Water Source Heat Pump

Water-to-Water Model WPWD

WSHP-DS-6

Introduction

The WPWD product is a heating and cooling hydronic fluid water-to-water heat pump capable of producing water temperature up to 130 F or temperatures down to 25 F. This extended operating range offers great opportunities in commercial, residential and industrial applications.

There are many load side applications for which the WPWD is suited. Typical usages include:

- ❑ Hydronic baseboard heating
- ❑ Radiant slab heating
- ❑ Space heating or cooling with Trane fan coils
- ❑ Ice and snow removal
- ❑ High volume water heating (non potable)
- ❑ Boiler replacement (@130 F)

In the heating mode, the water-to-water unit efficiently extracts heat from a water source (source side) such as a well, lake, boiler/tower loop or closed ground loop heat-exchanger, then transfers the heat to another flow of water (load side). The amount of heat added to the load side is greater than the amount taken from the source side. The electrical energy supplied to the compressor is added to the output heat of compression.

The Trane water-to-water product package includes:

- ❑ High efficient scroll compressor
- ❑ Compressor protection
- ❑ Water to refrigerant condensing coil
- ❑ Freeze protection
- ❑ Water to refrigerant evaporator coil
- ❑ Expansion valve
- ❑ Filter Drier
- ❑ Reversing Valve
- ❑ Internal desuperheater (optional)

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General

The water source heat pump model WPWD (water-to-water) offers a range of capacities from 2 tons to 6 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. *(See Figure 1)*.

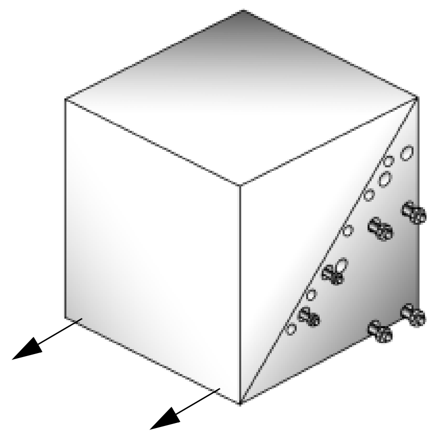

Figure 1: Unit access

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 high efficiency 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. *(See Figure 2 for cut-away)*.

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Figure 2: Brazed plate heat exchanger

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 1-inch brass swivel connectors. Because the connectors are swivel, a back-up wrench is not necessary when tightening.

24 Volt Controls

All electrical controls and safety devices are factory wired, tested, and mounted in the unit. The control package includes:

- Compressor contactor
- 24 Volt transformer
- Lockout relay
- Compressor run capacitor *(1-phase units only)*
- Reversing valve coil *(For heat pump only)*
- Fuse *(for desuperheater)*

A terminal strip with 1/4" fork connections will be provided for field thermostat control wiring. *(See Figure 3)*.

Safety Devices

Each Trane water-to-water unit contains safety devices to prevent compressor damage. These include:

- Low pressure switch
- High pressure switch
- Temperature sensor *(freezestat)*
- Internal overload protection

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 de-energizes the compressor when discharge pressure become excessive.

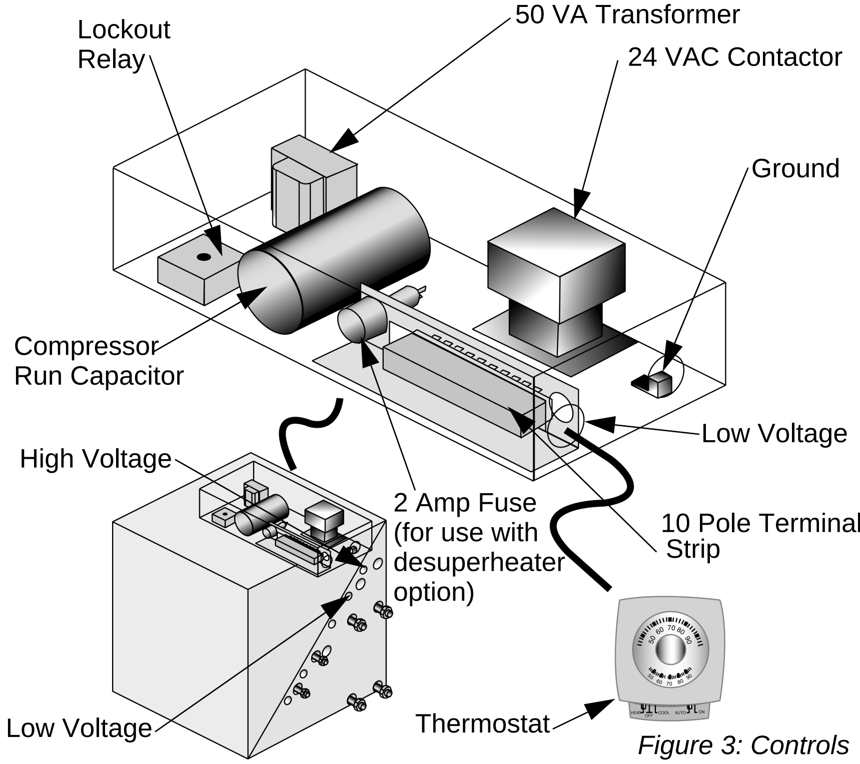


Figure 3: Controls

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 Hook-up

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. *(See Figure 4 for termination points*).

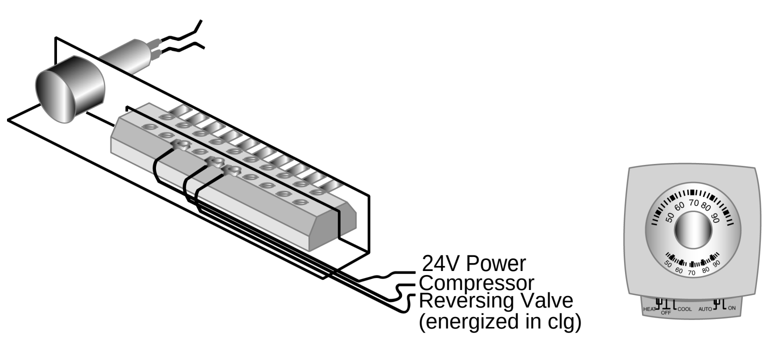


Figure 4: Typical thermostat termination points

Features and Benefits

Heat Recovery

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.

Standard equipment includes:

- ❑ Desuperheater (heat exchanger)
- ❑ Circulating pump
- ❑ Entering water temperature detector *(125 F stops pump)*
- ❑ Discharge refrigerant temperature detector *(145 F starts pump)*
- ❑ Fuse
- ❑ Water heater hook-up kit

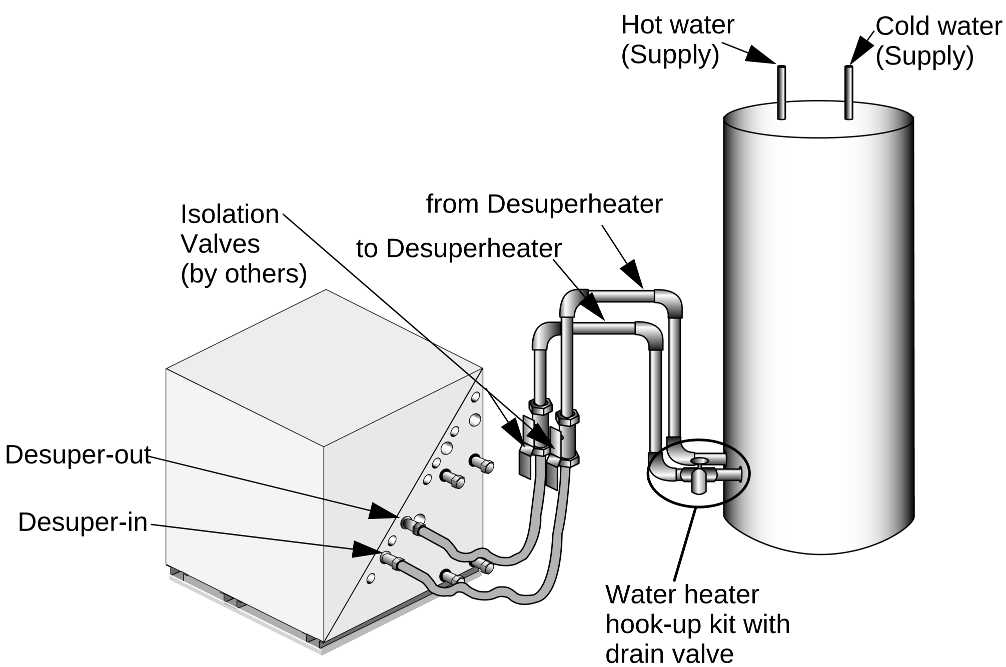
The unit employs a circulating pump to move water through a double wall heat exchanger. It then returns the heated water to the water tank. This water is heated by superheated refrigerant discharge gas from the compressor. This heat energy can now be utilized as a cost savings in water heating.

Circulating Pump

The pump is a circular, single stage open system pump. Its specifications include:

- ❑ 1/25 HP (horsepower)
- ❑ 230 Volt / 60 Hertz / 1 phase
- ❑ 90 Watts
- ❑ .40 Amps
- ❑ 2865 rpm (revolutions per minute)
- ❑ 2 MF (microfarad) / 400 Volt capacitor

The pump contains a minimum fluid temperature rating of 50 F, a maximum fluid temperature (open system) of 140 F, and a maximum working pressure of 145 psi.



Model Number Description

WP W D 042 1 0 B 2 2 1 0 0 T

1 5 10 15

Digits 1 & 2: Product Type
WP = Trane Commercial Water Source Heat Pump

Digit 3: Product Configuration
W = Water-to-Water

Digit 4: Development Sequence D

Digits 5-7: Unit Nominal Capacity
024 = 24.0 MBh
036 = 36.0 MBh
042 = 42.0 MBh
048 = 48.0 MBh
060 = 60.0 MBh
072 = 72.0 MBh

Digit 8: Voltage / Hertz / Phase
1 = 208-230/60/1
3 = 208-230/60/3
4 = 460/60/3
5 = 575/60/3
6 = 220-240/50/1
7 = 265/60/1
9 = 380-415/50/3

Digit 9: Unit Arrangement
0 = Water-to-Water

Digit 10: Design Sequence C

Digit 11: Freeze Protection *(source side)*
1 = Brazed Plate Heat Exchanger with 35 F (1.67 C) Freezestat
2 = Brazed Plate Heat Exchanger with 20 F (-6.67 C) Freezestat

Digit 12: Freeze Protection *(load side)*
1 = Brazed Plate Heat Exchanger with 35 F (1.67 C) Freezestat
2 = Brazed Plate Heat Exchanger with 20 F (-6.67 C) Freezestat

Digit 13: Desuperheater Option
0 = No Desuperheater
1 = With Desuperheater

Digit 14: Open
0 = Open Digit

Digit 15: Open
0 = Open Digit

Digit 16: Sticker Option
T = Trane
C = Command-Aire

General Data

Table G-1: Physical Data (English)

Model: WPWD		024	036	042	048	060	072
Unit Size	Width of cabinet (in)	23	23	23	23	23	23
	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
Compressor	Type	Scroll	Scroll	Scroll	Scroll	Scroll	Scroll
R-22	Refrigerant (lbs)	3.25	3.375	3.50	4.00	4.25	4.25
Approximate Weight (lbs)	With crate (lbs)	163	183	203	214	244	277

Table G-2: Specifications (English)

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

Note:

- ❑ *Source EWT (entering water temperature) is at 75 F*
- ❑ *Unit selection should be based upon extended specifications at lowest or highest expected source and load EWT (entering water temperature)*
- ❑ *Refer to pages 19-25 for extended performance tables.*

Closed Loop System

Closed loop systems (both ground source and surface water) provide heat rejection and heat addition to maintain proper water source temperatures.

Operating and maintenace cost are low because an auxillary fossil fuel boiler and cooling tower are not required to maintain the loop temperature. The technology has advanced to the point where many electric utilities and rural electric cooperatives are offering incentives for the installation of geothermal systems. These incentives are offered because of savings to the utilities due to reduced peak loads that flatten out the system demand curve over time.

For ground source geothermal systems, *(See Figure 5)*, when building cooling requirements cause loop water temperatures to rise, heat is dissapated into the cooler earth through buried polyethylene pipe heat exchangers. If reversed, heating demands cause the loop temperature to fall, enabling the earth to add heat to meet load requirements.

Where local building codes require water retention ponds for short term storage of surface run-off, a ground source surface water system, *(See Figure 6)*, can be very cost effective. This system has all the advantages as the geothermal system in cooling dominated structures.

Another benefit of the ground source system is that it is environmentally friendly. The loop is made of chemically inert, non-polluting polyethylene pipe. The heat pumps use HCFC-22 refrigerant, which has a lower ozone depletion potential than CFC-12. Because the closed loop system does not require a heat adder, there are no CO_2 emissions. Less electric power consumed reduces secondary emissions from the power plant. Therefore, the system offers advantages not seen by other central furnace or heat pump systems.

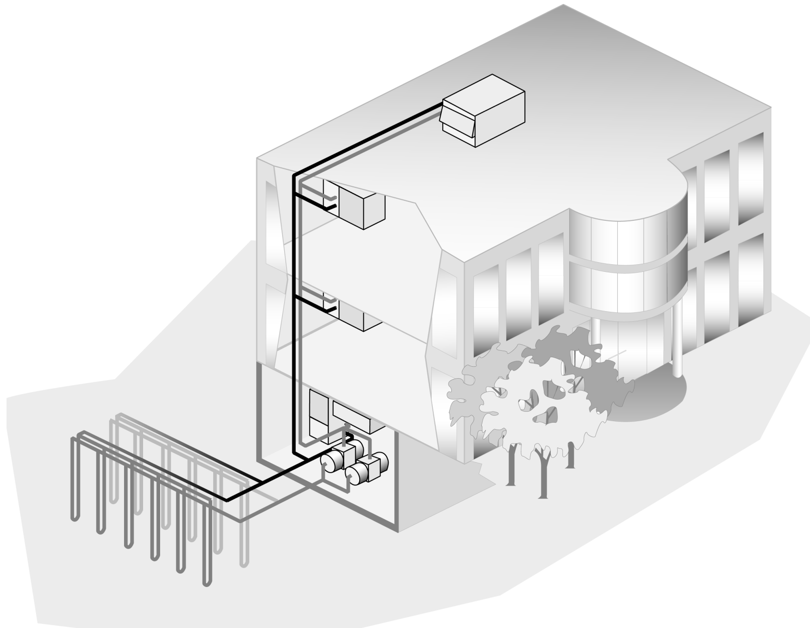


Figure 5: Ground source geothermal system

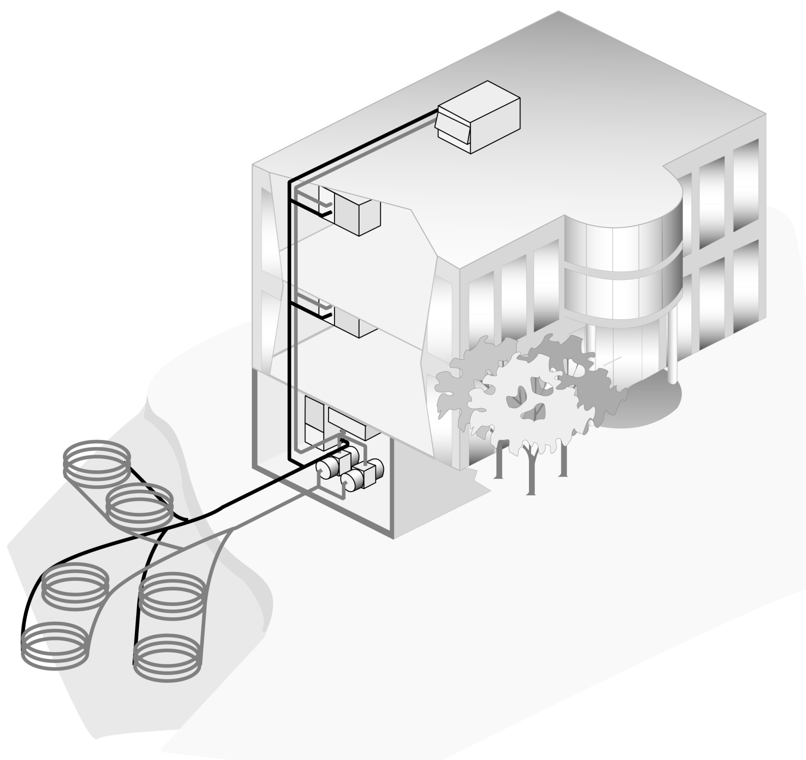


Figure 6: Ground source surface water system

Application Considerations

Open Loop System

Where an existing or proposed well can provide an ample supply of suitable quality water, ground water systems may be very efficient. *(See Figure 7)*

Operation and benefits are similar to those for closed loop systems. There are however several considerations that should be addressed prior to installation.

- ❑ An acceptable way to discharge the significant volume of used water from the heat pump should be defined. It may be necessary to install a recharge well to return the water to the aquifer.
- ❑ Water quality must be acceptable, with minimal suspended solids. To help ensure clean water, a straining device may be required.

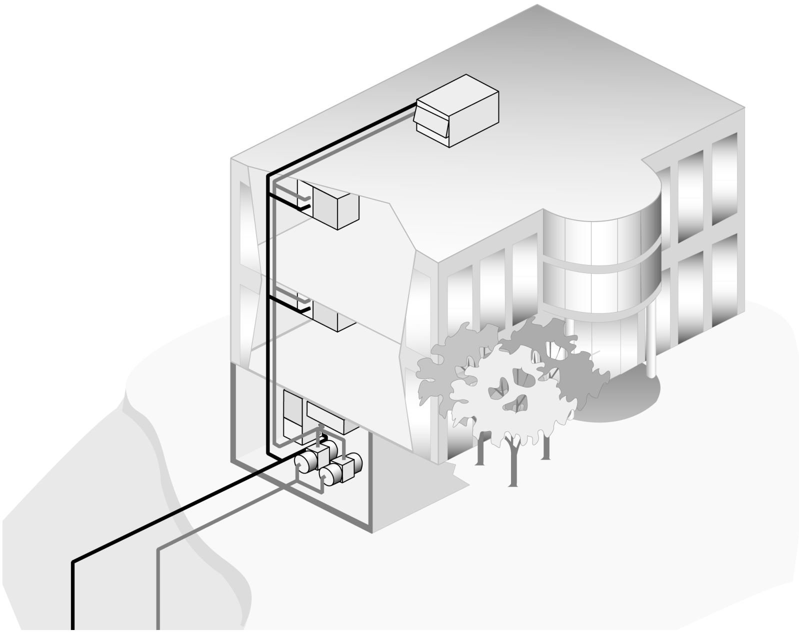


Figure 7: Open Loop system

Cooling Tower/Boiler System

A cooling tower/boiler system *(see Figure 8)* utilizes a closed heat recovery loop along with multiple water source heat pumps in a more conventional manner.

Typically, a boiler is employed to maintain closed loop temperatures above 60 F and a cooling tower to maintain closed loop temperature below 90 F. All the units function independantly, either by adding heat, or removing heat from the closed water loop, making this system more efficient than air cooled systems.

The cooling tower/boiler system provides a low installation cost to the owner than other systems. A good selection for large building design needs.

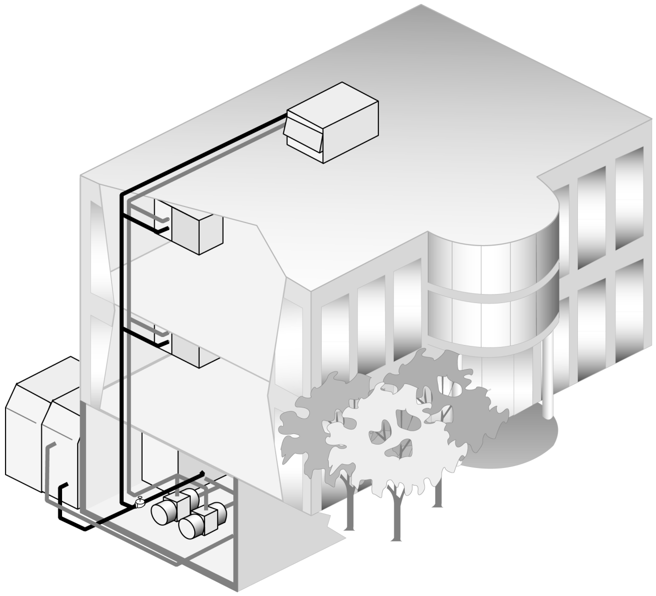


Figure 8: Cooling tower/boiler system

Source vs. Load

The model WPWD water-to-water system contains two water to refrigerant heat exchangers. The two heat exchangers enable the system to be divided into a source and load separation.

The "source side" heat exchanger performs as in a standard water to air heat pump system. The source is typically supplied through a cooling tower, boiler, closed loop, or open well system. During the refrigeration cycle, heat is transferred from the source side heat exchanger to the load side heat exchanger.

The "load side" heat exchanger takes the place of a DX (direct expansion) air coil. It provides treated fluid (hot or cold) to a mechanical device. These mechanical devices include designs such as radiant slab heating, hydronic coils, or fresh air ventilation units.

See *Figure 9* for a basic schematic of source side verses load side of a water-to-water system.

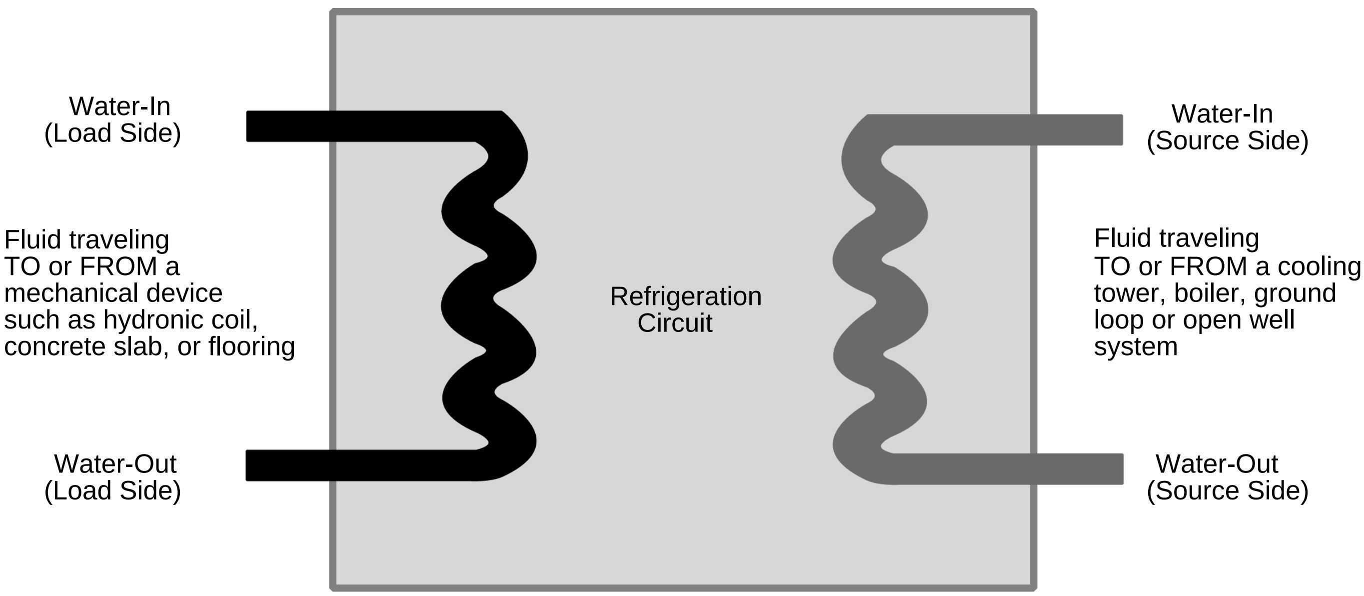
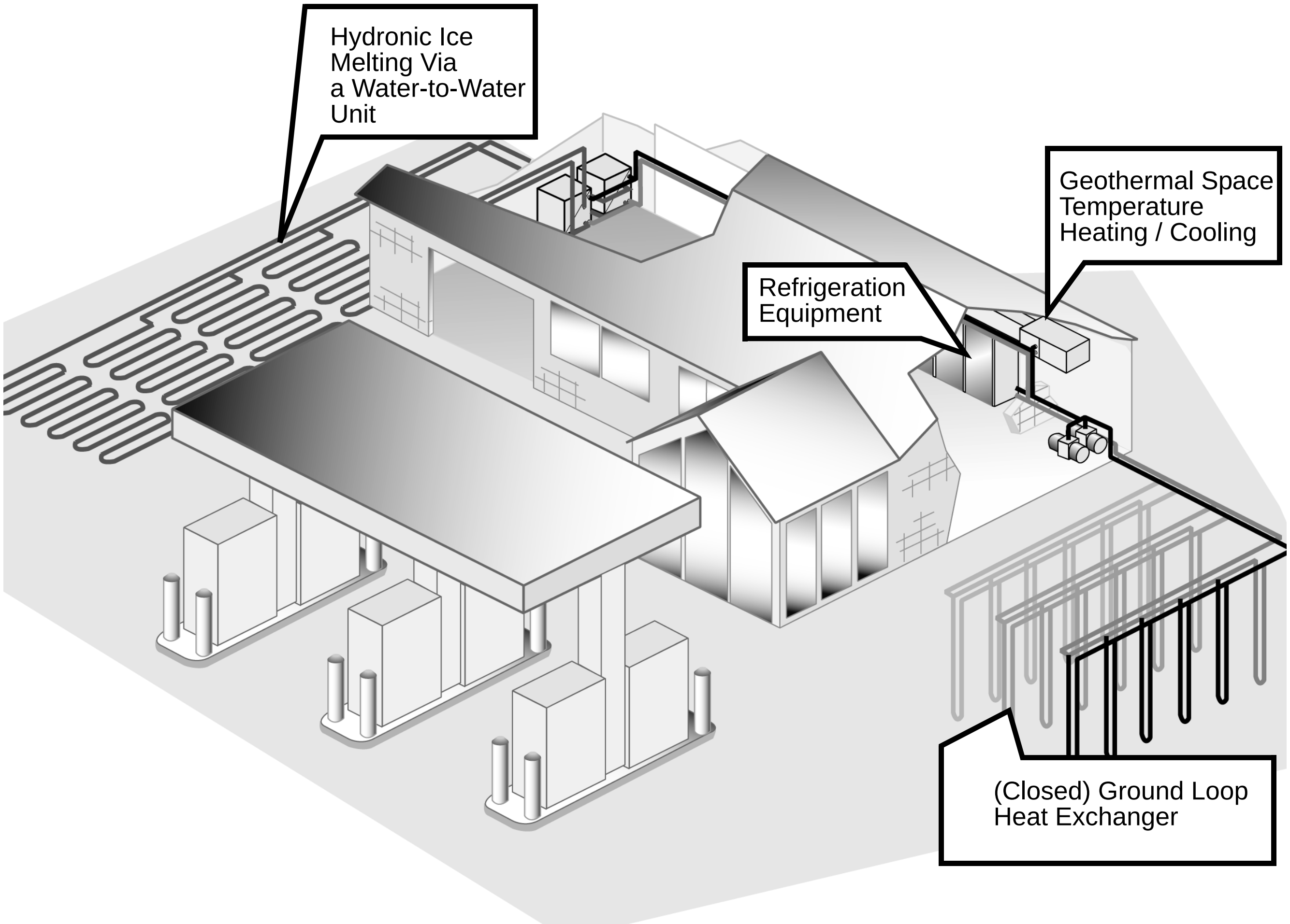


Figure 9: Source/Load schematic



Geothermal Integrated System

The Trane ground source heat pump is highly efficient in service station applications.

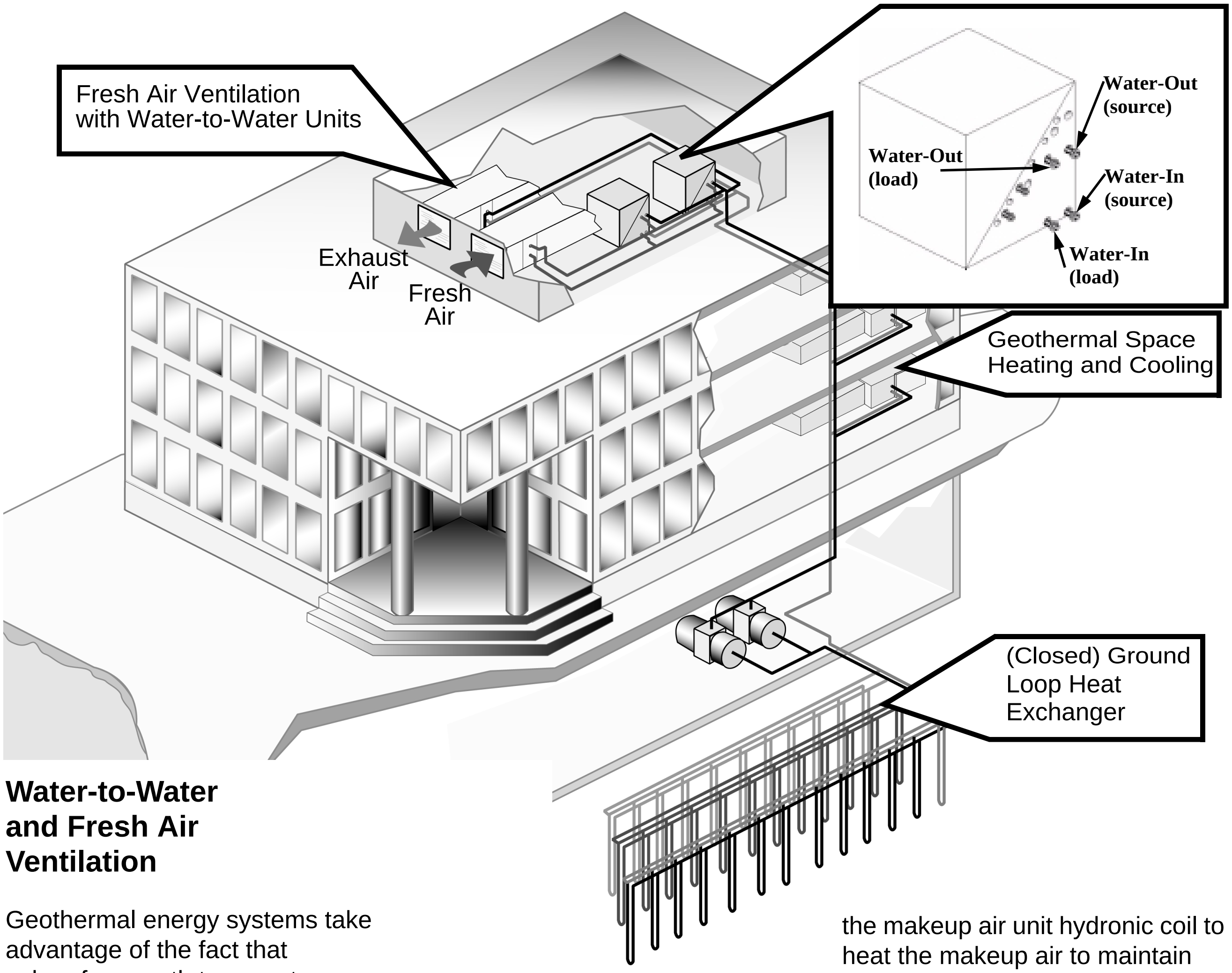
This integrated system design takes advantage of the earths relatively constant temperature (45 F to 70 F) to space condition the building. In addition, appliances such as freezers, ice makers and a display coolers may be added to the loop for further gains in the reduction of consumed energy.

Cold climates may take an even greater advantage of the heat rejected by the stores refrigeration equipment and space conditioning heat pumps. This rejected heat may be used by Trane's water-to-water heat pump(s) to heat water for a car wash and melt ice off of a driveway (allowing the car wash to remain open all winter).

This integrated system also eliminates thermal short circuiting between the intakes and the exhausts of an air cooled refrigeration system.

Typical Benefits

- Annual energy savings means lower operational costs
- Takes advantage of the earths constant temperature rather than high fluctuation of ambient temperature
- Heat energy rejected from the space conditioner can be utilized for ice or snow melting of a parking lot in colder climates
- **Two to three year estimated payback on installation costs**



Water-to-Water and Fresh Air Ventilation

Geothermal energy systems take advantage of the fact that subsurface earth temperatures are constant year-round, which makes the earth an ideal heat source and heat sink for heat pumps.

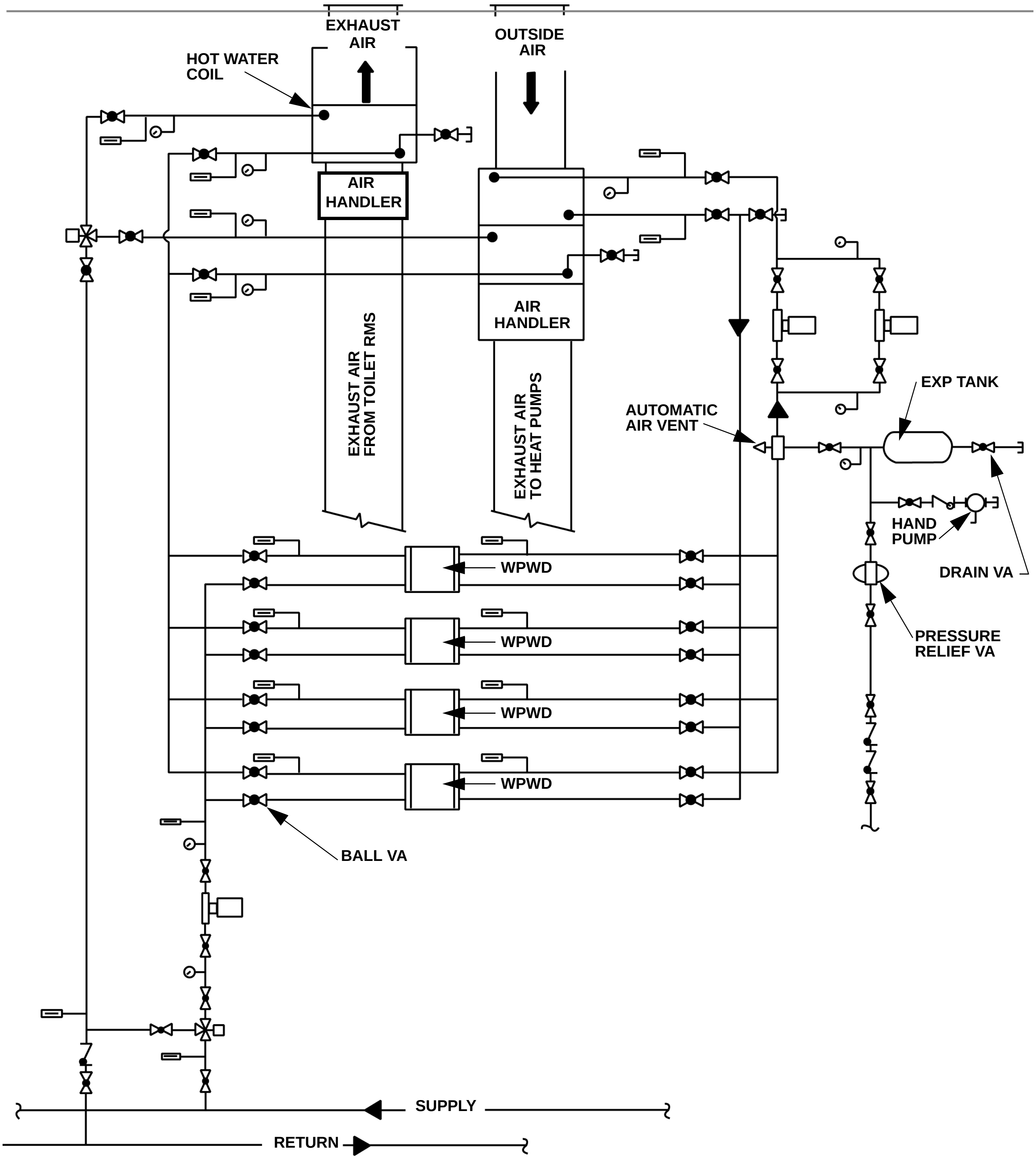
The above design goes further than just space heating and cooling. Fresh air ventilation is achieved by using Trane water-to-water units teamed with a hydronic outside air unit, and exhaust air unit to meet total building requirements.

In the cooling season, the evaporator water from the heat pumps is circulated through a hydronic coil in the makeup air unit to provide cooling and dehumidification. The condenser water is used to provide reheat energy to temper the ventilated air in accordance with the building needs. After leaving the reheat hydronic coil, the condenser water is then returned to the building loop for further heat rejection.

In heating, the water-to-water units switch to hot water generation. The water for ventilation air tempering first circulates through the hydronic coil to the exhaust air unit to pick up heat from the building exhaust airstream. The water then circulates through the water-to-water heat pumps for further heat introduction before being used by the makeup air unit hydronic coil to heat the makeup air to maintain building requirements. This ventilation system incorporates its own constant volume pumps to pull system water off the loop and return it. There is no need for additional heat injection using boilers for this system. *(See Page 14 for mechanical example)*.

Typical Benefits

- ❑ Annual energy savings means lower energy costs
- ❑ Building comfort and climate control


EXHAUST AIR
OUTSIDE AIR
HOT WATER COIL
AIR HANDLER
AIR HANDLER
EXHAUST AIR FROM TOILET RMS
EXHAUST AIR TO HEAT PUMPS
EXP TANK
AUTOMATIC AIR VENT
HAND PUMP
DRAIN VA
PRESSURE RELIEF VA
WPWD
WPWD
WPWD
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BALL VA
SUPPLY
RETURN

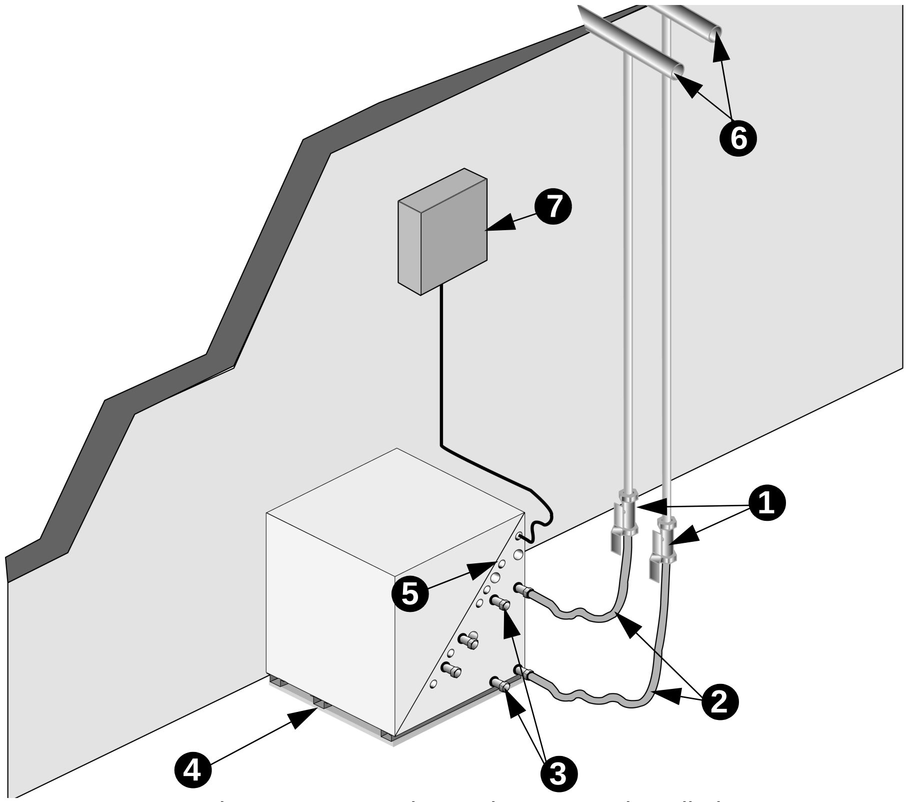

Figure 10: Central pumping system installation

General

A central pumping system involves a single pump design usually located within a basement or mechanical room to fulfill pumping requirements for the entire building system. With a central pumping system, an auxiliary pump is typically applied to lessen the likelihood of system down-time if the main pump malfunctions.
(See Figure 10 for unit installation of a central pumping system).

Central Pump Application

1. **Ball valves** should be installed in the supply and return lines for unit isolation and unit water flow rate balancing (if an automatic flow device is not selected). This connection, along with hoses, are also recommended for backflushing and chemical cleaning of the water to refrigerant heat exchanger.
2. **Flexible hoses** may be used to connect the water supply and return lines to the water inlets and outlets. These hoses reduce possible vibration between the unit and the rigid system.

   Note: Hoses and or pipes should be made of braided stainless steel, and sized suitably for the systems water pressure and flow rate.
3. **Load side connections** are typically used to supply the terminal devices with 45 F or 120 F fluid.
4. The **sound attenuation pad** should be slightly oversized for unit. This field supplied product is recommended for sound absorption of unit.
5. The **low voltage control connection** provided on the unit is large enough for attaching conduit.
6. **The central systems supply and return lines** should be sized to handle the required flow with a minimum pressure drop.
   Note: Pipe will sweat if low temperature water is run through the supply or return lines. Trane recommends that these lines be insulated to prevent damage from condensation.
7. The field supplied **line voltage disconnect** should be installed for branch circuit protection. The unit is supplied with an opening for attaching conduit.

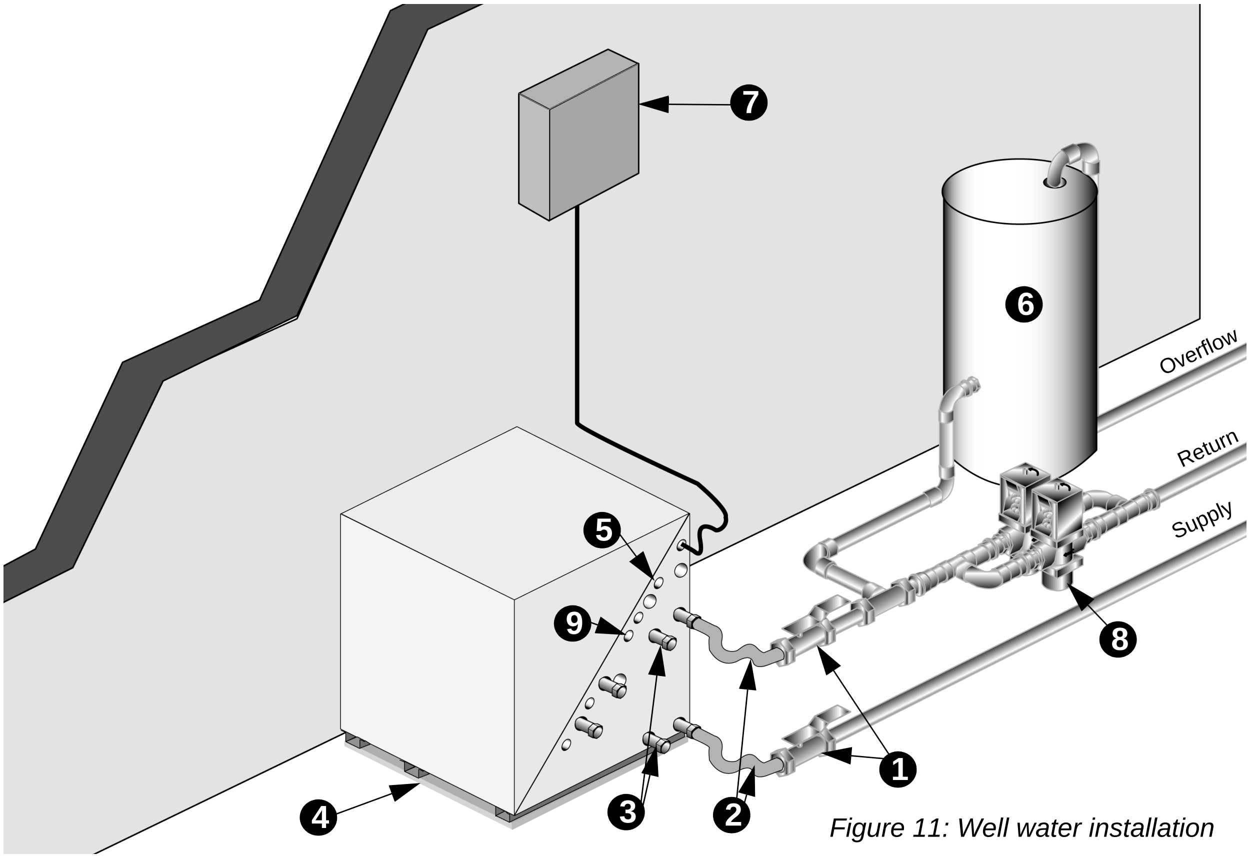

Figure 11: Well water installation

General

A well water application involves an open loop water supply. The water is drawn from an open well or pond into the unit. *A straining device is required with this application.*

Similar to the closed loop design, an open water supply usually remains at a constant temperature year round utilizing maximum efficiency in unit design.

See Figure 11 for open well water installation.

Well Water Application

1. **Ball valves** should be installed in the supply and return lines for unit isolation and unit water flow rate balancing (if automatic flow device is not selected). This connection, along with hoses, are also recommended for backflushing and chemical cleaning of the evaporator and the condenser.
2. **Flexible hoses** may be used to connect the water supply and return lines to the water inlets and outlets. These hoses reduce possible vibration between the unit and the rigid system.
   Note: Hoses and or pipes should be braided stainless steel, and sized suitable for the system's water pressure and flow rate.
3. **Load side connections** are used to supply the terminal device.
4. The **sound attenuation pad** should be slightly oversized for the unit. This field supplied product is recommended for sound absorption of unit.
5. The **low voltage control connection** provided on the unit is large enough for attaching conduit.
6. **The expansion tank** should be sized to maintain pressure on the system.
7. The **line voltage disconnect** should be installed for branch circuit protection. The unit is supplied with an opening for attaching conduit.
8. The **water regulating valve** assembly is used to maintain refrigerant pressure in refrigerant circuit as the entering water temperature varies or is cooler than ideal.
9. **Schrader connections** are factory installed for ease of attaching the water regulating valve assembly.

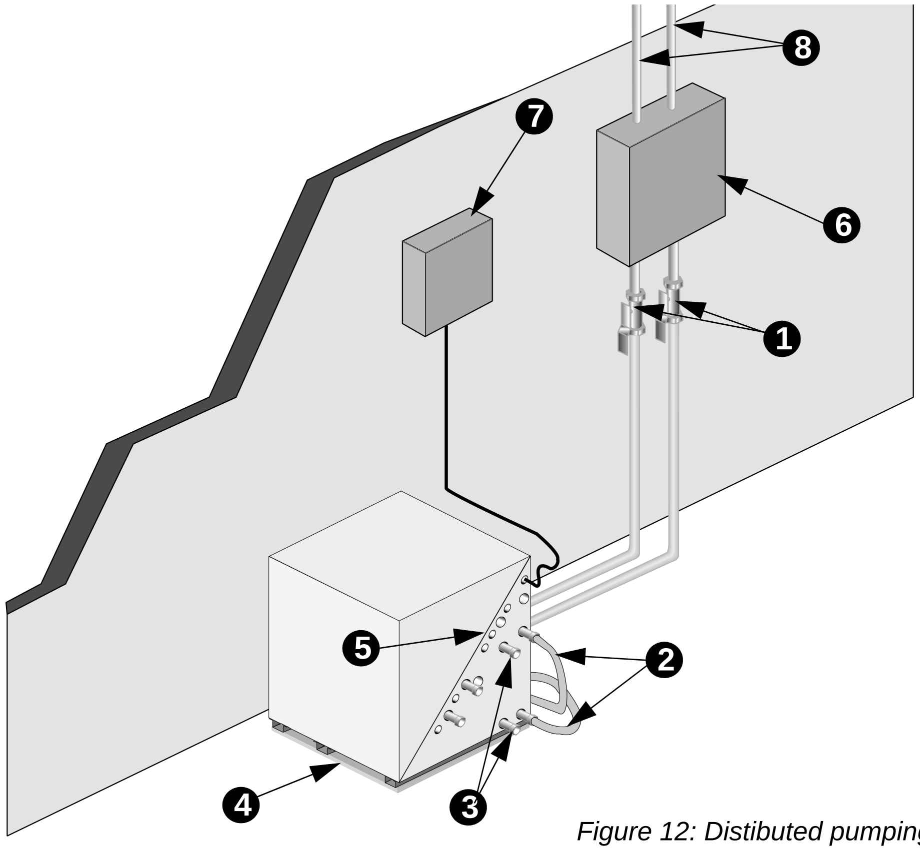

Figure 12: Distibuted pumping installation

General

A distributed pumping system contains either a single or dual pump module connected directly to the units supply and return source side. This design requires individual pump modules specifically sized for each water source heat pump. Centralized pumping is not required.

See Figure 12 for a distributed pumping installation.

Earth Coupled Application

1. **Ball valves** should be installed in the supply and return lines for unit isolation.
2. **Flexible hoses** may be used to connect the water supply and return lines to the water inlets and outlets. These hoses reduce possible vibration between the unit and the rigid system.
   Note: Hoses and or pipes should be braided stainless steel, and sized suitable for the system's water pressure and flow rate.
3. **Load side connections** are used to supply the terminal device.
4. The **sound attenuation pad** should be slightly oversized for the unit. This field supplied product is recommended for sound absorption of unit.
5. The **low voltage control connection** provided on the unit is large enough for attaching conduit.
6. The **ground loop pump module** is designed for circulating commercial loops that require a maximum flow rate of 20 gpm.
7. The **line voltage disconnect** should be installed for branch circuit protection. The unit is supplied with an opening for attaching conduit.
8. All **polyethene** pipe in the closed loop design should be insulated to eliminate the risk of sweating.

Electrical Data

Table E-1: Electrical Data

Model: WPWD	024	036	042	048	060	072
Voltage	208-230/60hz/1phase					
Compressor RLA	11.4	15	18.4	20.4	28	32.1
Compressor LRA	56	73	95	109	169	169
Minimum Circuit Ampacity	16	21	25.8	28.6	39	45
Max Fuse Size	25	30	40	45	60	70
Aux Pump Amps	2.5	2.5	2.5	2.5	2.5	2.5
Desuperheater Min Cir Ampacity	14.3	18.8	23	25.5	35	40.1
Desuperheater Pump RLA	0.4	0.4	0.4	0.4	0.4	0.4
Voltage	208-230/60hz/3phase					
Compressor RLA	-	10.7	11.4	13.9	20	19.3
Compressor LRA	-	63	77	88	123	137
Minimum Circuit Ampacity	-	15	16	19.4	28	27
Max Fuse Size	-	20	25	30	45	40
Aux Pump Amps	-	2.5	2.5	2.5	2.5	2.5
Desuperheater Min Cir Ampacity	-	13.4	14.3	17.4	25	24.1
Desuperheater Pump RLA	-	0.4	0.4	0.4	0.4	0.4
Voltage	460/60hz/3phase					
Compressor RLA	-	5	5.7	7.1	7.5	10
Compressor LRA	-	31	39	44	49.5	62
Minimum Circuit Ampacity	-	7	8	10	10.5	14
Max Fuse Size	-	15	15	15	15	20
Aux Pump Amps	-	2.5	2.5	2.5	2.5	2.5
Desuperheater Min Cir Ampacity	-	6.3	7.1	8.9	9.4	12.5
Desuperheater Pump RLA	-	0.4	0.4	0.4	0.4	0.4
Voltage	575/60hz/3phase					
Compressor RLA	-	-	-	-	6.4	7.8
Compressor LRA	-	-	-	-	40	50
Minimum Circuit Ampacity	-	-	-	-	9	11
Max Fuse Size	-	-	-	-	15	15
Aux Pump Amps	-	-	-	-	2.5	2.5
Desuperheater Min Cir Ampacity	-	-	-	-	8	9.8
Desuperheater Pump RLA	-	-	-	-	0.4	0.4
Voltage	265/60hz/1phase					
Compressor RLA	9.6	14.3	16.4	17.1	-	-
Compressor LRA	47	71	83	98	-	-
Minimum Circuit Ampacity	13.5	20	23	24	-	-
Max Fuse Size	20	30	35	35	-	-
Aux Pump Amps	2.5	2.5	2.5	2.5	-	-
Desuperheater Min Cir Ampacity	12	17.9	20.5	21.4	-	-
Desuperheater Pump RLA	0.4	0.4	0.4	0.4	-	-