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## Creating Revit® MEP Content for Engineering Coordination

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**ME318-1L** Intelligent Revit families that incorporate physical as well as mechanical and electrical parameters provide a single point of data for mechanical and electrical design. You'll learn the basics of building systems content, discipline-specific connectors, and how to map parameters to connectors and share these parameters among disciplines.

### **About the Speaker:**

Before accepting the role of Project Consultant at Autodesk, Martin worked as a mechanical and electrical systems designer and, most recently, as an engineering coordinator. Martin has been using AutoCAD since Release 10, and is fluent in the customization of Autodesk products, including AutoCAD Architecture, AutoCAD MEP .NET, and Revit MEP using .NET.

Martin has worked closely with both the AutoCAD MEP and the Revit MEP development team to share insights gained while consulting with customers, and has developed custom solutions for customers built on AutoCAD Revit MEP Suite to streamline documentation and analysis workflows.

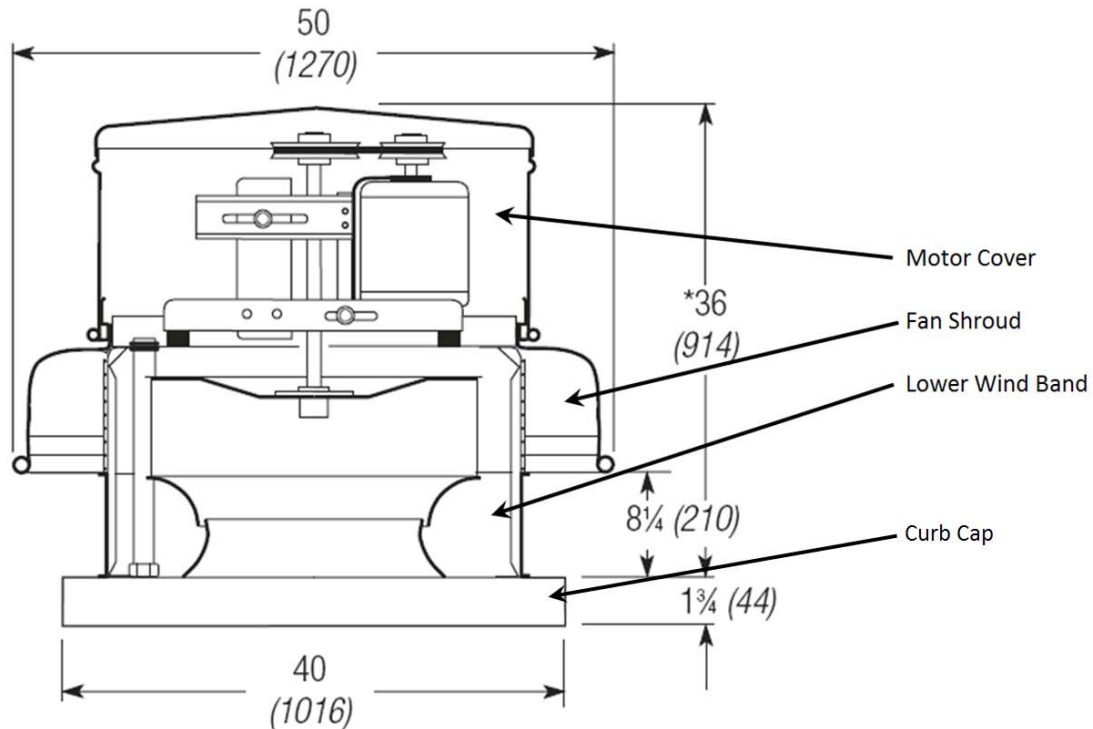


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## Introduction

In this session, we will build a simple exhaust fan including physical geometry, family parameters, shared parameters, and a type catalog. The basis of the fan is shown in the image below:

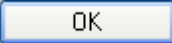


As you can see, we don't really have all the information to replicate all the dimensional information, so we will make some assumptions. Namely, we will assume that the height of the fan shroud is equivalent to the height of the lower wind band, and that the width of the motor cover and lower wind band are proportional to the fan shroud width. Since everything will be parametric, it is easy to modify later if necessary.

## Start the Family Editor

1. File > New > Family...
2. Select Generic Model.rft
3. Click .
4. Save the file as Exhaust Fan.rfa

### Define the Family Category

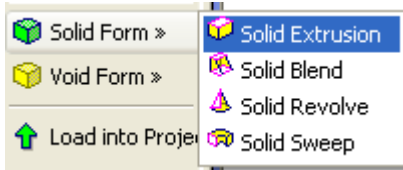
1. Settings > Family Category and Parameters...
2. Select Mechanical Equipment for the Family Category
3. Set the Behavior Type to Normal.
4. Set the Part Type to Equipment.
5. Click .

### Create the Physical Model

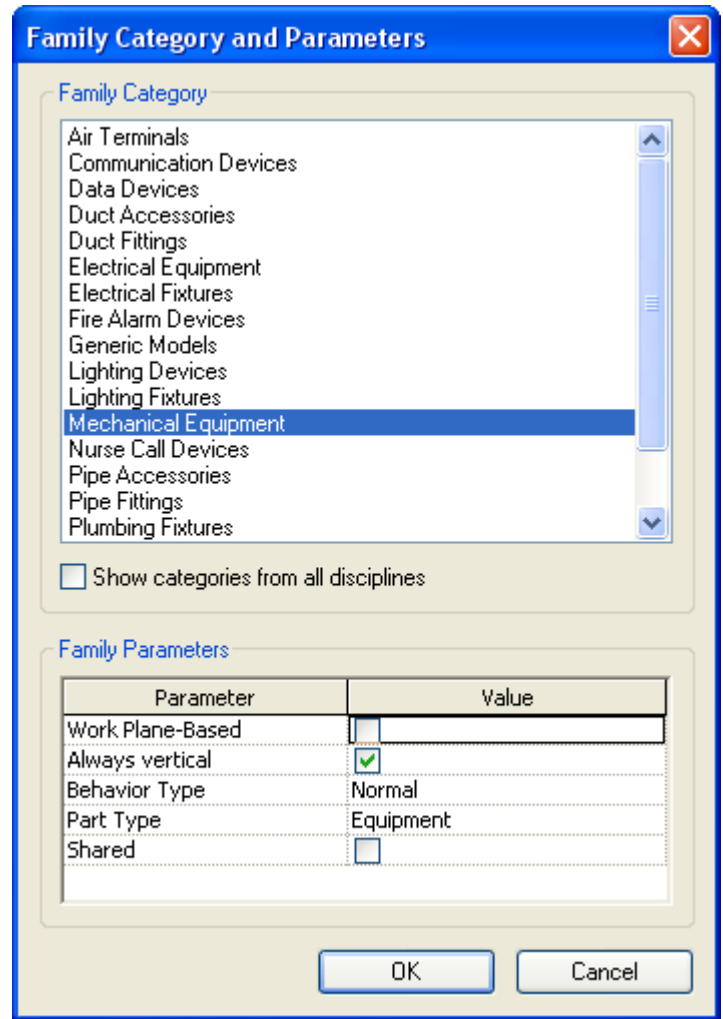
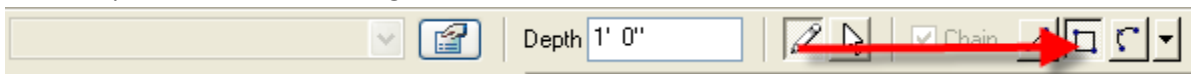
As we are creating the physical model, the actual sizes that are created will not really matter. We will come back after creating the model to define parameters to define the geometry.

### Create the Curb Cap

1. On the Family Design Bar, click Solid Form > Solid Extrusion...

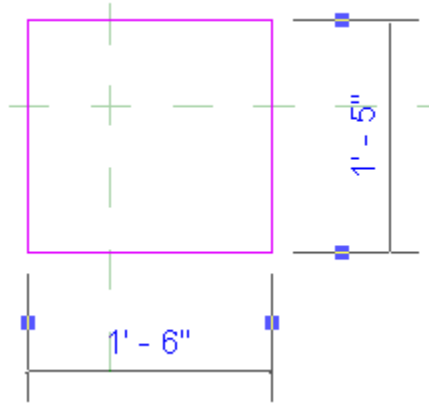



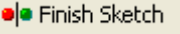

2. On the Options Bar, click Rectangle.

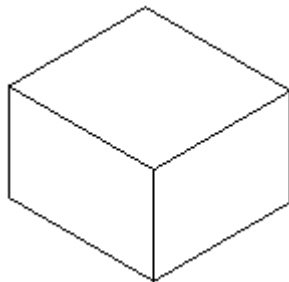




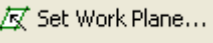
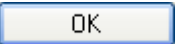
- Click two points to define the rectangle sketch crossing over the intersection of the reference planes:



- Click the two Make this Temporary Dimension Permanent controls . We will come back later and associate parameters with the dimension lines.
- Click  on the Family Design Bar.
- Click  to open the default 3D view.

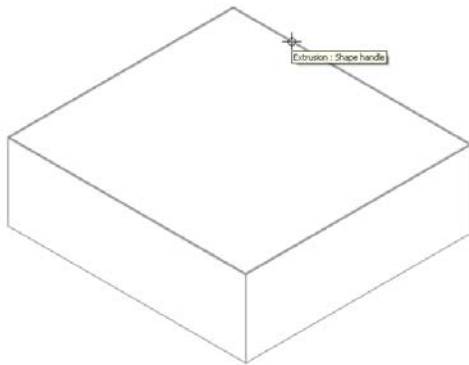


## Create the Lower Wind Band

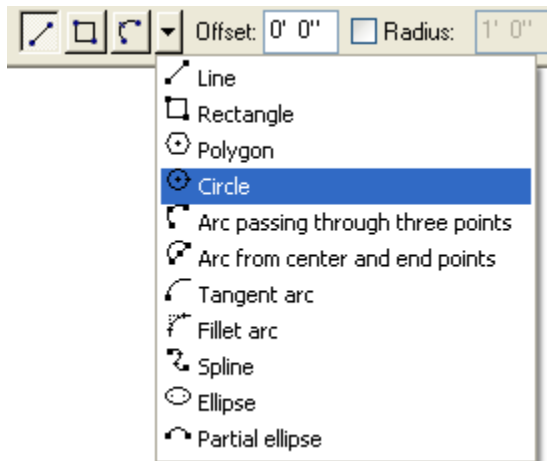
- Click Solid Form > Solid Extrusion.
- On the Design Bar, click .
- Select the Pick a plane option.
- Click .



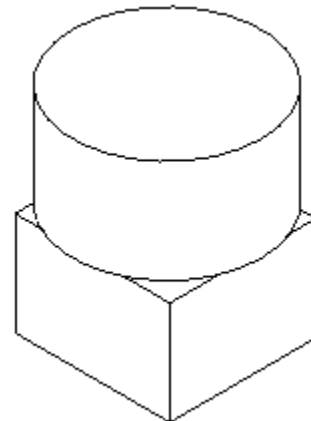
5. Move the cursor over the extrusion to highlight the top face, and then click.



6. On the Options Bar, click Circle:



7. Click somewhere near the middle of the top of the box to place the center of the circle, then click another point to define the radius.
8. Click Finish Sketch.

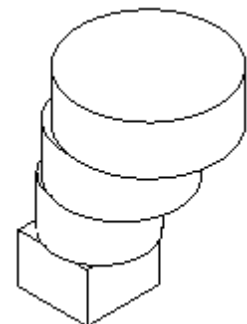


### Create the Fan Shroud and Motor Cover

1. Repeat the steps for creating the Lower Wind Band to define the Fan Shroud and Motor Cover:

### *Define Family Parameters for Geometric Sizing*


We will be defining the primary dimension parameters as Family Parameters, because we don't expect to include this information in Schedules or Tags.

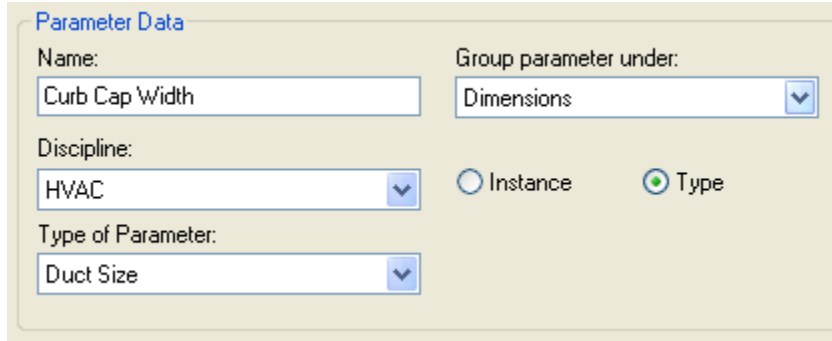


### Create the Family Parameters

1. Click  Family Types... on the Family Design Bar.



2. Click  under Parameters.
3. Define the parameter as shown below:

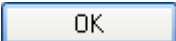


Parameter Data

Name:  Group parameter under:

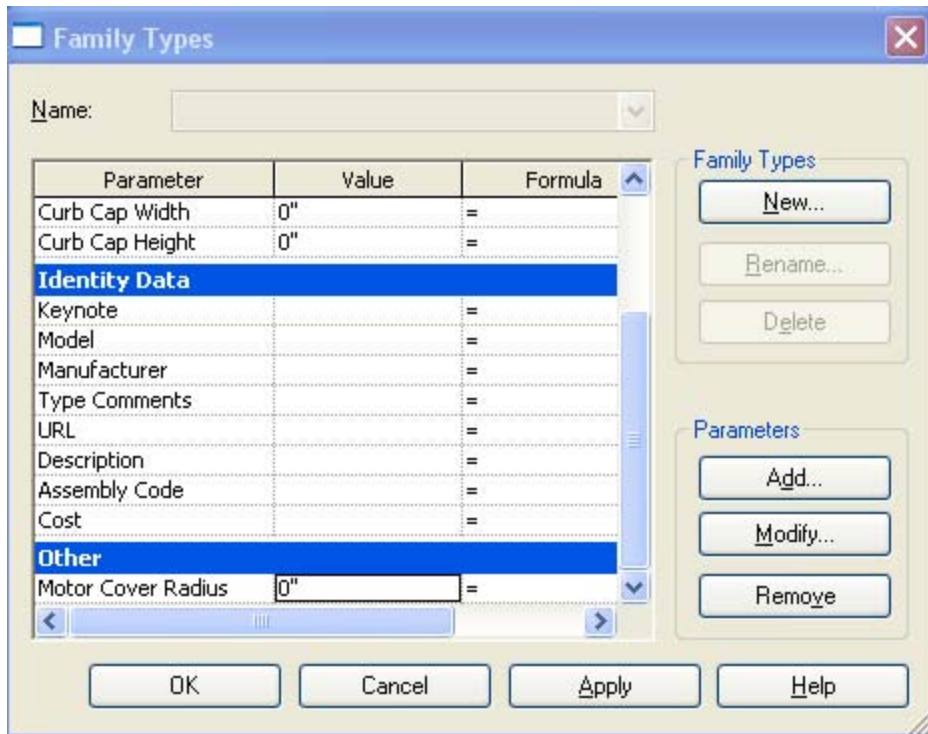
Discipline:   Instance  Type

Type of Parameter:

4. Click .
5. Repeat steps 2-4 to create additional parameters as defined below:

Name	Discipline	Type of Parameter	Group Parameter Under	Instance/Type
Curb Cap Height	HVAC	Duct Size	Dimensions	Type
Fan Shroud Height				
Fan Shroud Radius				
Lower Wind Band Height				
Lower Wind Band Radius				
Motor Cover Height				
Motor Cover Radius				
Overall Height				


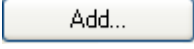
If you happen to mis-group a parameter, you can re-group it. For example, below, I accepted the default of 'Other' for the Motor Cover Radius. This really has no effect on the functionality, but it is nice to keep things organized under logical groups. To re-group it under Dimensions, simply select the row of the mis-grouped parameter, and click Modify, and then select the appropriate group. You can also use this method to rename the parameter and to change the Instance/Type setting.



Revit is case, spacing, and spelling sensitive, i.e., the following are all different:

- a. Lower Wind Band Height
- b. LowerWindBandHeight
- c. lower wind band height
- d. Lowr Wind Band Hight

Be very careful on your spelling, spacing, and casing.

If you incorrectly define the Discipline or Type of Parameter, you will have to first  the parameter, then  it again.

6. Using our base image for the fan, we will define the parameter values and formulae as follows:

Parameter	Value	Formula
Overall Height	36"	
Motor Cover Radius		Fan Shroud Radius * 0.8
Motor Cover Height		Overall Height – Lower Wind Band Height – Fan Shroud Height
Lower Wind Band Radius		Fan Shroud Radius * 0.6



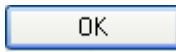
Lower Wind Band Height	8.25"	
Fan Shroud Radius	25"	
Fan Shroud Height		Lower Wind Band Height
Curb Cap Width	40"	
Curb Cap Height	1.75"	

Note: For instructional purposes, the grey cells indicate cells where you will NOT enter information.

When you are complete, your data should resemble:

Parameter	Value	Formula
<b>Dimensions</b>		
Overall Height	36"	=
Motor Cover Radius	20"	= Fan Shroud Radius * 0.8
Motor Cover Height	19 1/2"	= Overall Height - Lower Wind Band Height
Lower Wind Band Radius	15"	= Fan Shroud Radius * 0.6
Lower Wind Band Height	8 1/4"	=
Fan Shroud Radius	25"	=
Fan Shroud Height	8 1/4"	= Lower Wind Band Height
Curb Cap Width	40"	=
Curb Cap Height	1 3/4"	=

7. After you have defined all the parameters, click



## Associate Parameters with the Curb Cap Geometry

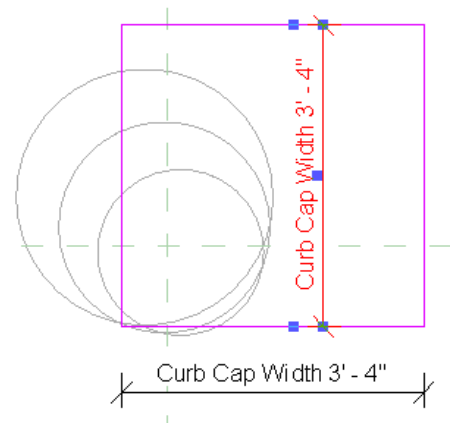
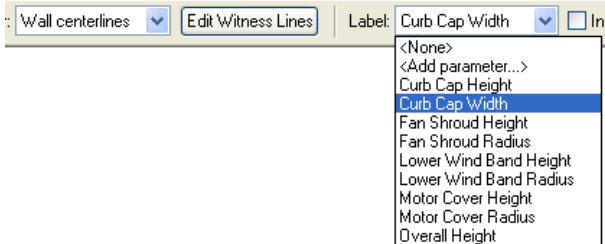
1. In the Project Browser, double click on the Ref. Level under Floor Plans to re-open the top view.



2. Select the rectangular extrusion, and click Edit on the Options Bar.


3. Select the two dimension lines (use Ctrl to select multiple).

4. On the Options Bar, select Curb Cap Width for the Label:

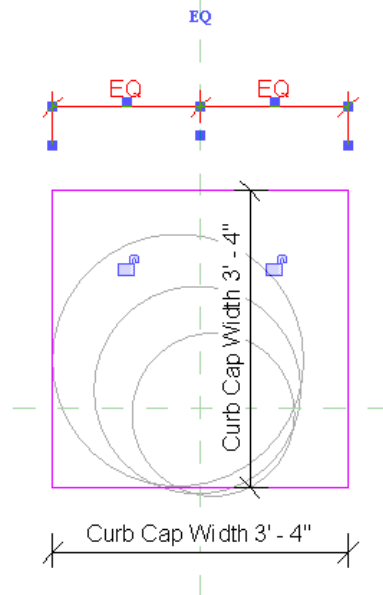




This will associate this parameter with the two dimensions.


5. Next, we will constrain the rectangle to be centered on the


reference planes. Click  Dimension on the Design Bar.

6. You will make a total of 4 clicks to create the dimension:
  - a. Click the left vertical magenta segment.
  - b. Click the vertical reference plane (green dashed line).
  - c. Click the right vertical magenta segment.
  - d. Click to place the dimension line above the rectangle.

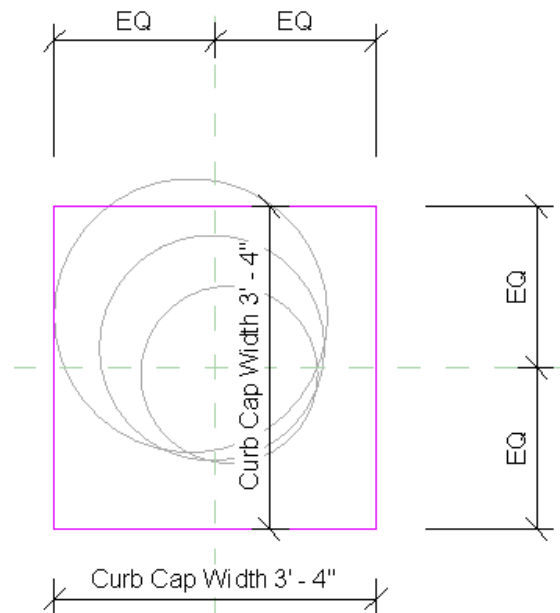
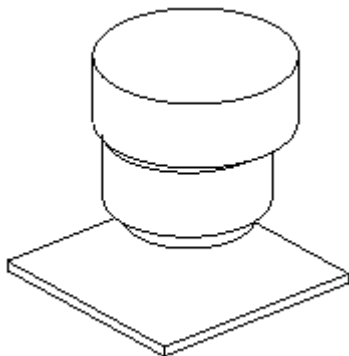


7. Click the  to change it to .
- Note that the rectangle is now centered on the vertical reference plane.
8. Repeat steps 5-7 to center the rectangle on the horizontal reference plane:

9. Click  Extrusion Properties .
10. Associate the Curb Cap Height parameter with the Extrusion End property:








- a. Click the little button in the right column in the Extrusion End row:
 
- b. Select Curb Cap Height.
- c. Click OK, OK.

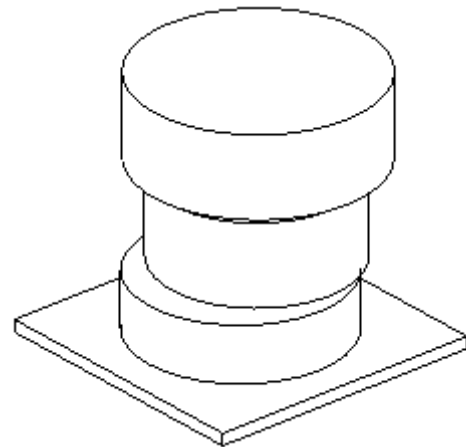
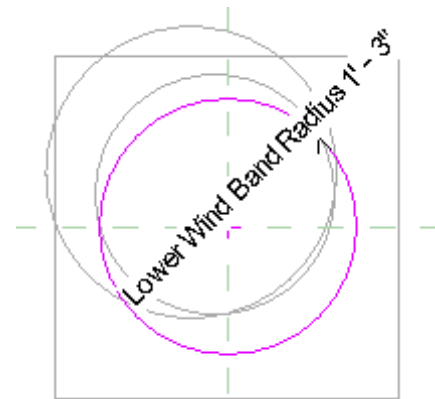
11. Click Finish Sketch.



## Associate Parameters with the Lower Wind Band Geometry

1. Select the circular extrusion representing the lower wind band.
2. Click Edit on the Options Bar.
3. Select the Magenta Circle.

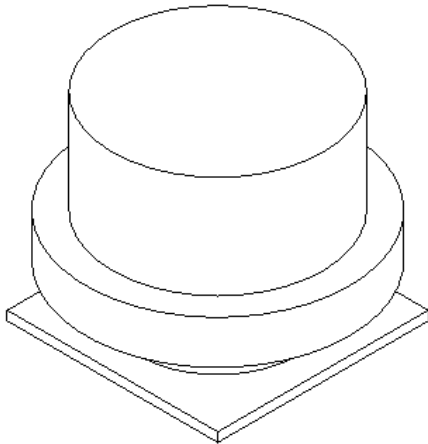
4. Click  on the Options Bar.
5. Check the Center Mark Visible Box.
6. Click OK.
7. Align and lock the circle to the horizontal and vertical reference planes (,ake sure you are in the Ref. Level Floor Plan view):
  - a. Click  on the Tool Bar.
  - b. Click the horizontal reference plane.
  - c. Click on the circle center mark.
  - d. Click the .
  - e. Click the vertical reference plane.
  - f. Click on the circle center mark.
  - g. Click the .
8. Click  on the Design Bar.
9. Select the Magenta Circle again.
10. Click the dimension control: .
11. Click  on the Design Bar.
12. Select the dimension.
13. On the Options bar, set the Label to Lower Wind Band Radius.
14. Click Extrusion Properties on the design bar.
15. Associate the Lower Wind Band Height with the Extrusion End property.
  - a. Click the button in the right column in the Extrusion End row.
  - b. Select Lower Wind Band Height.
16. Click OK, OK.
17. Click Finish Sketch.





## Associate Parameters with the Fan Shroud and the Motor Cover

1. Repeat the steps above for the Fan Shroud and Motor Cover. Use the parameters as applicable. Your final model should appear as follows:

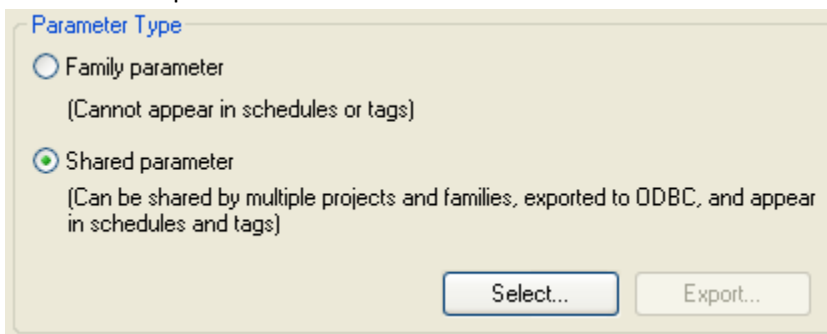


## Add a Duct Connector

To add a duct connector, you will likely want to define additional parameters for the duct opening, possibly for the height and width. This will be left as an exercise for the reader using the methods presented in this document.

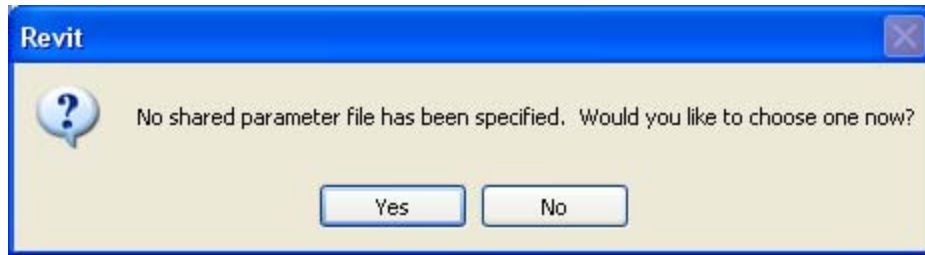
## Add Shared Parameters for Electrical Data

1. Click Family Types... on the Design Bar.
2. Click Add under Parameters.
3. Select Shared parameter:

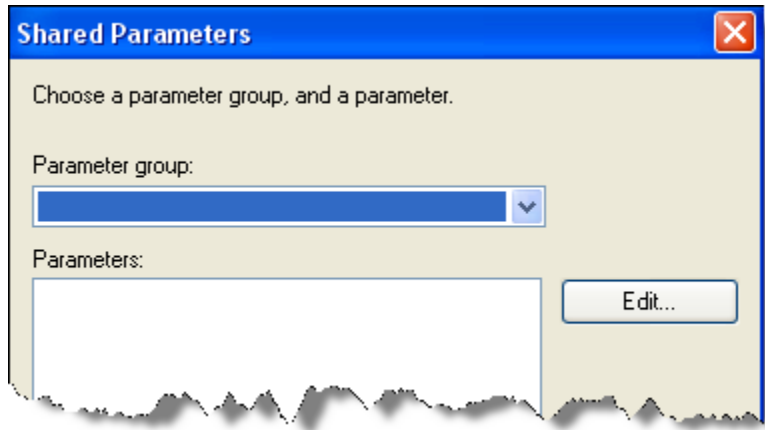


4. Click Select...
5. There may or may not be a shared parameter file defined on the machine you are working on.

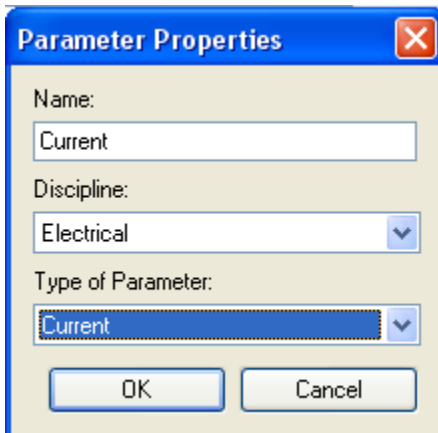
- a. If you are prompted with the following message, click Yes... then go to Step 6.



- b. If the Shared Parameters window opens, click Edit... Then go to Step 6.



6. Click Create...
7. Browse to an appropriate location.
8. Enter the name 'ME318-1L Shared Parameters.txt'
9. Click Save.
10. Under Groups, click New...
11. Enter the Name Electrical, and then click OK.
12. Under Parameters, click New...
13. Enter the Name: Electrical, Discipline: Electrical, Type of Parameter: Current, and then click OK.



14. Add two more New parameters:




- a. Under Parameters, click New...
    - i. Name: Number of Poles
    - ii. Discipline: Electrical
    - iii. Type of Parameter: Number of Poles
    - iv. Click OK.
  - b. Under Parameters, click New...
    - i. Name: Voltage
    - ii. Discipline: Electrical
    - iii. Type of Parameter: Electrical Potential
    - iv. Click OK.
  - c. Under Parameters, click New...
    - i. Name: Power
    - ii. Discipline: Electrical
    - iii. Type of Parameter: Power
    - iv. Click OK.
15. Click OK to close the Edit Shared Parameters window.
  16. Select Current, and then click OK.
  17. Group the Parameter under Electrical.
  18. Click OK.
  19. Under Parameters, click Add...
  20. Select Shared Parameter.
  21. Click Select...
  22. Select the Number of Poles parameter
  23. Click OK.
  24. Group the parameter under Electrical.
  25. Click OK.
  26. Repeat steps 19 – 23 to add the other Electrical Parameters:



Electrical		
Voltage	0.00 V	=
Power	0.00 VA	= Voltage * Current
Number of Poles	1	=
Current	0.00 A	=

27. Specify the Formula for Power as 'Voltage \* Current'
28. Click OK.
29. Save the Exhaust Fan.rfa file.

### ***Add an Electrical Connector***

1. On the Design Bar, click  Electrical Connector
2. Click to select a face to place the connector.
3. Click Modify on the Design Bar.



4. Select the connector.
5. Click  on the Options Bar.
6. Set the System Type to Power – Balanced.
7. Set the Load Classification to HVAC.
8. Click on each of the  buttons to associate the properties as follows:
  - a. Number of Poles : Number of Poles
  - b. Voltage : Voltage
  - c. Apparent Load : Power
9. Click OK.

## ***Define the Type Catalog***

A Type Catalog Based part requires a .txt file with the same file name as the Revit family .rfa file. The type catalog can define parameter values for the various types within a family. In this case, we will define multiple fan size/power combinations within the type catalog file.

Detailed information about defining the type catalog is available in the help, under:

Platform > Creating Your Own Components (Families) > Creating Type Catalogs > Creating a Type Catalog

## **Create the Type Catalog File**

A Type Catalog file contains data to define multiple types of a family. The first row in the text file specifies the parameters and their associated data and unit types.

1. Open Notepad.
2. Open another instance of Notepad.  
Save the empty file in the same folder as the Exhaust Fan.rfa file as Exhaust Fan.txt
3. Enter the following on the first line in the .txt file:  
`,Voltage##electrical_potential##volts,Number of Poles##other##,Current##electrical_current##amperes`  
Note the leading comma above, and that the above line should not word wrap in Notepad.

## **Add Parameters and Types to Type Catalog File**

1. For our specific family, we want to add additional parameters for:
  - a. Overall Height
  - b. Lower Wind Band Height
  - c. Fan Shroud Radius
  - d. Curb Cap Width
  - e. Curb Cap Height



2. For each of the above parameters, add to the end of the first row in Exhaust Fan.txt:

```
,<parameter name from above>##length##inches
```

The resultant first row in Exhaust Fan.rfa should be:

```
,Voltage##electrical_potential##volts,Number of  
Poles##other##,Current##electrical_current##amperes  
,Overall Height##length##inches  
,Lower Wind Band Height##hvac_duct_size##inches  
,Fan Shroud Radius##hvac_duct_size ##inches  
,Curb Cap Width##hvac_duct_size ##inches  
,Curb Cap Height##hvac_duct_size ##inches
```

Again, note the leading comma, and that there should be only one non-word wrapped line.

Revit is case, spacing, and spelling sensitive, i.e., the following are all different:

- Lower Wind Band Height
- LowerWindBandHeight
- lower wind band height
- Lowr Wind Band Hight

Be very careful on your spelling, spacing, and casing.

3. Enter the following subsequent rows into the text file

```
GB-260-4 115v 1p 1/4 hp,120,1,5.8  
GB-260-3 115v 1p 1/3 hp,120,1,7.2  
GB-260-5 115v 1p 1/2 hp,120,1,9.8  
GB-260-7 115v 1p 3/4 hp,120,1,13.8  
GB-260-10 208v 3p 1 hp,208,3,4.6  
GB-260-15 208v 3p 1 1/2 hp,208,3,6.6  
GB-260-20 208v 3p 2 hp,208,3,7.5  
GB-260-30 208v 3p 3 hp,208,3,10.6
```

4. Add the dimensional information after each row (for these catalog numbers, the geometry is the same, but the electrical characteristics change. When inspecting the actual catalog numbers and specifications, different model numbers have different dimensional information, which is why those parameters were defined parametrically.)

```
,36,8.25,25,40,1.75
```

The result of the entire file should be:

```
,Voltage##electrical_potential##volts,Number of  
Poles##other##,Current##electrical_current##amperes,Overall
```



Height##length##inches,Lower Wind Band Height##length##inches,Lower Wind Band Radius##length##inches,Curb Cap Width##length##inches,Curb Cap Height##length##inches ↵

GB-260-4 115v 1p 1/4 hp,120,1,5.8,36,8.25,25,40,1.75↵  
 GB-260-3 115v 1p 1/3 hp,120,1,7.2,36,8.25,25,40,1.75↵  
 GB-260-5 115v 1p 1/2 hp,120,1,9.8,36,8.25,25,40,1.75↵  
 GB-260-7 115v 1p 3/4 hp,120,1,13.8,36,8.25,25,40,1.75↵  
 GB-260-10 208v 3p 1 hp,208,3,4.6,36,8.25,25,40,1.75↵  
 GB-260-15 208v 3p 1 1/2 hp,208,3,6.6,36,8.25,25,40,1.75↵  
 GB-260-20 208v 3p 2 hp,208,3,7.5,36,8.25,25,40,1.75↵  
 GB-260-30 208v 3p 3 hp,208,3,10.6,36,8.25,25,40,1.75↵

Again, the first line should have no word wrapping. In the text above, I've shown ↵ in the only locations where there should be end-of-line returns.

5. Save and close the Exhaust Fan.txt file.

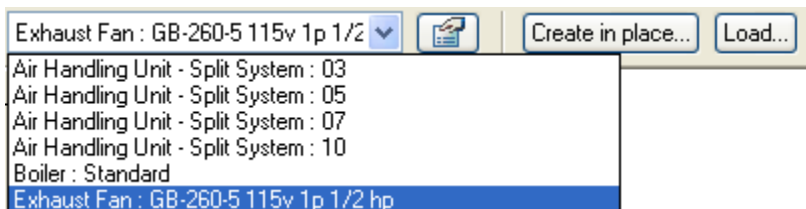
### Load the family into Revit MEP

1. Open a new Revit Project (click on the toolbar, click ).
2. On the Mechanical or Basics Design Bar, click  Mechanical Equipment
3. On the Options Bar, click
4. Browse to select the Exhaust Fan.rfa file.
5. In the lower portion of the Open window, select a horsepower/voltage combination.

Type	Voltage	Number of Poles	Current	Overall Height	Lower Wind Band Height	Lower Wind Band Radius	Curb Cap Width	Curb Cap Height
	(all) ▾	(all) ▾	(all) ▾	(all) ▾	(all) ▾	(all) ▾	(all) ▾	(all) ▾
GB-260-4 115v 1p 1/4 hp	120.00 V	1	5.80 A	36"	8 1/4"	25"	40"	1 3/4"
GB-260-3 115v 1p 1/3 hp	120.00 V	1	7.20 A	36"	8 1/4"	25"	40"	1 3/4"
GB-260-5 115v 1p 1/2 hp	120.00 V	1	9.80 A	36"	8 1/4"	25"	40"	1 3/4"
GB-260-7 115v 1p 3/4 hp	120.00 V	1	13.80 A	36"	8 1/4"	25"	40"	1 3/4"
GB-260-10 208v 3p 1 hp	208.00 V	3	4.60 A	36"	8 1/4"	25"	40"	1 3/4"
GB-260-15 208v 3p 1 1/2 hp	208.00 V	3	6.60 A	36"	8 1/4"	25"	40"	1 3/4"

Note that you can also select multiple rows to load multiple types.

6. Click Open. Note that the selected Type shows up in the Type Selector in the Options Bar.



7. Click to place an instance of the fan.



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If the fan type is changed to a different horsepower, the electrical characteristics will automatically be reflected on the connected circuit.

*Questions / Notes*