

Water-source heat-pump system

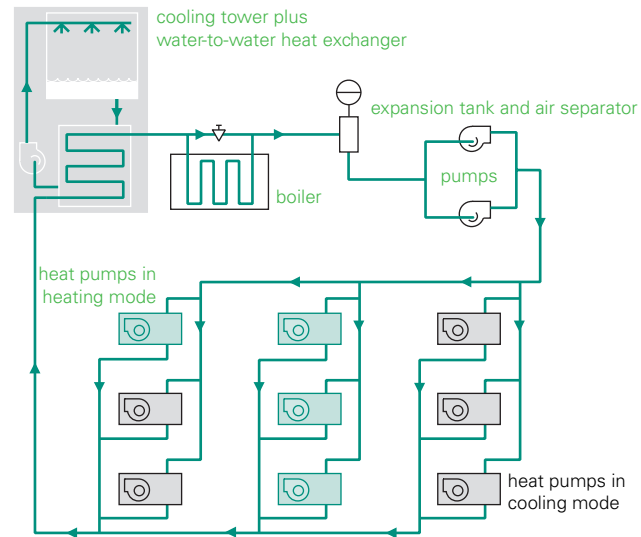


TRACE 700 generates a special report for HVAC designs that include water-source heat pumps. The **Thermal Storage** report provides an hourly profile of ambient conditions, plant-level cooling loads, heat-pump loads and energy consumption, and condenser-loop temperatures.

Water-source heat pumps (WSHPs) transfer heat from air to water and vice versa. Piping the heat pumps together in a common water loop creates a heat-recovery system that can redistribute heat where it is needed—for example, from interior zones to perimeter spaces. This capability saves energy by reducing the operating time of the cooling tower and boiler. It also makes applied WSHP systems popular in commercial buildings that have many spaces with dissimilar cooling and heating needs. In such applications, each space is served by one or more heat pumps and is controlled independently.

WSHP systems readily adapt to the special requirements of speculative jobs, because only the heat pumps required for the initial phase of occupancy must be procured. Additional heat pumps can be purchased, installed, and connected to the loop as needed. This offers the opportunity to meter individual spaces so that the tenants pay the individual operating costs of the spaces they occupy.

Figure 3–18 Applied water-source heat-pump system



Application considerations

- Design the air-distribution system to provide proper ventilation, either locally at each heat pump or centrally using a dedicated ventilation system.
- Heat pumps are situated in or near occupied spaces. Provide appropriate acoustical treatments to ensure that the noise from the compressors and fans is unobtrusive.
- For proper maintenance, heat pumps must be located in accessible areas. In new buildings, this requires coordination with the architect.

Related reading

- *Water-Source Heat-Pump Systems* Air Conditioning Clinic, one of the systems series (Trane literature number TRG-TRC015-EN)
- *Water Source Heat-Pump System Design* Applications Engineering Manual (Trane literature number SYS-AM-7)

Sample scenario

An applied, water-source heat-pump system (one heat pump per room) provides comfort cooling and heating for a multistory commercial building. The pump that circulates water through the common condenser loop is rated for 50 feet of static head. A gas-fired boiler and an auxiliary pump rated for 20 feet of static head serve as a backup if the condenser loop is unable to satisfy the entire heating load.

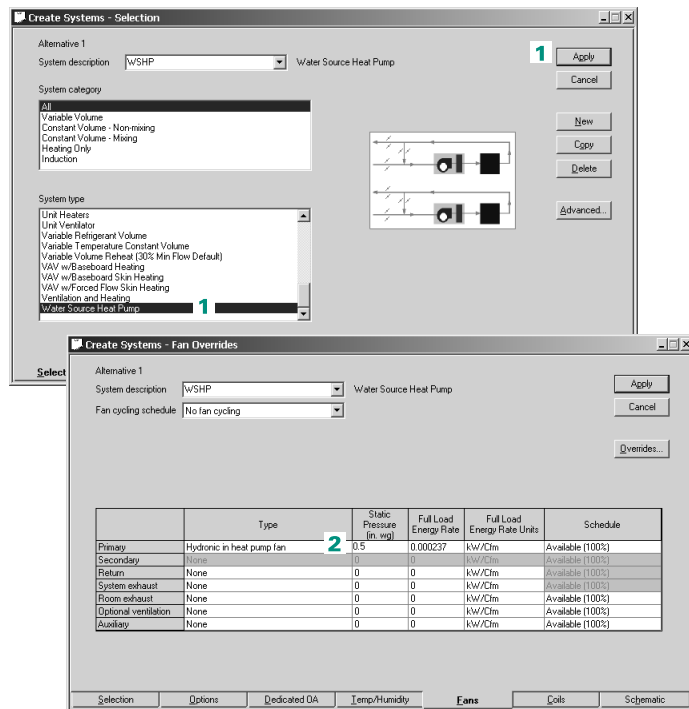
Note: TRACE 700 generates a special report, Thermal Storage, for HVAC designs that include thermal storage. The report provides an hourly profile of ambient conditions and plant-level cooling loads, as well as heat-pump loads, heat-pump energy consumption, and condenser-loop temperatures for hot and cold storage applications

The illustrations on pages 3–70 and 3–71 demonstrate how to model the air-distribution, cooling, and heating functions of the WSHP system and then assign the coil loads.

 To model an applied WSHP system, begin by defining **air distribution**.

1 Pick **Water Source Heat Pump** as the system type. Then click **Apply** to save your entries.

2 On the **Fans** tab, select **Hydronic in heat pump fan** and enter 0.5 for the static pressure.



Create Systems - Selection

Alternative 1
System description: WSHP Water Source Heat Pump
System category: All
System type: Water Source Heat Pump

Create Systems - Fan Overrides

Alternative 1
System description: WSHP Water Source Heat Pump
Fan cycling schedule: No fan cycling

	Type	Static Pressure (in. wg)	Full Load Energy Rate	Full Load Energy Rate Units	Schedule
Primary	Hydronic in heat pump fan	0.5	0.000237	kW/Cfm	Available (100%)
Secondary	None	0	0	kW/Cfm	Available (100%)
Return	None	0	0	kW/Cfm	Available (100%)
System exhaust	None	0	0	kW/Cfm	Available (100%)
Room exhaust	None	0	0	kW/Cfm	Available (100%)
Optional ventilation	None	0	0	kW/Cfm	Available (100%)
Auxiliary	None	0	0	kW/Cfm	Available (100%)

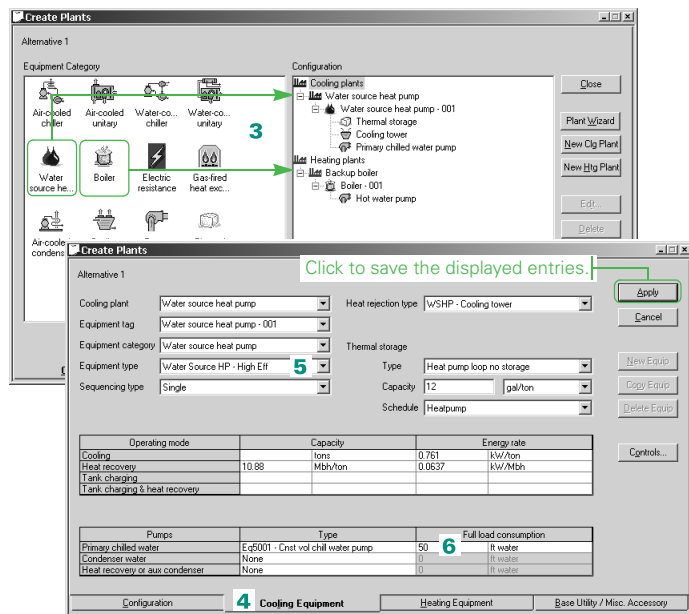
 Next, describe the **cooling and heating plants** represented by the WSHP system and backup boiler.

3 Drag the appropriate icons from the **Equipment Category** section to define each plant. Rename the cooling plant as **WSHP** and the heating plant as **Backup boiler**.

4 Select the cooling plant and click the **Cooling Equipment** tab.

5 Choose the water-source heat pump that best matches the target performance.

6 Enter the **full-load consumption** of the pump that serves the common water loop—the **primary chilled-water pump**, in this case.



Create Plants

Alternative 1

Equipment Category: Air-cooled chiller, Air-cooled unitary, Water-cooled chiller, Water-cooled unitary, Water source heat pump, Boiler, Electric resistance, Gas-fired heat exchanger, Air-cooled condenser

Configuration:

- Cooling plants:
 - Water source heat pump - 001
 - Thermal storage
 - Cooling tower
 - Primary chilled water pump
- Heating plants:
 - Backup boiler - 001
 - Hot water pump

Create Plants

Alternative 1

Cooling plant: Water source heat pump Heat rejection type: WSHP - Cooling tower
Equipment tag: Water source heat pump - 001
Equipment category: Water source heat pump
Equipment type: Water Source HP - High Eff
Sequencing type: Single

Thermal storage: Type: Heat pump loop no storage Capacity: 12 gal/ton Schedule: Heatpump

Operating mode	Capacity	Energy rate
Cooling	tons	0.761 kW/ton
Heat recovery	10.88 MBtu/ton	0.0837 kW/MBtu
Tank charging		
Tank charging & heat recovery		

Pump	Type	Full load consumption
Primary chilled water	Eq0001 - Crst vol chill water pump	50 ft water
Condenser water	None	0 ft water
Heat recovery or aux condenser	None	0 ft water

- 7 Click **Controls** to assign the excess heat from the common water loop to loads served by the heating plant identified as the **energy source**.

Note: Do not remove thermal storage. The water loop is modeled as a special thermal storage type in TRACE 700. Removing the thermal storage eliminates the water loop from the simulation.

This entry identifies the heating plant that will serve as a backup if the heat pumps cannot satisfy the load.

- 8 Be sure to apply your changes. On the **Heating Equipment** tab, pick the boiler that most closely matches the anticipated performance.

- 9 Enter the **full-load consumption** of the pump that circulates hot water from the boiler.

*Note: The **minimum operating condenser temperature** of the selected heat pump (refer to page 3–67) determines when the boiler turns on to maintain the condenser water temperature. To view or alter this entry, use the Library/Template Editors program.*

- 10  Finally, assign each coil load to the appropriate plant.