HVAC Tutorial

Design HVAC Equipment

Version 2014

PART OF HEXAGON

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SESSION 2

Design HVAC Equipment

Objective

By the end of this session, you will be able to:

- Design HVAC equipment in a model.

Before Starting this Procedure

- Smart 3D Overview
- Smart 3D Common Sessions
- Smart 3D Equipment Sessions

Overview

HVAC equipment is a custom assembly that contains members such as HVAC nozzles, shapes, and equipment components. Using the Equipment and Furnishings task, you can select HVAC equipment from the Smart 3D Catalog and position them in a 3D model. You can also create HVAC equipment in the model. In this case, you must select a type definition from the Catalog for the HVAC equipment. The type definition determines the property set associated with the HVAC equipment. The software builds the graphical representation of this HVAC equipment using primitive shapes. These equipment are called designed equipment.

In this session, you will learn the steps to design the following HVAC equipment:

- Air Handling Unit (AHU)
- Rectangular and round diffusers
- Grill
- Register

Before starting the HVAC tutorial sessions, define your workspace to include all objects in the **U06** system.

1. Start Smart 3D by clicking **Start > All Programs > Intergraph Smart 3D > Smart 3D**.
2. In the **New** dialog box, select the **EnglishUnits** or **MetricUnits** template, and then click **OK**.
3. Click **File** > **Define Workspace.**
4. Select **More** from the **Filter** list on the **Define Workspace** dialog box.
5. Select **U06** under **Plant Filters** or **Training Filters** on the **Select Filter** dialog box.
6. Click **OK** on the **Select Filter** dialog box.
7. Activate **PinPoint**, and set the active coordinate system to **Global**.
8. Click **Edit > Paste from Catalog** on the main menu.
9. Expand the **Modules** hierarchy until you see the **Modules > HVAC > HV Grids** folder.

10. Select **HVAC_CS**, and click **OK**.

    *The **Place Macro** dialog box displays.*

11. Keep the parent system for the grid objects as **Grids**, and click **OK**.
12. Type **0 ft** for **E**, **0 ft** for **N**, and **0 ft** for **El**. Then, click in the graphic view.
13. Click **View > Fit** on the main menu.

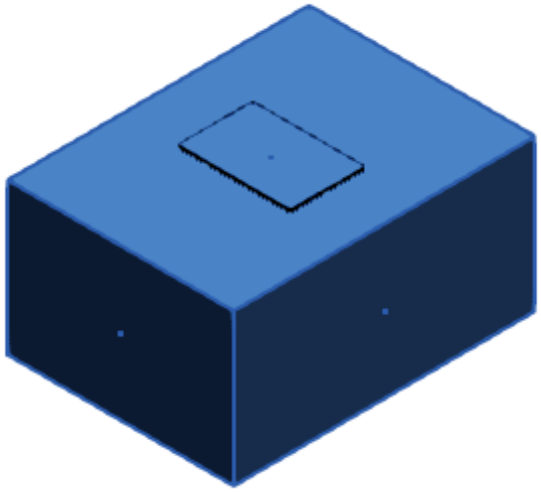
Design an AHU

Design an AHU named **AHU-01** under the **HVAC** system in the **Workspace Explorer** using the following specifications:

Type	Specifications	Values	
Design Equipment	Name	AHU-01	
	Equipment type	Variable Volume Air Distribution Assembly	
	Equipment Classification 0	HVAC equipment	
	Equipment Classification 1	Air Handling Unit	
	Shape	RectangularSolid 001	
	Shape Properties	8 ft for A, 6 ft for B, 4 ft for C	
Nozzle	Specifications	Nozzle 1	Nozzle 2
	Port Type	HVAC Port	HVAC Port
	Thickness	0.25 in	0.25 in
	Flange Width	0	0
	Flow Direction	Flow leaves this port	Flow enters this port
	Nozzle Length	1 in	1 in
	Port Depth	0	0
	Name	SP-01	RT-01
	Width	3 ft	2 ft

	Depth	2 ft	2ft
	Cross Section Shape	Rectangle	Rectangle
	Placement Type	Radial	Axial
	N1	4 ft	8 ft 1 in
	N2	2 ft 1 in	0
	OR1	270 deg	0
	OR2	0	0

Place the designed AHU in Unit U06 with active coordinate system **HVAC_CS** at the coordinates **31 ft** for **E**, **4 ft** for **N**, and **2 ft** for **El**.



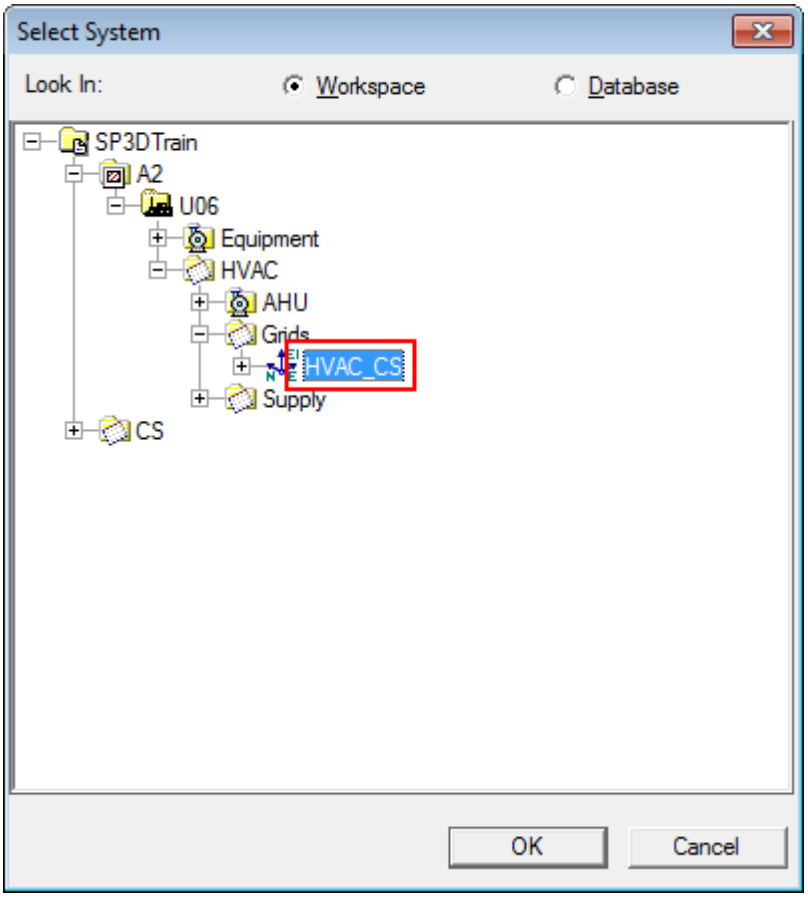
Activate the Equipment and Furnishings environment by clicking **Tasks > Equipment and Furnishings**. Set the Active Permission Group to **HVAC**.

1. Select **More** from the **Coordinate system** list on the **PinPoint** ribbon.

   *The **Select Coordinate System** dialog box displays.*

2. In the dialog box, expand **A2 > U06 > HVAC > Grids**, and select **HVAC_CS**.

3. Click **OK** to set the active coordinate system as **HVAC_CS**.

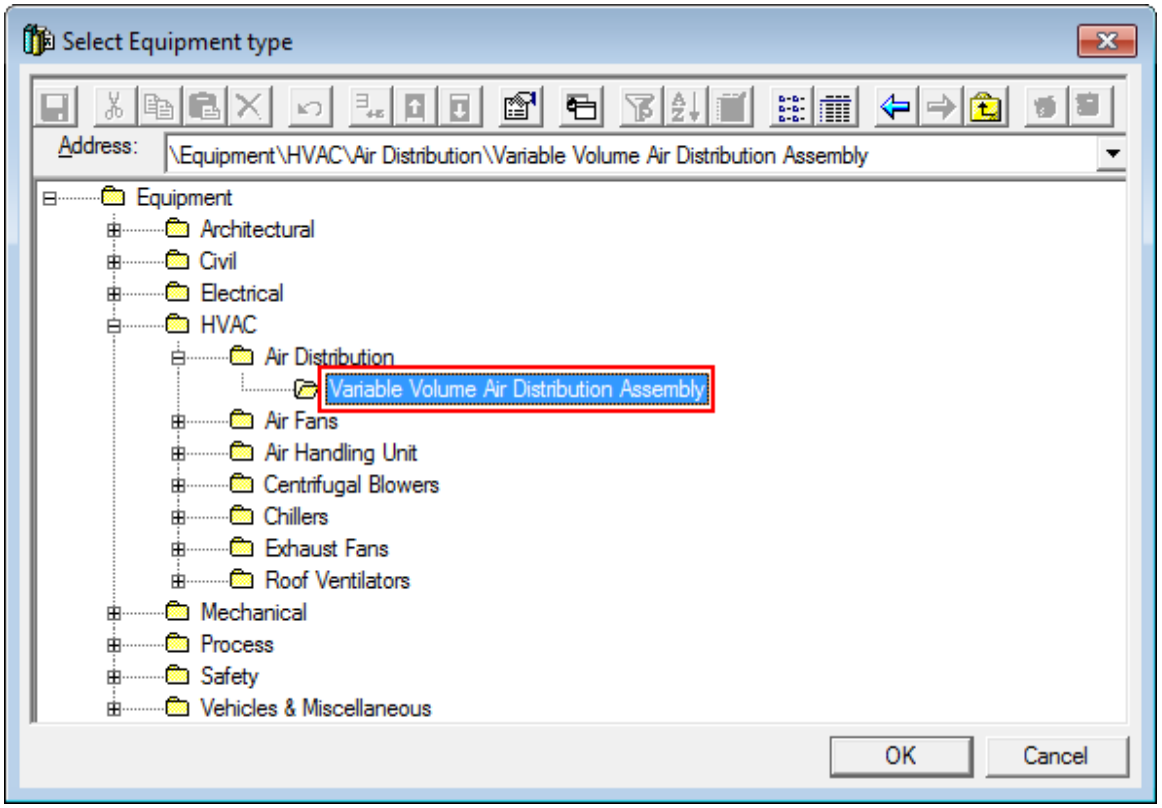


4. Click **Set Target to Origin** on the **PinPoint** ribbon to set the origin of the active coordinate system as the target.

5. Click **Place Designed Equipment** on the vertical toolbar.

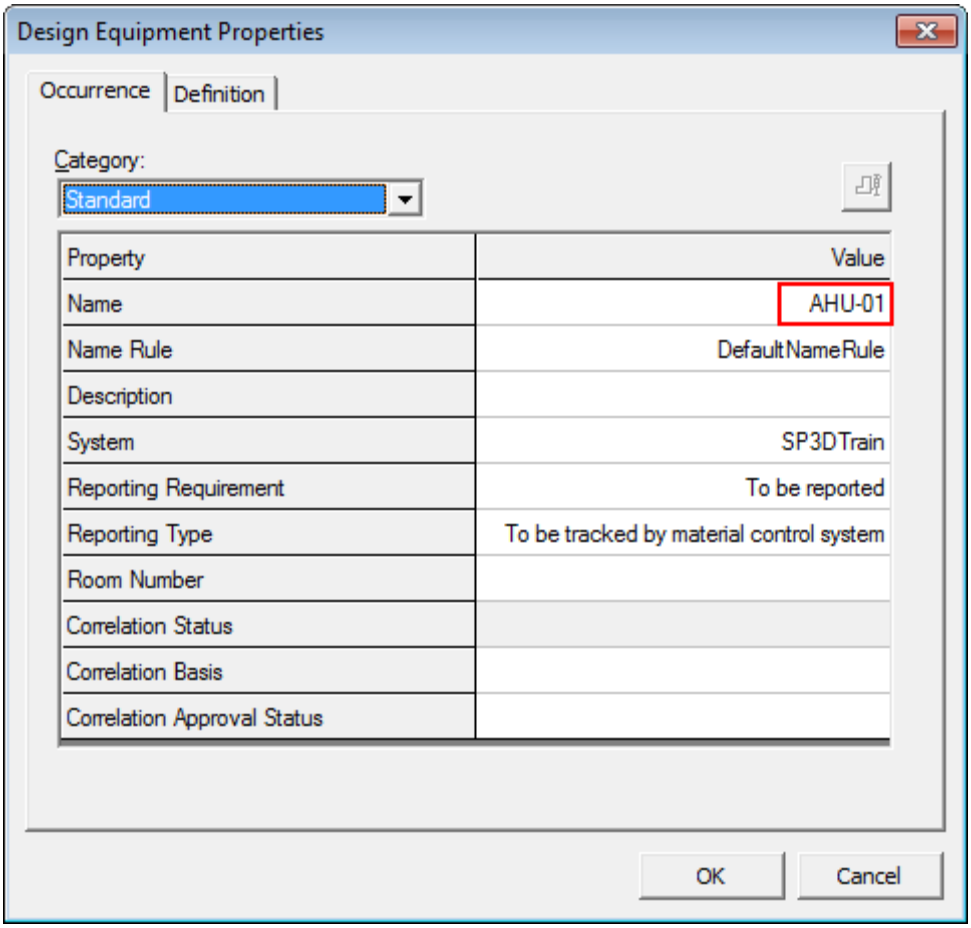
*The **Select Equipment type** dialog box displays.*

6. Expand **Equipment > HVAC > Air Distribution > Variable Volume Air Distribution Assembly** to select the required design equipment.



7. Click **OK**.
8. The **Design Equipment Properties** dialog box displays.

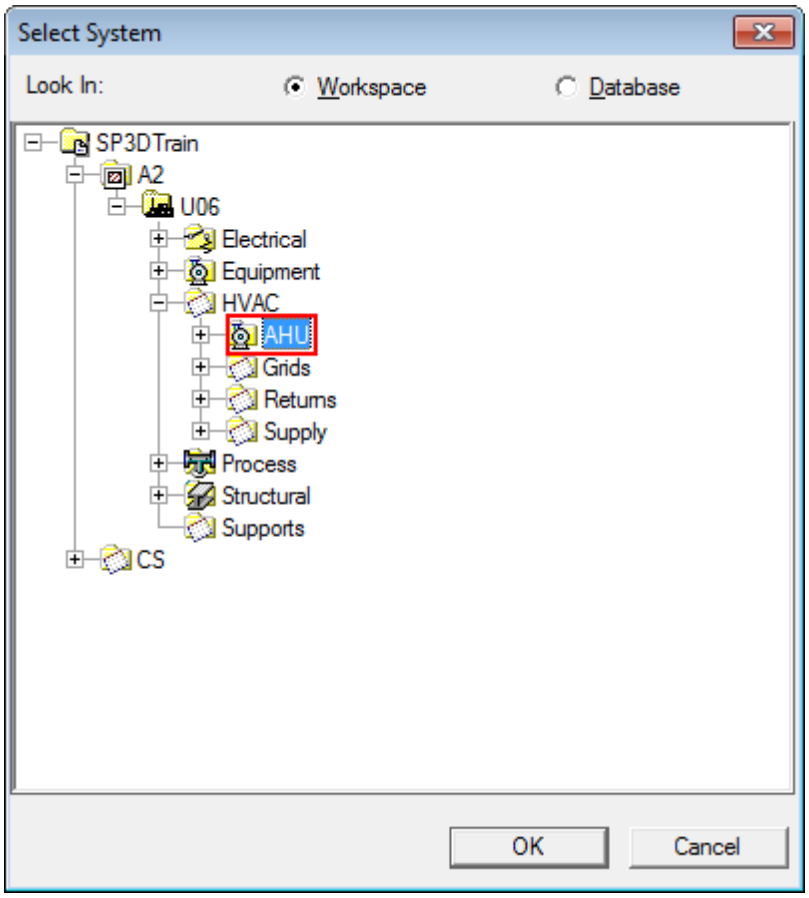
9. Type **AHU-01** in the **Name** box to name this equipment.



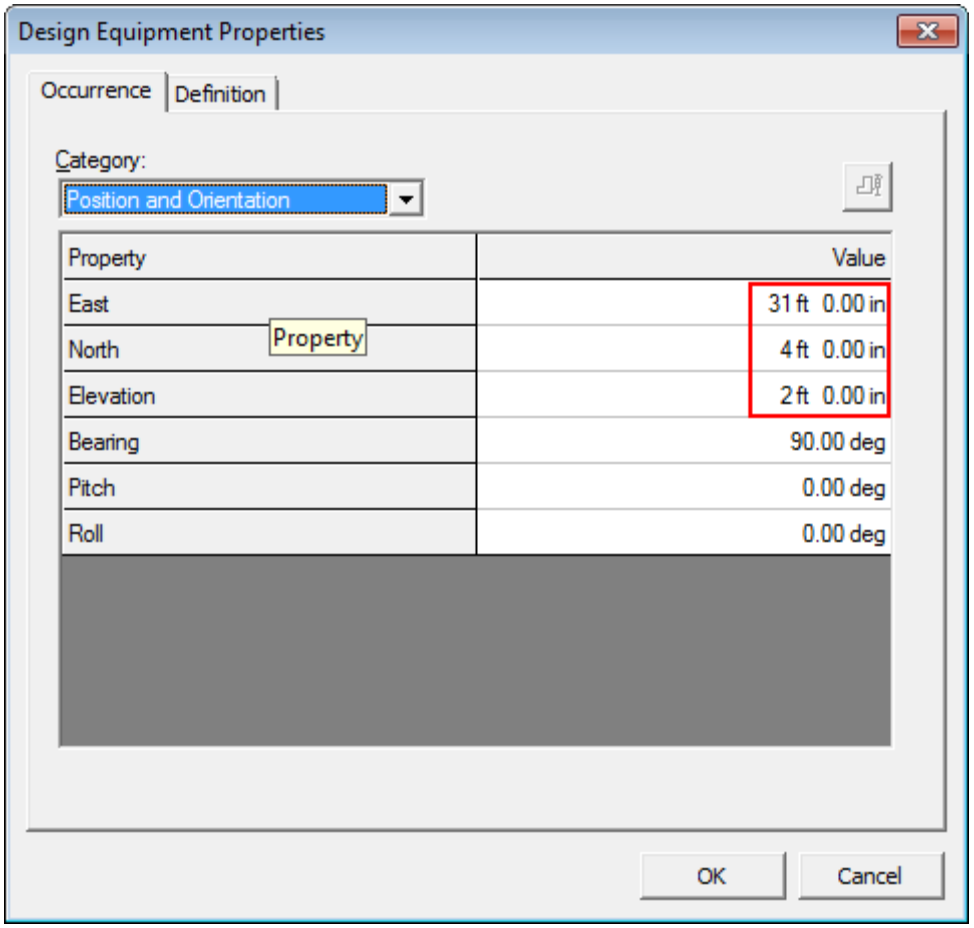
10. Select **More** from the **System** list.

    *The **Select System** dialog box displays.*

11. In the dialog box, expand **A2 > U06 > HVAC > AHU** to select the required system, and click **OK**.

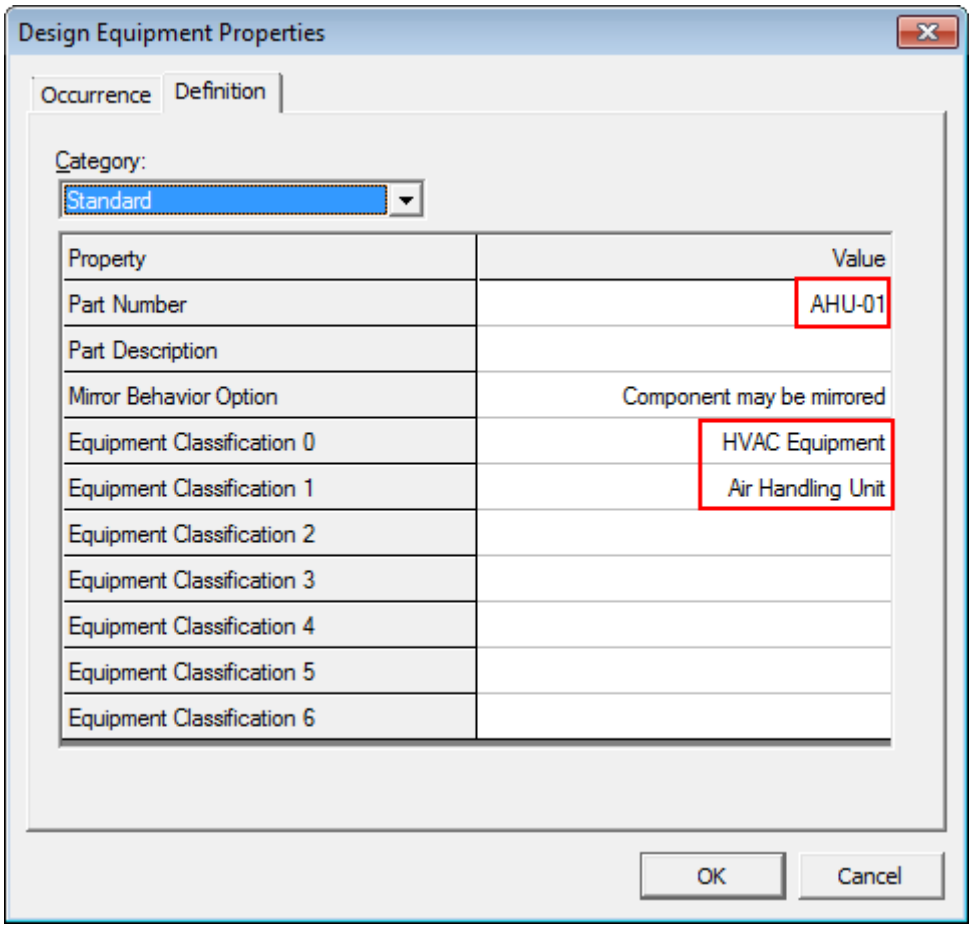


12. Select the **Position and Orientation** option in the **Category** list on the **Occurrence** tab to specify the position of the equipment. Type the values **31 ft** for **East**, **4 ft** for **North**, and **2 ft** for **Elevation**, as shown in the following figure:

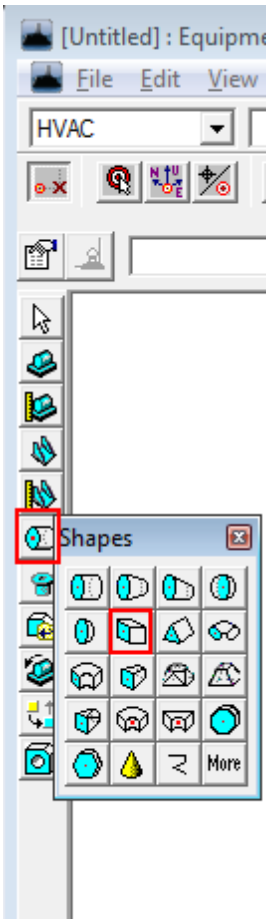


13. Click the **Definition** tab, and type **AHU-01** in the **Part Number** box.
14. Select **HVAC Equipment** from the **Equipment Classification 0** list.

15. Ensure that the **Equipment Classification 1** value is set to **Air Handling Unit**, and click **OK**.

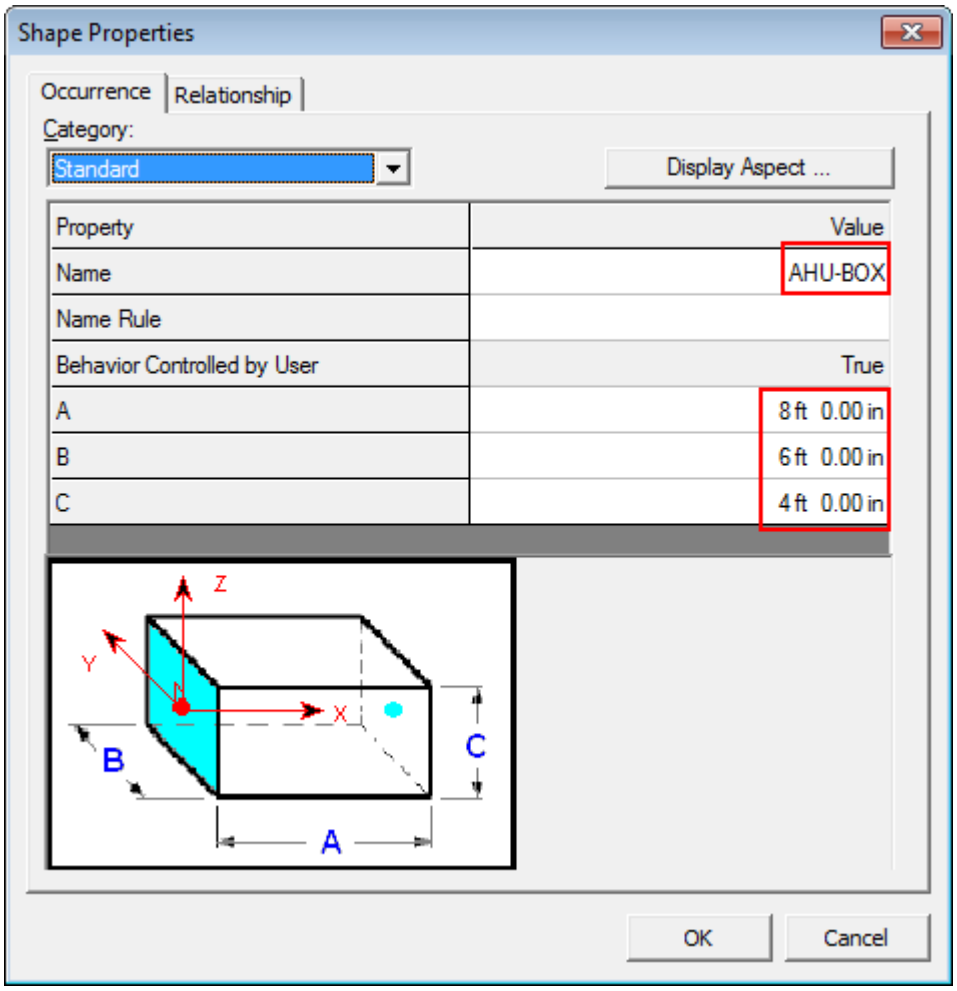


16. If prompted, select equipment **AHU-01** in the **Workspace Explorer**. Click **Place Shape**, and select **RectangularSolid 001** to specify the shape of the design equipment.



*The **Shape Properties** dialog box displays.*

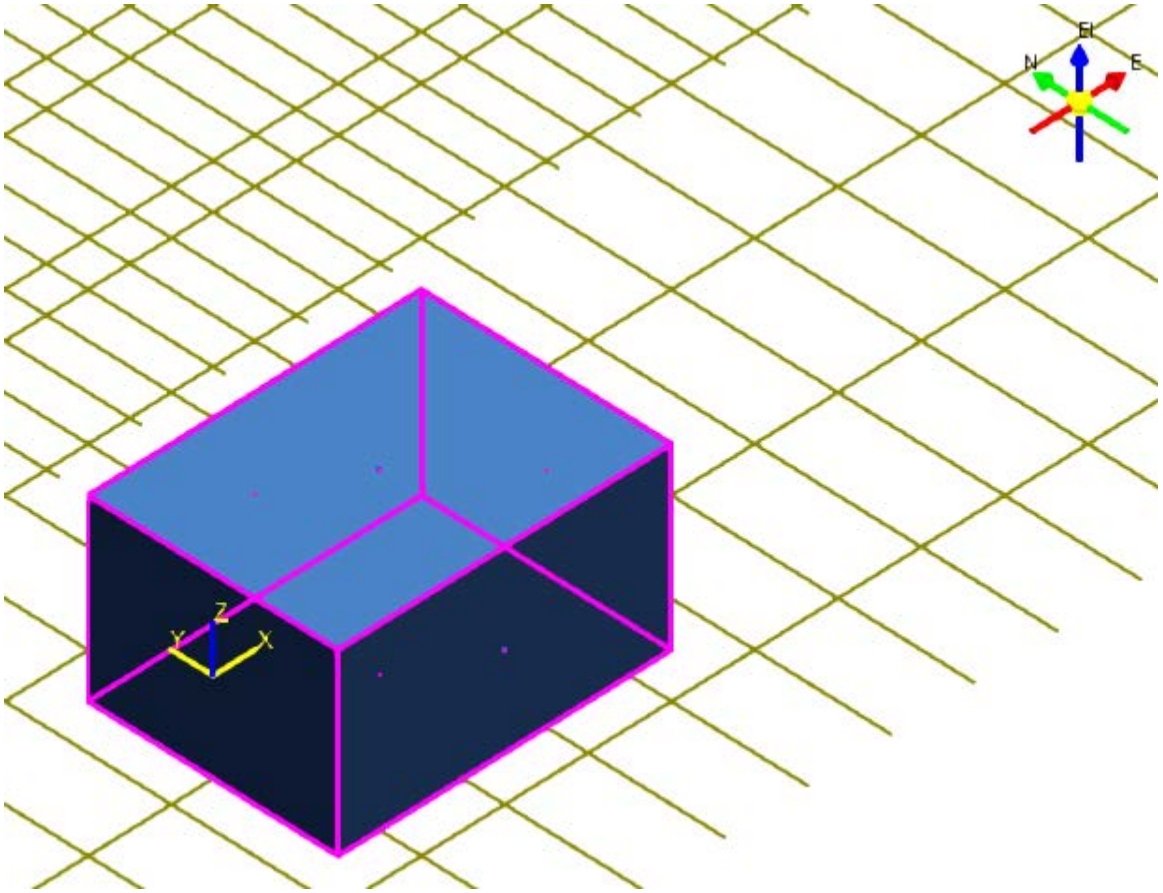
17. Change the name of the shape to **AHU-BOX**, and type the values **8 ft** for **A**, **6 ft** for **B**, and **4 ft** for **C**, as shown in the following figure:



18. Click **OK** to close the **Shape Properties** dialog box.

19. Type **31 ft** for **E**, **4 ft** for **N**, and **2 ft** for **El** on the **PinPoint** ribbon, and click in the graphic view to place the unit.

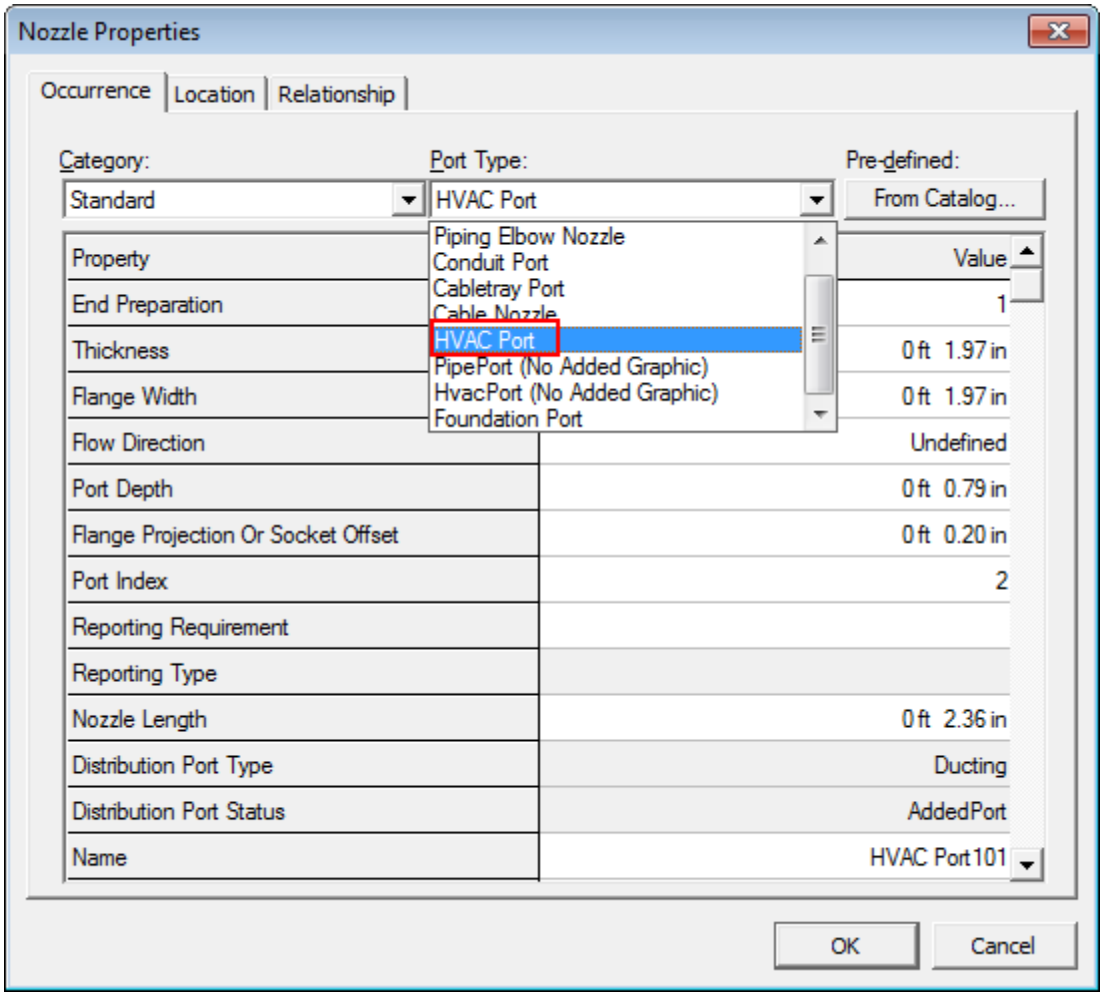
The designed AHU displays.



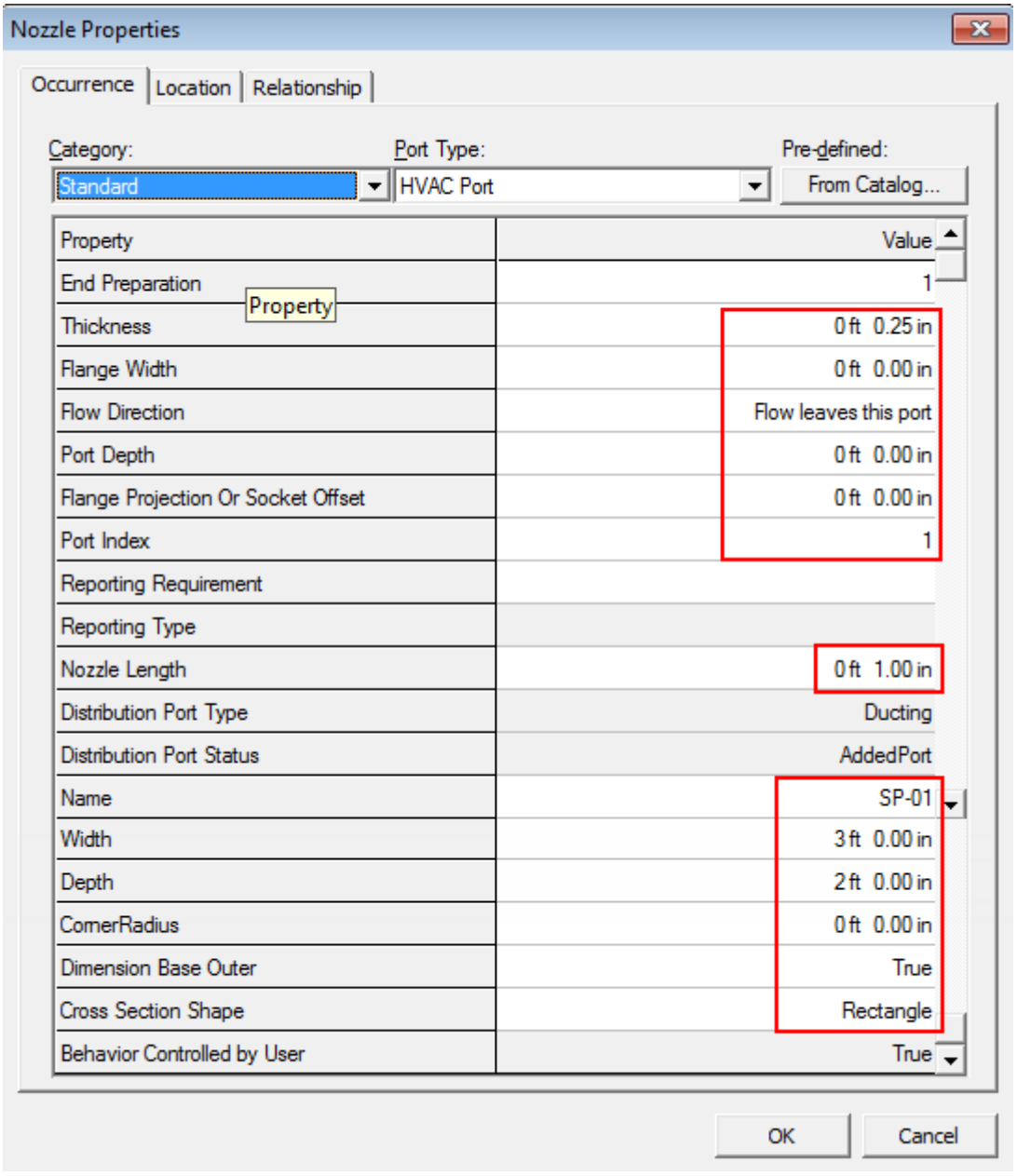
20. Click **Place Nozzle** to place HVAC nozzles on this equipment.
21. If prompted, select **AHU-BOX** shape graphically or in the **Workspace Explorer**.

    *The **Nozzle Properties** dialog box displays.*

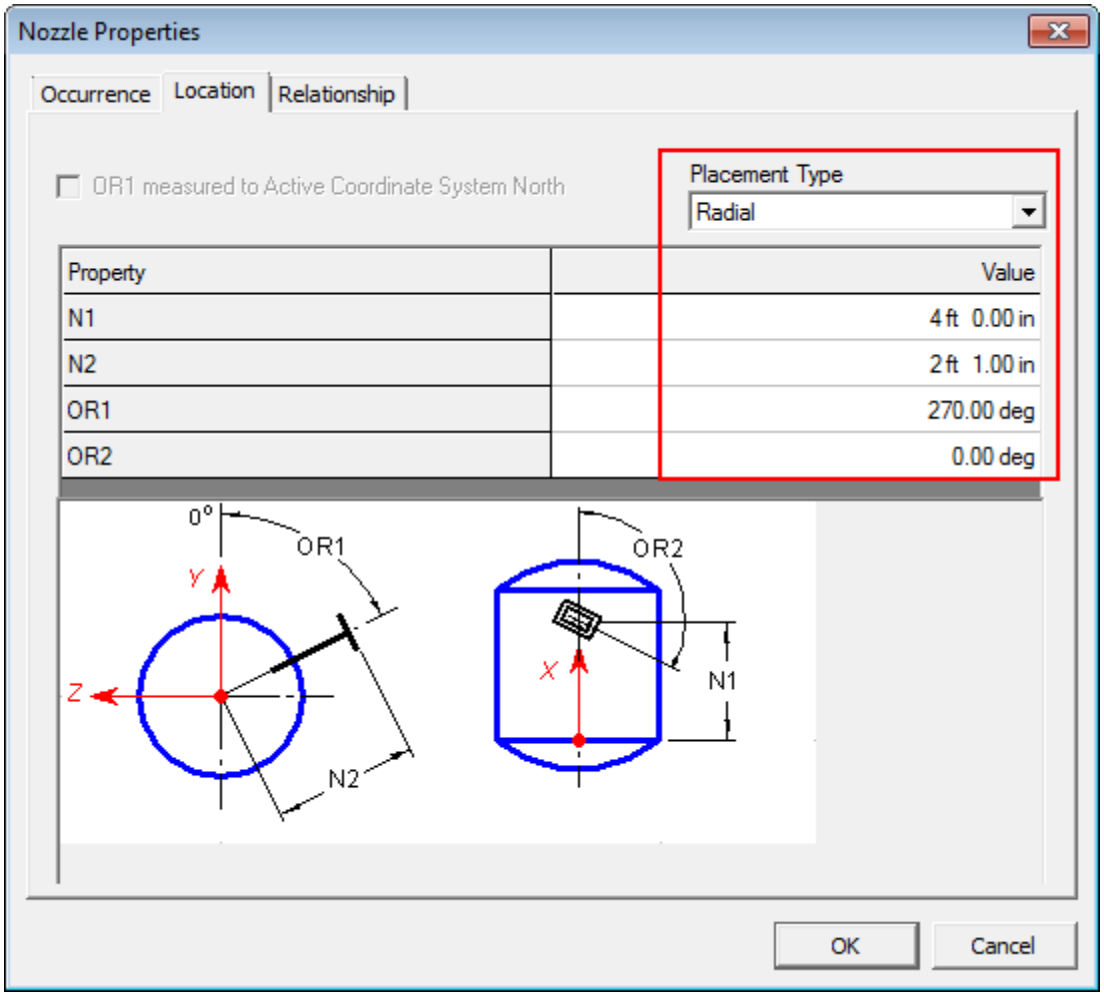
22. Select **HVAC Port** from the **Port Type** list.



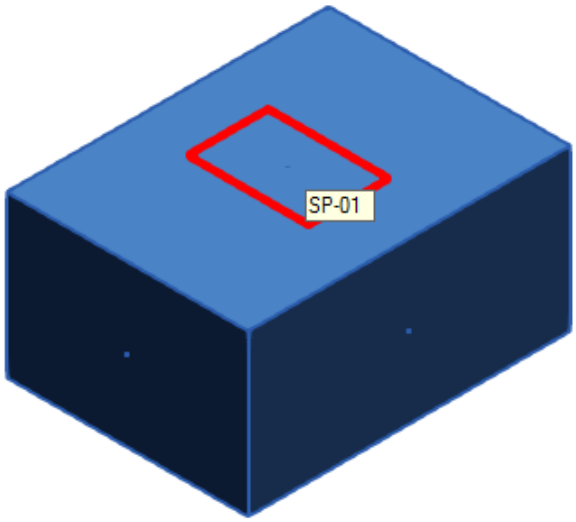
23. Click the **Occurrence** tab, and set the nozzle properties as highlighted in the following figure:



24. Click the **Location** tab, and select **Radial** from the **Placement Type** list.



The nozzle displays as highlighted in the following figure.

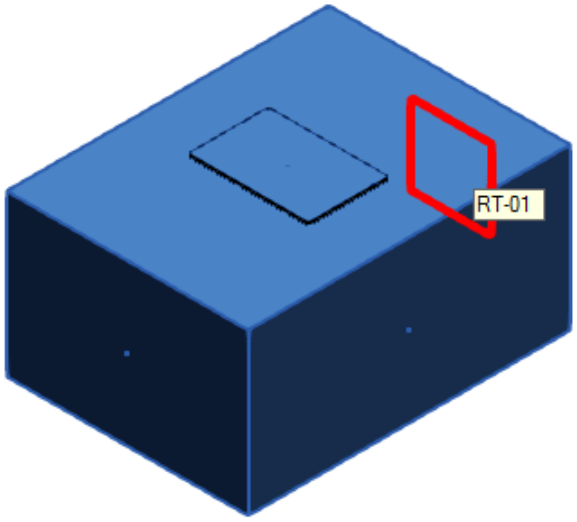


25. Repeat the previous steps to place the second nozzle with the following properties:

Occurrence tab	
Thickness	0.25 in
Flange Width	0
Flow Direction	Flow enters this port
Port Depth	0
Flange Projection	0
Port Index	2
Nozzle Length	1 in
Name	RT-01
Width	2 ft
Depth	2 ft
CornerRadius	0
Dimension Base Outer	True
Cross Section Shape	Rectangle

Location tab	
Placement Type	Axial
N1	8 ft 1 in
N2	0
OR1	0 deg
OR2	0 deg

The second nozzle displays.



Design Diffusers

Just as you designed AHU-01 in the previous activity, you design diffusers by using existing shapes in the Catalog and then modifying the required properties. You then appropriately name the designed equipment.

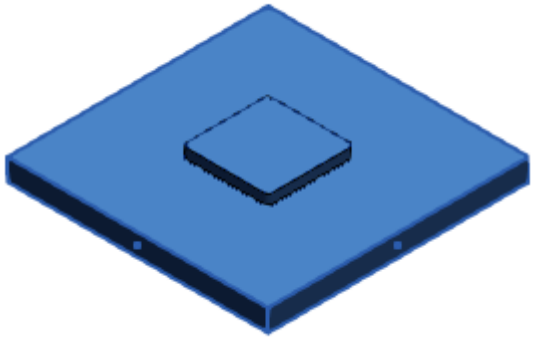
Design rectangular and round diffusers under the **Supply Devices** system in the **Workspace Explorer** with the following specifications:

Specifications for Rectangular Diffuser

Type	Specification	Values
Design Equipment	Name	D24X24REC8
	Equipment type	Generic Aides

	Equipment Classification 0	HVAC Equipment
	Equipment Classification 1	Air Moving Devices and Components
	Equipment Classification 2	Diffuser
	Shape	D-BOX
	Shape Properties	2 in for A, 2 ft 0 in for B, 2 ft for C
Nozzle	Port Type	HVAC Port
	Thickness	0
	Flange Width	0
	Flow Direction	Flow enters this port
	Nozzle Length	1 in
	Port Depth	0
	Name	Neck
	Width	8 in
	Depth	8 in
	Cross Section Shape	Rectangle
	Placement Type	Axial
	N1	-1 in
	N2	0
	OR1	0
	OR2	0

Place the designed rectangular diffuser in **Unit U06** at coordinates **20 ft** for **E**, **-20 ft** for **N**, and **0 ft** for **El**. The diffuser looks like the following figure after you place it.

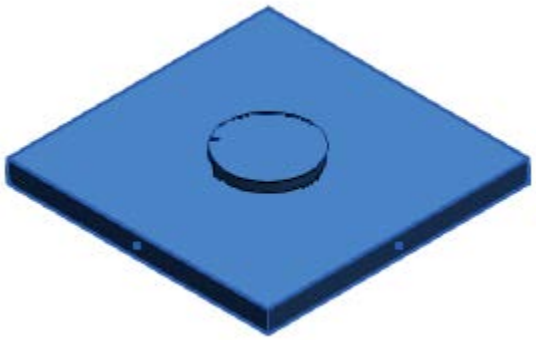


Specifications for Round Diffuser

Type	**Specification**	**Values**
Design Equipment	Name	D24X24RND8
	Equipment Type	Generic Aides
	Equipment Classification 0	HVAC Equipment
	Equipment Classification 1	Air Moving Devices and Components
	Equipment Classification 2	Diffuser
	Shape	D-BOX
	Shape Properties	A=2 in, B=2 ft, C=2 ft
Nozzle	Port Type	HVAC Port
	Thickness	0
	Flange Width	0
	Flow Direction	Flow enters this port
	Nozzle Length	1 in
	Port Depth	0

Type	Specification	Values
Design Equipment	Name	D24X24RND8
	Equipment Type	Generic Aides
	Name	Neck
	Width	8 in
	Depth	8 in
	Cross Section Shape	Round
	Placement Type	Axial
	N1	-1 in
	N2	0
	OR1	0
	OR2	0

Place the designed round diffuser in **Unit U06** at coordinates **23 ft** for **E**, **-20 ft** for **N**, and **0 ft** for **El**.

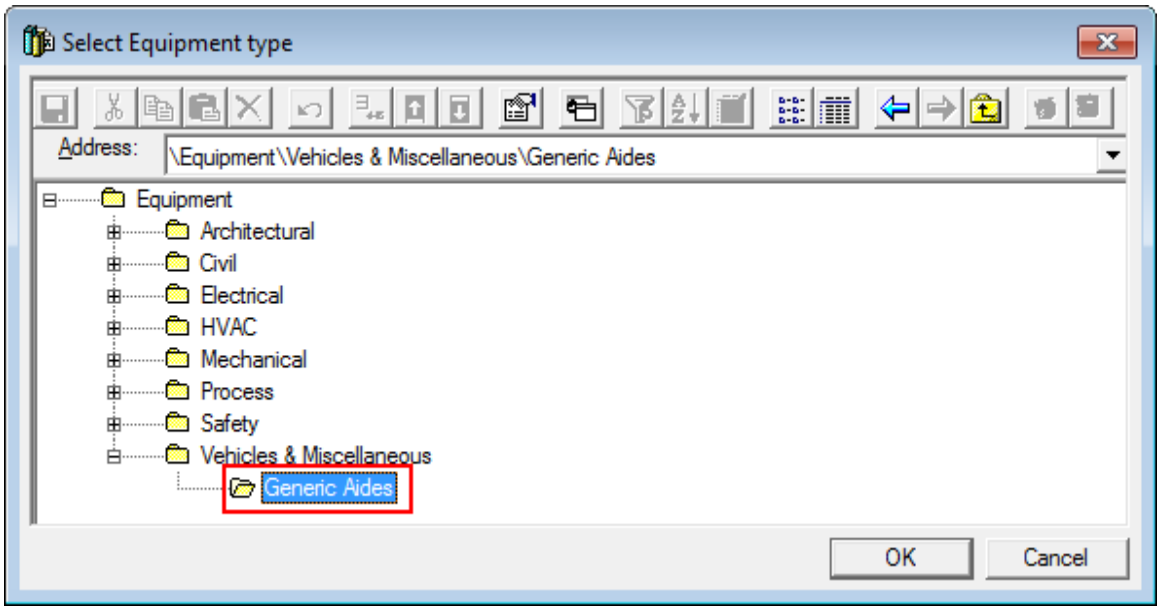


Designing the Rectangular Diffuser

1. Click **Place Designed Equipment** on the vertical toolbar.

   *The **Select Equipment type** dialog box displays.*

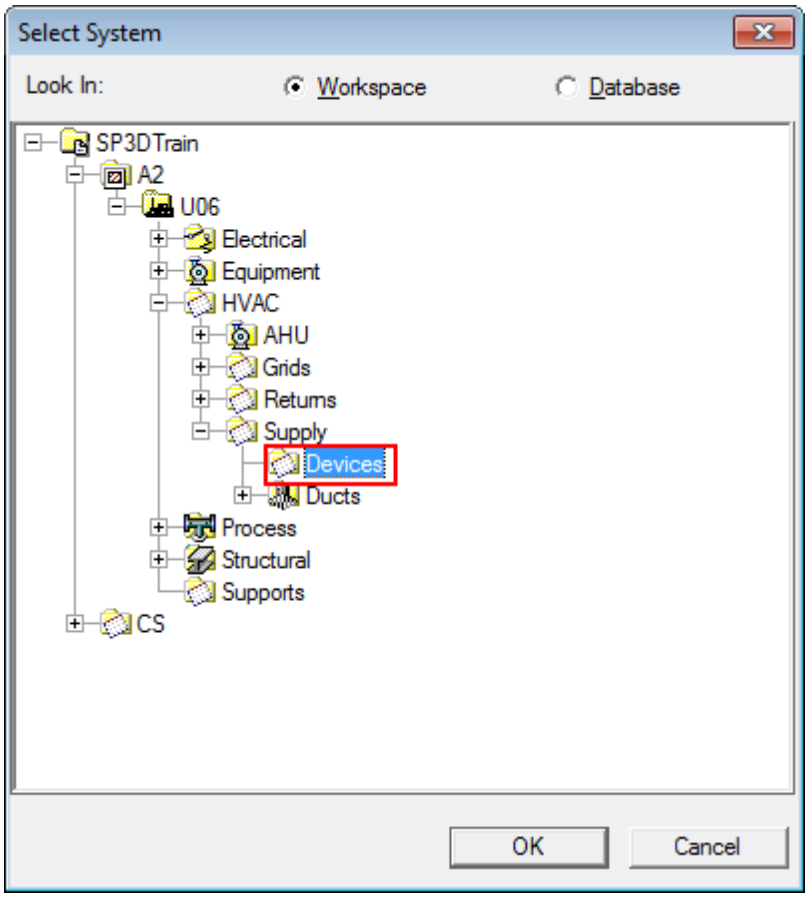
2. In this dialog box, expand **Equipment > Vehicles and Miscellaneous > Generic Aides**, and click **OK**.



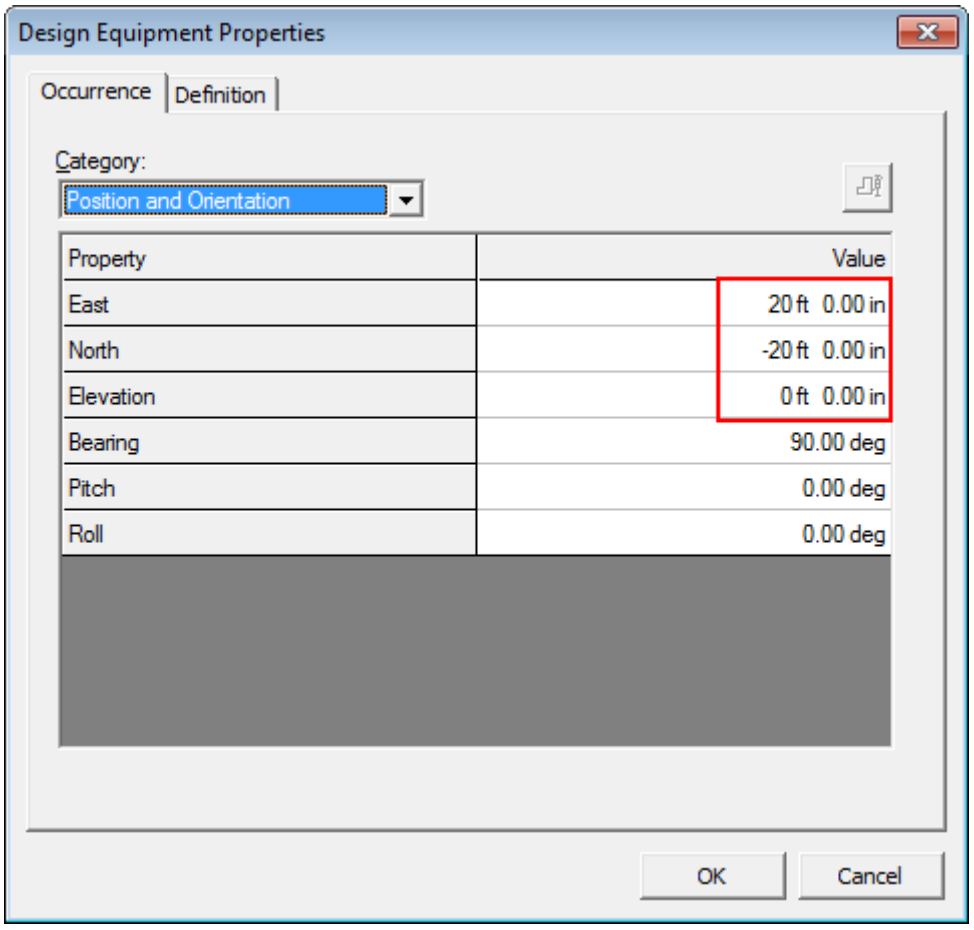
*The **Design Equipment Properties** dialog box displays.*

3. Change the name to **D24X24REC8**.

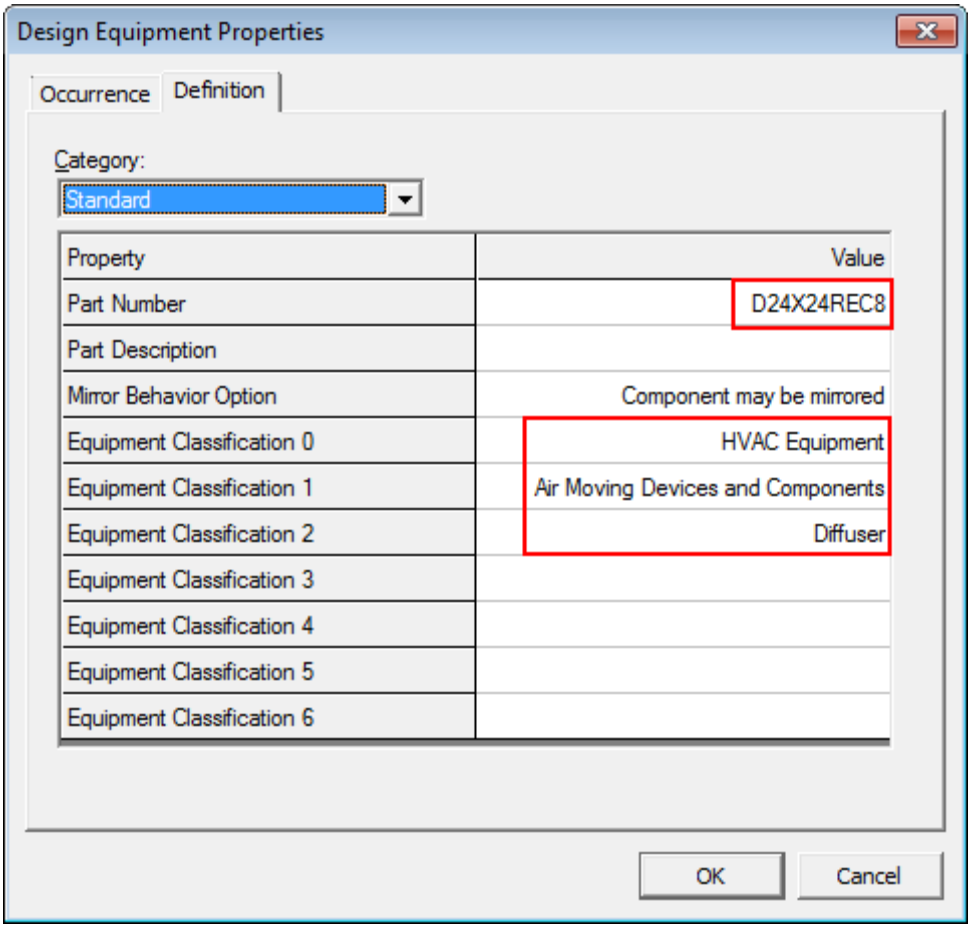
4. Expand **A2 > U06 > HVAC > Supply > Devices in the System** to select the appropriate system.



5. Switch to the **Position and Orientation** category, and type **20 ft** for **East**, **-20 ft** for **North**, and **0 ft** for **Elevation**.

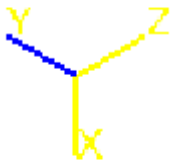


6. Click the **Definition** tab, make the changes shown in the following figure, and click **OK**.



The local coordinate system for the design equipment displays in the graphic view.

7. Click **Window > Tile Horizontally** to set the active view. Press the UP arrow key to change the axis of rotation to the Y-axis (blue color). Then, press the LEFT arrow key to rotate the triad so that X-axis is pointing downwards as shown in the following figure.



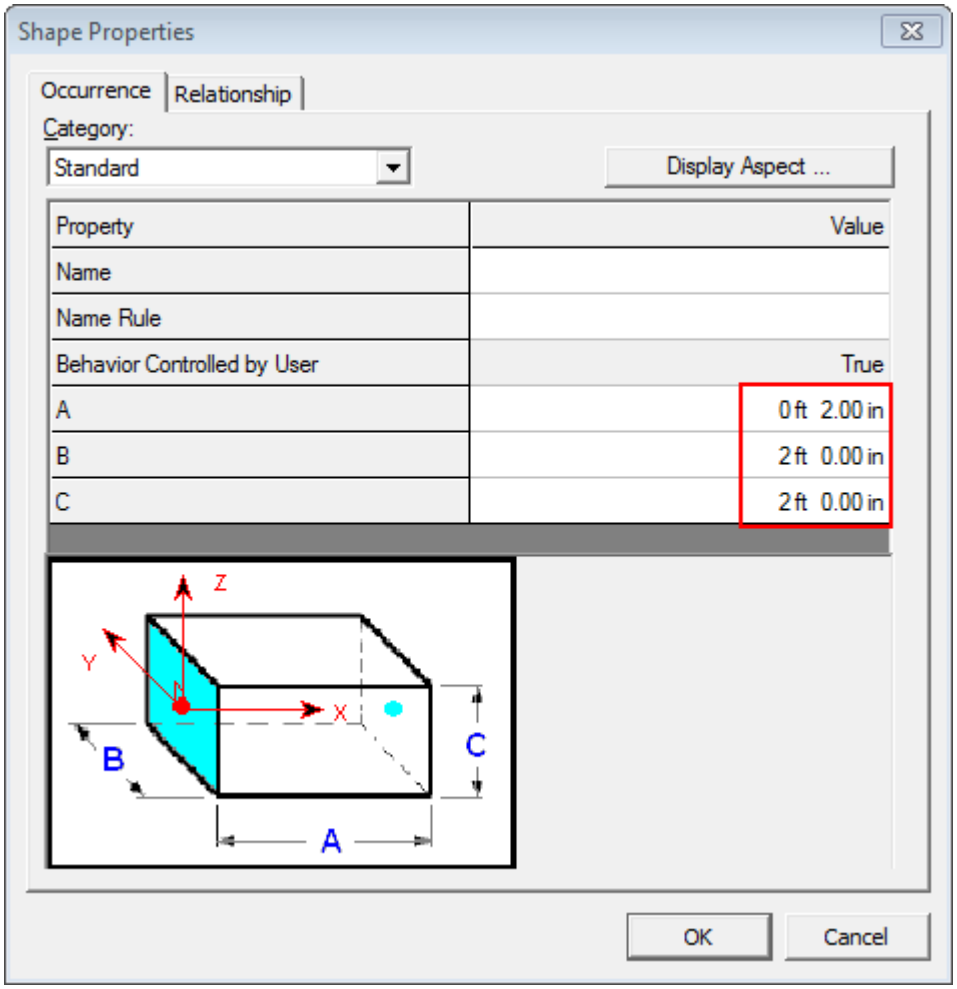
8. Click **Place Shape** .

   *The **Shapes** dialog box displays.*

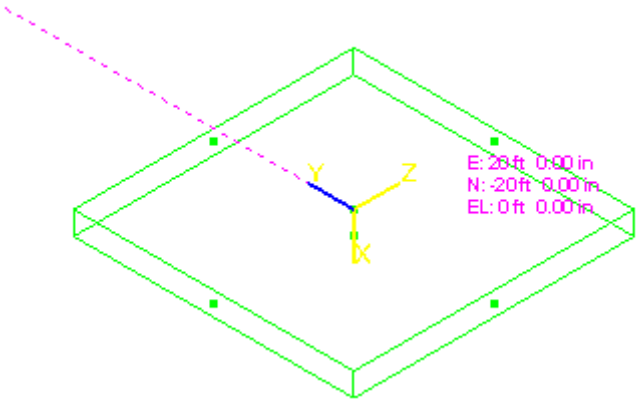
9. Select the **RectangularSolid 001** shape in the dialog box.

   *The **Shape Properties** dialog box displays.*

10. Type the values **2 in** for **A**, **2 ft** for **B**, and **2 ft** for **C**, and click OK.



11. On the **PinPoint** ribbon, type the values **20 ft** for **E**, **-20 ft** for **N**, and **0 ft** for **El**. Click in the graphic view to place the shape.



12. Rename the shape as **D-BOX** in the **Name** field on the ribbon.

13. Click **Place Nozzle**, and select the **D-BOX** shape as the nozzle parent.

    *The **Nozzle Properties** dialog box displays.*

14. Select **HVAC Port** from the **Port Type** list.

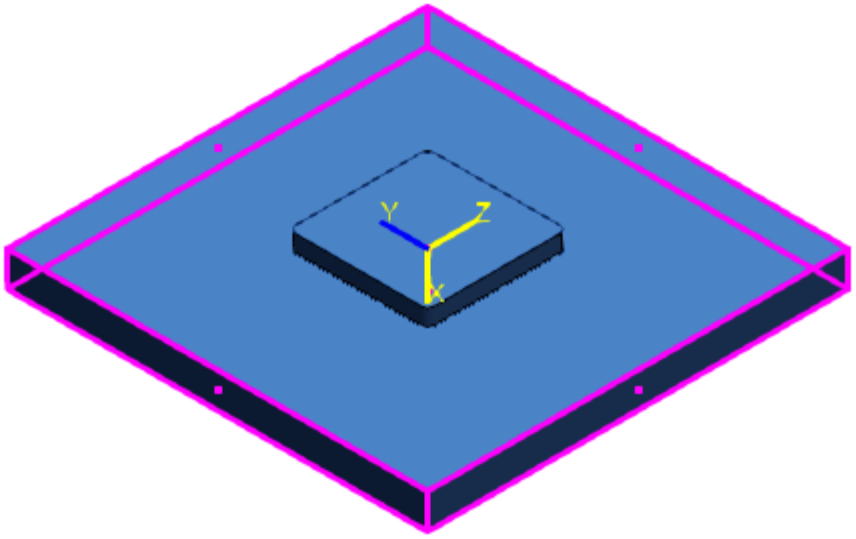
15. Change the properties as specified:

Occurrence tab	
Thickness	0
Flange Width	0
Flow Direction	Flow enters this port
Port Depth	0
Flange Projection	0
Port Index	1
Nozzle Length	1 in
Name	Neck
Width	8 in
Depth	8 in

Cross Section Shape	Rectangle

Location tab

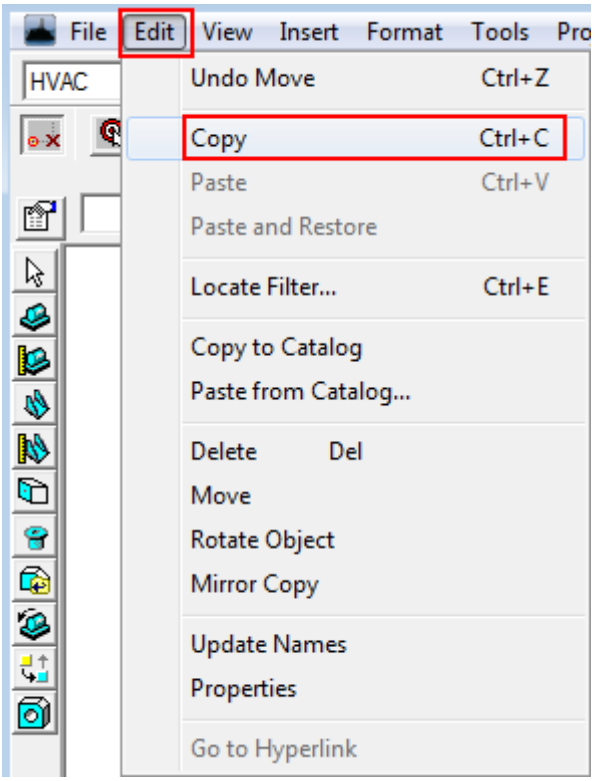
Placement Type	Axial
N1	-1 in
N2	0
OR1	0 deg
OR2	0 deg



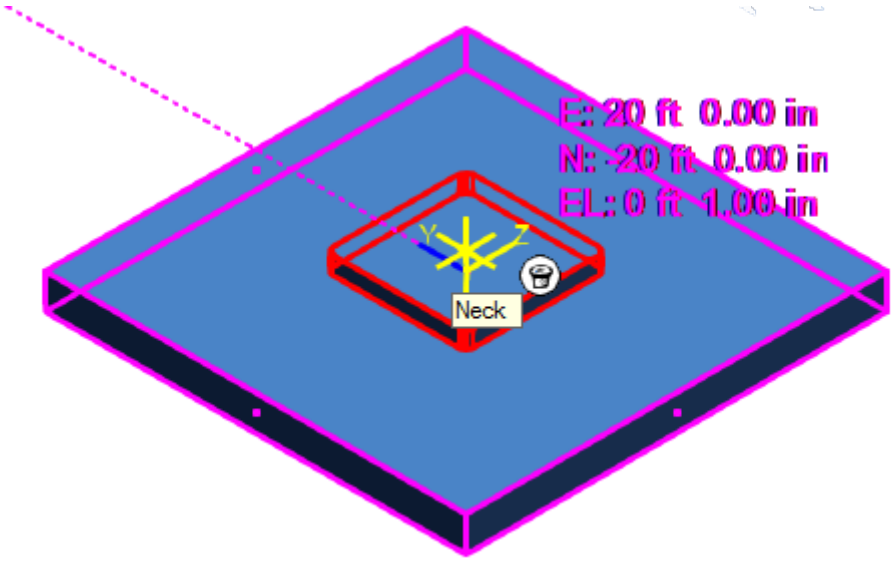
For designing a round diffuser, you copy the rectangular diffuser placed in the previous activity and paste the diffuser at the specified location. You then modify the specifications and properties of the diffuser to design it as required. Finally, you name the designed round diffuser.

Designing the Round Diffuser

1. Select the designed equipment **D24X24REC8**. Click **Edit > Copy**.



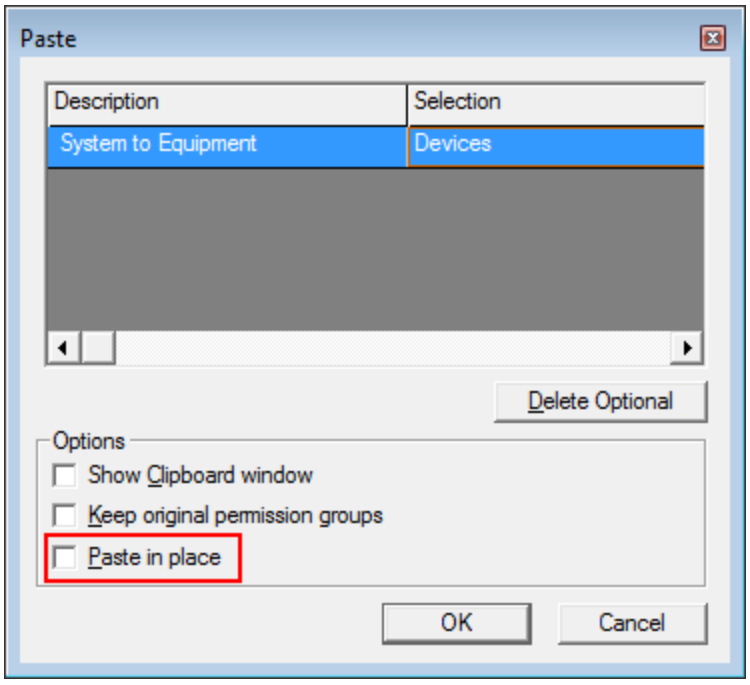
2. Click to select the center of the port as a reference point.



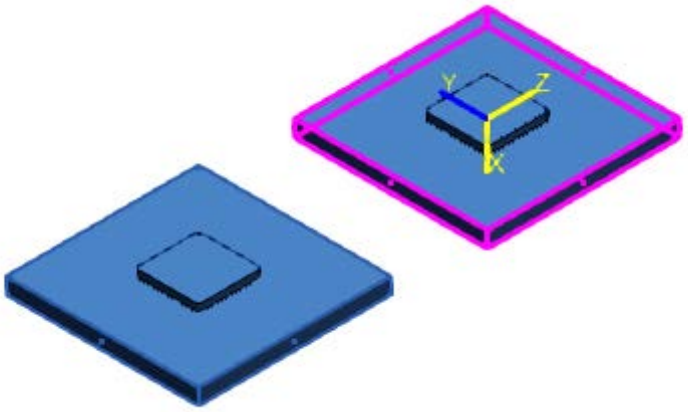
3. Click **Edit > Paste**.

   *The **Paste** dialog box displays.*

4. Keep the parent system for designed equipment as **Devices**. Ensure that the **Paste in place** check box is cleared, and click **OK**.

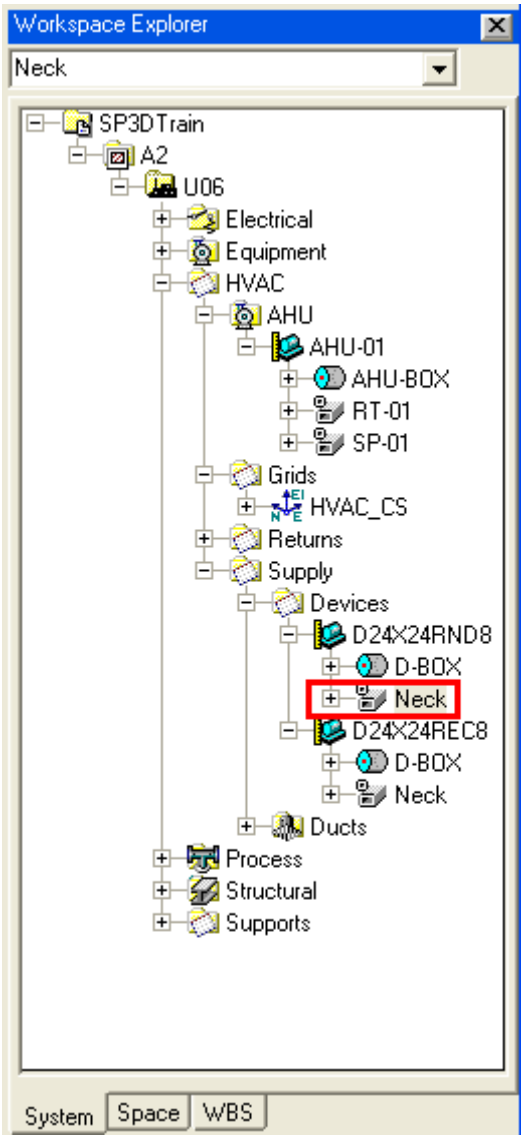


5. Type **23 ft** for **E**, **-20 ft** for **N**, and **0 ft** for **El** on the ribbon, and click to place the equipment as highlighted in the following figure.

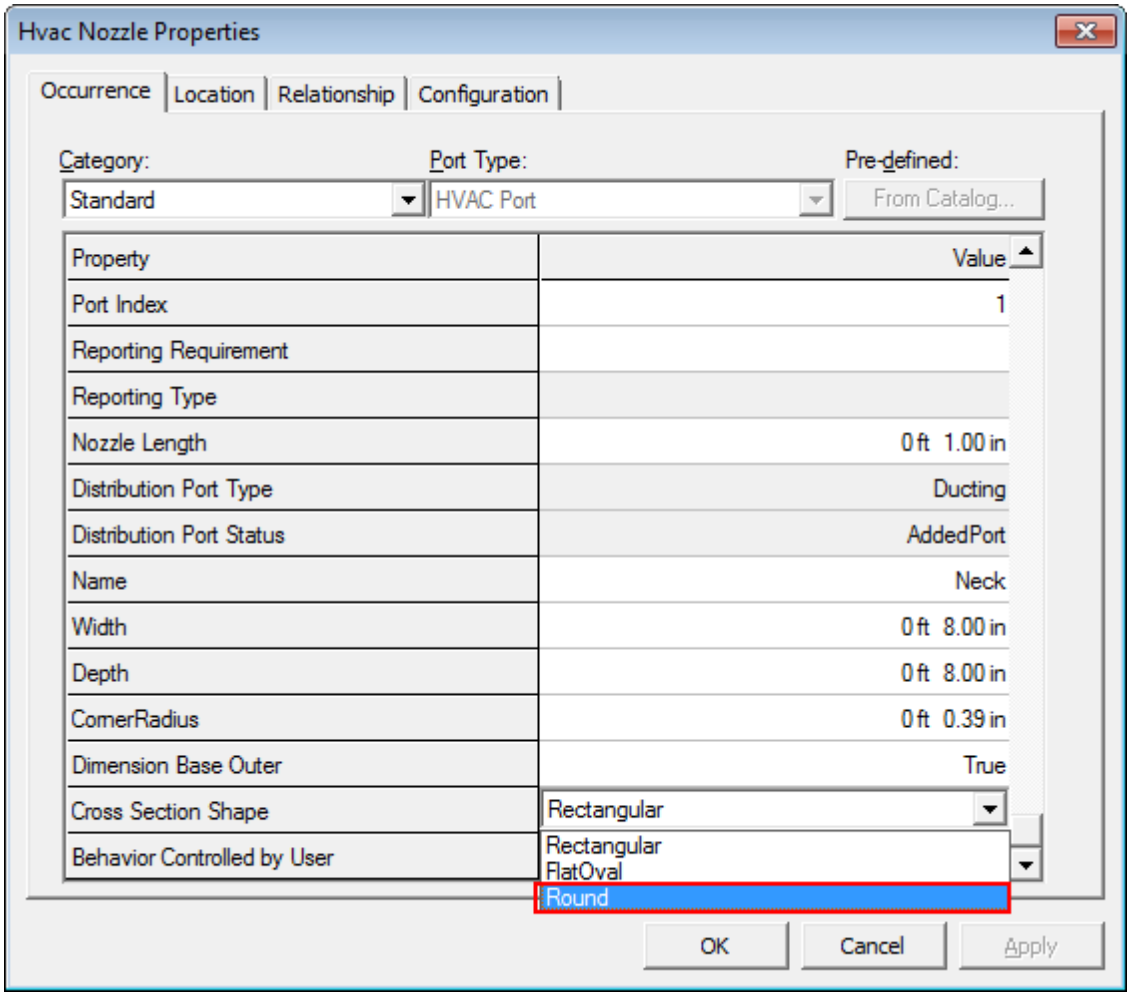


6. Type **D24X24RND8** in the **Name** box for the new shape.

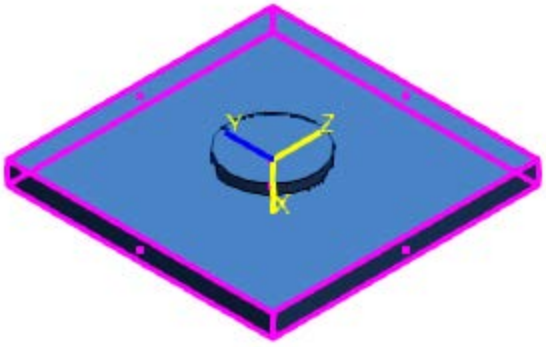
7. Select **HVAC Nozzle** from the **Locate Filter** list. Select the nozzle **Neck** under **D24X24RND8** in the **Workspace Explorer**.



8. Click **Properties** on the ribbon to open the **HVAC Nozzle Properties** dialog box. Change the **Cross Section Shape** to **Round**. Click **OK** to accept the change.



The round diffuser displays.



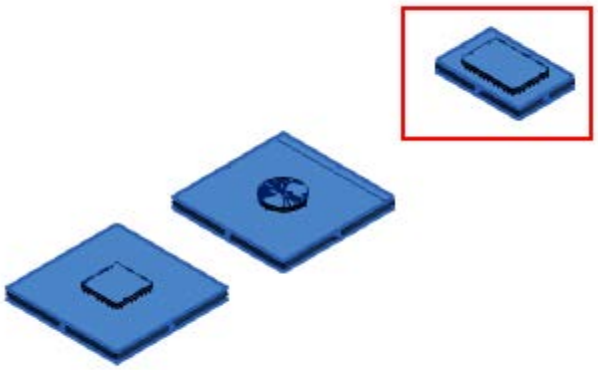
Design a Grill

Design a grill **G18X12REC12X8** under the **Return Devices** system with the following specifications:

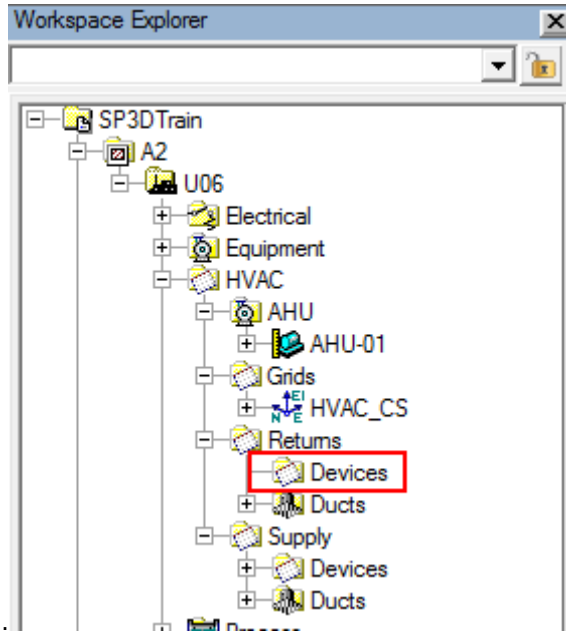
Type	Specification	Values
Design Equipment	Name	G18X12REC12X8
	Equipment Classification 0	HVAC Equipment
	Equipment Classification 1	Air Moving Devices and Components
	Equipment Classification 2	Grills
	Shape	G-BOX
	Shape Properties	2 in for A, 1 ft 6 in for B, 1 ft for C
Nozzle	Port Type	HVAC Port
	Thickness	0
	Flange Width	0
	Flow Direction	Flow leaves this port
	Nozzle Length	1 in
	Port Depth	0
	Name	Neck
	Width	1 ft
	Depth	8 in
	Cross Section Shape	Rectangle
	Placement Type	Axial
	N1	-1 in

	N2	0
	OR1	0
	OR2	0

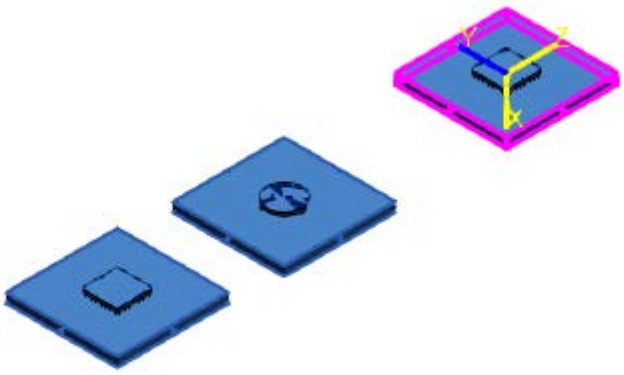
Place the grill in Unit **U06** at coordinates **27 ft** for **E**, **-20 ft** for **N**, and **0** ft for **El**.



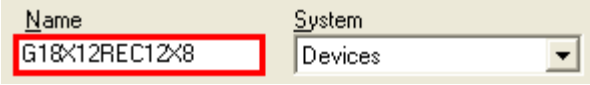
1. Copy and paste the diffuser **D24X24REC8** and place the diffuser under the **Return Devices** system in the **Workspace Explorer**.



2. Type the coordinates as **27 ft** for **E**, **-20 ft** for **N**, and **0 ft** for **El** on the ribbon, and click to place the equipment.

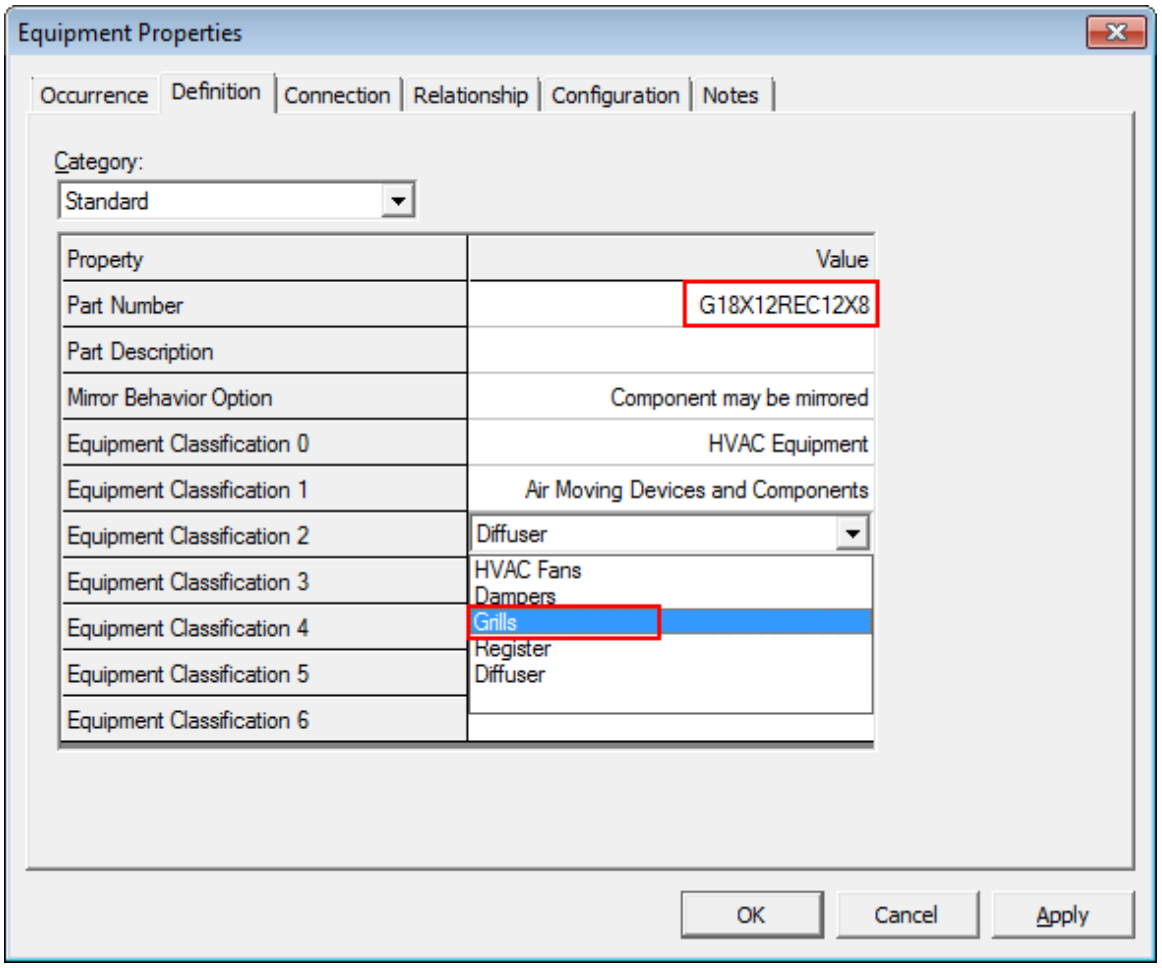


3. Rename the equipment as **G18X12REC12X8.**



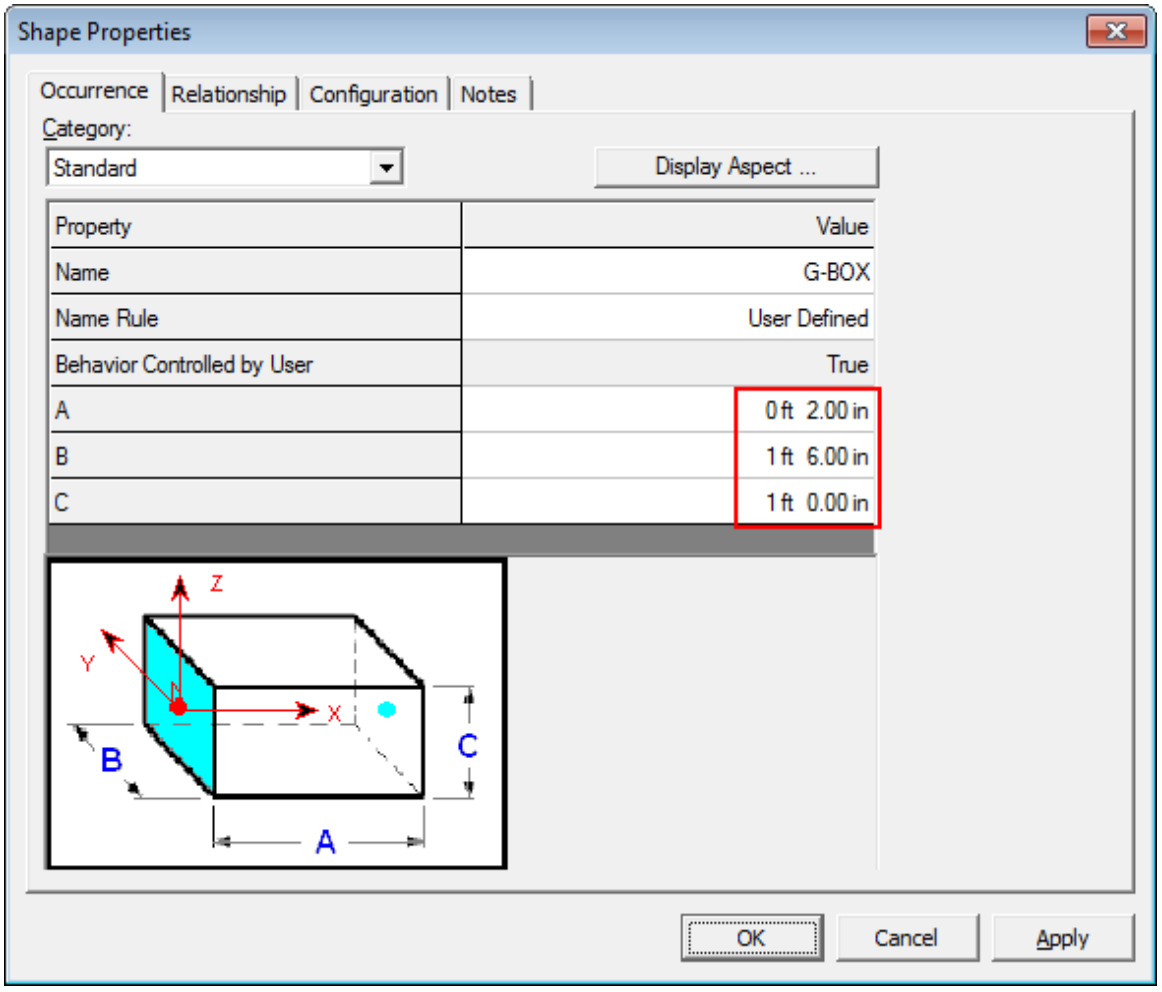
4. Click **Properties** to display the **Equipment Properties** dialog box for **G18X12REC12X8.**

5. Click the **Definition** tab on the **Equipment Properties** dialog box, change **Equipment Classification 2** to **Grills**, **Part Number** to **G18X12REC12X8**, and click **OK**.

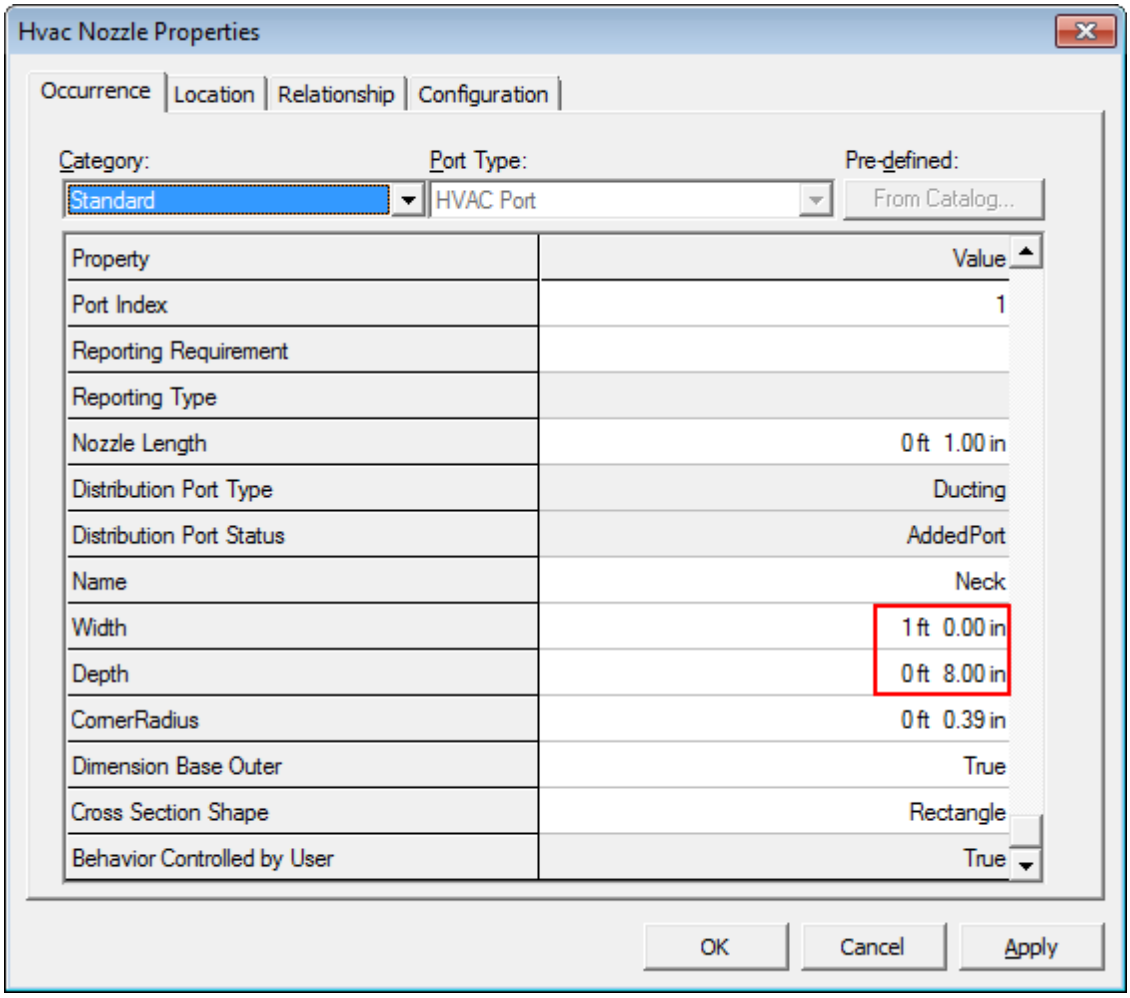


6. Select **Shape** from the **Locate Filter** list.
7. Select **D-BOX** under **G18X12REC12X8** in the **Workspace Explorer**, and change the name to **G-BOX**.
8. Click **Properties** on the ribbon to display the **Properties** dialog box for **G-BOX**.

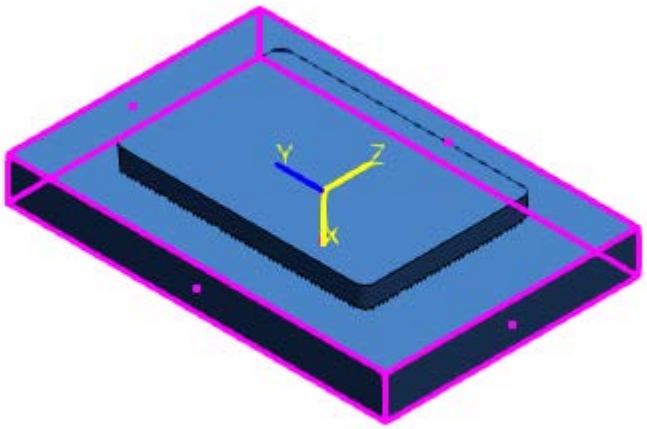
9. Type **2 in** for **A**, **1 ft 6 in** for **B**, and **1 ft** for **C**, and click **OK**.



10. Select **HVAC Nozzle** from the **Locate Filter** list. Select **Neck** (HVAC port) under **G18X12REC12X8** in the **Workspace Explorer**, and open the **HVAC Nozzle Properties** dialog box. Change the **Width** to **1 ft** and **Depth** to **8 in**.



The grill displays.



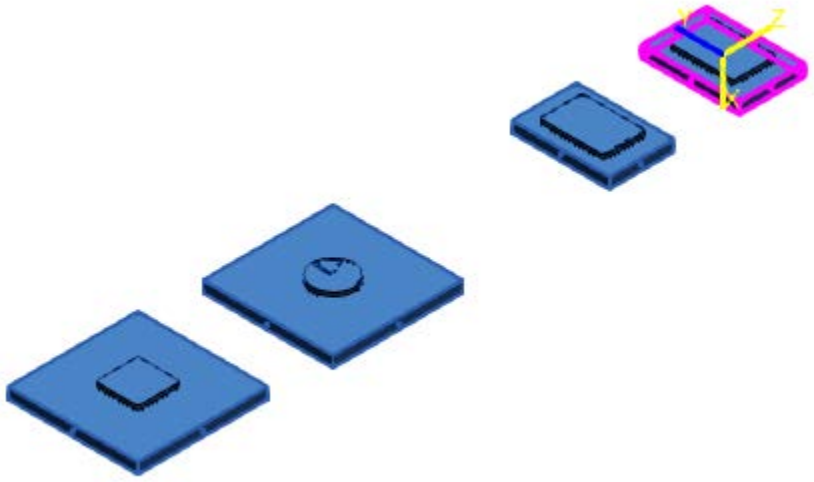
Design a Register

Design a register **R18X12REC12X8** under the **Return Devices** system in the **Workspace Explorer** with the following specifications:

Type	Specification	Values
Design Equipment	Name	R18X12REC12X8
	Equipment type	Generic Aides
	Equipment Classification 0	HVAC Equipment
	Equipment Classification 1	Air Moving Devices and Components
	Equipment Classification 2	Register
	Shape	R-BOX
	Shape Properties	2 in for A, 1 ft 6 in for B, 1 ft for C
Nozzle	Port Type	HVAC Port
	Thickness	0
	Flange Width	0

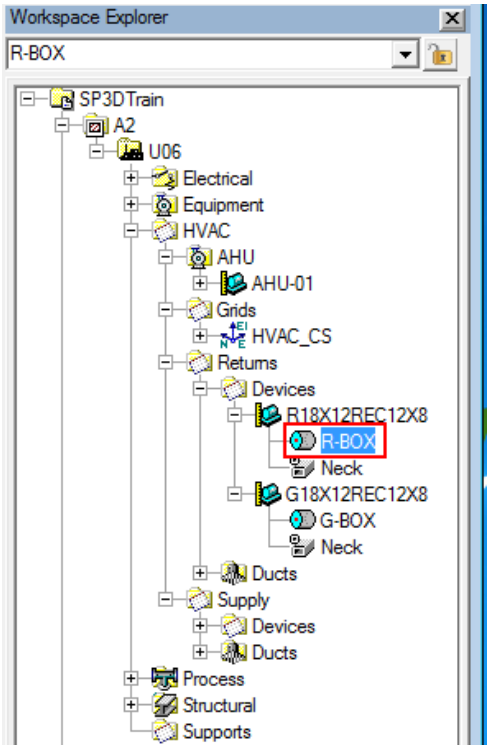
	Flow Direction	Flow leaves this port
	Nozzle Length	1 in
	Port Depth	0
	Name	Neck
	Width	8 in
	Depth	8 in
	Cross Section Shape	Rectangle
	Placement Type	Axial
	N1	-1 in
	N2	0
	OR1	0
	OR2	0

Place the register in **Unit U06** at coordinates **29 ft** for **E**, -**20 ft** for **N**, and **0 ft** for **El.**



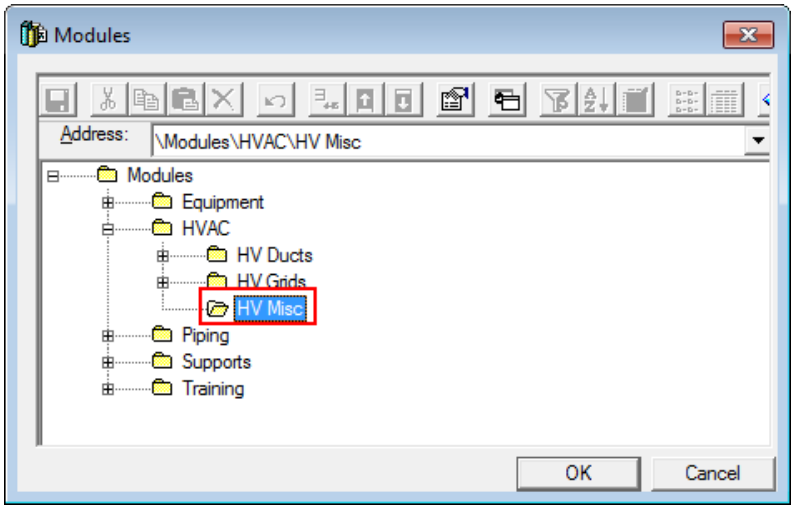
1. Copy and paste the grill **G18X12REC12X8**, and place the grill under the **Return Devices** system in the **Workspace Explorer**.
2. Type the coordinates as **29 ft** for **E**, -**20 ft** for **N**, and **0 ft** for **El** on the ribbon, and click to place the register.
3. Name the HVAC equipment as **R18X12REC12X8**.

4. Click **Properties** on the ribbon to display the **Equipment Properties** dialog box for **R18X12REC12X8**. On the **Definition** tab, change E**quipment Classification 2** to **Register**, **Part Number** to **R18X12REC12X8**, and click **OK**.
5. Select **Shape** from the **Locate Filter** list. Select the shape **G-BOX** under **R18X12REC12X8** in the **Workspace Explorer**, and change the name to **R-BOX**.



Copy to the Catalog

1. Select **Equipment** from the **Locate Filter** list.
2. Select the diffuser D24X24REC8 in the Workspace Explorer.
3. Click Edit > Copy to Catalog.
4. Select More from the Type list. The, click HVAC> HV Misc to add the diffuser to the miscellaneous folder. Click OK.

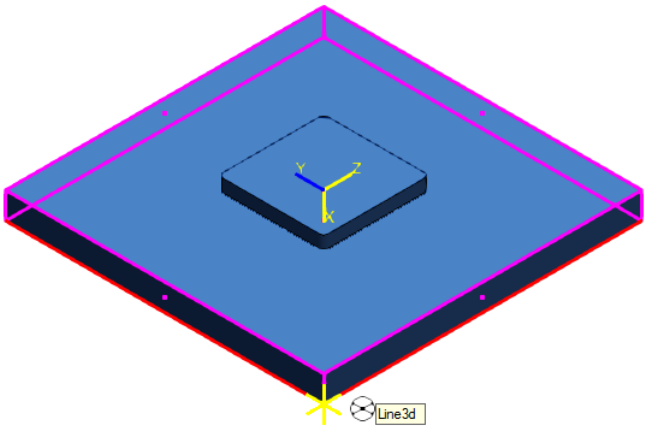


5. Type **D24X24REC8** in the **Name** field, and press ENTER.

Smart 3D prompts you for the placement point.

6. Select **Bottom SW** as the placement point.

TIP A center point is the most logical point for placement. However, we will use grid line intersections for placement,so the corner point is more useful. The following figure shows the center point selected and highlighted.



7. Click **OK** on the **Define Prompts** dialog box, and click **Finish** to complete adding the equipment to the Catalog.
8. Repeat the same steps to copy all other equipment to the Catalog.

For more information related to routing a duct, see **HVACUsersGuide.pdf**.