Commercial and Residential Water Source Heat Pumps

Boiler/Tower and Geothermal Applications

PRODUCT GUIDE

CLIMATEMASTER®
Water-Source Heat Pump Systems

SOLUTION 1

WATER-SOURCE HEAT PUMPS

Water-Loop heat pump systems combine water-source heat pumps on a common piping loop with a heat rejector and boiler, which are used to maintain the circulating water temperature within a controlled range, typically from 15°C to 35°C. The most common heat rejectors are open cooling towers with isolating heat exchangers, closed-circuit evaporative coolers, or dry coolers. Boilers are usually gas, oil, or electric.

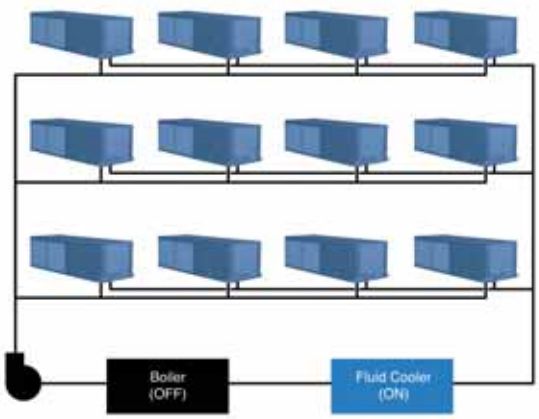
Each zone heat pump utilizes the water loop to provide heating or cooling at any time, during or after hours, regardless of the operating mode of the other heat pumps. This is accomplished without duplicate heat and cool distribution systems, without the double waste inherent in reheat modes, and without concurrent operation of the cooling source and boiler, unlike most HVAC systems that provide the same capabilities.

Water-loop heat pump systems also operate very efficiently at part-load conditions, such as when a small portion of the building remains occupied after hours. Only the required zone heat pumps are used, unlike systems that must keep a large central plant in operation at an inefficient scaled-back capacity in order to serve a small portion of the load.

A typical building has a perimeter with outside exposure that is directly affected by variable outdoor weather conditions and a core without outside exposure that is almost unaffected by the weather. In order to understand the energy sharing benefits of a water-source heat pump system, the interaction of the loads in the core and perimeter zones must be analyzed for occupied periods (internal gains present) and unoccupied periods (temperature setback/setup and little or no internal gains) throughout the year. For illustration, the following are the main energy consuming operating modes of an office building in a temperate climate.

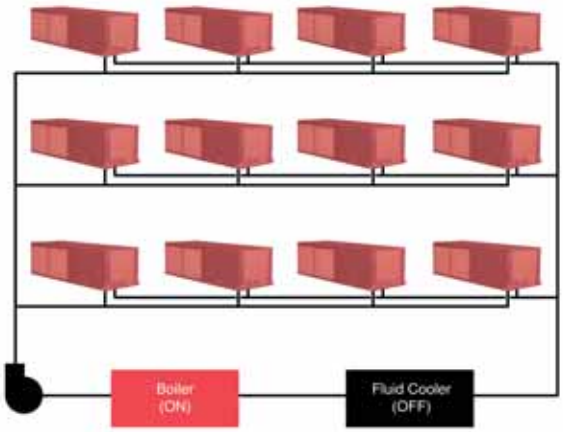
SUMMER OCCUPIED

All zones require cooling and are rejecting heat into the water loop. The heat rejector maintains the maximum water loop temperature according to a predetermined setpoint (fixed or outdoor reset). The boiler is off.



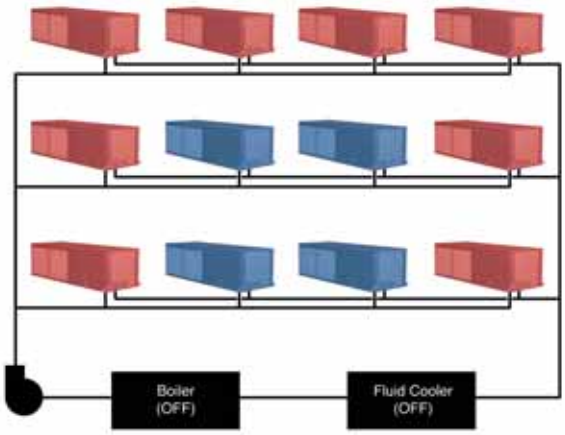
WINTER WARM-UP

During recovery from night setback, most zones will require heating and will be extracting heat from the water loop. The boiler maintains the minimum water loop temperature according to a predetermined setpoint. The heat rejector is off. The warm-up period is typically one hour or less per day.



WINTER OCCUPIED

Most core zones will require cooling because of the internal heat gains discussed previously. Most perimeter zones will require heating. Because heat is being simultaneously rejected into and extracted from the water loop, both the boiler and the heat rejector remain off much of the time. The inherent sharing of energy within the water loop minimizes boiler and heat rejector operation and provides maximum system efficiency.



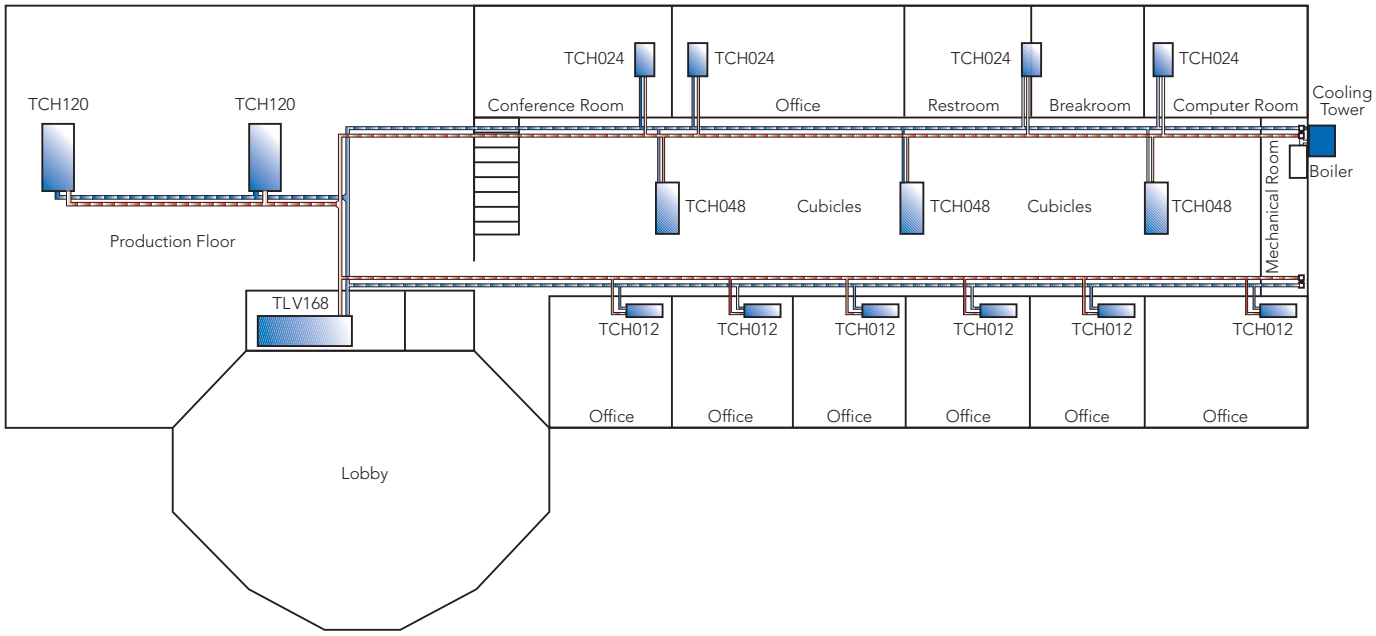
SOLUTION 1 EXAMPLE

A WATER-SOURCE EXAMPLE

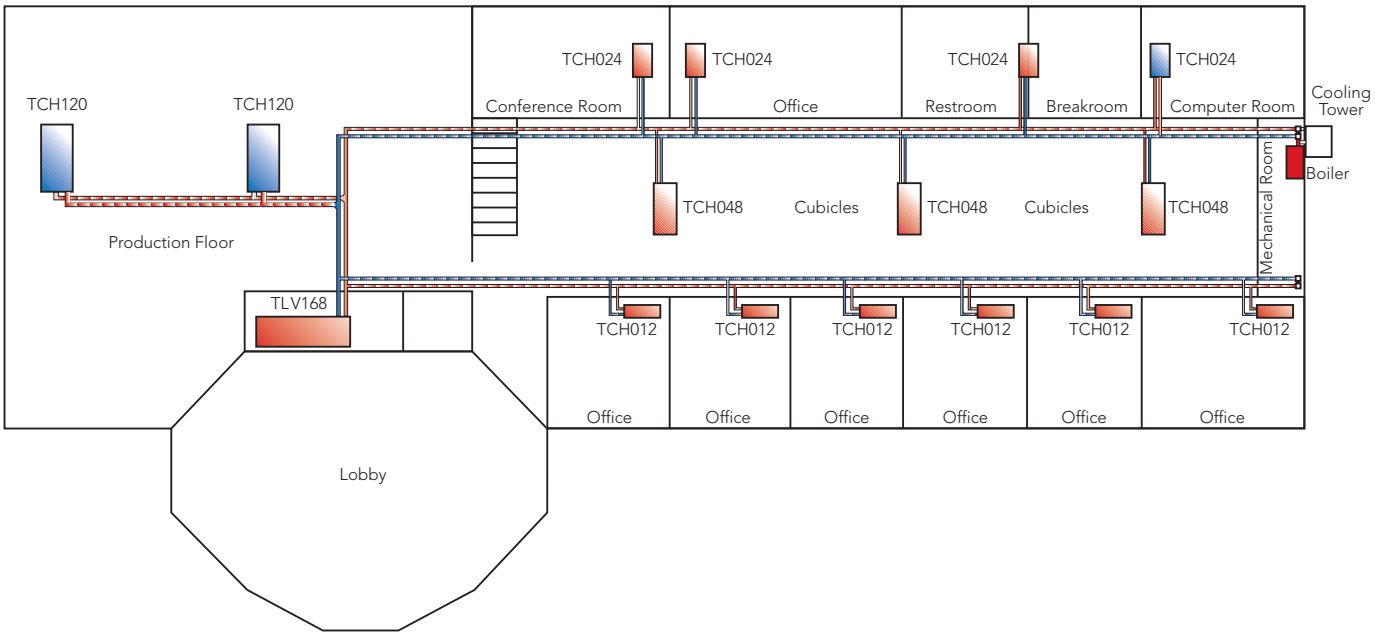
As an example of how water-source heat pumps can handle a variety of different applications, the building shown to the right is a fictional bronze statue foundry company in the midwest portion of the United States. The first floor comprises their production floor and office space. The second floor of the building is reserved for future use. The cooling tower and boiler work as needed to maintain an average loop temperature between 15 to 35°C. Water-source heat pumps can efficiently operate in either heating or cooling mode under these conditions. This gives individual and specialized zone control for maximum comfort and the ability to change operation modes as needed.

A mixture of units in heating mode and units in cooling mode create a constant temperature in the water loop. In Balanced Mode, there is no need for heat injection or rejection via the boiler or cooling tower. The heat is simply moved from one zone to another.

WARM WEATHER (HIGH COOLING DEMAND)



COOL WEATHER (HIGH HEATING DEMAND)



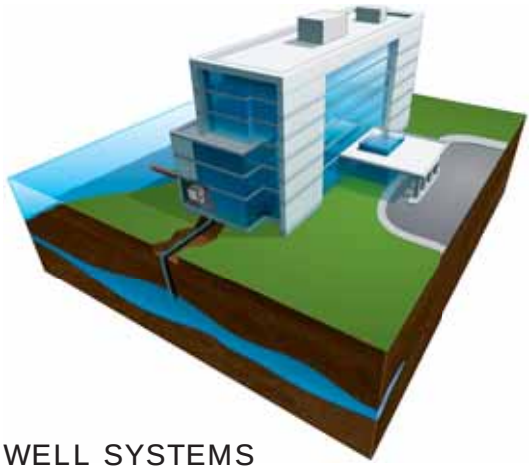
SOLUTION 2

GEOTHERMAL SYSTEMS

These "Boilerless/Towerless" heat pump systems use the natural thermal properties of the Earth to dissipate or capture heat for the water loop. Geothermal heat pumps operate in an identical fashion to water-source heat pump units. However, without the need for a boiler or cooling tower, they save substantial energy costs and space. The water loop system is underground and the units are inside the building. Thus, the environmentally friendly geothermal system preserves the architectural design of a building naturally.

LAKE LOOPS

Lake loops utilize a "slinky" assembly of geothermal loop piping placed at the bottom of a pond, lake, or other large body of water. An extremely cost effective loop system, lake loops are an easy alternative if the option is available.

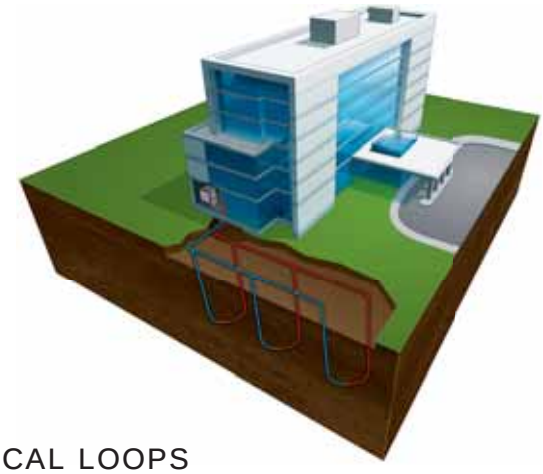


WELL SYSTEMS

Most commonly known as "Open Loop", well systems pump water out of a nearby body of water or water well, and then discharge the water into another body of water or water well. Well systems usually employ a plate heat exchanger inside the building to keep the building water loop separated from the well water. This prevents any contaminates from affecting unit performance and extends system life. Well systems are often the most efficient as the well water is always at the same temperature year-round.

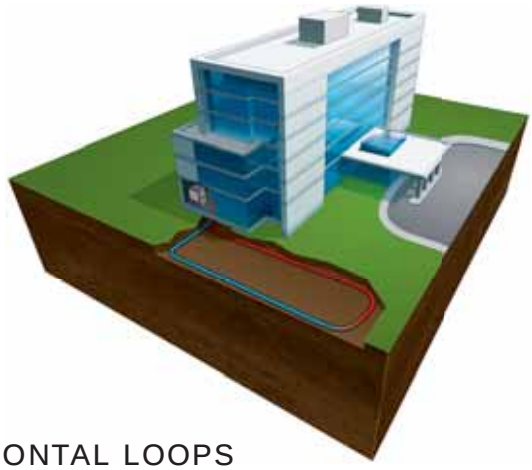
GEOTHERMAL EARTH LOOPS

Geothermal Earth Loops come in several different configurations depending on space availability and soil properties. Chances are at some point you have either stood over, or walked across a geothermal loop field. Loop fields can be located under parking lots, landscaped areas, or any number of other locations. All earth loops use high-density polyethylene pipe to circulate either water or an antifreeze mixture. All joints and connection fittings are thermally fused to prevent leaks and most piping comes with a 25 year or longer warranty.



VERTICAL LOOPS

Vertical loops utilize bore holes drilled to an average depth of 76 meters. Once the loop pipe is inserted into the bore, it is grouted using a Bentonite mixture for maximum thermal conductivity. When space is limited, vertical loops are the most common type of geothermal loop installed.



HORIZONTAL LOOPS

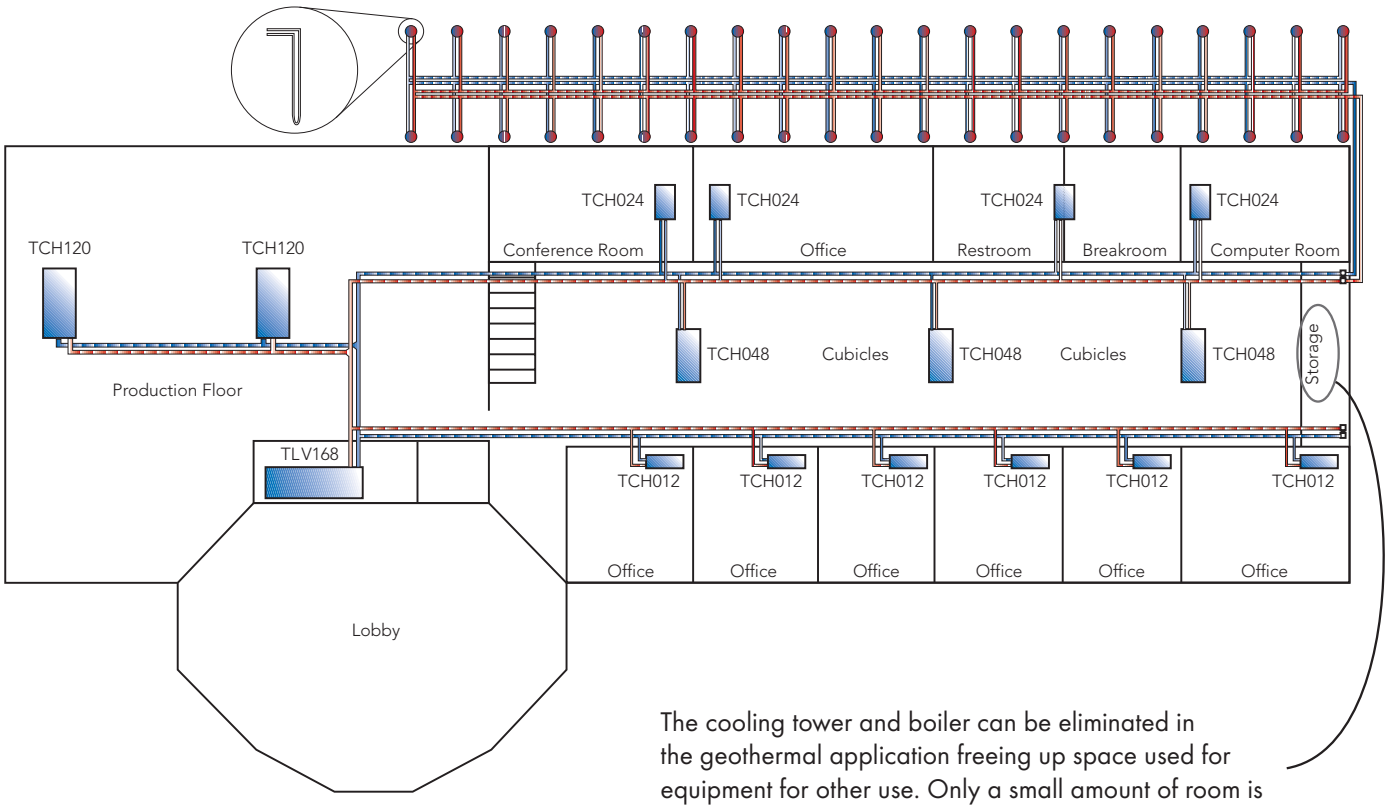
Horizontal loops utilize trenches dug to an average depth of 1.5 to 2 meters. As one of the more cost effective loops to install, horizontal loops are commonly found in open fields, parks or under parking lots.

SOLUTION 2 EXAMPLE

A GEOTHERMAL EXAMPLE

Using the same building model, the cooling tower and boiler are replaced with a geothermal vertical loop field. Identical in overall zone operation, the building benefits by having less overall equipment and reduced operation costs. Building aesthetics are also improved by eliminating outdoor equipment, and additional space is gained by eliminating the boiler and additional support equipment.

WARM WEATHER (HIGH COOLING DEMAND)



The cooling tower and boiler can be eliminated in the geothermal application freeing up space used for equipment for other use. Only a small amount of room is needed for loop circulation equipment.

PACKAGED UNITS

TRANQUILITY® 20 (TS) SERIES

- Models 006 through 070
- EarthPure® [HFC-410A] zero ozone depletion refrigerant
- Exceeds ASHRAE 90.1 efficiencies
- Galvanized steel construction with attractive black mat powder coat paint and silver accents
- Stainless steel drain pan
- Foil-backed insulation in air handler section
- Double isolation compressor mounting for quiet operation
- Insulated divider and separate compressor/air handler compartments
- Copeland scroll compressors (rotary for models 006 - 012)
- TXV metering device
- Extended range (-6.7 to 48.9°C) capable
- Microprocessor controls standard (optional DXM and/ or DDC controls)
- LonWorks, BACnet, Modbus and Johnson N2 compatibility options for DDC controls
- Factory-mounted hanger brackets for horizontal units
- Flush securely-mounted corner post water connections (no backup wrench required)
- Unit Performance Sentinel performance monitoring system
- Eight safeties standard
- Wide variety of options including factory installed service disconnect

TRANQUILITY® 16 COMPACT (TC) SERIES

- Models 006 (1.8 kW) through 060 (17.6 kW)
- EarthPure® [HFC-410A] refrigerant
- Galvanized steel construction with attractive matte black epoxy powder coat paint front access panel
- Epoxy powder painted galvanized steel drain pan
- Sound absorbing glass fiber insulation
- Double isolation compressor mounting for quiet operation
- Insulated divider and separate compressor/air handler compartments
- Scroll compressors (rotary for size 018 and below)
- TXV metering device
- Microprocessor controls standard (optional DXM and/or DDC controls)
- LonWorks, BACnet, Modbus and Johnson N2 compatibility options for DDC controls
- Factory-mounted hanger brackets for horizontal units
- PSC three-speed fan motor
- Unit Performance Sentinel performance monitoring system
- Eight safeties standard
- Extended range (-6.7 to 48.9°C) capable

LARGE UNITS

TRANQUILITY® LARGE VERTICAL (TLV) SERIES

- Vertical sizes 084 (24.6 kW) through 300 (87.9 kW)
- Unit configuration can be ordered with, or converted to front or back return and top, front, or back discharge.
- Field conversion uses all existing parts including panels and belts
- Electrical box can be field converted to be on front or back of unit
- Electric power can enter from the front or either side of unit
- Water and drain can be connected to either side
- Dual refrigeration circuits (TL168, 192, 240, 300)
- Exceeds ASHRAE 90.1 efficiencies
- TXV metering device
- Extended range (-6.7 to 48.9°C) capable
- Microprocessor controls standard (optional DXM and/or DDC controls)
- LonWorks, BACnet, Modbus and Johnson N2 compatibility options for DDC controls
- Unit Performance Sentinel performance monitoring system

TRANQUILITY® LARGE (TC) SERIES

- Models 072 (21.1 kW), 096 (28.1 kW), 120 (35.2 kW)
- Horizontal unit configuration can be ordered with left or right return air and straight or back supply air discharge. Discharge is field convertible. Field conversion uses all existing parts including panels and belts
- Vertical unit configuration can be ordered with front or back return air and top, front, or back supply air discharge. Discharge is field convertible. Field conversion uses all existing parts including panels and belts.
- Electrical box is on right side and can be field converted to left side of unit
- Electric power can enter from either side of front
- Water can be connected to either side
- Copeland scroll compressors
- Dual refrigeration circuits (All Models)
- Exceeds ASHRAE 90.1 efficiencies
- Galvanized steel construction with attractive matte black epoxy powder coat painted front access panel
- Insulated divider and separate compressor/air handler compartments
- TXV metering device
- Extended range (-6.7 to 48.9°C) operation (may require optional extended range insulation)

CONSOLE UNIT

TRANQUILITY® CONSOLE (TRC) SERIES

- Models 09 (2.6 kW) through 18 (5.3 kW)
- EarthPure® [HFC-410A] zero ozone depletion refrigerant
- High efficiency rotary compressors
- Two-piece chassis/cabinet design
- Galvanized steel cabinet with durable Polar Ice powder coat finish and black "matte" finish on subbase
- Slope top/aluminum rigid bar supply air grille. Front or bottom return
- Extended range (-6.7 to 48.9°C) capable
- Advanced digital auto or manual-change-over unit mounted controls with temperature display (°C or °F) and fault indication
- Remote-mounted controls available
- Microprocessor controls standard (optional DXM and/or DDC controls)
- LonWorks, BACnet, Modbus and Johnson N2 compatibility options for DDC controls
- Right or left-hand piping arrangement
- Unit Performance Sentinel™ performance monitoring system
- Eight safeties standard
- Wide variety of options including coated air coil

WATER-TO-WATER UNITS

TRANQUILITY® HIGH TEMPERATURE WATER-TO-WATER (THW) SERIES

- Models 8kW, 10kW, and 12kW
- High temperature scroll compressor, up to 63°C leaving water temperature
- Ultra high efficiencies (4.2 COP at ground loop conditions; up to 5.5 COP at ground water conditions!)
- Built-in programmable controller with Outdoor Temperature Reset and Warm Weather Shutdown
- Large, back-lit digital user interface
- Rugged coaxial (tube-in-tube) "Source" heat exchanger (copper or cupro-nickel)
- Close approach temperature brazed plate stainless steel "Load" heat exchanger
- Galvanized steel construction with protective powder coat paint and stainless steel, hinged front access door
- Hinged front access door and 3 removable panels for ease of installation and service
- Flush-mount 1" FPT fittings, secured to the cabinet (no backup wrench required)
- TXV metering device
- 12-point low voltage terminal strip for ease of installation
- Disconnect and CE Mark controls
- Wide variety of options including dedicated mode for domestic hot water generation and factory installed internal load and source pump(s) with expansion tanks.

TRANQUILITY® MODULAR WATER-TO-WATER (TMW) SERIES

- Models 036 (10.5 kW) through 340 (100 kW)
- Copeland scroll compressors
- Dual independent refrigeration circuits (120 and 340)
- Exclusive single side service access (front of unit) allows multiple units to be installed side-by-side for large capacity installations
- Top water connections, staggered for ease of manifolding multiple units (170 and 340)
- Heavy gauge galvanized steel construction with polyester powder coat paint and stainless steel front access panels
- Insulated compressor compartment
- Extended range (-5 to 45°C) capable
- Microprocessor controls standard LonWorks, BACnet, Modbus and Johnson N2 compatibility options for DDC controls
- Compressor "run" and "fault" lights on the front of the cabinet (170 and 340)
- Seven safeties standard
- Options include UltraQuiet sound attenuation package and cupro-nickel heat exchanger(s)

FEATURE COMPARISON:

Tranquility® Console (TRC)	Tranquility® Large Horizontal (TC)	Tranquility® Large Vertical (TLV)	Tranquility® 16 Compact (TC)	Tranquility® 20 (TS)	Packaged and Console Series	
•	•	•	•	•	EarthPure® (HFC-410A) Refrigerant	Standard Features
•	•	•	•	•	Microprocessor CXM Controls	
•	•	•	•	•	Copper Coil	
•	•	•	•	•	TXV	
	•	•	•	•	Dual Level Compressor Isolation	
	•		•	•	Field Convertible Discharge (Horizontal Units)	
			•	•	3 Access Panels	
	•	•	1	1	Scroll Compressors	
	•		•	•	Factory Installed Hanger Brackets (Horizontal Units)	
•	•	•	•	•	Remote Reset at Thermostat	
•	•	•	•	•	Condensate Overflow Protection	
•	•	•	•	•	Cupro-Nickel Coil	Factory Installed Options
		•	•		High Static Blower	
•	•	•	•	•	UltraQuiet Package	
•	•	•	•	•	Extended Range Operation (-6.7 to 48.9°C)	
•				•	Auto-Flow Regulation	
•		•		•	Two-Way Control Valve	
				•	DownFlow Configuration	
				•	Desuperheater Coil	
•	•	•	•	•	DDC Controller	
•	•	•	•	•	Deluxe DXM Controller	
•	•	•	•	•	Coated Air Coil	

1. High efficiency rotary or scroll compressor depending on model.
2. Size 060 only.

Tranquility® Modular (TMW)	Tranquility® High Temp (THW)	Water-to-Water Series	
•	•	EarthPure® (HFC-410A) Refrigerant	Standard Features
•	•	Microprocessor CXM Controls	
•	•	Copper Coil	
•	•	TXV	
•	•	Dual Level Grommet Compressor Isolation	
•	•	3 Access Panels	
•	•	Extended Range Operation (-5 to 45°C)	
•	•	Scroll Compressors	
•	•	Cupro-nickel Coil	Factory Installed Options
•		UltraQuiet Package	
•		Desuperheater Coil	
•		DDC Controller	
•		Deluxe DXM Controller	
	•	Dedicated DHW Mode	

ClimateMaster's manufacturing facility in Oklahoma City, Oklahoma, U.S.A.

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