# Features and Benefits

## Controls by Trane

Whether involved in retrofit or new construction applications, Trane has the control design to fit the system requirement. With the new control options, the broad range of packages offered range from a basic, cost efficient, 24V stand-alone solution to a complete building control system provided from an ICS (Integrated Comfort™ System) design. The following chart explains the difference in the control design.

<table>
<thead>
<tr>
<th>Graphic</th>
<th>Description</th>
<th>Application</th>
<th>ICS</th>
<th>Protocol</th>
<th>Where to find</th>
</tr>
</thead>
</table>
| Basic 24V | Compressor lock-out relay, low and high pressure switches | Retrofit market where single and multiple unit replacement occurs  
New building design where field provided controls are specified | No | Non Applicable | Page 14 |
| Deluxe 24V | 24V electro-mechanical board designed to provide control of the entire unit, as well as multiple relay offerings to maximize system performance | Retrofit market where single and multiple unit replacement occurs  
Multi-unit installation where units may be daisy-chained directly to the Trane Tracer™ Loop Controller | No | Non Applicable | Page 16 |
| Tracer ZN.510™ | Direct Digital Control board designed to provide control of the entire unit as well as outputs for unit status and fault detection | Retrofit market where overall system upgrade is specified  
Multi-unit (100) installation where units are linked by a common twisted pair of wire for a communication link | Yes | Comm5 | Page 20 |
| TUC | Direct Digital Control board used in an ICS setting to combine HVAC and building management into one comfort system | Retrofit market where a full building management system is specified  
Multi-unit (100+) installation where units are linked to a Tracer or Tracer Summit system to provide complete building management control | Yes | Comm4 | Page 24 |
| Tracer™ Loop Controller | Microprocessor-based controller that coordinates the water side (boiler, pumps, cooling tower, etc.) of a water-source heat pump system | Wherever the Deluxe or Tracer ZN.510 controls are specified | Yes | Comm5 | WSHP-MG-3 |
| Tracer Summit® | Microprocessor based controller that coordinates full building automation from HVAC to lighting | Where the TUC controller is specified | Yes | Comm4 | EMTX-IOP-1 |
Features and Benefits
Basic 24V Controls

Basic 24V Electronic Controls
The basic 24V electro-mechanical unit control provides component protection devices for maximum system reliability. Each device is factory mounted, wired, and tested in the unit. The control package includes:

- 50 VA transformer
- Compressor contactor
- Compressor run capacitor (for single-phase units only)
- General alarm
- Low pressure switch
- High pressure switch
- Lockout relay
- Reversing valve coil (for heating and cooling units only)
- Multi-speed fan motor
- 18-pole terminal strip (for low voltage field wiring)
- Optional: Condensate overflow

See Figure 20/21 for the horizontal or vertical basic 24V control box.
Features and Benefits
Basic 24V Controls

Safety Devices
All unit safety devices are provided to prevent compressor damage.

Low Pressure Switch
The low pressure switch prevents compressor operation under low charge, excessive loss of charge situations, and under low temperature operation. This device is installed on the suction side of the refrigeration circuit. It is set to activate at refrigerant pressures of 20 psig to fit most applications.

High Pressure Switch
The high pressure switch prevents compressor operation during high or excessive discharge pressures. This device is located on the discharge side of the compressor. The pressure switch de-energizes the compressor when discharge pressure exceeds 395 psig. See Figure 22 for pressure switches.

Lockout Relay
The lockout relay works with the low and high pressure switch to prevent compressor operation if the unit is under low or high refrigerant circuit pressure, or condensate overflow conditions. The lockout relay may be reset at the thermostat, or by cycling power to the unit.

General alarm is accomplished through the lockout relay and is used for driving light emitting diodes (LEDs). This feature will drive dry contacts only and cannot be used to drive field installed control inputs.

Stand-alone System
The 24V electro-mechanical design may be applied as a stand-alone control system. The stand-alone design provides accurate temperature control directly through a wall-mounted mercury bulb or electronic thermostat. This system set-up may be utilized in a replacement design where a single unit retrofit is needed. It may be easily interfaced with a field provided control system by way of the factory installed 18-pole terminal strip.

This stand-alone control is frequently utilized on lower volume jobs where a building controller may not be necessary, or where field installed direct digital controls are specified. This type of control design does require a constant flow of water to the water source heat pump. With a positive way to sense flow to the unit, the units safety devices will trigger the unit off.

The stand-alone system design provides a low cost option of installation while still allowing room control freedom for each unit. See Figure 23 for 24V stand-alone system controls.
Deluxe 24V Electronic Controls

The deluxe 24V electronic unit control provides component protection devices similar to the basic design, but contains upgraded features to maximize system performance to extend the system life. Each device is factory mounted, wired, and tested in the unit. The deluxe micro-processor based package includes:

- 75 VA transformer
- Compressor contactor
- Compressor lockout relay
- Compressor run capacitor (for 1-phase units only)
- Anti-short cycle compressor protection
- Random start delay
- Brown-out protection
- Low pressure time delay
- Low pressure switch
- High pressure switch
- Compressor delay on start
- Reversing valve coil (for heating and cooling units only)
- Multi-speed fan motor
- 18-pole terminal strip (for low voltage hook-up)
- Optional: Condensate overflow
- Optional: Night setback
- Optional: Hot gas reheat (for dehumidification)
- Optional: Electric heat
- Optional: Compressor enable

See Figure 24/25 for the horizontal or vertical deluxe 24V control box.
Microprocessor Design
The 24 volt deluxe design is a microprocessor-based control board conveniently located in the control box. The board is unique to Trane water-source products and is designed to control the unit as well as provide outputs for unit status and fault detection. The Trane microprocessor board is factory wired to a terminal strip to provide all necessary terminals for field connections. See figure 26 for the deluxe 24V control board.

Brown-out Protection
The brown-out protection function measures the input voltage to the controller and halts the compressor operation. Once a brown-out situation has occurred, the anti-short cycle timer will become energized. The general fault contact will not be affected by this condition. The voltage will continue to be monitored until the voltage increases. The compressors will be enabled at this time if all start-up time delays have expired, and all safeties have been satisfied.

Compressor Disable
The compressor disable relay provides a temporary disable in compressor operation. The signal would be provided from a water loop controller in the system. It would disable the compressor because of low water flow, peak limiting or if the unit goes into an unoccupied state. Once the compressor has been disabled, the anti-short cycle time period will begin. Once the compressor disable signal is no longer present, and all safeties are satisfied, the control will allow the compressor to restart.

Generic Relay
The generic relay is provided for field use. Night setback or pump restart are two options that may be wired to the available relay. (Note: Night setback is available as factory wired). An external Class II 24VAC signal will energize the relay coil on terminals R1 and R2. Terminals C (common), NO (normally open), and NC (normally closed) will be provided for the relay contacts.

Safety Control
The deluxe microprocessor receives separate input signals from the refrigerant high pressure switch, low pressure switch and condensate overflow.

In a high pressure situation, the compressor contactor is de-energized, which suspends compressor operation. The control will go into soft lockout mode initializing a three minute time delay and a random start of 3 to 10 second time delays. Once these delays have expired, the unit will be allowed to run. If a high pressure situation occurs within one hour of the first situation, the control will be placed into a manual lockout mode, halting compressor operation, and initiating the general alarm.

In a low temperature situation, the low pressure switch will transition open after the compressor starts. If the switch is open for 45 seconds during compressor start, the unit will go into soft lockout mode initializing a three minute time delay and a random start of 3 to 10 second time delays. Once these delays have expired, the unit will be allowed to run. If the low pressure situation occurs again, and the device is open for more than 45 seconds, the control will be placed into a manual lockout mode, halting compressor operation, and initiating the general alarm.

In a condensate overflow situation, the control will go into manual lockout mode, halting compressor operation, and initiating the general alarm.

The general alarm is initiated when the control goes into a manual lockout mode for either high pressure, low pressure or condensate overflow conditions.
Features and Benefits
Deluxe 24V Controls

Microprocessor Board
The application drawing in Figure 27 references component device connections to the microprocessor board.

Three LED’s (light emitting diodes) are provided for indicating the operating mode of the controller. The LED’s are intended to aid in troubleshooting and unit maintenance. The LED’s are labeled on the circuit board with numbers as referenced in Table 3.

Table 3: Diagnostic LED’s

<table>
<thead>
<tr>
<th>Color: Green</th>
<th>Color: Red</th>
<th>Controller Mode</th>
</tr>
</thead>
<tbody>
<tr>
<td>LED1</td>
<td>LED2</td>
<td>LED3</td>
</tr>
<tr>
<td>OFF</td>
<td>OFF</td>
<td>OFF</td>
</tr>
<tr>
<td>ON</td>
<td>OFF</td>
<td>OFF</td>
</tr>
<tr>
<td>ON</td>
<td>OFF</td>
<td>FLASH</td>
</tr>
<tr>
<td>ON</td>
<td>OFF</td>
<td>ON</td>
</tr>
<tr>
<td>FLASH</td>
<td>ON</td>
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<td>ON</td>
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<tr>
<td>ON</td>
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<td>ON</td>
</tr>
<tr>
<td>ON</td>
<td>ON</td>
<td>FLASH</td>
</tr>
<tr>
<td>ON</td>
<td>FLASH</td>
<td>OFF</td>
</tr>
<tr>
<td>ON</td>
<td>ON</td>
<td>OFF</td>
</tr>
</tbody>
</table>

Figure 27: Microprocessing board
Features and Benefits
Deluxe 24V Controls

Small Building Control
The deluxe 24V electro-mechanical design may be applied as a stand-alone control system or as a multi-unit installation system. With a stand-alone design, units run independently of one another with a mercury bulb or electronic digital thermostat.

With a multiple unit installation, the units may be daisy-chained directly to the Trane Tracer loop controller (TLC), pump(s), boiler, and tower for a complete networked water-source system. The TLC provides a night setback output, and a pump request input for system optimization. See Figure 28 for 24V deluxe control system.

Figure 28: 24V deluxe control system
Tracer ZN.510 Controls

Tracer ZN.510 is a direct digital control (DDC) system, specifically designed for water-source units to provide control of the entire unit, as well as outputs for unit status and fault detection. Each device is factory installed and commissioned to ensure the highest level of quality in unit design. The Tracer ZN.510 control package includes:

- 75 VA transformer
- Compressor contactor
- Compressor lockout relay
- Compressor run capacitor (for single-phase units only)
- Random start delay
- Heating/cooling status
- Occupied/unoccupied mode
- Fan and filter status
- Low pressure switch
- High pressure switch
- Reversing valve coil (for heating and cooling units only)
- Multi-speed fan motor
- 18-pole terminal strip (for low voltage hook-up)
- Optional: Condensate overflow

See Figure 29/30 for the horizontal and vertical Tracer ZN.510 control box.
Direct Digital Controls
In addition to being factory configured to control the unit fan, compressor, and reversing valve of the unit, the Tracer ZN.510 controller is designed to coordinate the water side of the water-source system. If applied in a peer-to-peer communication environment, data between similar controllers may be exchanged without requiring a building automation system. See Figure 31 for the Tracer ZN.510 board.

Features and Benefits
Tracer ZN.510 Controls

Compressor Operation
The compressor is cycled on and off to meet heating or cooling zone demands. Single compressor units use the unit capacity and pulse width modulation (PWM) logic along with minimum on/off timers to determine the compressor’s operation. The compressor is controlled ON for longer periods as capacity increases and shorter periods as capacity decreases.

Random Start
To prevent all of the units in a building from energizing major loads at the same time, the controller observes a random start from 0 to 25 seconds. This timer halts the controller until the random start time expires.

Reversing Valve Operation
For cooling, the reversing valve output is energized simultaneously with the compressor. It will remain energized until the controller turns on the compressor for heating. At this time, the reversing valve moves to a de-energized state. In the event of a power failure or controller OFF situation, the reversing valve output will default to the heating (de-energized) state.

Fan Operation
The supply air fan operates at the factory wired speed in the occupied or occupied standby mode. When switch is set to AUTO, the fan is configured for cycling ON with heating or cooling. The fan will run for 30 seconds beyond compressor shutdown in both occupied and unoccupied mode.

Filter Maintenance Timer
The controller’s filter status is based on the unit fan’s cumulative run hours. The controller compares the fan run time against an adjustable fan run hours limit and recommends unit maintenance as required.

Data Sharing
The Tracer ZN.510 controller is capable of sending or receiving data (setpoints, fan request, or space temperature) to and from other controllers on the communication link. This allows multiple units to share a common space temperature sensor in both stand-alone and building automation applications.

Night Setback
The four operations of the Tracer ZN.510 controller include occupied, occupied standby, occupied bypass and unoccupied.

In an occupied situation, the controller uses occupied heating and cooling setpoints to provide heating and cooling to the building. This occupied operation is normally used during the daytime hours when the building is at the highest occupancy level.

In an occupied standby situation, the controllers heating and cooling setpoints are usually much wider than the occupied setpoints. This occupied standby operation is used during daytime hours when people are not present in the space (such as lunchtime or recess). To determine the space occupancy, an occupancy sensor is applied.

In an unoccupied situation, the controller assumes the building is vacant, which normally falls in evening hours when a space may be empty. In the unoccupied mode, the controller uses the default unoccupied heating and cooling setpoints stored in the controller. When the building is in unoccupied mode, individual units may be manually placed into timed override of the unoccupied mode at the units wall sensor. During timed override, the controller interprets the request and initiates the occupied setpoint operation, then reports the effective occupancy mode as occupied bypass.

In the occupied bypass mode, the controller applies the occupied heating and cooling setpoint for a 120 minute time limit.

Figure 31: Tracer ZN.510 board
Features and Benefits
Tracer ZN.510 Controls

High and Low Pressure Safety Controls
The Tracer ZN.510 controller detects the state of the high pressure or low pressure switches. When a fault is sensed by one of these switches, the corresponding message is sent to the Tracer ZN.510 controller to be logged into the fault log. When the circuit returns to normal, the high pressure control and low pressure control automatically reset. If a second fault is detected within a thirty-minute time span, the unit must be manually reset.

Condensate Overflow
When condensate reaches the trip point, a condensate overflow signal generates a diagnostic which disables the fan, unit water valves (if present), and compressor. The unit will remain in a halted state until the condensation returns to a normal level. At this time, the switch in the drain pan will automatically reset. However, the controller’s condensate overflow diagnostic must be manually reset to clear the diagnostic and restart the unit.

Tracer ZN.510 Board
The application drawing in Figure 32 references component device connections to the Tracer ZN.510 board.

Three LED’s (light emitting diodes) are provided for indicating the operating mode of the controller. See Table 4 for LED specifics.

Table 4: Tracer ZN.510 LED’s

<table>
<thead>
<tr>
<th>LED Activity</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>RED LED OFF</td>
<td>Continuously when power is applied to the controller</td>
</tr>
<tr>
<td>RED LED ON</td>
<td>Continuously, even when power is applied to the controller</td>
</tr>
<tr>
<td>RED LED FLASHES</td>
<td>Restore the unit to normal operation with Rover™</td>
</tr>
<tr>
<td>GREEN LED ON</td>
<td>Power ON (normal operation)</td>
</tr>
<tr>
<td>GREEN LED BLINKS (one blink)</td>
<td>Manual output test mode. No diagnostics present</td>
</tr>
<tr>
<td>GREEN LED BLINKS (two blinks)</td>
<td>Manual output test mode. One or more diagnostics present</td>
</tr>
<tr>
<td>GREEN LED BLINKS (1/4 second on/off for 10 seconds)</td>
<td>WINK mode for controller indentification</td>
</tr>
<tr>
<td>GREEN LED OFF</td>
<td>Power off. Abnormal condition. Test button is pressed.</td>
</tr>
<tr>
<td>YELLOW LED OFF</td>
<td>Controller not detecting communication</td>
</tr>
<tr>
<td>YELLOW LED BLINKS</td>
<td>Controller detects communication</td>
</tr>
<tr>
<td>YELLOW LED ON</td>
<td>Abnormal condition</td>
</tr>
</tbody>
</table>

Figure 32: Tracer ZN.510 board
Features and Benefits  
Tracer ZN.510 Controls

Building Control Advantages
The Tracer ZN.510 controller has the ability to share information with one or several units on the same communication link. This sharing of information is made possible via a twisted pair of wire and a building automation system or through Trane’s Rover™ service tool.

This type of application would most commonly be used for a large space(s) that may require more than one unit. In addition to this application design, the Tracer ZN.510 controller provides a way for units located within the same space to share the same zone sensor to prevent units from simultaneously heating and cooling in the same space. See Figure 33 for Tracer ZN.510 control system.

Figure 33: Tracer ZN.510 control system
Terminal Unit Controls

The terminal unit controller (TUC) is a direct digital control used in both Integrated Comfort Systems (ICS), and stand-alone control packages. In the ICS setting, Trane combines building comfort via Trane HVAC equipment, integral unit controllers and building management, designed and commissioned with Trane application expertise, to provide comfort, efficiency and reliability, as well as single-source warranty and service. With ICS, installation costs are often lower because the HVAC units have turn-key factory installed controls and every component of the system is designed to fit together. Efficiencies are higher because the components are designed to work together. The TUC package includes:

- 75 VA transformer
- Compressor contactor
- Compressor lockout relay
- Compressor run capacitor (for single-phase units only)
- Low pressure switch
- High pressure switch
- Reversing valve coil (for heating and cooling units only)
- Multi-speed fan motor
- 18-pole terminal strip (for low voltage hook-up)
- Anti-short cycle compressor protection
- Random start delay
- Low pressure time delay
- Cooling/heating status
- Night setback
- Optional: Fan and filter status
- Optional: Condensate overflow
- Optional: Hot gas reheat (for Dehumidification)
- Optional: Electric heat
- Optional: Mixed-air/return-air

Figure 34: Horizontal TUC control box

Figure 35: Vertical TUC control box
Direct Digital Controls
In addition to being factory configured to control the unit fan, compressor, and reversing valve of the unit, the TUC can be applied to other Trane HVAC equipment, offering a complete solution for zone control. The TUC contains sensor input circuits, service adjustments and microprocessing control electronics. See Figure 36 for TUC control board.

Figure 36: TUC control board

TUC features include:

- **Compressor Operation**
  The compressor is cycled on and off based upon load conditions as sensed by a zone sensor. Compressor operation is overridden by a preset three minute time delay in order to maintain oil return to the compressor when the unit is either initially energized, manually reset, switched between models, or cycled within a single mode.

- **Random Start**
  To prevent all units in a building from energizing at the same time, the controller observes a random start. The fan and compressor start is delayed from 3 to 32 seconds when power has been either restored after a loss of outage, or after the unit is enabled.

- **Reversing Valve Operation**
  The reversing valve is energized in the cooling mode. The valve will remain energized until the heating cycle is initiated. Reversing valve operation will be delayed after compressor shutdown to reduce noise due to refrigerant migration. In the event of a power failure, the reversing valve fails to the heating mode.

- **Fan Operation**
  The supply air fan operates at the factory wired speed in the occupied mode. During the occupied mode, if ON, the fan operates continuously. When switch is set to AUTO, the fan is cycled with the compressor operation. The fan will run for 30 seconds beyond compressor shutdown in both occupied and unoccupied mode. If the fan output and fan status do not match, the fan status option will shut down the unit and indicates an alarm.

- **Freeze Protection**
  Freeze protection is intended to sense and prevent water coil freeze-up during low temperature conditions. A low temperature condition locks out compressor operation until a manual reset of the control is processed. However, the pump output or the isolation valve output remains energized when the low temperature condition is detected regardless of compressor operation. The low temperature setting is factory set at 35 F. The setting is field adjustable for ground source applications where antifreeze is used in the loop.

- **Dirty Filter Operation**
  A dirty filter sensor is located on each side of the air filter. The dirty filter alarm identifies if the filter is clogged and should be replaced. A dirty filter alarm will not lock out the compressor.

- **Mixed-Air/Return-Air Temperature**
  The mixed-air/return-air temperature is a combination of outside air and return air. It is used in estimating the portion of outside air supplied to the space, and as a low limit for DX coil input temperature. It is located in the return-air, airstream.

- **Auxiliary Electric Heat**
  A boilerless control heat option is provided for units not being satisfied while in the heating mode. A single stage of auxiliary heat is energized to satisfy zone temperature.

- **Night Setback**
  The two settings of the TUC system are occupied, and unoccupied.

In an occupied situation, the controller uses occupied heating and cooling setpoints to provide heating and cooling to a building. This occupied operation is normally used during the daytime hours when the space is occupied.

In the unoccupied mode, the unit is in a shut-down state with outside air in a closed position. If the space temperature sensed by the zone sensor falls above or below the unoccupied setpoint, the compressor, fan, and reversing valve is energized based on the need for either heating or cooling until the unoccupied setpoint is reached. Unoccupied mode is used during night time hours when space is not occupied.
Features and Benefits

TUC Controls

High and Low Pressure Safety Controls
The TUC detects the state of each switch’s circuit. If either the high pressure or low pressure control opens, a fault condition occurs in the refrigeration circuit. Compressor operation is halted until the system has been manually reset by cycling the power at the sensor or at the power source.

Condensate Overflow
When condensate reaches the trip point, a condensate overflow signal generates a diagnostic which disables the fan, and compressor. The unit will remain in a halted state until the condensate returns to a normal level or unit is serviced.

TUC Board
The application drawing in Figure 37 references component device connections to the TUC board. Five LED’s (light emitting diodes) are provided for indicating the operating mode of the controller. The LED’s are labeled on the circuit board as referenced below.

CR35 referred to as SYS, indicates the TUC is currently powered ON.

CR30 referred to as HEAT, indicates heating.

CR32 referred to as COOL indicates cooling.

CR34 referred to as SERVICE indicates service is required (such as dirty filter).

CR24 referred to as COMM indicates whether communication is being made to the board.

Figure 37: TUC board
Features and Benefits
TUC Controls

Building Control Advantages
Integrating the TUC on water source equipment, and tying them to a Tracer Summit® system provides a complete building management system. The TUC is linked directly to the Tracer or Tracer Summit by a twisted pair of communication wire requiring no additional interface.

Each Tracer can connect to a maximum of 64 TUC's. With the ICS system, the tracer can initiate an alarm on a loss of performance or equipment malfunctions; allowing problems to be handled in a timely manner before compromising comfort. See Figure 38 for TUC control system.

Figure 38: TUC control system
Cooling Mode *(Figure 39)*

If cooling is called for, the thermostat activates the centrifugal blower and sets the reversing valve into the cooling position. If all safeties are met, high temperature refrigerant vapor is pumped from the compressor through the reversing valve to the refrigerant-to-water heat exchanger. The refrigerant vapor condenses to a liquid as it passes through the heat exchanger, giving up its heat to the circulating water loop. High pressure liquid refrigerant then passes through the expansion devise into the refrigerant-to-air fin tube coil heat exchanger. As the low pressure refrigerant passes through the coil, it evaporates to become a low temperature vapor, absorbing heat from the air, which is drawn over the coil by the blower. The refrigerant then flows as a low pressure gas through the reversing valve back to the suction side of the compressor where the cycle begins again.

*Figure 39: Cooling refrigeration cycle*

**Note:**
The heat energy generated from the compressor motor operation will also be rejected to the water-to-refrigerant heat exchanger.
Application Considerations

Heating Mode (Figure 40)
If heating is called for, the thermostat activates the centrifugal blower and sets the reversing valve into the heating position. If all safeties are met, high temperature refrigerant vapor is pumped from the compressor through the reversing valve to the refrigerant-to-air fin tube coil heat exchanger. The high pressure refrigerant vapor condenses to a liquid as it passes through the coil, giving up its heat to the air which is drawn over the coil by the blower. Liquid refrigerant then passes through the expansion devise into the refrigerant-to-water heat exchanger. As the low pressure refrigerant passes through the heat exchanger, it evaporates to become a low temperature vapor, absorbing heat from the circulating water. The refrigerant then flows as a low pressure gas through the reversing valve back to the suction side of the compressor where the cycle begins again.

Figure 40: Heating refrigeration cycle

Note:
The heat energy generated from the compressor motor operation will also be rejected to the air-to-refrigerant heat exchanger.
Geothermal System

Closed-loop systems (both ground source and surface water) provide heat rejection and heat addition to maintain proper water-source temperatures. The choice of vertical, horizontal, or lake loop earth coupling, should be based on the characteristics of each application. Horizontal and vertical systems can be designed to provide the same fluid temperatures under a given set of conditions. The surface (lake) loop system may see a greater variance of fluid temperatures, but the reduced installation cost may compensate for any minor reduction in performance. The three earth coupling methods should be considered at each application, with the most cost effective method chosen after all have been evaluated.

Operating and maintenance cost are low because an auxiliary electric/fossil fuel boiler and cooling tower are not required to maintain the loop temperature in a properly designed system.

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.

When building cooling requirements cause loop water temperatures to rise, heat is dissipated into the cooler earth through buried high density polyethylene pipe heat exchangers in a ground source geothermal system (See Figure 41). 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 42), can be very cost effective. This system has all the advantages of 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 low ozone depletion potential. Because the closed-loop system does not require a heat adder, there are no CO₂ emissions. Less electric power is consumed by the system, thereby reducing secondary emissions from the power plant. Therefore, the system offers advantages not seen by other HVAC system types.
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 43)

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 and proper pH. To help ensure clean water, a straining device may be required.

Cooling Tower/Boiler System
A cooling tower/boiler system (See Figure 44) utilizes a closed-water 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 independently, either by adding heat, or removing heat from a common closed water loop. Because the heat from a building is being rejected through a cooling tower, the system is more efficient than air cooled systems.

The cooling tower/boiler system provides a low installation cost to the owner when compared to other systems and is the most common application. It also allows the owner to add units to the condensor water loop as needed.
Central Pumping System

Application Considerations
Application Considerations

Central Pumping System
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. An auxiliary pump is typically applied to lessen the likelihood of system down-time if the main pump malfunctions. See Page 32 for a horizontal installation of a central pumping system.

1. Hose kits are used to connect the water supply and return lines to the water inlets and outlets. Trane includes various hose kit combinations to better facilitate system flow balancing. These flexible hoses, reduce vibration between the unit and the rigid piping system. See Page 121 for hose kit specifications.

2. The units (2) 3/4-inch high voltage and (3) 1/2-inch low voltage connections are located on the left chamfered corner of the unit. They are designed to accept conduit.

3. The field supplied line voltage disconnect should be installed for branch circuit protection.

4. The central systems supply and return lines should be sized to handle the required flow with a minimum pressure drop.

Note: Pipe can 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 when condenser loop is designed to be below 60 F.

5. For acoustically sensitive areas, a six-inch deep fiberglass insulation should be installed below the horizontal unit. This field supplied insulation should be approximately twice the footprint size of the unit. It provides sound damping of the unit while in operation.
Application Considerations

Distributed Pumping System
Application Considerations

Distributed Pumping System
A distributed pumping system contains either a single or dual pump module connected directly to the units supply and return. This design requires individual pump modules specifically sized for each water-source heat pump. See Page 34 for a horizontal installation of a distributed pumping system.

1 Hose kits are used to connect the water supply and return lines to the water inlets and outlets. Trane includes various hose kit combinations to better facilitate system flow balancing. These flexible hoses, reduce vibration between the unit and the rigid piping system. See Page 121 for hose kit specifications.

2 The units (2) 3/4-inch high voltage and (3) 1/2-inch low voltage connections are located on the left chamfered corner of the unit. They are designed to accept conduit.

3 The field supplied line voltage disconnect should be installed for branch circuit protection.

4 The unit pump module together with the hose kit make a complete self contained pumping package. The module is designed for circulating commercial loops that require a maximum flow rate of 20 gpm. Each pump module is fully assembled for connection to water and electrical points. See Page 104 for pump module specifications.

5 The supply and return lines should be sized to handle the required flow with a minimum pressure drop.

6 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 when condenser loop is designed to be below 60 F.

7 For acoustically sensitive areas, a six-inch deep fiberglass insulation should be installed below the horizontal unit. This field supplied insulation should be approximately twice the footprint size of the unit. It provides a sound damping of the unit while in working mode.
Application Considerations

Typical Vertical Installation
Application Considerations

Installation of the GEVA

Whether securing the GEVA to a central pumping system, or a distributed pumping system, Trane recommends a few accessory considerations to the system installation. See Page 36 for a horizontal installation.

1 The field supplied line voltage disconnect should be installed for branch circuit protection.

2 The units (2) 3/4-inch high voltage and (3) 1/2-inch low voltage connections are located on the left chamfered corner of the unit. They are designed to accept conduit.

3 Trane recommends that the condensate system be set up per negative pressure trapping in consideration of the unit’s draw-through design. With this properly trapped system, when condensate forms during normal operation, the water level in the trap rises until there is a constant outflow.

5 For acoustically sensitive areas, a 1/2-inch thick field provided vibration pad should be installed below the vertical unit. This field provided piece should be equal to the overall foot-print size of the unit to provide sound damping of the unit while in operation.

6 Hose kits are used to connect the water supply and return lines to the water inlet and outlets. Trane includes various hose kit combinations to better facilitate system flow balancing. These flexible hoses, reduce vibration between the unit and the rigid piping system. For more information on the types of hose kits Trane recommends, review the HKTA-IOM-1 manual. See Page 121 for hose kit specifications.
Hanging the Horizontal

The horizontal unit GEHA is a ceiling hung unit. It is usually applied as a totally concealed unit above an acoustical ceiling grid.

Because the GEHA is equipped with several inlet and discharge arrangements, it allows for numerous application needs.

When hanging the horizontal design, the unit should be pitched approximately 1/4-inch per foot toward the drain in both directions. This aids in condensate removal from the drain pan. (*See Figure 45 for unit slope*).

**Hanging Devices and Duct Attachments**

All GEHA units are shipped with a factory mounted hanging bracket and rubber isolation grommet. The 3/8-inch all-thread and 3/8-inch washer and nut are field provided.

One-inch duct collars are provided for field duct attachment to the supply-air outlet. The duct collars, filter racks, filter and grommets are field installed. These items are shipped in an inclosure external to the unit. (*See Figure 46 for unit duct collar and hanging device installation*).
Condensate Traps
When designing a condensate trap for the water-source system, it’s important to consider the unit’s draw through design.

Under normal conditions, condensate runs down the coil fins and drips into a condensate pan. In situations where no trap is installed, the water level that would be maintained in the trap to create a seal, backflows through the drainline into the unit. Because the fan pulls air through the air-to-refrigerant heat-exchanger, this incoming air stream could launch water droplets, forming at the base of the coil, into the air. Air flowing through the coil can then spray condensate into the fan intake, with the possibility of propelling moisture into other parts of the mechanical system. This aerosol mist can be carried through the ducts and into the conditioned air space.

Another problem with air backflow, is the source of that air. Drain lines typically flow into waste or sewage lines, giving the potential to introduce methane and other contaminants from the drain system into the airstream.

In a properly trapped system, when condensate forms during normal operation, the water level in the trap rises until there is a constant outflow. See Figure 47, for the appropriate dimensions required in designing a negative pressure system.

Figure 47: Condensate trap installation
Duct Design for Noise Control
Proper acoustics are often a design requirement. Most of the problems that are associated with HVAC generated sound can be avoided by properly selecting and locating the components of the system. Acoustical modeling should be used to find the lowest cost design to meet a specific sound requirement, however, there are some general do's and don'ts that should be observed.

Figure 48 shows a supply air duct that is placed too close to the blower to provide substantial noise attenuation. It also, represents the effects on sound that a short supply branch connected to the discharge may produce. Avoid these forms of connections when designing ductwork where noise attenuation is critical.

The following suggestions will reduce the amount of sound that reaches the occupied space:

- Design the duct run with two 90-degree turns
- Line the first 5 feet of the supply trunk
- Line elbows and transition pieces, as well as a short distance upstream and downstream of the fittings
- Use flexible connections to isolate vibrations
- Provide multiple discharges
- Keep duct velocity low

See Figure 49 for a positive representation of supply duct work design for noise attenuation on units over 1 1/2 tons.
Sound control applies to the return side of the duct design as well as the supply side. Figure 50 demonstrates a poor installation. Note that the return air opening is close to the cabinet of the unit. Figure 51 graphic represents proper installation of return-air duct. This includes:

- Two 90-degree bends prior to the intake
- Lining the first 10 feet of the return air duct
- Locating the return-air intake away from the unit blower

A duct system with noise control in mind can be designed by:

- Keeping air flow velocities low
- Using aerodynamic fittings
- Using a duct liner if metal duct is applied
- Avoiding line-of-sight connections between a noise source and an outlet
- Avoiding line-of-sight connection between a noise source and an inlet
- By properly locating balancing dampers
- Sealing cracks, seams and joints in the duct run and equipment panels
- Blocking transmission through walls, ceiling and floors
- Mounting and supporting the ductwork with isolation devices that absorb vibration
- Using flexible duct connections
- Using flexible braided hoses on the water connections
Installation Made Easy

Installing a horizontal unit inside a corridor to enhance sound attenuation provides value to duct design. Trane takes this fact one step further.

The new GEHA design offers same side return-air/supply-air access to the unit. This access is contained within the overall dimension of the units length as shown in Figure 52. The duct access to the unit allows the unit to be installed closely against a corridor wall, while at the same time eliminating space required for the duct design.

Most horizontal unit designs provide an opposite supply air from the return air arrangement, or an end supply arrangement option. See Figure 53 for end-supply example. An end-supply design increases the overall unit length of the system to accommodate a 90-degree duct turn. This not only requires added space, but also adds cost in both materials and installation.

Service Access

To add more value in installation requirements, the same side return-air/supply-air design eliminates a requirement for a four sided service access. See Figure 54 for service access. When installing the same side return/supply access, a brief 3-inch minimum is all that is required between the unit and the wall.

Access to the TXV may not be possible with this application.
Application Considerations

Dual Filtration
Flexibility of model GEHA allows for dual filtration in a free return application. With the field installed dual filtration accessory, filter maintenance of the unit is significantly less. (See Figure 55 for dual filtration).

The accessory package includes both the bottom and top filter rack, and one 1-inch or 2-inch filter. The following part numbers are provided in the Trane ordering system in proportion to unit sizing.

Table 5: Filter accessory kit

<table>
<thead>
<tr>
<th>Unit Size</th>
<th>1&quot; Filter</th>
<th>Filter Kit Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>006-015</td>
<td>4474 0630 0100</td>
<td></td>
</tr>
<tr>
<td>018-030</td>
<td>4474 0631 0100</td>
<td></td>
</tr>
<tr>
<td>036, 042</td>
<td>4474 0632 0100</td>
<td></td>
</tr>
<tr>
<td>048, 060</td>
<td>4474 0633 0100</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Unit Size</th>
<th>2&quot; Filter</th>
<th>Filter Kit Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>006-015</td>
<td>4474 0634 0100</td>
<td></td>
</tr>
<tr>
<td>018-030</td>
<td>4474 0635 0100</td>
<td></td>
</tr>
<tr>
<td>036, 042</td>
<td>4474 0636 0100</td>
<td></td>
</tr>
<tr>
<td>048, 060</td>
<td>4474 0637 0100</td>
<td></td>
</tr>
</tbody>
</table>

When the Unit(s) Arrives
The package that encloses the horizontal and vertical units are specifically designed to reduce shipping damage and provide ease of installation to the installer by providing the correct tools in the best location.

The shipping package includes a 1-inch top pad with specific cut-outs to accommodate the unit filter, supply-air duct flange, the return-air duct flange, mounting screws, and the installation literature. Isolation grommets are located in the return-air section of the unit.

A number T-20 Torx®-head drill bit is included in every literature baggie for the installers use during field installation and set-up. (See Figure 56 for location of field installed parts).

Figure 55: Dual Filtration

Figure 56: Shipping package
Selection Procedure

Selection Program
All WSHP products should be selected through the Trane Official Product Selection System, TOPSS.

If this program has not been made available, ask a local Trane sales engineer to supply the desired selections or provide a copy of the program.

Required Fields
The first step in the selection is to determine either:

- Total cooling capacity
- Sensible capacity
- Heating capacity

The maximum allowable water pressure drop and selection ranges can also be identified.

Fields shadowed in red identify what is required to run a TOPPS calculation. The selection folder is divided into five fields to allow ease of input for the selection process. These fields include:

- Fan information
- Cooling input information
- Heating input information
- Hose kit information
- All fields
Selection Procedure

New Performance Ratings
All performance data in this catalog is rated to the new ARI-ISO 13256-1 standard. The following information should be used in gaining a clearer understanding of the differences on the new ARI-ISO standard versus the ARI 320/330 standards of today.

The ARI-ISO 13256-1 standard includes adjustment to include pump wattage and fan wattage. For these new calculations, review **SP-1 for ISO pump penalty adjustment calculation** and **SP-2 for fan wattage adjustment calculation**.

**SP-1: ISO pump penalty adjustment calculation**

<table>
<thead>
<tr>
<th>ISO Pump Penalty (GPM, Feet of pressure drop)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Calculate the pump penalty for the ISO standard</td>
</tr>
<tr>
<td>2. Calculations must be done in SI (International Standard) units</td>
</tr>
<tr>
<td><strong>Note:</strong> GPM = Gallons per minute, the actual flow of water.</td>
</tr>
<tr>
<td>FtHd = The measured water side pressure drop in feet of head</td>
</tr>
</tbody>
</table>

Flow = GPM x 0.0631  \hspace{1cm} Convert GPM to liters per second.
PressDrop = FtHd x 2990  \hspace{1cm} Convert feet of water to pascals
Pump Penalty = Flow x PressDrop / 300  \hspace{1cm} Note: 300 is a constant

**SP-2: ISO fan wattage adjustment calculation**

<table>
<thead>
<tr>
<th>ISO Fan Wattage Adjustment (CFM, SP)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Calculate the fan watt factor for the ISO standard</td>
</tr>
<tr>
<td>2. Subtract watts from total watts</td>
</tr>
<tr>
<td>3. Calculations must be done in SI (International Standard) units</td>
</tr>
<tr>
<td><strong>Note:</strong> CFM = Cubic feet per minute of air-flow</td>
</tr>
<tr>
<td>SP = External static pressure in inches of water glass</td>
</tr>
</tbody>
</table>

Flow = CFM x 0.472  \hspace{1cm} Convert CFM to liters per second.
ESP = SP x 249  \hspace{1cm} Convert inches of water to pascals
Fan Watt Adjustment = Flow x ESP / 300  \hspace{1cm} Note: 300 is a constant

Differences in test conditions for ARI-ISO versus ARI 320/330 are listed below.

<table>
<thead>
<tr>
<th>Test Conditions</th>
<th>ARI 320</th>
<th>ISO WLHP (water loop heat pump)</th>
<th>ARI 330</th>
<th>ISO GLHP (ground loop heat pump)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cooling Capacity</td>
<td>F</td>
<td>F</td>
<td>F</td>
<td>F</td>
</tr>
<tr>
<td>Entering-Air (Dry Bulb)</td>
<td>80</td>
<td>80.6</td>
<td>80</td>
<td>80.6</td>
</tr>
<tr>
<td>Entering-Air (Wet Bulb)</td>
<td>67</td>
<td>66.2</td>
<td>67</td>
<td>66.2</td>
</tr>
<tr>
<td>Entering Water</td>
<td>85</td>
<td>86</td>
<td>77</td>
<td>77</td>
</tr>
<tr>
<td>Leaving Water</td>
<td>95</td>
<td>Note 2</td>
<td>Note 2</td>
<td>Note 2</td>
</tr>
<tr>
<td>Fluid Flow Rate</td>
<td>Note 1</td>
<td>Note 3</td>
<td>Note 3</td>
<td>Note 3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Heating Capacity</th>
<th>F</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Entering-Air (Dry Bulb)</td>
<td>70</td>
<td>68</td>
</tr>
<tr>
<td>Entering Water</td>
<td>70</td>
<td>68</td>
</tr>
<tr>
<td>Fluid Flow Rate</td>
<td>Note 1</td>
<td>Note 3</td>
</tr>
</tbody>
</table>

**Note 1:** Flow rate is set by standard rating, cooling test.

**Note 2:** As determined by the flowrate to be specified by the manufacturer.

**Note 3:** Flow rate specified by the manufacturer.
ISO Cooling Data Calculations

Examples for cooling calculations in reference to ARI-ISO 13256-1 is listed below. This step-by-step example, utilizes the unit information as shown in SP-3, to verify the ISO calculations found in SP-4.

SP-3: Unit information

<table>
<thead>
<tr>
<th>Unit Information</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Unit Watts</td>
<td>1129</td>
</tr>
<tr>
<td>Air Flow, CFM</td>
<td>609</td>
</tr>
<tr>
<td>Static Pressure at the unit (in. wg)</td>
<td>0.12</td>
</tr>
<tr>
<td>GPM</td>
<td>5.97</td>
</tr>
<tr>
<td>Total Pressure Drop across water side (Ft. of water)</td>
<td>2.08</td>
</tr>
<tr>
<td><strong>Air Side Capacity</strong></td>
<td></td>
</tr>
<tr>
<td>Sensible Capacity (Btuh)</td>
<td>14000</td>
</tr>
<tr>
<td>Latent Capacity (Btuh)</td>
<td>7572</td>
</tr>
<tr>
<td>Total Cooling Capacity before adjustment (Btuh)</td>
<td>21572</td>
</tr>
<tr>
<td>Sensible/Total Heat Ratio</td>
<td>0.649</td>
</tr>
</tbody>
</table>

Explanation of Cooling Calculations

**STEP 1:**
To calculate the fan power adjustment, refer to SP2 on Page 45 for the procedure on how to calculate the fan power adjustment factor.

*In this example:*

CFM = 609  
SP = 0.12

**Fan Power Adjustment**

\[= (\text{CFM} \times 0.472) \times (\text{SP} \times 249) / 300\]

\[= (609 \times 0.472) \times (0.12 \times 249) / 300\]

\[= 29 \text{ Watts}\]

**STEP 2:**
To calculate pump penalty, refer to SP1 on Page 45 for the procedure on how to calculate the pump penalty.

*In this example:*

GPM = 5.97  
FtHd = 2.08

**Pump Penalty**

\[= (\text{GPM} \times 0.0631) \times (\text{PressDrop} \times 2990) / 300\]

\[= (5.97 \times 0.0631) \times (2.08 \times 2990) / 300\]

\[= 8 \text{ Watts}\]

**STEP 3:**
To calculate capacity adjustment, multiply 3.413 times the Fan Power Adjustment factor rounded to the nearest integer.

*In this example:*

Capacity adjustment = Fan Power Adjustment x 3.413

**Result:**

=29 x 3.413

=99 Btuh

**STEP 4:**
To calculate the ARI-ISO Cooling Capacity Rating, add the Cooling Capacity Adjustment (Btuh) to the Total Cooling Capacity.

*In this example:*

ARI-ISO 13256-1 Cooling Capacity Rating = 21572 + 99

**Result:**

ARI-ISO 13256-1 Cooling Capacity Rating = 21671

**STEP 5:**
To calculate ARI-ISO 13256-1 Ratings Power Input (watts), add the actual total measured watts to the pump penalty, then subtract the Fan Power adjustment watts.

*In this example:*

Power Input = 1129 + 8 - 29

**Result:**

Power Input = 1108

**STEP 6:**
To calculate the Energy Efficiency Ratio, divide the ARI-ISO Cooling Capacity by the ARI-ISO Power Input watts.

*In this example:*

Energy Efficiency Ratio = 21671 / 1108

**Result:**

Energy Efficiency Ratio = 19.56
Selection Procedure

ISO Heating Data Calculations
Examples for heating calculations in reference to ARI-ISO 13256-1 is listed below. This step-by-step example, utilizes the unit information as shown in SP-5, to verify the ISO calculations found in SP-6.

**SP-5: Unit information**

<table>
<thead>
<tr>
<th>Unit Information</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Unit Watts</td>
<td>1592</td>
</tr>
<tr>
<td>Air Flow, CFM</td>
<td>629</td>
</tr>
<tr>
<td>Static Pressure at the unit (in. wg)</td>
<td>0.14</td>
</tr>
<tr>
<td>GPM</td>
<td>5.02</td>
</tr>
<tr>
<td>Total Pressure Drop across water side (Ft. of water)</td>
<td>2.08</td>
</tr>
</tbody>
</table>

**SP-6: ISO calculations**

<table>
<thead>
<tr>
<th>ISO Calculations</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>ARI-ISO Power Adjustment</td>
<td>34</td>
</tr>
<tr>
<td>Pump Penalty (watts)</td>
<td>7</td>
</tr>
<tr>
<td>ARI-ISO Capacity Adjustment</td>
<td>116</td>
</tr>
<tr>
<td>Heating Capacity (Btuh)</td>
<td>25002</td>
</tr>
<tr>
<td>Power Input (watts)</td>
<td>1565</td>
</tr>
<tr>
<td>Coefficient of Performance (COP)</td>
<td>4.68</td>
</tr>
</tbody>
</table>

**Explanation of Heating Calculations**

**STEP 1:**
To calculate the fan power adjustment, refer to SP2 on Page 45 for the procedure on how to calculate the fan power adjustment factor.

*In this example:*
CFM = 629
SP = 0.14

**Fan Power Adjustment**

\[
\text{Fan Power Adjustment} = (\text{CFM} \times 0.472) \times (\text{SP} \times 249) / 300 \\
= (629 \times 0.472) \times (0.14 \times 249) / 300 \\
= 34 \text{ Watts}
\]

**STEP 2:**
To calculate pump penalty, refer to SP1 on Page 45 for the procedure on how to calculate the pump penalty.

*In this example:*
GPM = 5.02
FtHd = 2.08

**Pump Penalty**

\[
\text{Pump Penalty} = (\text{GPM} \times 0.0631) \times (\text{PressDrop} \times 2990) / 300 \\
= (5.02 \times 0.0631) \times (2.08 \times 2990) / 300 \\
= 7 \text{ Watts}
\]

**STEP 3:**
To calculate capacity adjustment, multiply 3.413 times the Fan Power Adjustment factor rounded to the nearest integer.

*In this example:*
Capacity adjustment = Fan Power Adjustment x 3.413

**Result:**
=34 x 3.413
=116 Btuh

**STEP 4:**
To calculate the ARI-ISO 13256-1 Heating Capacity Rating, subtract the Heating Capacity Adjustment (Btuh) from the Total Heating Capacity.

*In this example:*
ARI-ISO 13256-1 Heating Capacity Rating = 25118 - 116

**Result:**
ARI-ISO 13256-1 Heating Capacity Rating = 25002

**STEP 5:**
To calculate ARI-ISO 13256-1 Ratings Power Input (watts), add the actual total measured watts to the pump penalty, then subtract the Fan Power adjustment watts.

*In this example:*
Power Input = 1592 + 7 - 34

**Result:**
Power Input = 1565

**STEP 6:**
To calculate the Coefficient of Performance, divide the ARI-ISO Heating Capacity by (ARI-ISO Power Input watts x 3.413).

*In this example:*
Energy Efficiency Ratio = 25002 / (1565 x 3.413)

**Result:**
Energy Efficiency Ratio = 4.68
## Water-Source Comfort System

**Model Number**

**GEHA 036 11 A 0110 BL D 010 N 0011 000000000000**

**DIGIT 1-3: UNIT CONFIGURATION**
- **GEH** = General Efficiency
- **GEV** = General Efficiency Vertical

**DIGIT 4: DEVELOPMENT SEQUENCE A**

**DIGIT 5-7: NOMINAL SIZE (MBH)**
- 006 = 6.0 MBH
- 009 = 9.0 MBH
- 012 = 12.0 MBH
- 015 = 15.0 MBH
- 018 = 18.0 MBH
- 024 = 24.0 MBH
- 030 = 30.0 MBH
- 036 = 36.0 MBH
- 040 = 40.0 MBH (vertical ONLY)
- 042 = 42.0 MBH
- 048 = 48.0 MBH
- 060 = 60.0 MBH

**DIGIT 8: VOLTAGE (Volts/Hz/Phase)**
- 0 = 115/60/1
- 1 = 208/60/1
- 2 = 230/60/1
- 3 = 208/60/3
- 4 = 460/60/3
- 5 = 575/60/3
- 6 = 220-240/50/1
- 7 = 265/60/1
- 8 = 230/60/3
- 9 = 380-415/50/3

**DIGIT 9: HEAT EXCHANGER**
- 1 = Copper Water Coil
- 2 = Cupro-nickel Water Coil

**DIGIT 10: DESIGN SEQUENCE**
- A = First Design

**DIGIT 11: REFRIGERATION CIRCUIT**
- 0 = Heating and Cooling Circuit
- 2 = Heating and Cooling Circuit w/ Hot Gas Reheat
- A = Cooling ONLY Circuit
- C = Cooling ONLY Circuit w/ Hot Gas Reheat

**DIGIT 12: BLOWER CONFIGURATION**
- 1 = Standard Blower
- 2 = High Static Blower

**DIGIT 13: CUSTOMER CHANNEL**
- 1 = Boiler / Tower Design
- 2 = Geothermal Design
- 5 = International Design

**DIGIT 14: OPEN DIGIT**
- 0 = Standard Design

**DIGIT 15: SUPPLY-AIR ARRANGEMENT**
- B = Back Supply-Air Arrangement
- L = Left Supply-Air Arrangement
- R = Right Supply-Air Arrangement
- T = Top Supply-Air Arrangement

**DIGIT 16: RETURN-AIR ARRANGEMENT**
- L = Left Return-Air Arrangement
- R = Right Return-Air Arrangement

**DIGIT 17: CONTROL TYPES**
- 0 = Basic 24V Controls
- D = Deluxe 24V Controls
- C = ComfortLink 10 Controls
- A = TUC Standalone Controls
- T = TUC/ICS Controls

**DIGIT 18: T'STAT / SENSOR LOCATION**
- 0 = Wall Mounted Location

**DIGIT 19: FAULT SENSORS**
- 0 = No Fault Sensor
- 1 = Condensate Overflow Sensor
- 2 = Filter Maintenance Timer
- 3 = Condensate Overflow and Filter Maintenance Timer
- 4 = Fan Status Sensor
- 5 = Dirty Filter Sensor
- 6 = Condensate Overflow and Fan Status Sensor
- 7 = Condensate Overflow and Dirty Filter Sensor
- 8 = Fan Status and Dirty Filter Status Sensor
- 9 = Fan Status, Dirty Filter Status and Condensate Overflow Sensor

**DIGIT 20: TEMPERATURE SENSOR**
- 0 = No Additional Temperature Sensor
- 1 = Entering Water Sensor
- 2 = Return-Air / Mixed-Air Temperature Sensor
- 3 = Entering Water / Mixed-Air Temperature Sensor

**DIGIT 21: NIGHT SETBACK**
- 0 = No Night Setback Relay
- N = Night Setback Relay

**DIGIT 22: ELECTRIC HEAT OPTION**
- 0 = No Electric Heat
- 1 = Boilerless Control Electric Heat
### Model Number

**DIGIT 23: UNIT MOUNTED DISCONNECT**
- 0 = No Unit Mounted Disconnect

**DIGIT 24: FILTER TYPE**
- 0 = 1-inch Filter; No Duct Flange
- 1 = 1-inch Throwaway Filter
- 2 = 2-inch Throwaway Filter

**DIGIT 25: ACOUSTIC ARRANGEMENT**
- 0 = Sound Attenuation Package
- 1 = Enhanced Sound Attenuation Package

**DIGIT 26: FACTORY CONFIGURATION**
- 0 = Standard Factory Configuration

**DIGIT 27: PAINT COLOR**
- 0 = No Paint Selection Available

**DIGIT 28: OUTSIDE AIR OPTION**
- 0 = No Outside Air Available

**DIGIT 29: PIPING ARRANGEMENT**
- 0 = Standard Piping Configuration
- 1 = Standard Piping w/ Schrader Connection for Water Regulating Valve

**DIGIT 30-36: DOES NOT APPLY TO HORIZONTAL/VERTICAL PRODUCTS**
- 0000000 = Digit 30-36 Does NOT Apply to the Horizontal/Vertical Products
## General Data

### Table G-1: Physical Data (GEHA 006-015)

<table>
<thead>
<tr>
<th>Model: GEHA 006-015</th>
<th>006</th>
<th>009</th>
<th>012</th>
<th>015</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Unit Size</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Length of cabinet (in)</td>
<td>40</td>
<td>40</td>
<td>40</td>
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</tr>
<tr>
<td>Height (in)</td>
<td>15</td>
<td>15</td>
<td>15</td>
<td>15</td>
</tr>
<tr>
<td>Width (in)</td>
<td>20</td>
<td>20</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td><strong>Compressor Type</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rotary</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>R-22 Refrigerant (oz)</strong></td>
<td>19</td>
<td>20</td>
<td>26</td>
<td>30</td>
</tr>
<tr>
<td><strong>Approximate Weight</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>With Pallet</td>
<td>188</td>
<td>188</td>
<td>188</td>
<td>188</td>
</tr>
<tr>
<td>Without Pallet</td>
<td>158</td>
<td>158</td>
<td>158</td>
<td>158</td>
</tr>
<tr>
<td><strong>Blower Wheel Size (in)...Direct Drive</strong></td>
<td>9 x 4</td>
<td>9 x 4</td>
<td>9 x 4</td>
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</table>

### Table G-2: Physical Data (GEHA 018-036)

<table>
<thead>
<tr>
<th>Model: GEHA 018-036</th>
<th>018</th>
<th>024</th>
<th>030</th>
<th>036</th>
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<tbody>
<tr>
<td><strong>Unit Size</strong></td>
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</tr>
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<td>Length of cabinet (in)</td>
<td>46</td>
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<td>46</td>
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</tr>
<tr>
<td>Height (in)</td>
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<td>17</td>
<td>17</td>
<td>19</td>
</tr>
<tr>
<td>Width (in)</td>
<td>23</td>
<td>23</td>
<td>23</td>
<td>25</td>
</tr>
<tr>
<td><strong>Compressor Type</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rotary</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reciprocating</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>R-22 Refrigerant (oz)</strong></td>
<td>48</td>
<td>57</td>
<td>60</td>
<td>70</td>
</tr>
<tr>
<td>(heat pump)</td>
<td>34</td>
<td>43</td>
<td>46</td>
<td>52</td>
</tr>
<tr>
<td>(cooling only)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Approximate Weight</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>With Pallet</td>
<td>278</td>
<td>278</td>
<td>278</td>
<td>318</td>
</tr>
<tr>
<td>Without Pallet</td>
<td>248</td>
<td>248</td>
<td>248</td>
<td>288</td>
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<tr>
<td><strong>Blower Wheel Size (in)...Direct Drive</strong></td>
<td>9 x 6</td>
<td>10 x 6</td>
<td>10 x 6</td>
<td>12 x 8</td>
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### Table G-3: Physical Data (GEHA 042-060)

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<th>Model: GEHA 042-060</th>
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<th>060</th>
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<tbody>
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<td><strong>Unit Size</strong></td>
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</tr>
<tr>
<td>Length of cabinet (in)</td>
<td>50</td>
<td>58</td>
<td>58</td>
</tr>
<tr>
<td>Height (in)</td>
<td>19</td>
<td>21</td>
<td>21</td>
</tr>
<tr>
<td>Width (in)</td>
<td>25</td>
<td>33</td>
<td>33</td>
</tr>
<tr>
<td><strong>Compressor Type</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reciprocating</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Scroll</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>R-22 Refrigerant (oz)</strong></td>
<td>72</td>
<td>80</td>
<td>94</td>
</tr>
<tr>
<td>(heat pump)</td>
<td>54</td>
<td>66</td>
<td>80</td>
</tr>
<tr>
<td>(cooling only)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Approximate Weight</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>With Pallet</td>
<td>318</td>
<td>428</td>
<td>428</td>
</tr>
<tr>
<td>Without Pallet</td>
<td>288</td>
<td>398</td>
<td>398</td>
</tr>
<tr>
<td><strong>Filter Size (nominal inches)</strong></td>
<td>18 3/4 x 25 1/2</td>
<td>20 3/4 x 29 7/8</td>
<td>20 3/4 x 29 7/8</td>
</tr>
<tr>
<td><strong>Blower Wheel Size (in)...Direct Drive</strong></td>
<td>12 x 8</td>
<td>12 x 11</td>
<td>12 x 11</td>
</tr>
</tbody>
</table>
# General Data

## Table G-4: Physical Data (GEVA 006-015)

<table>
<thead>
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<th>Model: GEVA 006-015</th>
<th>006</th>
<th>009</th>
<th>012</th>
<th>015</th>
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<tbody>
<tr>
<td><strong>Unit Size</strong></td>
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</tr>
<tr>
<td>Length of cabinet (in)</td>
<td>21.5</td>
<td>21.5</td>
<td>21.5</td>
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</tr>
<tr>
<td>Height (in)</td>
<td>31.25</td>
<td>31.25</td>
<td>31.25</td>
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</tr>
<tr>
<td>Width (in)</td>
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<td>19.5</td>
<td>19.5</td>
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</tr>
<tr>
<td><strong>Compressor Type</strong></td>
<td>Rotary</td>
<td>Rotary</td>
<td>Rotary</td>
<td>Rotary</td>
</tr>
<tr>
<td>R-22 Refrigerant (oz)</td>
<td>21</td>
<td>21</td>
<td>24</td>
<td>30</td>
</tr>
<tr>
<td><strong>Approximate Weight</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>With Pallet</td>
<td>178</td>
<td>178</td>
<td>178</td>
<td>178</td>
</tr>
<tr>
<td>Without Pallet</td>
<td>158</td>
<td>158</td>
<td>158</td>
<td>158</td>
</tr>
<tr>
<td>Filter Size (nominal inches)</td>
<td>16 x 20</td>
<td>16 x 20</td>
<td>16 x 20</td>
<td>16 X 20</td>
</tr>
<tr>
<td>Blower Wheel Size (in)...Direct Drive</td>
<td>9 x 4</td>
<td>9 x 4</td>
<td>9 x 4</td>
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## Table G-5: Physical Data (GEVA 018-030, 040)

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<th>Model: GEVA 018-030, 040</th>
<th>018</th>
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<th>030</th>
<th>040</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Unit Size</strong></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Length of cabinet (in)</td>
<td>21.5</td>
<td>21.5</td>
<td>21.5</td>
<td>21.5</td>
</tr>
<tr>
<td>Height (in)</td>
<td>39.25</td>
<td>39.25</td>
<td>39.25</td>
<td>39.25</td>
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<tr>
<td>Width (in)</td>
<td>21.5</td>
<td>21.5</td>
<td>21.5</td>
<td>21.5</td>
</tr>
<tr>
<td><strong>Compressor Type</strong></td>
<td>Reciprocating</td>
<td>Reciprocating</td>
<td>Reciprocating</td>
<td>Reciprocating</td>
</tr>
<tr>
<td>R-22 Refrigerant (oz)</td>
<td>58 (heat pump) 44 (cooling only)</td>
<td>63 (heat pump) 45 (cooling only)</td>
<td>60 (heat pump) 46 (cooling only)</td>
<td>58 (heat pump) 44 (cooling only)</td>
</tr>
<tr>
<td><strong>Approximate Weight</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>With Pallet</td>
<td>268</td>
<td>268</td>
<td>268</td>
<td>268</td>
</tr>
<tr>
<td>Without Pallet</td>
<td>248</td>
<td>248</td>
<td>248</td>
<td>248</td>
</tr>
<tr>
<td>Filter Size (nominal inches)</td>
<td>18 X 25</td>
<td>18 X 25</td>
<td>18 X 25</td>
<td>18 X 25</td>
</tr>
<tr>
<td>Blower Wheel Size (in)...Direct Drive</td>
<td>10 x 6</td>
<td>10 x 6</td>
<td>10 x 6</td>
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## Table G-6: Physical Data (GEVA 036, 042-060)

<table>
<thead>
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<th>Model: GEVA 036, 042-060</th>
<th>036</th>
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<th>048</th>
<th>060</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Unit Size</strong></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Length of cabinet (in)</td>
<td>26.5</td>
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<td>Height (in)</td>
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</tr>
<tr>
<td>Width (in)</td>
<td>24.5</td>
<td>24.5</td>
<td>26.5</td>
<td>26.5</td>
</tr>
<tr>
<td><strong>Compressor Type</strong></td>
<td>Reciprocating</td>
<td>Reciprocating</td>
<td>Reciprocating</td>
<td>Scroll</td>
</tr>
<tr>
<td>R-22 Refrigerant (oz)</td>
<td>74 (heat pump) 56 (cooling only)</td>
<td>72 (heat pump) 54 (cooling only)</td>
<td>84 (heat pump) 70 (cooling only)</td>
<td>98 (heat pump) 84 (cooling only)</td>
</tr>
<tr>
<td><strong>Approximate Weight</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>With Pallet</td>
<td>308</td>
<td>308</td>
<td>396</td>
<td>396</td>
</tr>
<tr>
<td>Without Pallet</td>
<td>288</td>
<td>288</td>
<td>376</td>
<td>376</td>
</tr>
<tr>
<td>Filter Size (nominal inches)</td>
<td>20 X 25</td>
<td>20 X 25</td>
<td>28 X 30</td>
<td>28 X 30</td>
</tr>
<tr>
<td>Blower Wheel Size (in)...Direct Drive</td>
<td>10 x 6</td>
<td>12 x 8</td>
<td>12 x 11</td>
<td>12 x 11</td>
</tr>
</tbody>
</table>