DAIKIN NORTH AMERICA LLC
1645 Wallace Drive, Suite 110
Carrollton, TX 75006 USA

TEL: 866-4DAIKIN
FAX: 972-245-1038
www.daikinac.com

Modeling Guide for Daikin VRV in eQUEST

DAIKIN NORTH AMERICA LLC
1645 Wallace Drive, Suite 110
Carrollton, TX 75006 USA

TEL: 866-4DAIKIN
FAX: 972-245-1038
www.daikinac.com

Table of Contents

DAIKIN NORTH AMERICA LLC
1645 Wallace Drive, Suite 110
Carrollton, TX 75006 USA

TEL: 866-4DAIKIN
FAX: 972-245-1038
www.daikinac.com

Introduction

This modeling guide contains step-by-step instructions for modeling Daikin VRV IV, III and WIV systems in eQUEST (version 3-65). To download and learn more about eQUEST, please visit http://www.doe2.com/equest/.

Please visit Daikin AC website: http://www.daikinac.com/content/resources/software-tools/, or Daikin city website https://www.daikincity.com/ following the path: **Library Home > 07 VRV/LC Sales Partners > Sales Tools & Applications Resources > Sales and Applications Tools > Energy Simulation** for new products information update.

The Daikin VRV library file includes cooling and heating performance curves for Daikin VRV IV (RXYQ and REYQ series), VRV III air-cooled (RXYQ and REYQ series) and VRV WIV water-cooled (RWEYQ series) products. The cooling/heating curves are:

- Total Capacity; *f(t evaporator entering wet bulb, t condenser entering dry bulb)*
  These curves model equipment capacity at 100% load based on
  - For air-cooled products, ambient and indoor air temperature.
  - For water-cooled products, entering water and indoor air temperature.
- Electric Input Ratio; *f(t evaporator entering wet bulb, t condenser entering dry bulb)*
  These curves model equipment power input at 100% load based on
  - For air-cooled products, ambient and indoor air temperature.
  - For water-cooled products, entering water and indoor air temperature.
- Part Load Ratio; *f(part load ratio)*
  This curve adjusts system power input based on the part load ratio of the condensing unit.

This document and its associate library file are intended to provide necessary data to help designers optimize the design of Daikin VRV systems based on building energy cost. This guide should be used as a guideline only. The modeling accuracy is highly dependent on the user input data and it is the users' responsibility to understand how the input data will affect the program output.

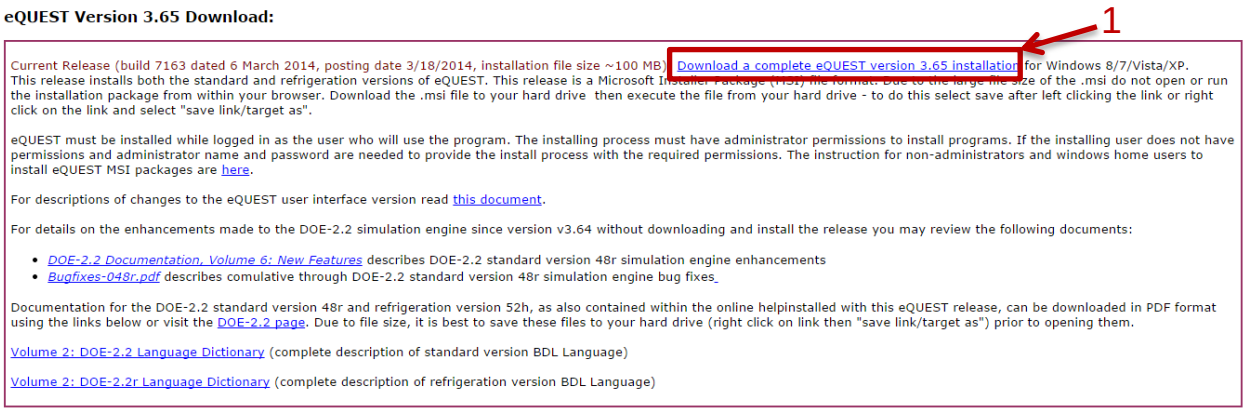
DAIKIN NORTH AMERICA LLC
1645 Wallace Drive, Suite 110
Carrollton, TX 75006 USA

TEL: 866-4DAIKIN
FAX: 972-245-1038
www.daikinac.com

Program Installation

To install eQUEST:

1. Download the latest version of eQUEST from the DOE website http://www.doe2.com/equest/.



eQUEST Version 3.65 Download:

1

Current Release (build 7163 dated 6 March 2014, posting date 3/18/2014, installation file size ~100 MB) Download a complete eQUEST version 3.65 installation for Windows 8/7/Vista/XP. This release installs both the standard and refrigeration versions of eQUEST. This release is a Microsoft Installer Package (.MSI) file format. Due to the large file size of the .msi do not open or run the installation package from within your browser. Download the .msi file to your hard drive then execute the file from your hard drive - to do this select save after left clicking the link or right click on the link and select "save link/target as".

eQUEST must be installed while logged in as the user who will use the program. The installing process must have administrator permissions to install programs. If the installing user does not have permissions and administrator name and password are needed to provide the install process with the required permissions. The instruction for non-administrators and windows home users to install eQUEST MSI packages are here.

For descriptions of changes to the eQUEST user interface version read this document.

For details on the enhancements made to the DOE-2.2 simulation engine since version v3.64 without downloading and install the release you may review the following documents:

- *DOE-2.2 Documentation, Volume 6: New Features* describes DOE-2.2 standard version 48r simulation engine enhancements
- *Bugfixes-048r.pdf* describes comulative through DOE-2.2 standard version 48r simulation engine bug fixes

Documentation for the DOE-2.2 standard version 48r and refrigeration version 52h, as also contained within the online helpinstalled with this eQUEST release, can be downloaded in PDF format using the links below or visit the DOE-2.2 page. Due to file size, it is best to save these files to your hard drive (right click on link then "save link/target as") prior to opening them.

Volume 2: DOE-2.2 Language Dictionary (complete description of standard version BDL Language)

Volume 2: DOE-2.2r Language Dictionary (complete description of refrigeration version BDL Language)

2. Save the downloaded file (.msi) to your preferred location.
3. Double click the downloaded file (.msi) and follow the program prompts to finish the installation, using the default settings.

DAIKIN NORTH AMERICA LLC
1645 Wallace Drive, Suite 110
Carrollton, TX 75006 USA

TEL: 866-4DAIKIN
FAX: 972-245-1038
www.daikinac.com

Importing Daikin VRV Library File

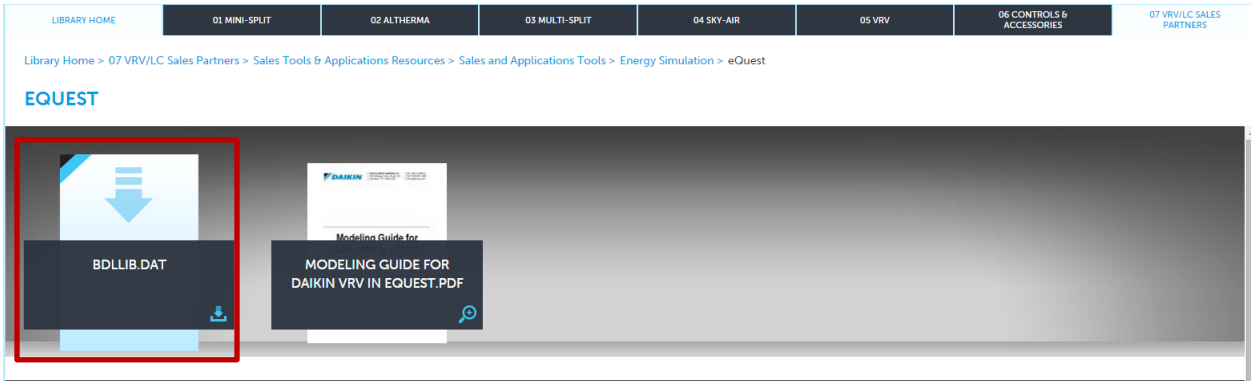
This session demonstrates how to replace the default library file in eQuest with the Daikin VRV library file.

To import the Daikin VRV library file into eQUEST:

1. Download the library file (BDLLIB.dat) from Daikin AC website

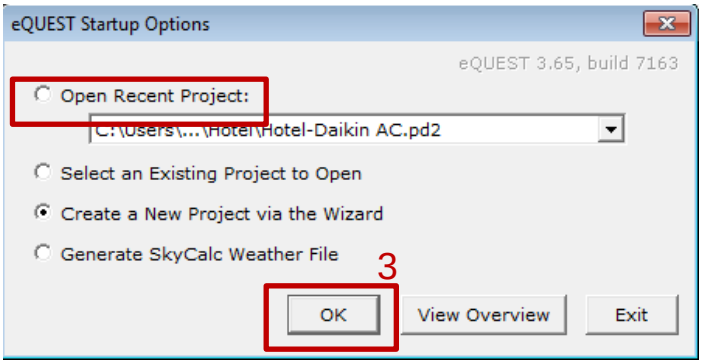
   http://www.daikinac.com/content/resources/software-tools/

   or Daikin City https://www.daikincity.com following the path: **Library Home > 07 VRV/LC Sales Partners > Sales Tools & Applications Resources > Sales and Applications Tools > Energy Simulation>eQUEST**



2. If you are an experienced user of eQUEST, jump to step 7. If not, double click the eQUEST icon 

on your desktop to launch eQUEST. The eQUEST startup options dialog box appears:

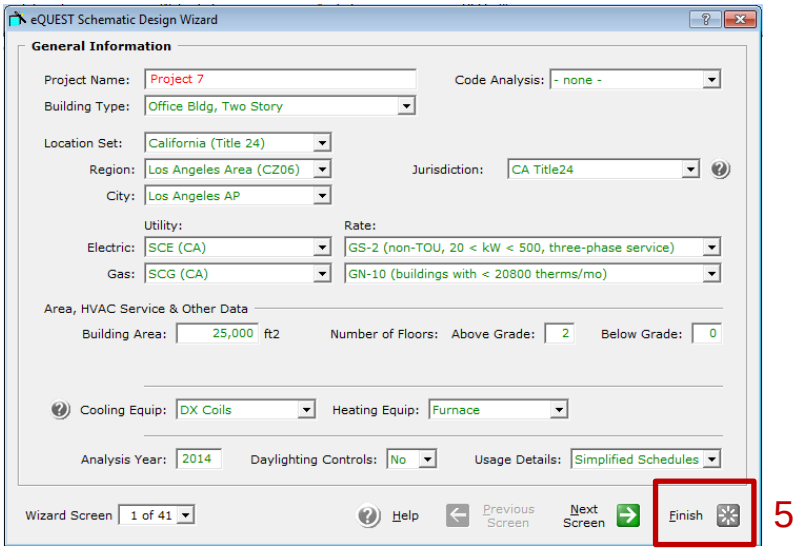


3. Click the **OK** button to create a new project. If this is not the first time opening eQUEST, open the recent project instead.
4. If you choose to create a new project, the Which Wizard box will pop out as the following. Click the **Schematic Design Wizard** button. If you choose to open the recent project, jump to step 6.

DAIKIN NORTH AMERICA LLC
1645 Wallace Drive, Suite 110
Carrollton, TX 75006 USA

TEL: 866-4DAIKIN
FAX: 972-245-1038
www.daikinac.com

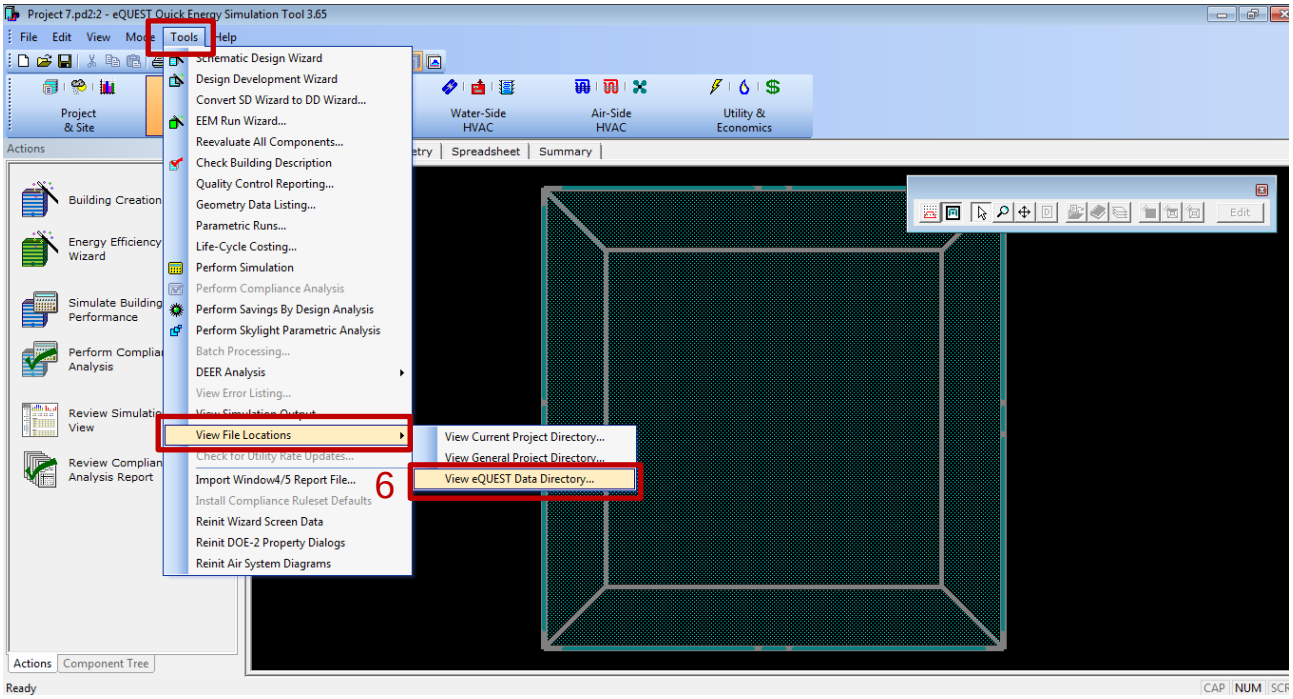
5. When the Wizard appears, click the **Finish** button. The Wizard closes.



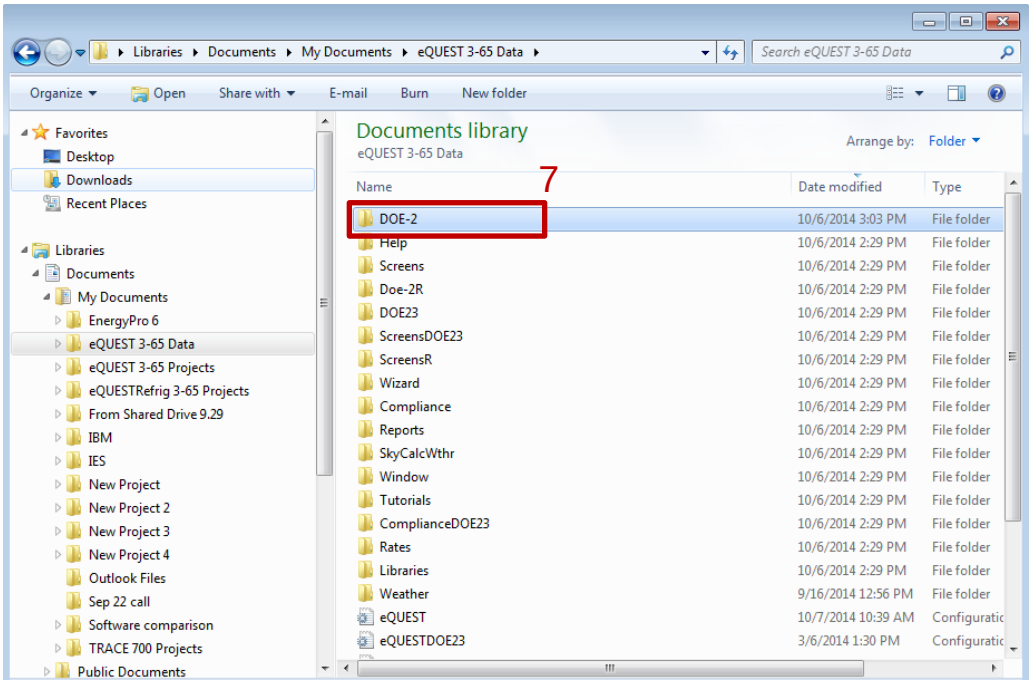
6. Click **Tools > View File Locations > View eQUEST Data Directory**.

DAIKIN NORTH AMERICA LLC
1645 Wallace Drive, Suite 110
Carrollton, TX 75006 USA

TEL: 866-4DAIKIN
FAX: 972-245-1038
www.daikinac.com



7. The eQUEST data directory appears in Windows Explore. Double click the **DOE-2** folder.



8. A list of files appears. Rename the BDLLIB.DAT file to Original-BDLLIB.DAT. So you can return to the default file if the need arises.

9. Copy the Daikin VRV library file (BDLLIB.DAT) you downloaded from the Daikin website and paste it to this dialog box.
10. Close the dialog box.
11. In eQUEST, click **File > Exit** to close the program.

DAIKIN NORTH AMERICA LLC
1645 Wallace Drive, Suite 110
Carrollton, TX 75006 USA

TEL: 866-4DAIKIN
FAX: 972-245-1038
www.daikinac.com

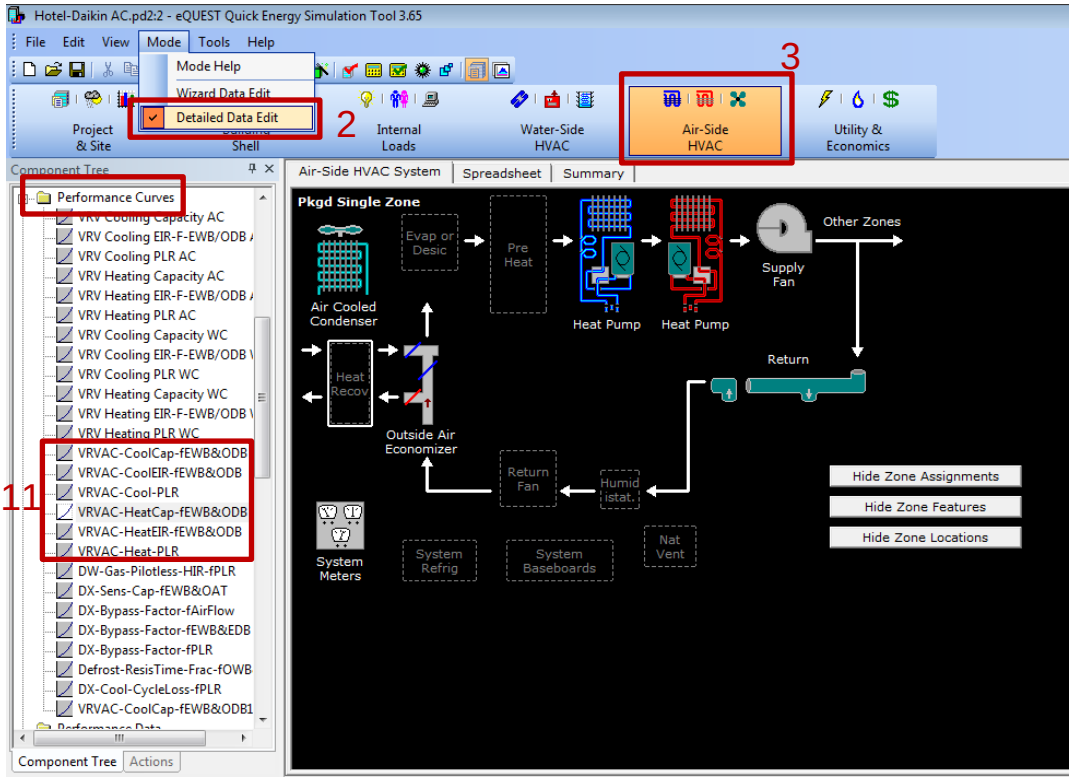
System Modeling

The variable refrigerant flow (VRF) is not incorporated within eQUEST as a specific system type. This guide uses the package single zone system to model the VRV system as an example. It is the users' responsibility to evaluate the calculation methodology of the various system types within eQUEST and select the most proper one for their buildings. Also, this session only provides the necessary steps to set up the VRV system in eQUEST. Users should make their own choices and inputs on the other variables that are not mentioned in this guide.

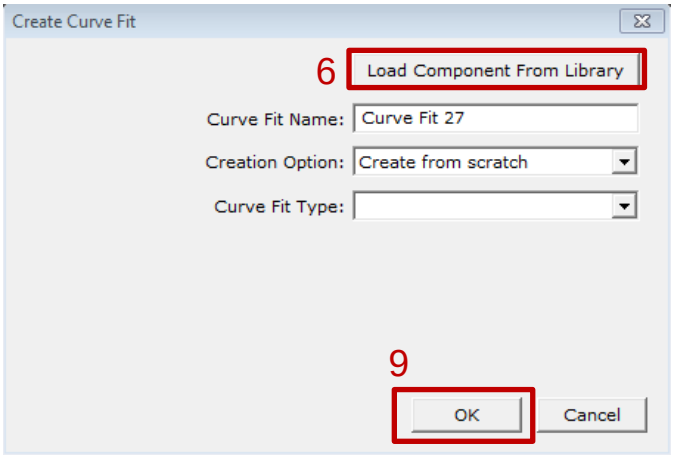
Implementing the performance curves

To implement the wanted performance curves into your project:

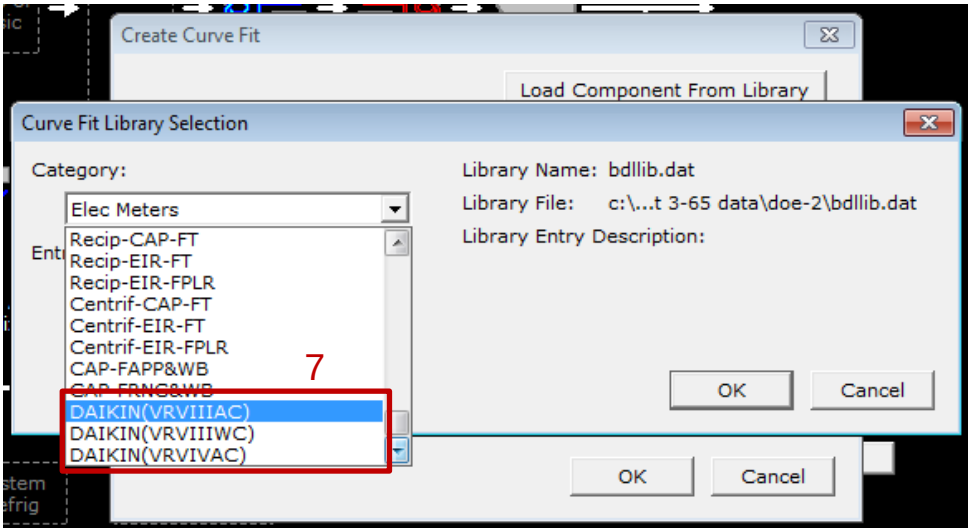
1. Double click the eQUEST icon  on your desktop again to open the program.
2. Click **Mode > Detailed Data Edit**.

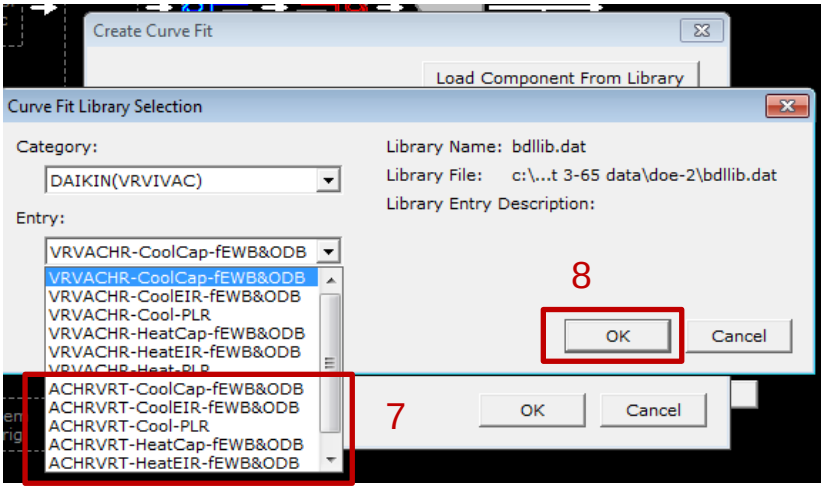


3. Click the **Air-Side HVAC** button.
4. To the left of the pane, locate the **Performance Curves** folder in the tree.
5. Right click the folder and select **Create Curve Fit**.
6. Click the **Load Component from Library** button.

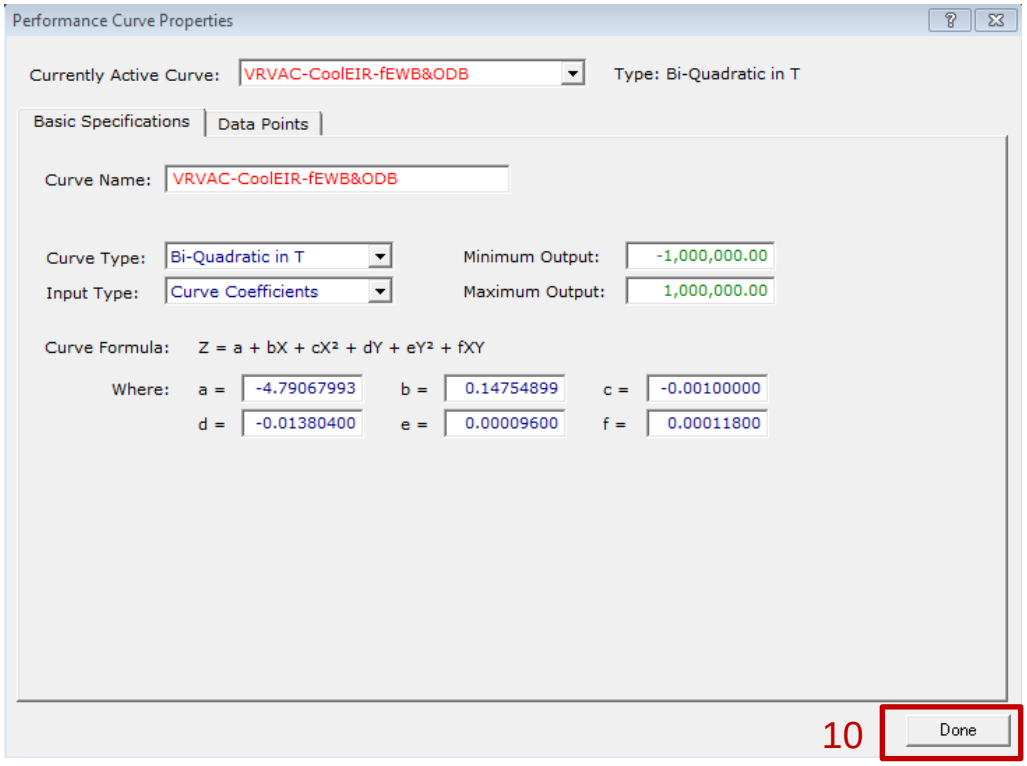


7. Select the desired product series based on your needs in the **Category** list. The **Entry** list populates with all the heating and cooling performance curves for the outdoor units. The meaning of the curves is:
   - *CoolCap* / *HeatCap*: Cooling/Heating capacity
   - *CoolEIR* / *HeatEIR*: Cooling/Heating electric input ratio
   - *Cool-PLR* / *Heat-PLR*: Cooling/Heating part load ratio





8. To make a full calculation, all the 6 curves are needed. Select one now as an example, and click the **OK** button. The set of 'ACHRVRT' curves can enable the consideration of the VRT benefits for the VRV IV products.
9. The dialog box disappears and the curve you selected will appear. Click the **OK** button.
10. The dialog box disappears and the performance curve properties appear. Click the **Done** button.

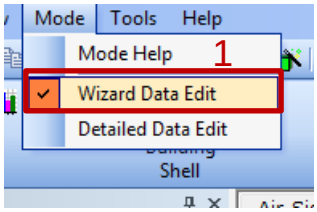


11. Repeat the procedure (step 5 – 10) to obtain all the 6 curves that are needed for the calculation. The curves will appear on the **Performance Curves** Tree.

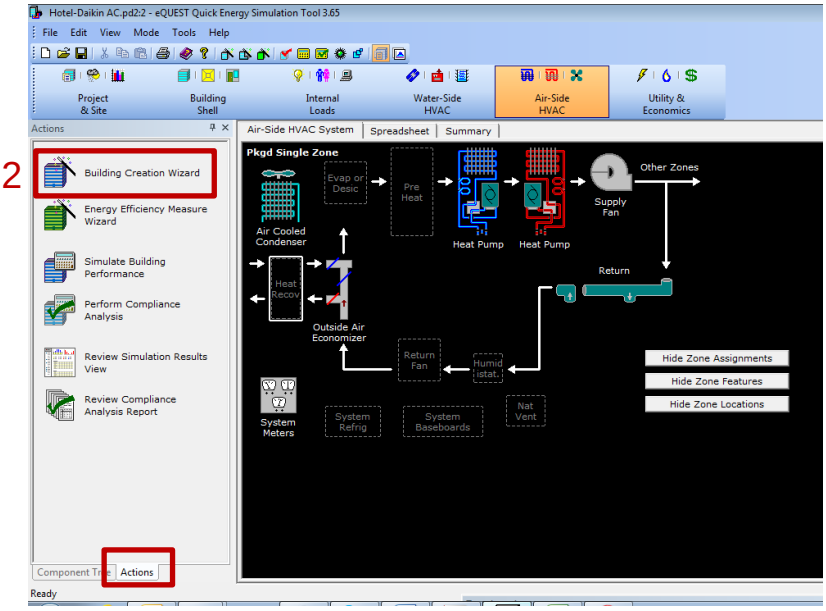
Modeling air-cooled outdoor units

To model the outdoor units for air-cooled products:

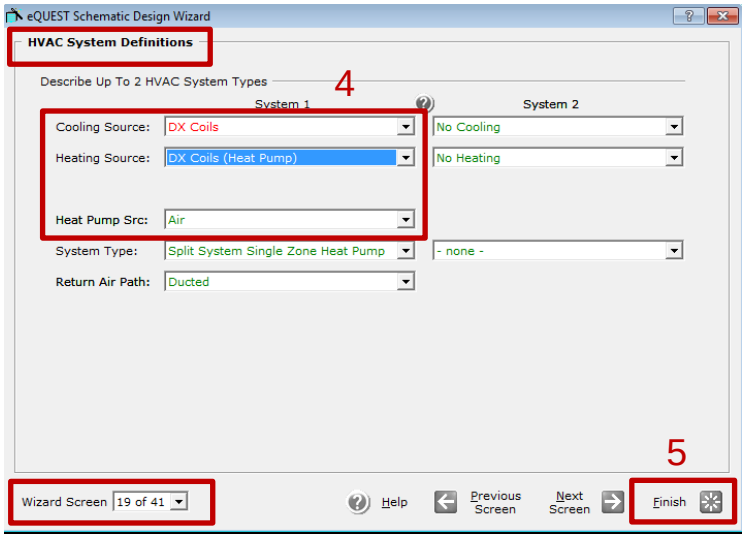
1. Change the Mode back to **Wizard Data Edit**.



2. To the left of the panel, click **Building Creation Wizard** on the **Actions** panel.



3. A window pops out, asking if save changes to current project. Click the **Yes** button. If another Wizard Warning window pops out, click the **OK** button.
4. The window of eQUEST Schematic Design Wizard will appear. Define the project building geometry, material property, etc. based on your needs. Choose the **HVAC System Definitions** on the wizard screen, select **DX coils** for the cooling source and **DX coils (Heat pump)** for the heating source. Choose **Air** as the heat pump source.



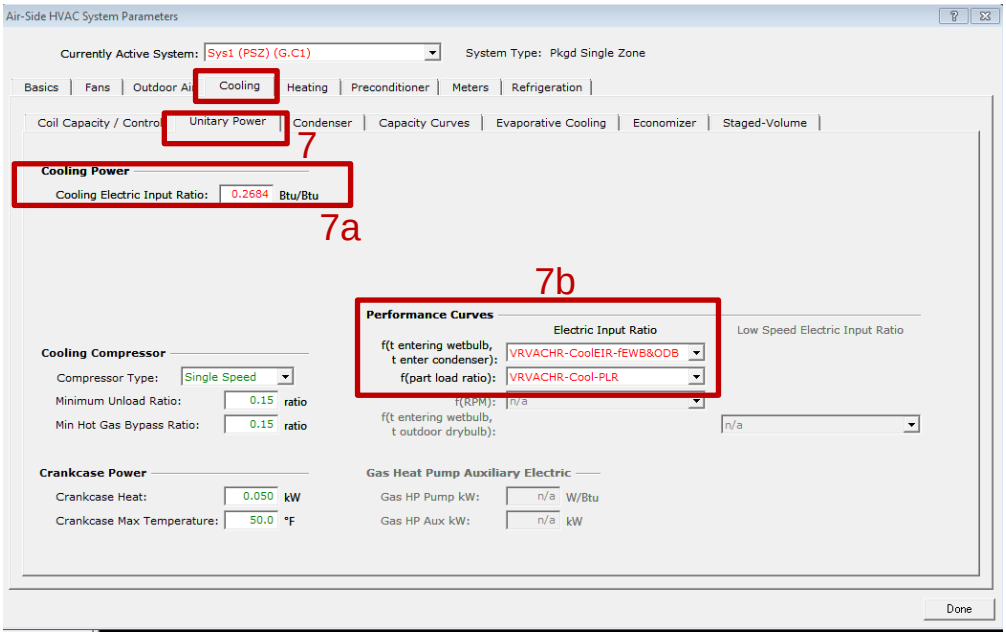
5. Click the **Finish** button when all the wanted design is finished.
6. The **Air-Side HVAC** panel will appear. Double click the **Air Cooled Condenser** Icon, the Air-Side HVAC System Parameters dialog will appear.
7. Locate **Cooling > Unitary Power** on the upper column.

   a). Input the Cooling Electric Input Ratio (EIR) as

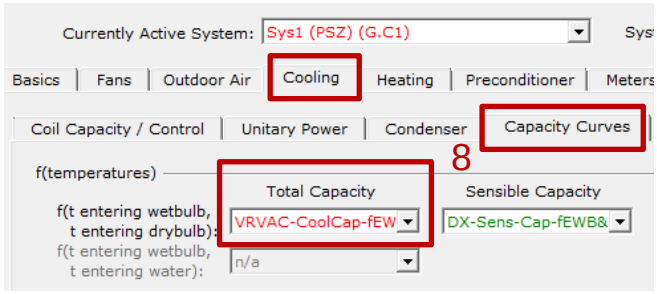
   - **0.2565** (Btu/Btu) for VRV III
   - **0.2651** for VRV IV heat pump w/o VRT
   - **0.2684** for VRV IV heat recovery w/o VRT

   If you are aware of the exact product number that is used in the system, please input the corresponding Cooling EIR of that product based on the values listed in ***Appendix A***.

   b). Select the proper performance curve for the EIR column, as it appears on the following figure.



8. Locate **Cooling > Capacity Curves** on the upper column. Select the proper performance curve for the cooling capacity, as it appears on the following figure.



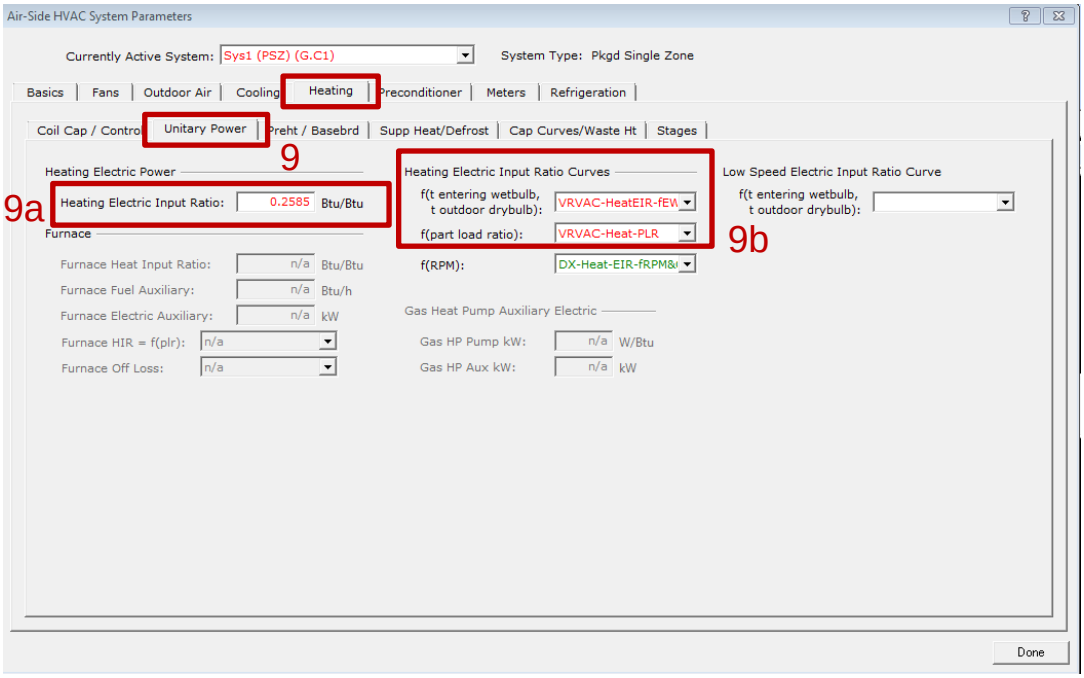
9. Then locate **Heating > Unitary Power** on the upper column.

a). Input the Heating Electric Input Ratio (EIR) as

- **0.2585** (Btu/Btu) for VRV III
- **0.2340** for VRV IV heat pump without VRT
- **0.2235** for VRV IV heat pump with VRT
- **0.2827** for VRV IV heat recovery without VRT
- **0.2416** for VRV IV heat recovery with VRT.

If you are aware of the exact model number that is used in the system, please input the corresponding Heating EIR of that model based on the values listed in ***Appendix A***.

b). Select the proper performance curve for the EIR column, as it appears on the following figure.



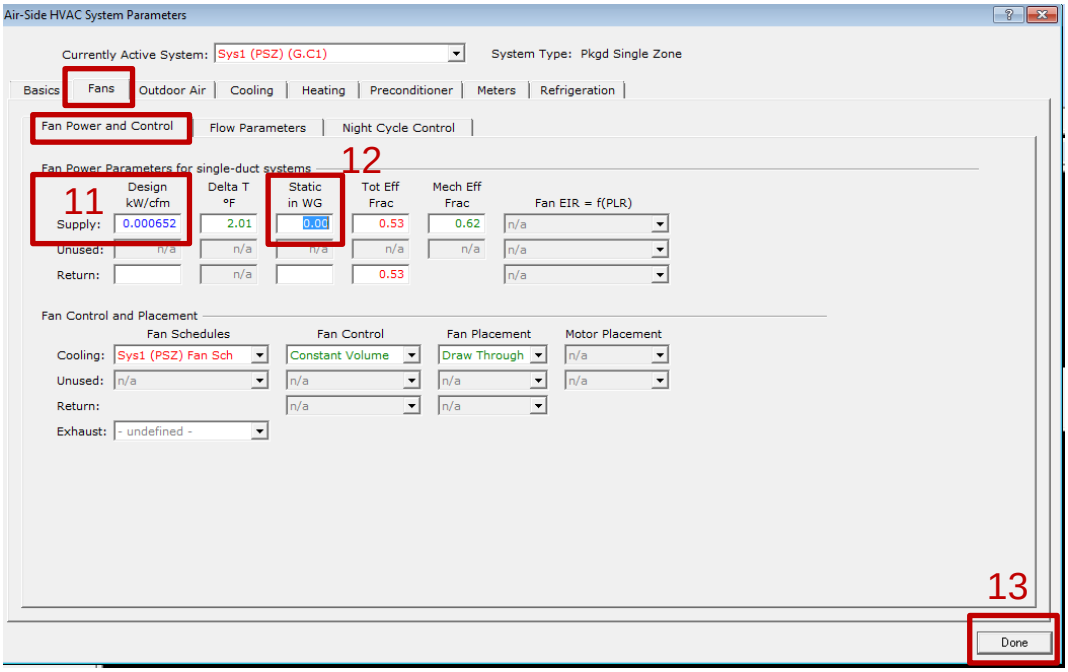
10. Locate **Heating > Cap Curves/Waste Ht** on the upper column. Select the proper performance curve for the cooling capacity, as it appears on the following figure.

Modeling fan power of the indoor units

To continue the previous step,

11. Locate **Fans > Fan Power and Control** on the upper column. Input the Design kW/cfm value in the box. The values for Daikin VRV indoor units at high speed can be found in ***Appendix B***.
    a. Since eQUEST does not apply library files for zone level air side equipment and only a single fan definition exists for the one system, an average assumed fan power density must be used for the system if different indoor units are used within the system. For example, the indoor units used for

one system is 2 x FXDQ07MVJU, 3 x FXDQ09MVJU and 4 x FXDQ12MVJU. For 07 and 09, the tonnage is 7.5 and 9.5 ton. The total tonnage of the system is 2 x 7.5 + 3 x 9.5 + 4 x 12 = 91.5. The average full load energy rate is (2 x 7.5 x 0.0002946 + 3 x 9.5 x 0.0002946 + 4 x 12 x 0.0003054)/91.5 = 0.00030027.



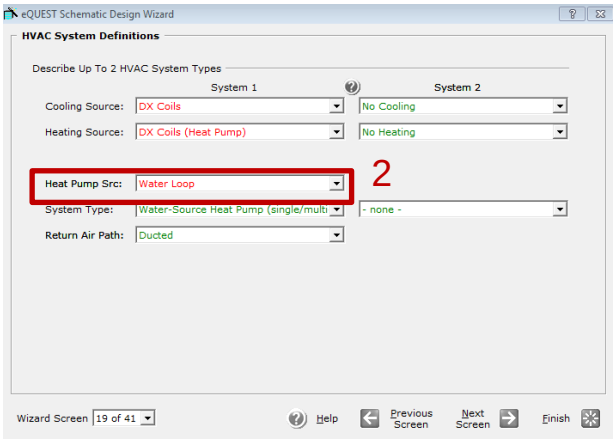
12. For duct free units (FXFQ-T, FXZQ-M, FXHQ-M, FXAQ-P, FXLQ-M and FXNQ-M series), the static pressure input should be zero. For ducted units (FXTQ-P, FXMQ-P, FXMQ-M, FXDQ-M series), the nominal External Static Pressure (ESP) values are given in the ***Appendix B***. For engineering data manual, please visit http://www.daikinac.com/content/resources/manuals/engineering-manuals/vrv-systems/.
13. Click the **Done** button.

Modeling water-cooled outdoor units

Modeling the water-cooled outdoor units has similar steps to the modeling of air-cooled units.

1. Implement the water-cooled performance curves in the **Category Daikin(WC)**. Please refer to *page 7 step 7*.

2. Follow the step 1-4 in modeling air-cooled outdoor units (*page 9*). Select **Water Loop** for the Heat Pump Src.



3. Then follow the previous step 5-13 (*page 10-12*) to define the water-cooled system by choosing the water-cooled performance curves. The cooling EIR (*refer to page 10 step 7a*) for water-cooled system is **0.2123** and the heating EIR (*refer to page 11 step 9a*) is **0.1808**. The exact value for each product is listed in ***Appendix C***.

DAIKIN NORTH AMERICA LLC
1645 Wallace Drive, Suite 110
Carrollton, TX 75006 USA

TEL: 866-4DAIKIN
FAX: 972-245-1038
www.daikinac.com

Appendix A1 Cooling and Heating EIR for VRV III Products

VRV III Model	Cooling EIR	Heating EIR	VRV III Model	Cooling EIR	Heating EIR
RXYQ72PBTJ/PBYD	0.219	0.249	**REYQ72PBTJ/PBYD**	0.214	0.236
RXYQ96PBTJ/PBYD	0.247	0.250	**REYQ96PBTJ/PBYD**	0.261	0.262
RXYQ120PBTJ/PBYD	0.258	0.270	**REYQ120PBTJ/PBYD**	0.268	0.265
RXYQ144PBTJ/PBYD	0.240	0.261	**REYQ144PBTJ/PBYD**	0.246	0.259
RXYQ168PBTJ/PBYD	0.235	0.249	**REYQ168PBTJ/PBYD**	0.258	0.251
RXYQ192PBTJPBYD	0.243	0.251	**REYQ192PBTJ/PBYD**	0.277	0.262
RXYQ216PBTJ/PBYD	0.253	0.253	**REYQ216PBTJ/PBYD**	0.295	0.268
RXYQ240PBTJ/PBYD	0.258	0.253	**REYQ240PBTJ/PBYD**	0.310	0.274
RXYQ264PBTJ/PBYD	0.246	0.255	**REYQ264PBTJ/PBYD**	0.291	0.278
RXYQ288PBTJ/PBYD	0.245	0.250	**REYQ288PBTJ/PBYD**	0.280	0.264
RXYQ312PBTJ/PBYD	0.249	0.252	**REYQ312PBTJ/PBYD**	0.292	0.268
RXYQ336PBTJ/PBYD	0.255	0.254	**REYQ336PBTJ/PBYD**	0.301	0.272
RXYQ360PBTJ/PBYD	0.258	0.254			

DAIKIN NORTH AMERICA LLC
1645 Wallace Drive, Suite 110
Carrollton, TX 75006 USA

TEL: 866-4DAIKIN
FAX: 972-245-1038
www.daikinac.com

Appendix A2 Cooling and Heating EIR for VRV IV Products

VRV IV Model	Cooling EIR w/o VRT	Heating EIR without VRT	Heating EIR with VRT	VRV IV Model	Cooling EIR w/o VRT	Heating EIR without VRT	Heating EIR with VRT
RXYQ72TTJU/TYDN	0.219	0.230	0.220	**REYQ72TTJU/TYDN**	0.196	0.230	0.220
RXYQ96TTJU/TYDN	0.217	0.209	0.200	**REYQ96TTJU/TYDN**	0.199	0.207	0.198
RXYQ120TTJU/TYDN	0.256	0.240	0.229	**REYQ120TTJU/TYDN**	0.233	0.241	0.230
RXYQ144TTJU/TYDN	0.280	0.234	0.223	**REYQ144TTJU/TYDN**	0.256	0.242	0.230
RXYQ168TTJU/TYDN	0.329	0.241	0.232	**REYQ168TTJU/TYDN**	0.282	0.258	0.246
RXYQ192TTJU/TYDN	0.242	0.243	0.227	**REYQ192TTJU/TYDN**	0.247	0.242	0.231
RXYQ216TTJU/TYDN	0.239	0.226	0.217	**REYQ216TTJU/TYDN**	0.254	0.232	0.221
RXYQ240TTJU/TYDN	0.256	0.240	0.229	**REYQ240TTJU/TYDN**	0.259	0.243	0.233
RXYQ264TTJU/TYDN	0.269	0.237	0.227	**REYQ264TTJU/TYDN**	0.273	0.250	0.241
RXYQ288TTJU/TYDN	0.278	0.234	0.223	**REYQ288TTJU/TYDN**	0.278	0.259	0.249
RXYQ312TTJU/TYDN	0.305	0.237	0.227	**REYQ312TTJU/TYDN**	0.292	0.266	0.254
RXYQ336TTJU/TYDN	0.328	0.240	0.230	**REYQ336TTJU/TYDN**	0.316	0.279	0.266
RXYQ360TTJU/TYDN	0.256	0.240	0.229	**REYQ360TTJU/TYDN**	0.279	0.245	0.234
RXYQ384TTJU/TYDN	0.278	0.232	0.223	**REYQ384TTJU/TYDN**	0.306	0.265	0.253
RXYQ408TTJU/TYDN	0.284	0.231	0.221	**REYQ408TTJU/TYDN**	0.317	0.282	0.269
				REYQ432TTJU/TYDN	0.332	0.289	0.277
				REYQ456TTJU/TYDN	0.366	0.301	0.289

DAIKIN NORTH AMERICA LLC
1645 Wallace Drive, Suite 110
Carrollton, TX 75006 USA

TEL: 866-4DAIKIN
FAX: 972-245-1038
www.daikinac.com

Appendix B Fan Power for Indoor Units

Non-ducted

Model	Design (kW/cfm)	Model	Design (kW/cfm)	Model	Design (kW/cfm)
FXAQ07PVJU	0.00007308	**FXFQ07TVJU**	0.00006667	**FXL(N)Q07MVJU9**	0.00019184
FXAQ09PVJU	0.00010000	**FXFQ09TVJU**	0.00007029	**FXL(N)Q09MVJU9**	0.00019184
FXAQ12PVJU	0.00010345	**FXFQ12TVJU**	0.00007029	**FXL(N)Q12MVJU9**	0.00028214
FXAQ18PVJU	0.00006600	**FXFQ15TVJU**	0.00008008	**FXL(N)Q18MVJU9**	0.00021429
FXAQ24PVJU	0.00007874	**FXFQ18TVJU**	0.00010270	**FXL(N)Q24MVJU9**	0.00019286
FXEQ07PVJU	0.00013613	**FXFQ24TVJU**	0.00010296	**FXUQ18PVJU**	0.00011321
FXEQ09PVJU	0.00011947	**FXFQ30TVJU**	0.00015198	**FXUQ24PVJU**	0.00011321
FXEQ12PVJU	0.00012830	**FXFQ36TVJU**	0.00016652	**FXUQ30PVJU**	0.00018265
FXEQ15PVJU	0.00014791	**FXHQ12MVJU**	0.00021951	**FXUQ36PVJU**	0.00018265
FXEQ18PVJU	0.00011911	**FXHQ24MVJU**	0.00017887	**FXZQ07MVJU9**	0.00025000
FXEQ24PVJU	0.00013929	**FXHQ36MVJU**	0.00019398	**FXZQ09MVJU9**	0.00025000
				FXZQ12MVJU9	0.00023881
				FXZQ15MVJU9	0.00025773
				FXZQ18MVJU9	0.00026263

DAIKIN NORTH AMERICA LLC
1645 Wallace Drive, Suite 110
Carrollton, TX 75006 USA

TEL: 866-4DAIKIN
FAX: 972-245-1038
www.daikinac.com

Ducted

Model	ESP	Design (kW/cfm)	Model	ESP	Design (kW/cfm)
FXDQ07MVJU	0.03	0.00032857	**FXMQ07PA(PB)VJU**	0.2	0.00025237
FXDQ09MVJU	0.03	0.00032857	**FXMQ09PA(PB)VJU**	0.2	0.00025237
FXDQ12MVJU	0.04	0.00033929	**FXMQ12PA(PB)VJU**	0.2	0.00042222
FXDQ18MVJU	0.06	0.00042045	**FXMQ15PA(PB)VJU**	0.4	0.00035714
FXDQ24MVJU	0.06	0.00033103	**FXMQ18PA(PB)VJU**	0.4	0.00033071
FXTQ12PAVJU	0.3	0.00024750	**FXMQ24PA(PB)VJU**	0.4	0.00033430
FXTQ18PAVJU	0.3	0.00025500	**FXMQ30PA(PB)VJU**	0.4	0.00032907
FXTQ24PAVJU	0.3	0.00020250	**FXMQ36PA(PB)VJU**	0.4	0.00033628
FXTQ30PAVJU	0.3	0.00024900	**FXMQ48PA(PB)VJU**	0.4	0.00033406
FXTQ36PAVJU	0.3	0.00028000	**FXMQ54PA(PB)VJU**	0.4	0.00028325
FXTQ42PAVJU	0.3	0.00032000	**FXMQ48MFVJU**	0.88	0.00056693
FXTQ48PAVJU	0.3	0.00041313	**FXMQ72MFVJU**	0.96	0.00055668
FXTQ54PAVJU	0.3	0.00049167	**FXMQ96MFVJU**	1.03	0.00051780
			FXMQ72MVJU	0.95	0.00072789
			FXMQ96MVJU	0.95	0.00066116

DAIKIN NORTH AMERICA LLC
1645 Wallace Drive, Suite 110
Carrollton, TX 75006 USA

TEL: 866-4DAIKIN
FAX: 972-245-1038
www.daikinac.com

Appendix C Cooling and Heating EIR for Water-Cooled Products

Model	Cooling EIR	Heating EIR
RWEYQ72PCTJ/PCYD	0.1990	0.1685
RWEYQ84PCTJ/PCYD	0.2275	0.1950
RWEYQ144PCTJ/PCYD	0.1990	0.1685
RWEYQ168PCTJ/PCYD	0.2275	0.1950
RWEYQ216PCTJ/PCYD	0.1990	0.1685
RWEYQ252PCTJ/PCYD	0.2275	0.1953