPs to allow for conditioning of more than one room;
- **vertical or horizontal DX fan-coil** (closet, valance or above corridor ceiling location) with ductwork to conditioned spaces in apartment in the case of mini-split heat pump outdoor unit. One group, First Company, produces a range of indoor configurations to use with any manufacturer's heat pump.
- **ductless** in the case of conventional mini-split heat pump with wall-mounted or ceiling mounted indoor unit or a through-the-wall heat pump.

Temperature control of supplementary heat and heat pump operation can be optionally controlled from a remote wall mounted thermostat with most PTHPs and through-the-wall heat pump equipment. In most cases, the second stage of these wall mounted thermostats could be used to control electric baseboards. Mini-split heat pumps are not designed at present to be used in conjunction with electric baseboard heaters.

5.3 AVAILABLE HEAT PUMP EQUIPMENT

Data on available equipment was obtained either from the manufacturer's website or from a local distributor/representative. The resulting product information is assembled in an equipment manual (Appendix D) which includes a detailed table of contents and a list of other information sources. Fourteen manufacturers are included.

The equipment manual is divided into four parts:

- Packaged Terminal Heat Pumps (PTHP),
- Through-the-Wall Heat Pumps,
- Mini-Split Heat Pumps,
- Indoor Unit Configurations Compatible with Other Heat Pump Outdoor Units.

The packaged terminal and through-the-wall heat pump parts are sub-divided into >35°F and <35°F sections, indicating the defrost capabilities of the unit. Each part or section is subdivided by manufacturer, under which further information is listed.

This information includes specifications, special features, and, in most cases, dimensional and installation details.

The organizational format allows an easy comparison between available units, for the purpose of replacing a given air-conditioning unit with a heat pump.

5.4 PREDICTED ENERGY COST SAVINGS/OWNER ECONOMICS

5.4.1 Predicted Heating and Cooling Loads

Four different apartment types (bachelor, one, two, and three bedroom) were modelled using the DOE 2.1E building energy analysis program to obtain both peak and annual space heating and cooling loads. The four apartments were assumed to have 500, 650, 1000 and 1500 ft² of floor area respectively. These values were taken from actual apartment building architectural design drawings which Caneta Research has used in previous simulation studies.

The apartments were assumed to have a depth of 25 feet with the length varied to obtain the necessary floor area. Corner apartments were the exception and these were assumed to be square with window area divided equally between the two walls. All apartments had 21 ft² of exterior door area.

The base or average case for modelling purposes was assumed as follows:

- an external window to wall ratio of 25%, based on a range of values observed in CMHC studies for low- and high-rise MURBs;
- the overall wall U-value was assumed to be 0.55 W/m²°C which represents an overall R-value of approximately ten;
- internal loads, including equipment and appliances, were assumed to be 410 watts for the bachelor apartment and 442, 522 and 636 watts respectively for the one, two and three bedroom apartments:
- ventilation was assumed to be 45 cfm per apartment, preheated by a corridor ventilation system and supplied through apartment door cracks;
- infiltration rate was assumed to be 1.39 l/s/m² of exterior wall area.

Variations in each of the above parameters representing minimum and maximum anticipated values were also modelled using DOE 2.1E. These are contained in a separately bound Appendix (Appendix E). In total, almost 300 hour-by-hour simulations were undertaken. This report only presents the results from the **average** case.

The four single exterior wall apartments facing the four principal directions (N, S, E, W) and the two and three bedroom units on four corners (NW, NE, SE, SW) were analysed in three Ontario

locations - Ottawa, Toronto and Windsor.

The DOE 2.1E energy simulation results are summarized in Appendix A. The predicted annual heating and cooling loads on the equipment and the peak loads for equipment sizing are presented in the two tables in Appendix A.

5.4.2 Heat Pump Energy Savings

The following efficiency levels were assumed for the original air-conditioning unit and for the various heat pump/alternative retrofit options analysed.

	EER	COP@47°F	COP@17°F	SSE**(%)
Existing* air conditioner	6.1	-	-	-
Standard efficiency PTHP	8.8	2.6	2.3	-
High efficiency PTHP	10.5	3.2	2.5	-
Standard efficiency ductless HP	9.5	2.8	2.0	-
High efficiency ductless HP	10.5	3.3	2.2	-
Suburban PTAC	8.6	-	-	81

^{*}EER based on 1983 Energy Measures published by NRC.

Through-the-wall heat pumps were assumed to have the same standard and high efficiency ratings as the PTHPs.

Peak cooling and heating load results from the DOE 2.1E simulation runs were used in a bin method procedure to predict the seasonal cooling and heating efficiencies for the various heat pump retrofit options. These are summarized in Table 5.1. These seasonal values were found to be relatively independent of orientation and where applied to the annual heating and cooling loads to calculate the purchased electrical energy. The energy savings compared to the electric heating/electric cooling existing case were then determined. These results are tabulated in the first three tables in Appendix B for the three cities of interest. Tables B-1 to B-21 contain the detailed results of the energy use and savings calculations for the six apartments in the three cities.

^{**}SSE - steady-state efficiency (%).

Table 5.1: Seasonal Heating and Cooling Efficiencies for Heat Pump Options/Alternatives

		Cut-off	Tor	onto	Ott	awa	Win	dsor
			HSPF	SEER	HSPF	SEER	HSPF	SEER
PTAC Base Case	1983 Energy Measure	es -	-	7.88	-	7.97	-	7.98
PTHP	Standard Efficiency	25°F	4.97	11.32	4.30	11.45	5.48	11.46
	High Efficiency	25°F	5.08	14.91	4.36	15.15	5.63	15.16
	Standard Efficiency	35°F	3.91	11.32	3.77	11.45	4.02	11.46
	High Efficiency	35°F	3.97	14.91	3.81	15.15	4.09	15.16
Mini-Split	Standard Efficiency	0°F	6.74	12.46	5.99	12.62	6.83	12.62
	High Efficiency	0°F	7.37	13.47	6.39	13.62	7.5	13.63
PTAC w/gas	Suburban	NA	2.70	8.60	2.70	8.60	2.70	8.60

5.4.3 Predicted Owner Economics

5.4.3.1 Method and Cost Assumptions

Economic evaluation of the different heat pump retrofit options was done by a life-cycle cost analysis. A twenty year life-cycle was assumed with a discount rate of 10%. An electrical rate (run-off rate) of seven cents (CDN) per kWh was assumed for each of the three cities.

Prices for the through-the-wall heat pumps were based on Means [5] data for packaged terminal air-conditioners, and adjusted for heat pumps using data from Carrier. Package terminal heat pumps were based on Means through-the-wall heat pump data. Mini-split prices were based on a single source given for two Friedrich units (Energy Design Update [6]). Packaged terminal air-conditioning units with gas heat was based on Suburban pricing. The cost increase due to higher efficiency is from ASHRAE 90.1 [7]. Note that the authors consider the scaling of this cost increase to be somewhat inflated. This should result in conservative economic results.

All incremental capital costs are with respect to a standard efficiency (EER = 8.8) PTAC unit. This is therefore the baseline to which all alternative equipment is compared. Prices for the baseline unit is from cost data from Means. Since the high efficiency heat pumps are also compared to the same standard efficiency baseline unit, the economics of these heat pumps will not be as attractive as if they had been compared to an air-conditioner of equivalent EER. Installation costs are assumed to be the same as the baseline installation costs for all units except

those requiring a gas connection. For gas an installation cost is added, based on the installed costs of a building retrofitted with electric cool/gas heat units [8].

Table 5.2 presents the costs for the baseline and retrofit alternatives. For the through-the-wall and PTHPs, the standard efficiency level is taken as EER = 8.8 and the high efficiency as EER = 10.5. For the mini-split heat pumps these are 9.5 and 10.5 respectively.

Maintenance costs for through-the-wall and packaged terminal heat pumps are assumed to be the same as the baseline packaged terminal air-conditioner. Mini-split systems are assumed to have greater maintenance costs, however, and this was determined from DCH data [9], adjusted to current costs through comparison of ADM Associates, 1985 [10] results and ADM Associates, 1999 [11] results for split systems. This gives an annual incremental maintenance costs of \$CDN 25.60/ton for mini-split systems over the baseline maintenance costs.

Table 5.2: Equipment Costs (\$CDN)

Equipment Type			Capacity (tons)				
		0.5	0.75	1	1.5	2	
PTAC (baseline)	std.	\$933	\$955	\$987	\$1440	\$1467	
Through-the-wall heat pump	std.	981	1027	1083	1584	1659	
	high eff.	1325	1387	1462	2139	2240	
	std.	1360	1440	1547	2640	2907	
packaged-terminal heat pump	high eff.	1837	1945	2089	3565	3926	
Mini-split heat pump	std.	1755	2316	2877	4000	5122	
	high eff.	2071	2733	3395	4720	6045	
DTA Carried and American	unit cost	1895	1935	1975	2055	2135	
PTAC with gas heat	incr. Inst.	1473	1473	1473	1473	1473	
Con entired with mile	unit cost						
Gas-assisted mini-split	incr. Inst.	1473	1473	1473	1473	1473	

5.4.3.2 Economic Results

Appendix C contains the individual apartment results of the life-cycle cost analysis of the various heat pump options and alternatives. When through-the-wall heat pumps are assumed to have the same annual performance as PTHPs, the owner's actual payback period compared to the existing electric heat/electric cool unit is generally under two years for standard efficiency units and under ten years for high efficiency units. The latter assumed the base case was the standard efficiency air-conditioner (EER = 8.8) and not a high efficiency air-conditioner (EER = 10.5). The payback would be shorter in that case.

The next table presents the individual apartment size economic results for the PTHP unit which cuts-off at 35°F. These are similar to the units installed in the Forest Laneway complex. While

some apartment sizes exhibit actual payback periods under ten years, there are many, particularly the high efficiency (he) cases, over twenty years.

The third table presents the individual apartment size results for the PTHP case where the heat pump unit cut-off is at 25°F. Here the standard efficiency cases always exhibit an actual payback period well under ten years; often seven years or less. The higher cost high efficiency units exhibit an actual payback period between about five and sixteen years. Again, these high efficiency heat pumps are compared to standard efficiency air-conditioners.

The fourth table presents the individual apartment size mini-split or ductless heat pump economics. These units are assumed to operate over the full range of outdoor conditions for the city of Toronto (ie. down to an outdoor temperature of -17°C). The standard efficiency units have an actual payback period between seven and twenty years in most cases, The more expensive high efficiency units have much longer payback periods, generally greater than ten years, often greater than twenty years.

The fifth table presents the individual apartment unit PTAC with direct-fired gas furnace results. These units operate as a PTAC in summer, while in winter, heating is provided from a compact gas-fired, direct-vent furnace. The incremental installed capital cost is significantly higher reflecting the added expense of retrofitting a natural gas service to the building and to the individual suites. Actual payback periods relative to the base case existing PTAC and electric baseboards is greater than 20 years in most cases. Only three bedroom suites with north west and north east orientations exhibit payback periods in the vicinity of ten years.

Generally the economics are better in the large suites, particularly the corner orientations in the north east and north west ends of a building where the heating loads are highest. In section 6 examples will illustrate how to estimate whole building economics.

Similar trends are evident from examination of the remainder of the tables in Appendix C for the other two cities.

5.5 HOW TO USE THE GUIDELINES

Three examples will be presented to illustrate how the results in Appendix B can be used to assess a MURB heat pump retrofit opportunity. The example to which the Guidelines will be applied is a two building complex consisting of 642 apartment units.

Building #1 has 81 bachelor apartments, 170 one bedroom apartments and 113 two bedroom units. Building #2 has 114 one bedroom units, 110 two bedroom and 54 three bedroom apartments. In building #1, there are 2 bedroom apartments on each corner, while in building #2, there are both two bedroom and three bedroom units in the corners.

The apartments are evenly distributed in the principal directions and corner directions. The sizing of the existing fifteen year old PTAC units is as follows:

- bachelor apartments 1.5 tons;
- one bedroom apartments 1.0 ton;
- two bedroom apartments 2.0 tons;
- three bedroom apartments two units, one 1.5 ton and .5 ton.

Three examples will illustrate how to obtain the following estimates for the apartment complex:

- 1. Energy saving comparisons from retrofitting with PTHPs with a cut-off of 25°F and 35°F;
- 2. The potential capital savings for the complex as a result of the more accurate sizing possible with the Guidelines;
- 3. The economics of retrofitting the complex with PTHPs with a cut-off of 25°F for two cases retrofitting where no air-conditioners were before and replacing existing PTACs.

5.5.1 Example 1 - Retrofitting with PTHPs with Cut-off of 25°F and 35°F

This example will illustrate how the Guidelines can be used to compare energy savings in Toronto associated with retrofitting the example apartment complex with PTHPs cutting off at 35°F and 25°F.

This example is summarized in Tables 6.1(a) and 6.1(b). The savings per apartment unit are summarized in the tables. These savings are found in Appendix B, Heat Pump Energy Savings in the Toronto table – base loads. The total number of apartments for each size have been distributed equally in the principal directions and corners. The energy savings for each apartment size are subtotalled and the total savings for the building is shown in the bottom right corner of the table.

It is evident that the annual electricity savings from using the 25°F rather than 35°F cut-off is 799,888 kWh, about \$50,000.

5.5.2 Example 2 - Potential Capital Savings

Table 6.2 illustrates how the more accurate sizing of air-conditioning units, now possible with the Guidelines, can result in capital savings. The same apartment but on a different orientation will experience significantly different loads which can be used to advantage by the Service Company.

Again the different apartment units have been distributed equally in the principal directions and corners. The installed capacity is that of the existing units. The installed capacity is the same regardless of orientation of the suites. It was assumed that if the owner went to another contractor to have the air-conditioning units replaced they would install equivalent capacities to the existing. The required capacity is that determined from the Guidelines, Appendix A, Apartment Peak Loads for Toronto.

The total installed cost savings for this example complex is estimated to be \$245,683. This advantage could be used to prepare very competitive proposals.

5.5.3 Example 3 - Economics of PTHP Retrofit

The last example is shown in Table 6.3. Here the annual energy savings are the same as in Table 6.1(a). This amounts to about \$114,000, as shown at the bottom of Table 6.3. The new PTHP costs are total rather than incremental and are obtained from Table 5.2. This would be the case where Ontario Hydro Services Company install and own the equipment. The simple payback period would be just over ten years. If the replacement costs of new PTACs were included in the economics this payback period would be only 3.6 years.

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