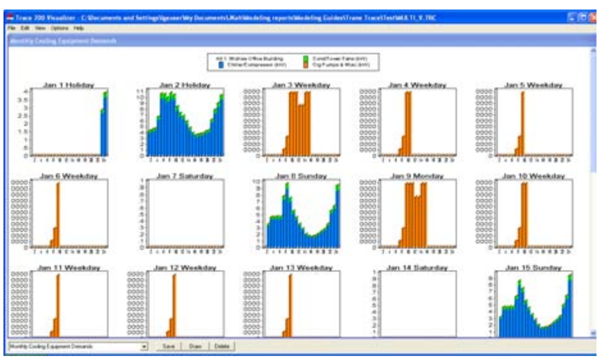
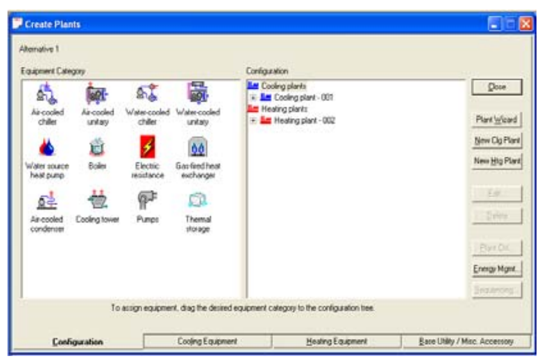
TRACE™ 700 Building Energy Modeling Guide for LG Multi V™





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This Guide

The Trane Trace 700 Building Energy Modeling Guide for LG Multi V contains step-by-step instructions to help users model LG Multi V system options. The definitions of the code-words are cited from Modeling Guide TRACE® 700 Building Energy and Economic Analysis version 6.2.

Disclaimer

The Building Energy Modeling Guide and Trane Trace 700 library files are for comparisons and should be used as a guideline only. Building load/energy has been approximated for modeling purposes or input value of equipment (capacity, power input, etc.), and actual results may vary depending on the situation. The conclusions of this Modeling Guide and Trane Trace 700 library file do not guarantee actual energy costs or savings.

This Modeling Guide and Trane Trace 700 library file are intended as a design-and analysis guide to help designers optimize the design of the LG Multi V VRF system based on energy utilization. Modeling accuracy is highly dependent on user-supplied data. It is the user's responsibility to understand how the data entered affects program output, and to understand that any predefined libraries are to be used only as guidelines and Trane Trace 700 library file for entering that data. The calculation results and reports by this guide and Trane Trace 700 library file are meant to aid the system designer and are not a substitute for design services, judgment, or experience.

USING Trane Trace 700 TO DESIGN VRF SYSTEMS

This section briefly describes how to use TRANE TRACE 700 to design VRF systems. All VRF design work requires the same general five step procedure:

1. **Define the Problem.**

   First define the scope and objectives of the design analysis.

2. **Gather Data.**

   Before design calculations can be performed, information about the building, its environment and its HVAC equipment must be gathered. This step involves extracting data from building plans, evaluating building usage and studying HVAC system needs. Specific types of information needed include:

   - Weather data for the building site.
   - Construction material data for envelopes of exterior and interior including walls, roofs, windows, doors, and floors.
   - Building size and layout data including wall, roof, window, door and floor areas, exposure orientations and external shading features.
   - Internal load characteristics determined by levels and schedules for occupancy, lighting systems, equipment, and ventilation within the building.
   - Data concerning HVAC equipment, controls and components to be used.
   - Define the utility rates for the project

3. **Enter Data Into TRANE TRACE 700.**

   Next, use TRANE TRACE 700 to enter building and equipment data. When using TRANE TRACE 700, your base of operation is the main program window. Then define the following types of data which are needed for system design work:

   a. **Select Weather Data.**

   - Open the Weather dialog box using either of these methods:
     - In the Project Navigator view, click Weather icon in the toolbar or click the Select weather information button in the floating Project Navigator toolbar.
     - In any view, use the menu bar to select Actions > Select Weather Info.
   - Click on the region of the map where the building is located to display a list of available weather locations for that region.

- Scroll through the list to find the desired location and select it. The location you picked appears in the lower left corner of the Weather dialog box.
- Click OK to return to the main screen.

b. **Create Spaces/Rooms.**

TRACE performs cooling and heating load calculations for each individual room, so a "room" is the smallest space for which you can calculate loads. A room can be a single office surrounded by walls or can be the perimeter portion of a large open-plan office area. In other areas of the program, you have the option of grouping rooms into zones and/or systems for higher level design calculations (i.e. design airflows, coil capacities, design temperatures, etc.).

When creating rooms, you essentially "assign" to it all of the components that contribute to or affect its cooling and heating loads. These load components include, but are not limited to:

- Size and mass of room
- Room design thermostat settings
- Size, construction, and direction of external walls and roofs
- Size, properties, and direction of external windows and skylights
- Internal loads, such as people, lights, and miscellaneous equipment
- Infiltration
- Ventilation requirements
- Partition walls and exposed or slab-on-grade floors

c. **Enter System Data.**

Along with entering room information, you also need to define the HVAC air distribution, or "airside," systems serving the building so that the program knows how to size the fans and coils. This is done by selecting a System Type and entering any appropriate system information. After the program performs cooling and heating load calculations for individual rooms, it calculates room airflows, coil loads, fan sizes, and other system design information. Defining the System Type tells the program how to calculate this design information ("block" vs. "sum-of-peaks") and what components (coils, fans, etc.) make up the system.

4. **Use TRANE TRACE 700 to Generate Design Reports.**

When you have finished all the steps in creating a project file, you are ready for the program to do its job and perform the Design, System, Energy, and Economics simulation phases.

To start the calculation process:

a. In the Project Navigator view, click the Calculate Output icon on Project Navigator or the toolbar or select Calculate from the TRACE Actions menu.

b. Click the Calc Now button. This generates the reports and provides you with the View Results dialog box from which you can select reports to print.

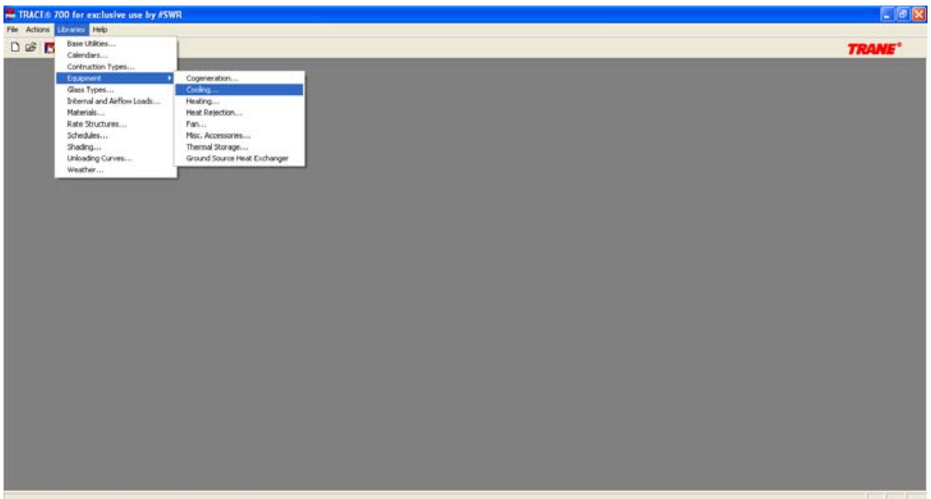
5. **Select Equipment.**

   Finally, use data from the reports you generated to select the appropriate cooling and heating equipment from LG VRF product catalogs. System and plant design reports provide information necessary to select all the components of your VRF system including outdoor units, indoor units, and control equipments.

   LG can provide a wide variety of electronic catalogs to make selecting equipment quick and easy. Please contact your local LG sales office or LG distributor for details.

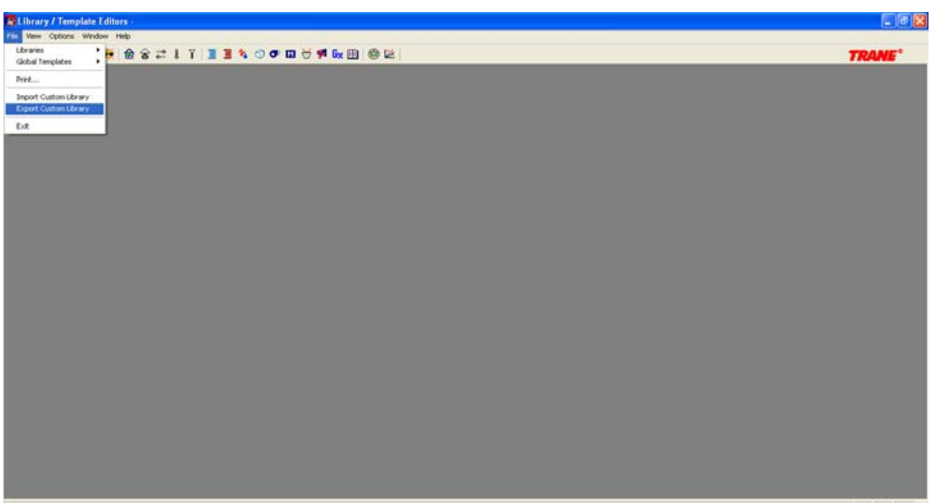
Import Library

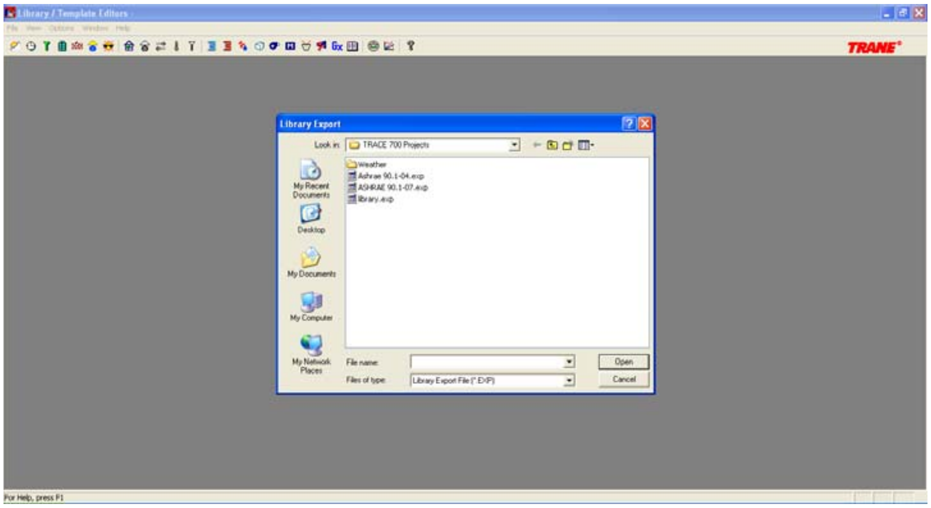
The TRACE 700 program includes a separate Library/Template Editor application that lets users view the detailed information found in the standard templates and libraries. Use the TRACE700 "Library Template Editor" to import the library file accompanying this document.



To Import the library:

1. Click Equipment on the Libraries menu.
2. Select "Export Custom Library" from the "File" Menu.
3. Rename the library .exp file to original_libray.exp. This allows users the ability to return to the default file if needed.



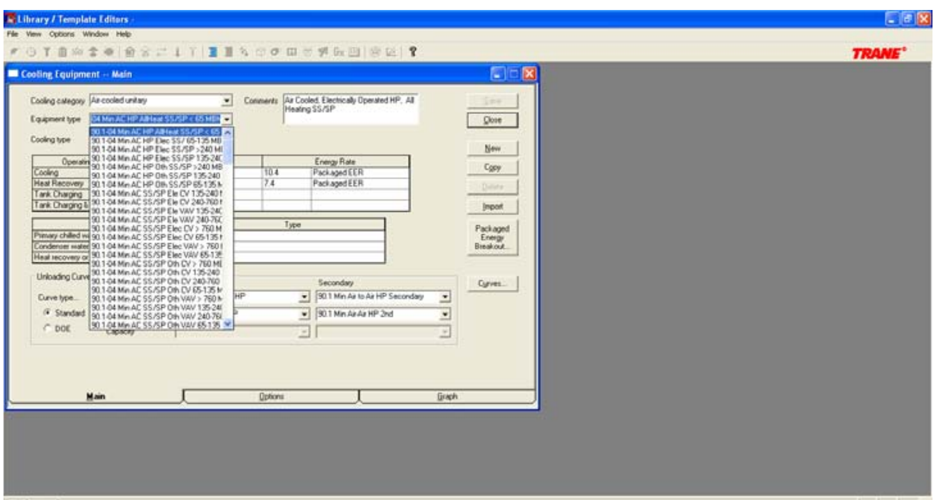


4. Close the dialog box.

Testing the Library File

To test the library file:

1. Click Equipment on the Libraries menu.
2. Click Cooling on the Equipment menu. The Library/Template Editors program will display the Cooling Equipment window.
3. View current Equipment lists in the TRACE 700 Data Directory.

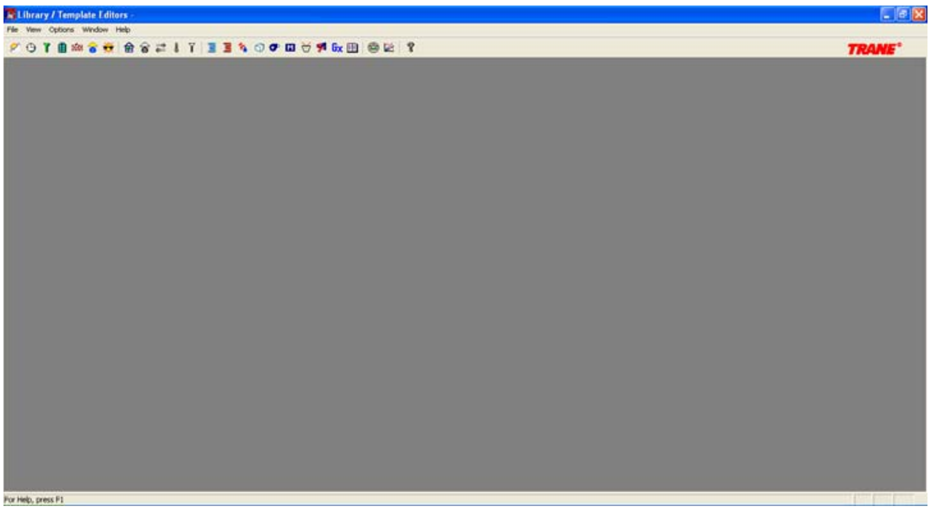


4. Close the dialog box.
5. Close the Library/Template Editors.

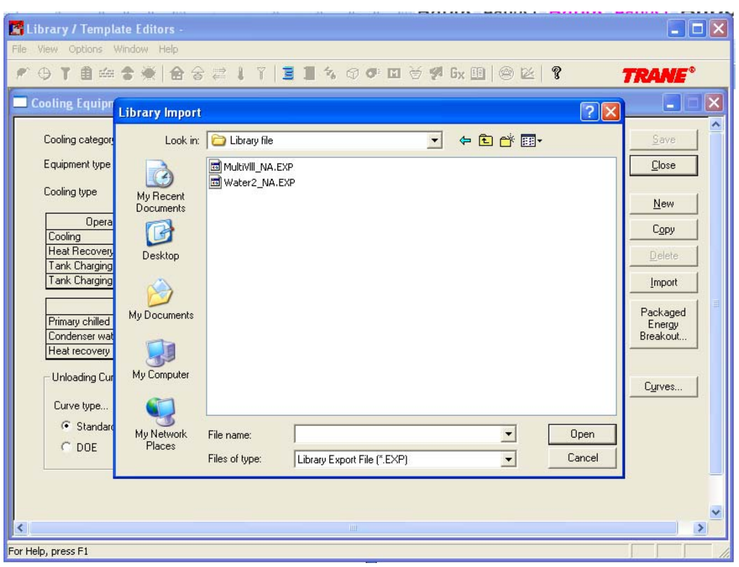
Import the Multi V Library File

To import the Multi V library file into TRACE 700:

1. Obtain the Multi V library files from your LG Sales Representative.
2. Double click the Trace 700 icon on your desktop to launch Trace 700. Or From the Start menu, select Program Files > C.D.S. >Applications > TRACE 700 > TRACE 700
3. Click the TRACE 700 "Library Template Editor. The Library/Template Editors appears:



4. Select the path where the library file was copied to and select "Import Custom Library" from the "File" Menu.



Note: During library file import, if shown an option to overwrite an existing duplicate library data for LG Multi V products from the import file, set to "yes" this option will allow to overwrite an existing database.

5. Close the dialog box.
6. Close the Library/Template Editors.
7. In TRACE 700, click File > Exit to close the program.

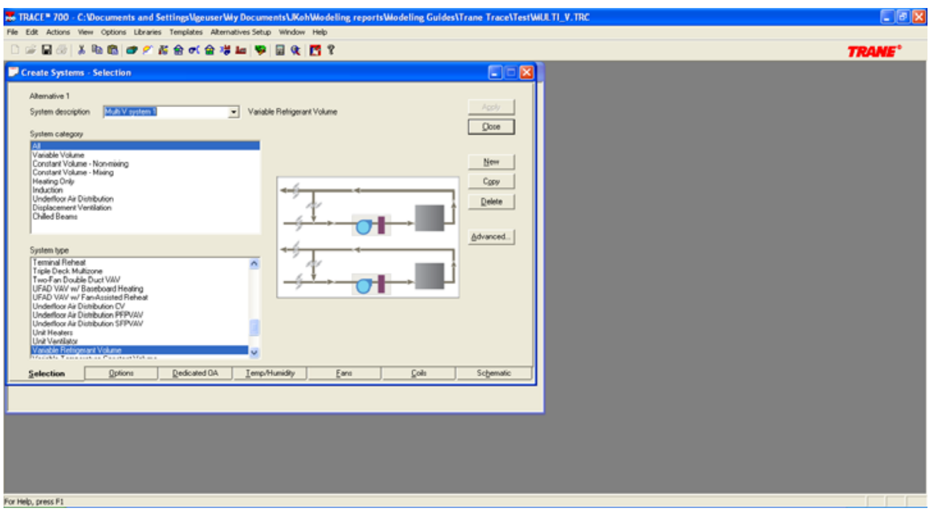
Multi V (Air Source) System

Create Systems

The following procedure demonstrates how to model the Multi V system, cooling and heating equipment, as well as assigning the coil loads.

To create a system:

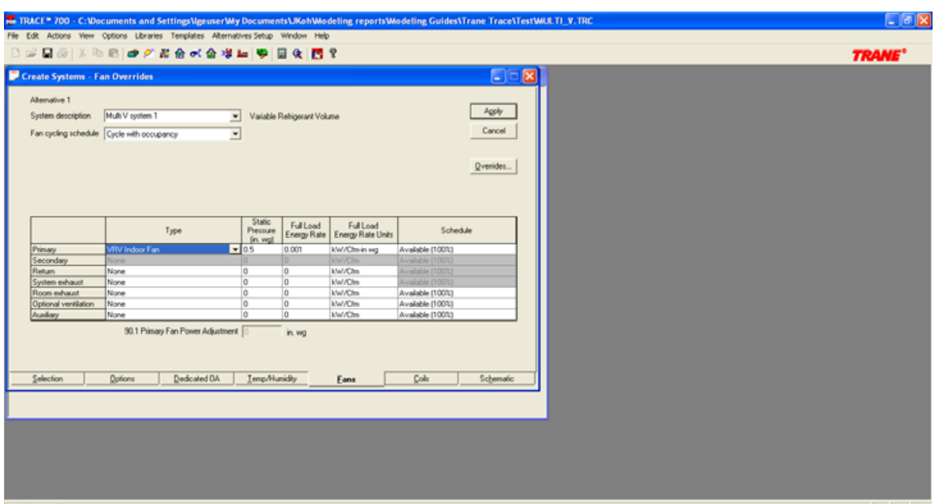
1. The Multi V system type in TRACE is listed under the “Variable Volume” system category under the “Create Systems” section.
2. Pick Variable Refrigerant Volume as the system type.
3. Click Apply to save your entries.



Fan selection

To select a fan:

1. On the Fans tab of the “Create Systems” dialog box, select VRV Indoor Fan.
2. Enter the total static pressure and fan energy rate used. The total static pressure and fan energy rate is different for each type of Multi V indoor unit. No library files have been provided for the zone level indoor VRF equipment.
3. Select an indoor unit (IDU) for each zone/space using LG Multi V Product Lineup.
4. Set total static pressure of the indoor unit fan at design flow rate. Refer to the LG’s engineering manual for Multi V Indoor units and building design data. Pressure losses should include filters, coils, and distribution system. Design full-load power of the supply fan per unit of supply air flow rate at sea level.
5. TRACE 700 currently does not utilize library files for zone level air side equipment. Instead, a system type is defined in TRACE, and that system is assigned to the appropriate TRACE “Plant” (each individual outdoor VRF compressor unit). At the system level only a single fan definition exists for the entire system, so an average assumed fan power density must be used for the system which is an average representation of the associated zones attached to that system.

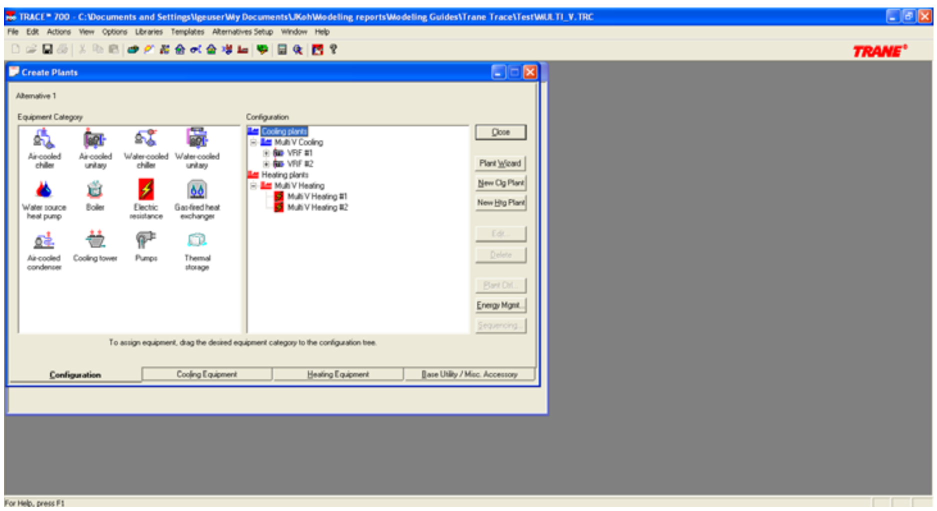


Create Plants

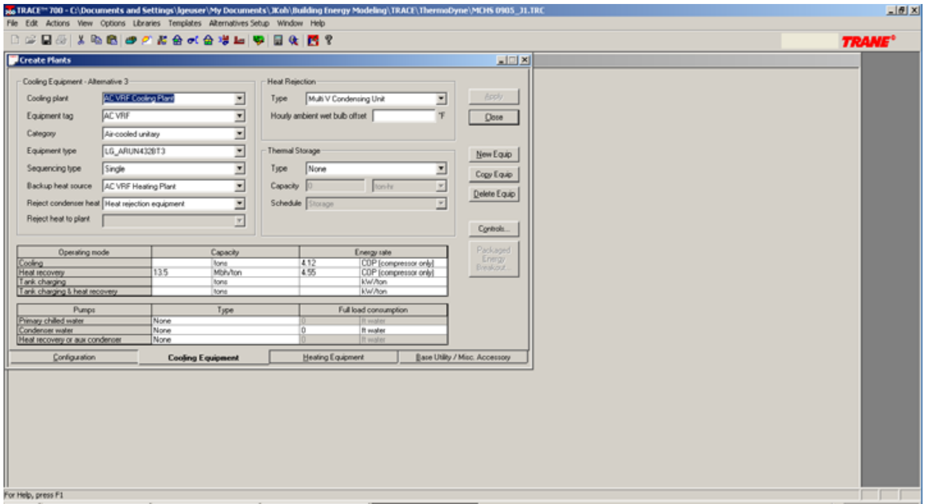
Next, describe the cooling and heating plants represented by the VRF system and backup electric resistance heat. VRF plants are considered Air-Cooled Unitary plants.

To create plants:

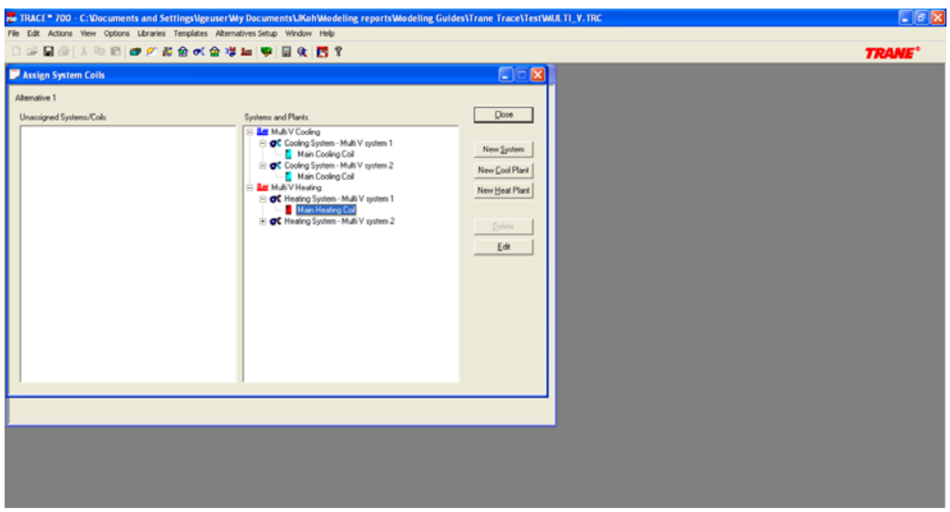
1. Drag the appropriate icons from the Equipment Category section to define each plant.
2. Rename the cooling plant as VRF and the heating plant as Backup electric resistance by selecting the plant and clicking the Edit button.



3. Select the cooling plant and click on the Cooling Equipment tab.
4. Choose the VRF plant that best matches the target performance and operation. There are two categories of plant available: VRF Heat Pump and VRF Heat Recovery.



5. Specify Backup electric resistance as the backup heat source.
6. If necessary, on the Heating Equipment tab, refine a backup heating plant.
7. Finally, assign each coil load to the appropriate plant.

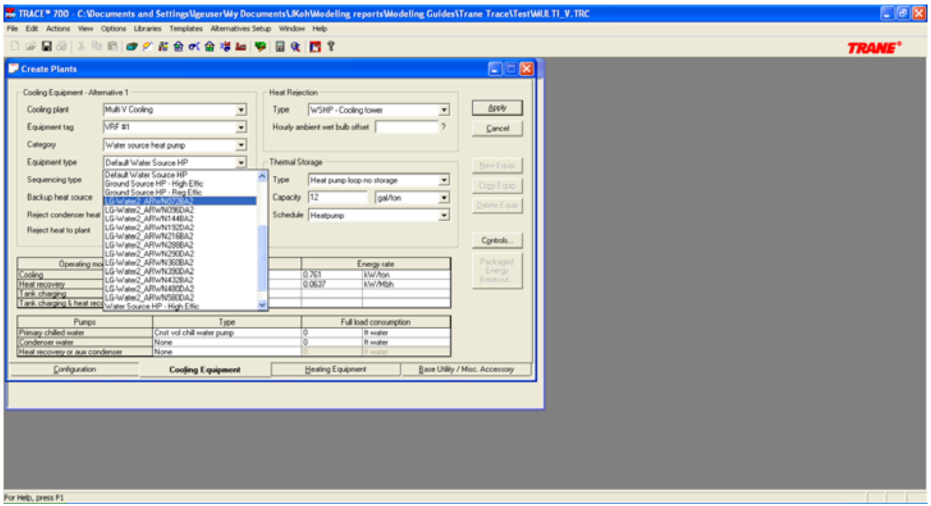


Note[1]: The VRF Heat Recovery option is able to recover heat from one VRF indoor unit and share it with other indoor units that are connected to the same refrigerant circuit. TRACE assumes that heat can be recovered between all zones that are assigned to the system. To accurately model VRF heat recovery, the design capacity of all the indoor units (zones) assigned to the system should be no larger than the available capacity of the VRF Heat Recovery outdoor unit. This might require the creation of several systems and several cooling plants. The TRACE 700 for air source heat pump system requires the option for the heat reject fan power however, Multi V Air performance library data are already included fan power information in the performance curves.

Multi V Water (Water Source) System

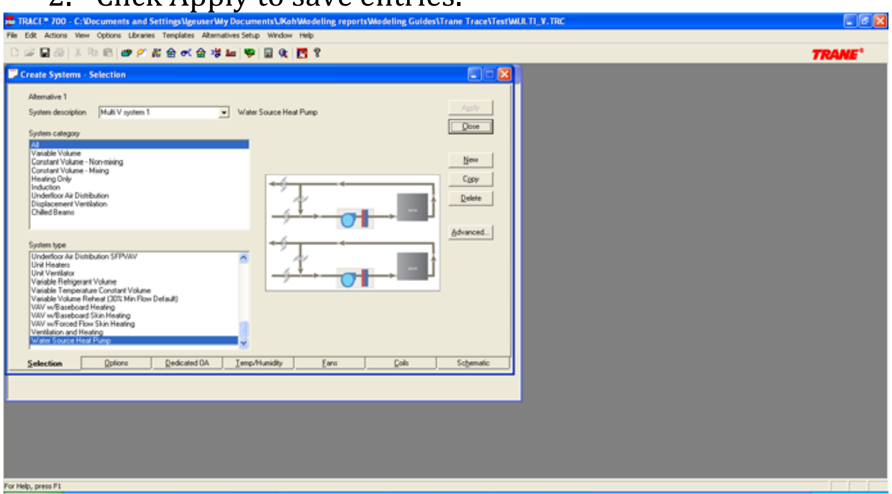
A WLHP loop is primarily intended to serve water-loop heat-pump systems. Individual WLHP units operate according to their zone thermostats, and reject heat to or take heat from this loop. Depending on the relative number of units operating in the heating or cooling mode, the loop will be thermally unbalanced and the loop temperature will either rise or fall. One or more boilers and one or more cooling towers operate to keep the loop within specified limits. In addition to WLHP units, any cooling unit with a water cooled condenser may be assigned to this loop.

Create Systems



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

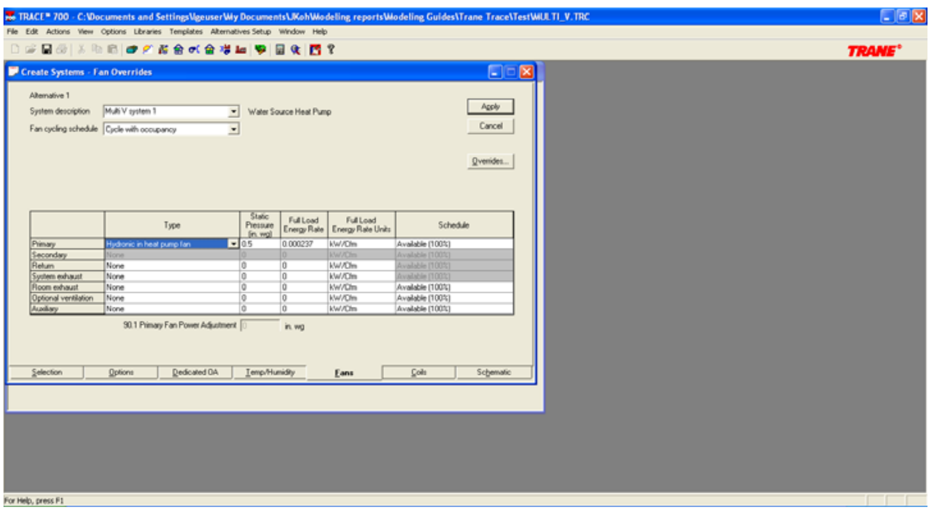
1. Pick Water Source Heat Pump as the system type.
2. Click Apply to save entries.



Fan selection

To select a fan:

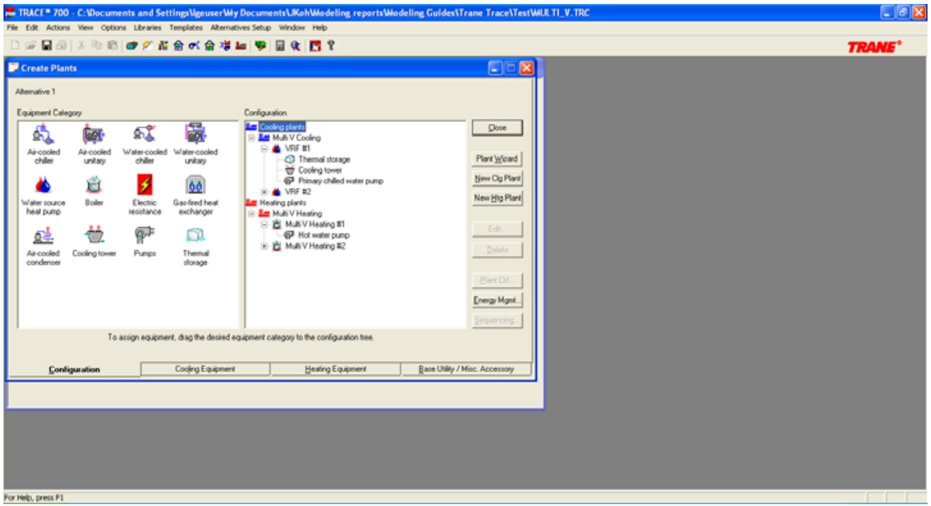
1. On the Fans tab of the “Create Systems” dialog box, select Hydronic in heat pump fan and enter the total static pressure and fan energy rate used. The total static pressure and fan energy rate will be different for each type of Multi V indoor unit.
2. Set the total static pressure of the indoor unit fan at design flow rate. Refer to the LG’s engineering manual for Multi V Indoor units and building design data. Pressure losses should include filters, coils, and distribution system.



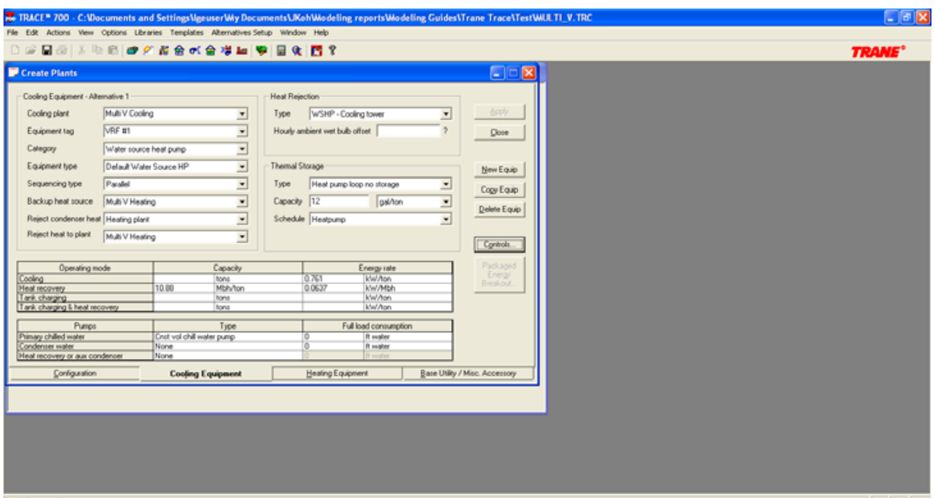
Create Plants

To create a plant:

1. Next, describe the cooling and heating plants represented by the WSHP system and backup boiler.
2. Drag the appropriate icons from the Equipment Category section to define each plant.
3. 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.



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.

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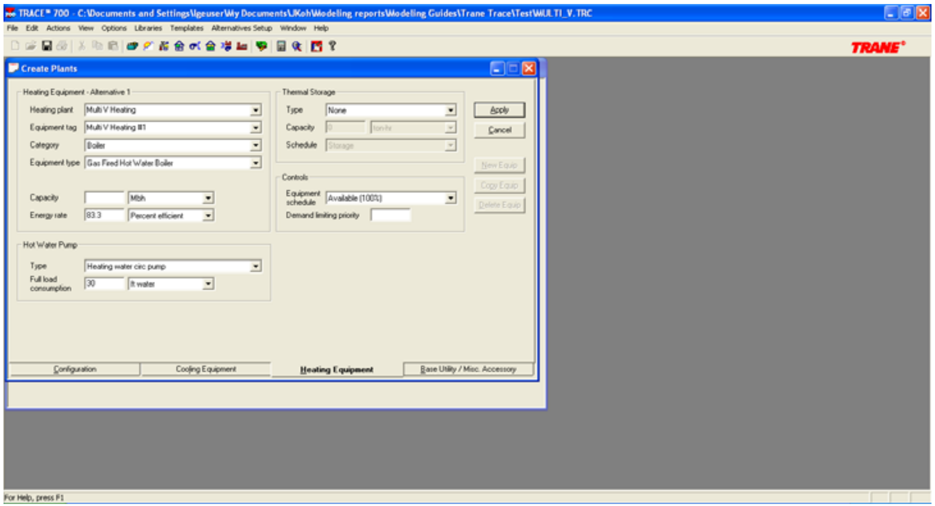
8. Be sure to apply your changes. On the Heating Equipment tab, pick the boiler that most closely matches the anticipated performance.

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 determines when the boiler turns on to maintain the condenser water temperature. To view or alter this entry, use the Library/Template Editors program.

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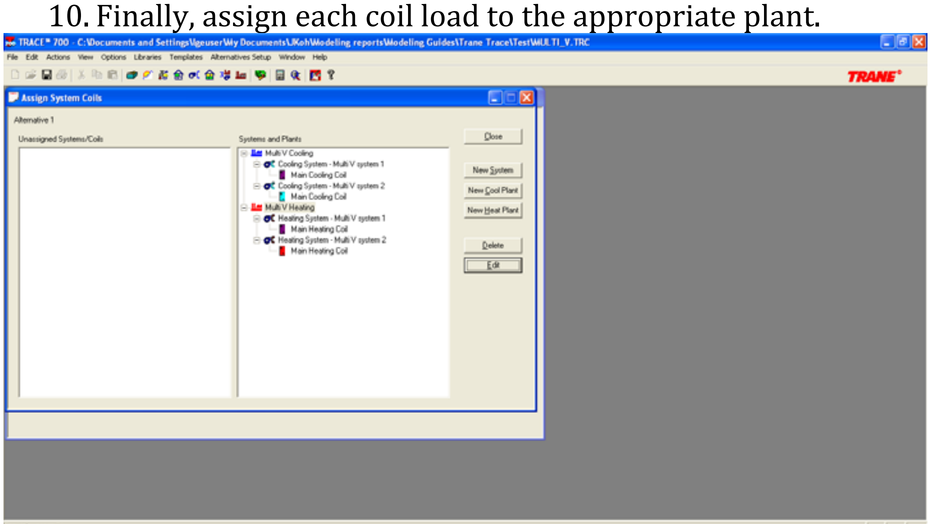
10. Finally, assign each coil load to the appropriate plant.



Dedicated Outdoor Air System /Energy Recovery Ventilator

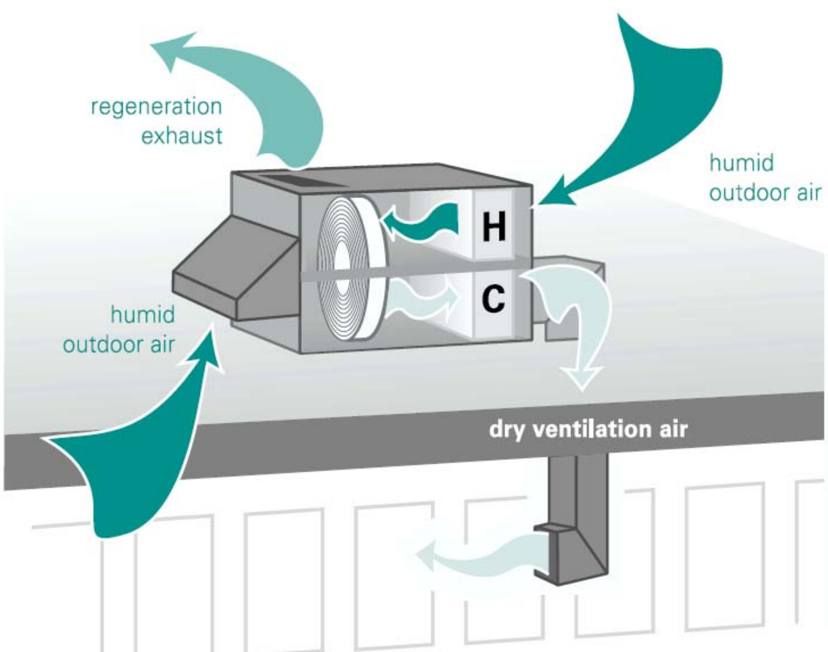
An enthalpy wheel is a revolving cylinder filled with a desiccant treated medium that is suited for transferring sensible and latent heat. Heat transfer occurs when adjacent air streams (usually supply and exhaust) pass through the wheel in a counterflow arrangement. The exchange medium inside the wheel collects sensible heat from the warmer of the two air streams and releases it in the cooler air stream. Latent heat transfer occurs as the medium collects moisture from the more humid air stream and releases it, through evaporation, in the drier air stream.

Like other energy-recovery devices, enthalpy wheels can yield significant energy savings in systems that exhaust large amounts of air. Their recent growth in popularity can be attributed, at least in part, to the increased ventilation requirements mandated by ASHRAE Standard 62 to provide acceptable indoor air quality.

Application considerations

_ The air streams targeted for energy transfer (usually exhaust air and ventilation air) must be situated near each other.

Figure 4-6 Enthalpy wheel



_ Enthalpy wheels can recover both latent heat and sensible heat with an effectiveness that typically ranges from 65 percent to 80 percent. Adding a wheel usually increases the system static pressure by 0.4 in. wg to 0.7 in. wg.

_ Cross-contamination between air streams is possible. To minimize air carryover in critical applications, add an effective purge arrangement. Placement of the fan in relation to the wheel should promote leakage from the outdoor (ventilation) air stream to the exhaust air stream rather than the reverse.

_ The relatively compact size of an enthalpy wheel can permit factory installation in air handlers, rooftop air conditioners, and some terminal devices such as unit ventilators.

_ Climates that economically favor heat pumps are good candidates for successful enthalpy-wheel applications. When applied in cold climates, it may be necessary to supplement the heating capacity of the wheel by adding preheat.

Sample scenario

The air-distribution system for a building includes an enthalpy wheel with an effectiveness of 70 percent. The wheel preconditions the outdoor air entering the building by exchanging both sensible and latent heat with the main exhaust-air stream.

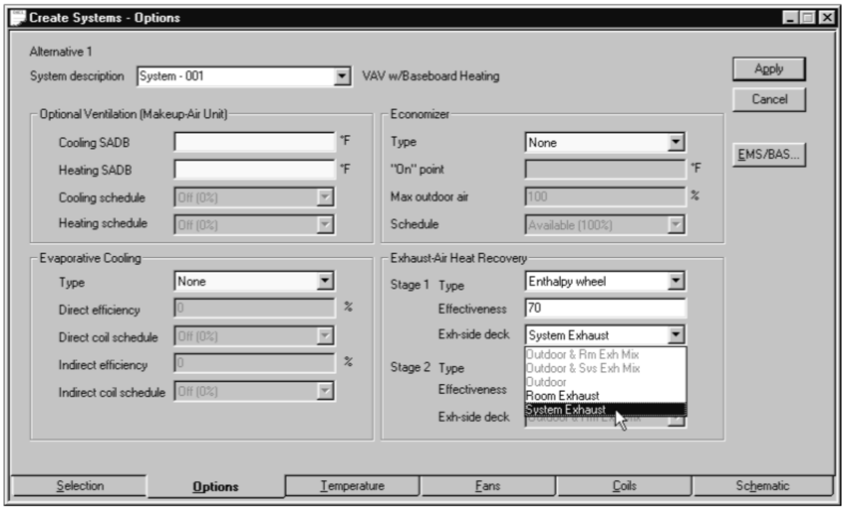
When operating in the heating mode, the wheel warms and humidifies the outdoor air; during the cooling mode, it cools and dehumidifies.

Page 4-22 illustrates how to model the enthalpy wheel in this example.

After choosing an airside system:

1 Pick the desired type of exhaust-air heat recovery from the options available.

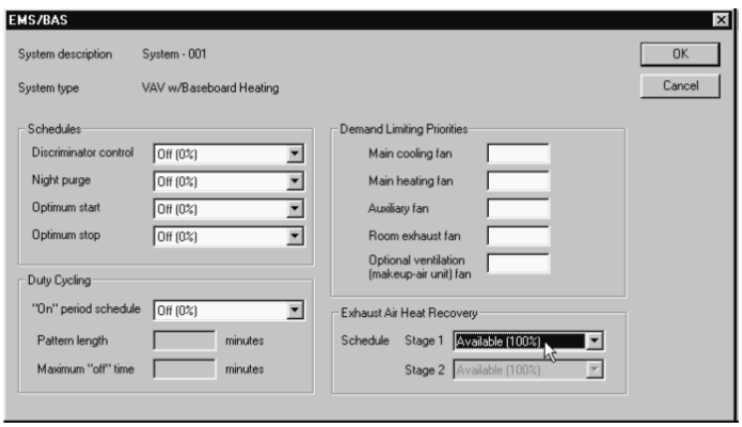
For this example, select enthalpy wheel. By default, its process air stream is located on the ventilation deck.



2 Describe the wheel's effectiveness—that is, how efficiently it recovers energy.

3 Identify the scavenger air stream by describing the location of the exhaust side deck.

4 Choose the schedule that describes when the enthalpy wheel is permitted to operate.



Appendix: Multi V performance Data Library

Please contact to http://www.lg-vrf.com or LG Multi V Sales Representatives.

References

1. Modeling Guide Trane TRACE® 700 Building Energy and Economic Analysis version 6.2, American Standard Inc. 2012
2. 2012 ASHRAE Handbook—HVAC Systems and Equipment, Chapter 18 Variable Refrigerant Flow
3. ASHRAE/IESNA Standard 90.1-2007 : http://www.ashrae.org