

Smart 3D Equipment Tutorial



PROCESS, POWER & MARINE

TSP3D-TP-100105A



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SECTION 1

Equipment: An Overview

Objective

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

- Describe the equipment modeling functions in Smart 3D.

Before Starting this Procedure

- Smart 3D Overview

Overview

The equipment model in Smart 3D provides:

- Equipment properties for identification, engineering design, and management purposes.
- Precision port definition.
- Detailed geometry to perform interference detection and visual recognition.

To support the detail design of the connected routed system, precision port definition specifies the positions and properties of the ports, such as nozzles, cable connections, and ducts, on equipment components.

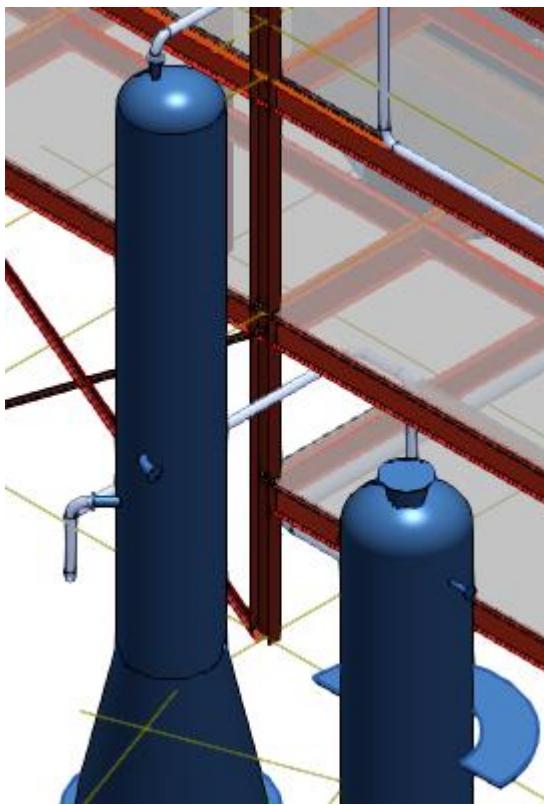
Since the equipment model does not contain every necessary detail needed to fabricate the equipment, the parameters of the equipment are used, along with specification standards, to complete the detailed design.

You can place two types of equipment:

- **Catalog Equipment** - Equipment that references a programmatic definition in the catalog. Catalog equipment, also known as equipment, is typically driven by properties. **Definition Properties** are fixed to specific values in the catalog. **Occurrence Properties** can be edited after placement. **Catalog Part Definition** controls how the equipment changes when the properties are modified.
- **Designed Equipment** - Equipment that you can edit. The designed equipment type determines the property set upon creation.

Both types of equipment can be composed of equipment components, ports, and geometric shapes. Shapes are parametric geometry with no other properties. You can import the geometry of a shape from SAT files or MicroStation files. Equipment components are defined in the catalog, and must be a direct system child of a piece of catalog equipment or designed equipment. In complex equipment models, you can define a designed equipment component that consists of shapes and ports.

For example, the tank below is a designed equipment that consists of a shape and a catalog equipment component. The equipment component consists of a basic shape, with graphics associated with the equipment component, datum points, and ports:



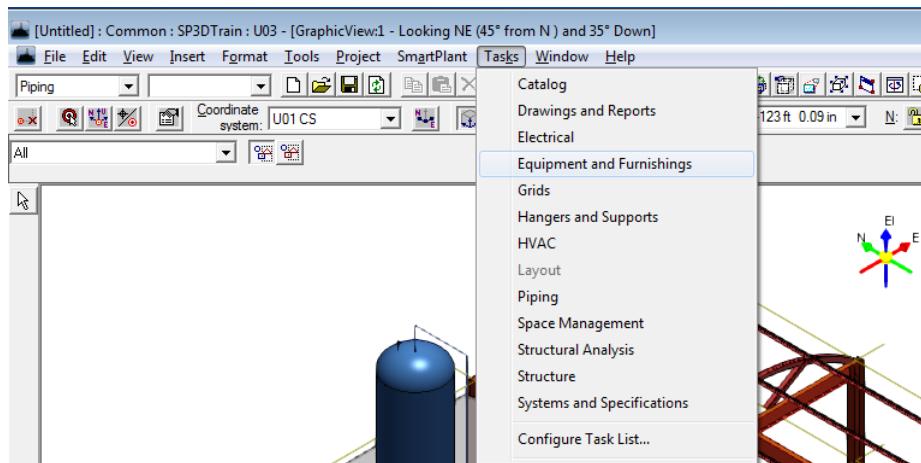
Common Tasks in Equipment and Furnishings

When in the Equipment task, you can perform the following tasks by using the commands available on the vertical toolbar.

- ↳ **Select** - Used to select objects in the model.
- ↳ **Place Equipment** - Specifies any piece of equipment from the Equipment folder of the catalog and places an occurrence of it inside the model.
- ↳ **Place Designed Equipment** - Places equipment types that have been defined in the reference data.
- ↳ **Place Equipment Component** - Specifies any equipment component from the Equipment Components folder of the catalog and places an occurrence of it inside the model.
- ↳ **Place Designed Equipment Component** - Specifies any equipment component from the Equipment Components folder of the catalog and places an occurrence of it inside the model.

- **Place Shape** - Adds additional shapes to an existing equipment or equipment component type.
- **Place Nozzle** - Adds different types of ports to an equipment or equipment component object.
- **Place Imported Shape from File** - Adds geometry to a designed equipment object that was modeled with solid modeling software and saved to an SAT or MicroStation DGN file format to an equipment or equipment component object.
- **Rotate Equipment** - Repositions equipment by rotating along a universal axis defined for the model view as well as an occurrence axis unique to the equipment itself.
- **Replace Equipment** - Exchanges a selected equipment or equipment component in the model for a different item from the catalog.
- **Place Designed Solid** - Creates highly customized designed solids for both complex concrete needs and equipment modeling.

To open the **Equipment and Furnishings** tasks, select **Tasks > Equipment and Furnishings**.

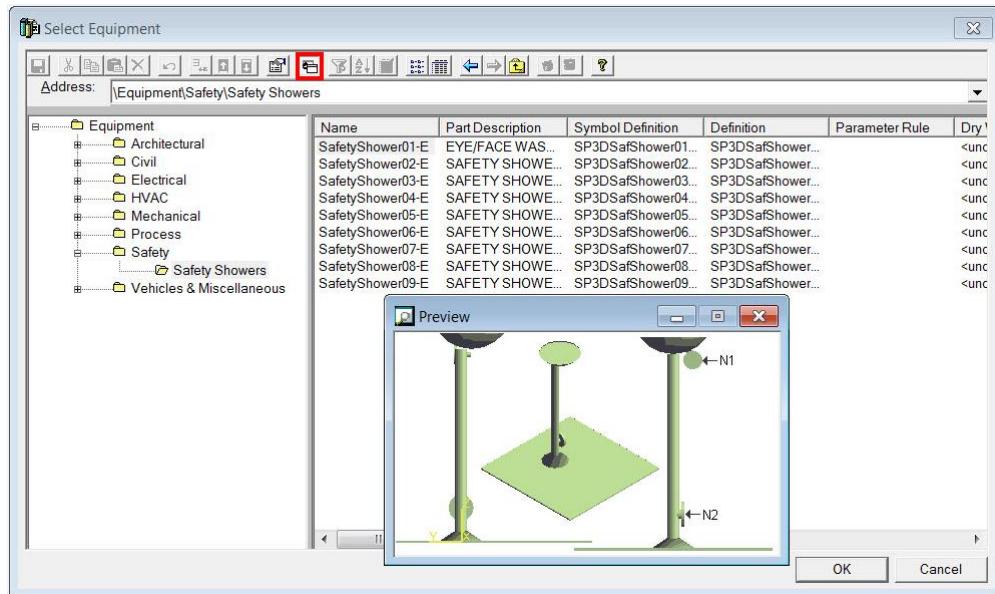


The following tasks are commonly performed in the **Equipment and Furnishings** environment:

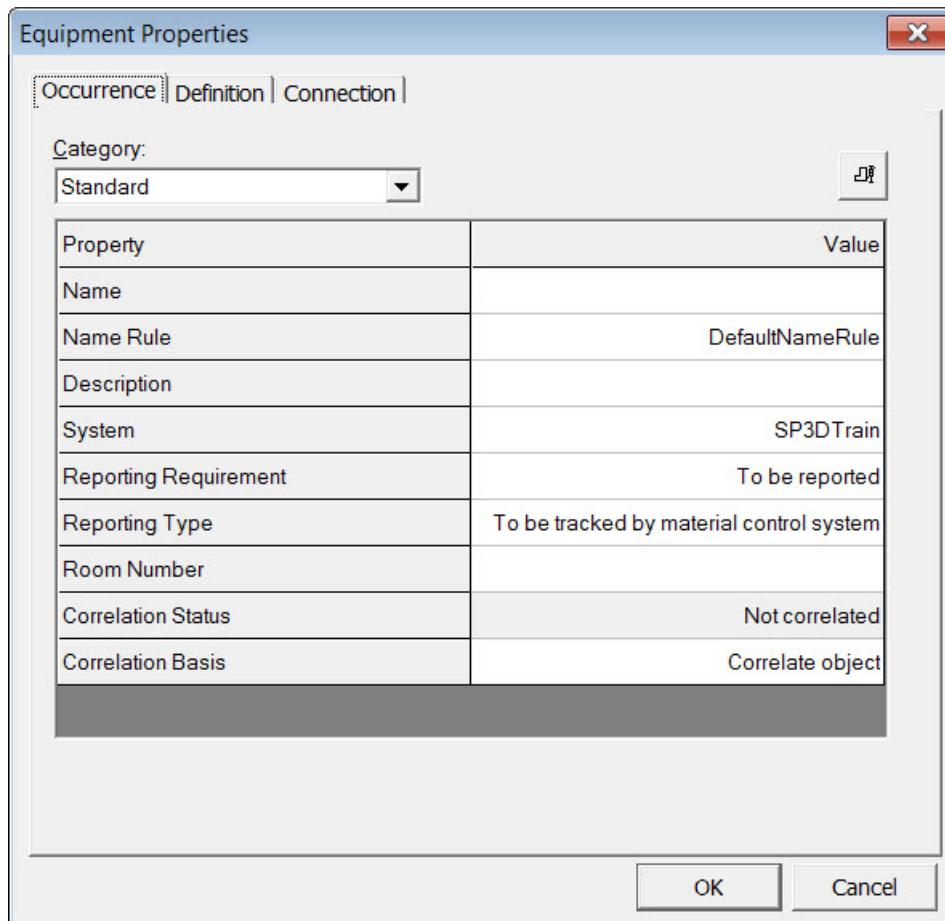
- Place equipment from the catalog - You can interactively place equipment from the Smart 3D catalog. More details can be added to the equipment by adding primitive geometric shapes, nozzles, and access steel (platforms, ladders, handrails) to the catalog equipment.
- Build customized equipment - You can build designed equipment by using primitive geometric shapes. You can also design or place equipment components from the catalog.
- Set positioning relationships - You can create a positioning relationship among the equipment you place and other surfaces or reference geometry that you select.
- Manipulate equipment - You can copy, move, rotate, and delete equipment in the **Equipment and Furnishings** environment.

Catalog Equipment

You can browse the available catalog equipment by clicking **Place Equipment** . After you select a piece of equipment, you can preview the equipment in the **Select Equipment** dialog box by clicking **Preview** .



From the **Select Equipment** dialog box, click **Properties**  to view the properties of the selected equipment. If the equipment has ports, the **Connection** tab also displays in the **Part Properties** dialog box. You then can view the properties of each port by selecting the port from a list.



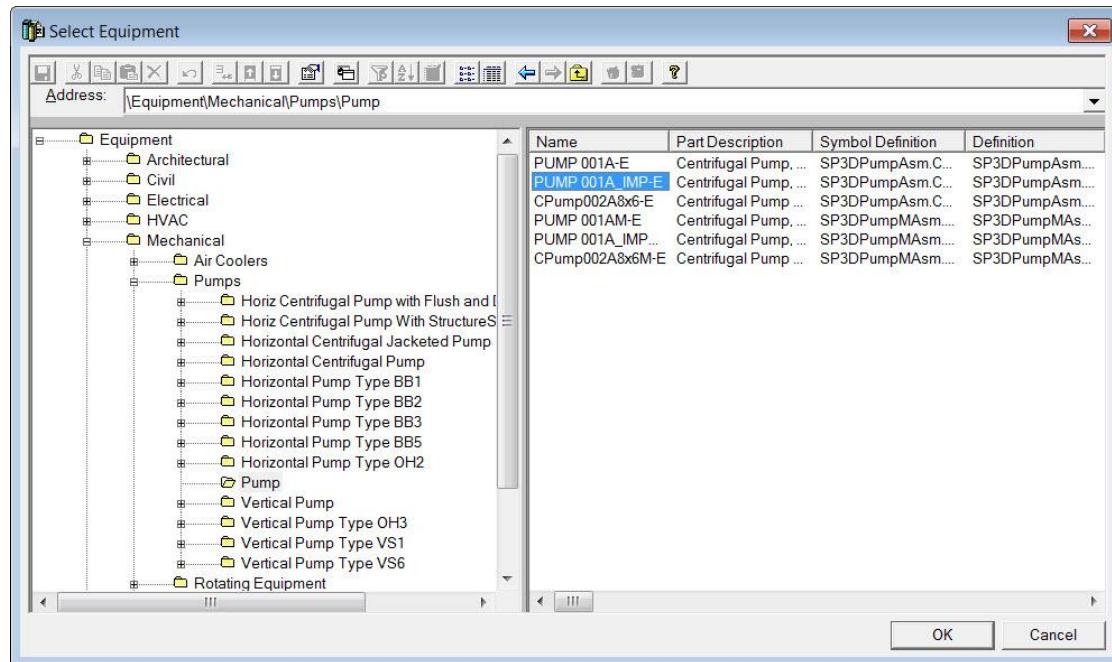
The procedures for selecting designed equipment, equipment components, and shapes are similar.

Designed Equipment

Any catalog equipment type can be selected as the **Type** for the designed equipment. You can see the available types by clicking **Place Designed Equipment** . The properties of the designed equipment are the same as the selected catalog equipment. You must supply the geometry by using **Place Equipment Component** , **Place Shape** , and **Place Nozzle** .

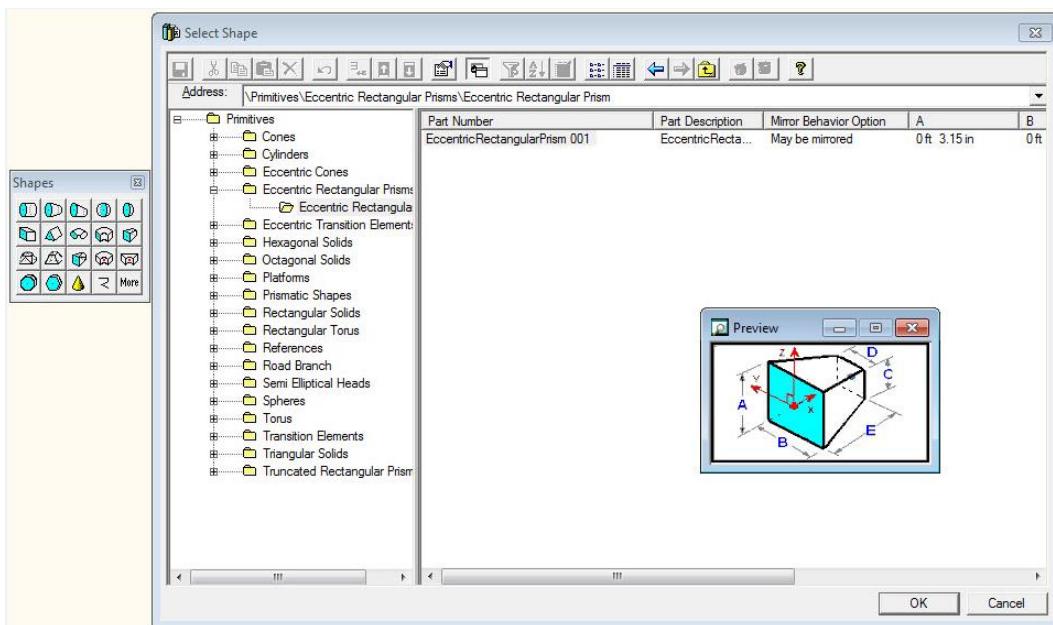
Equipment Components

You can browse the available catalog equipment components by clicking **Place Equipment Component** . With an equipment component selected, click **Preview**  in the **Select Equipment Component** dialog box to see a picture of the equipment component geometry. The port locations, if any, are shown in the **Preview** dialog box.



Shapes

You can browse the available catalog shapes by clicking **Place Shape**  and clicking **More** in the **Shapes** window. With a shape selected, select **Preview**  in the **Select Shape** dialog box to see a preview of the shape geometry.



Aspects of Equipment

Equipment defines physical geometry and geometry representing spatial requirements, such as the volume of space needed to operate or maintain the object. Geometric aspects can exist as part of the equipment definition within the catalog, or they can be added to the equipment after it is placed.

The standard equipment aspects you can define are:

- **Simple physical aspect** - This aspect includes equipment objects, and represents the physical shape of the equipment during normal operation. It also represents simpler geometry to speed up the display.
- **Detailed physical aspect** - This aspect provides a detailed graphical view of the equipment.
- **Insulation aspect** - This aspect represents the volume around a piece of equipment, if insulation is present.
- **Operation aspect** - This aspect includes the space around an object required for the object to operate. For example, this aspect can define the space needed for thermal expansion.
- **Maintenance aspect** - This aspect includes the space around an object required to perform maintenance on the object.
- **Reference aspect** - This aspect defines the geometry representing non-physical shapes, such as datum points.

Equipment Ports

Once you place equipment, you can connect piping and other distributed systems, such as conduits and HVAC, to the equipment. Ports allow you to make the connection and generate the required detail connection parts. When you place a port on a piece of equipment, you can specify its location, orientation, and properties.

The available ports are:

- **Pipe ports** - Connects piping and instruments to equipment. The properties of the piping ports, or nozzles, are used to determine the appropriate piping components, such as flanges.
- **HVAC ports** - Connects ducting to equipment.
- **Conduit ports** - Connects conduits to equipment.
- **Cable tray ports** - Connects cable trays to equipment.
- **Foundation ports** - Connects the foundation to equipment. Foundation ports determine the foundation type.

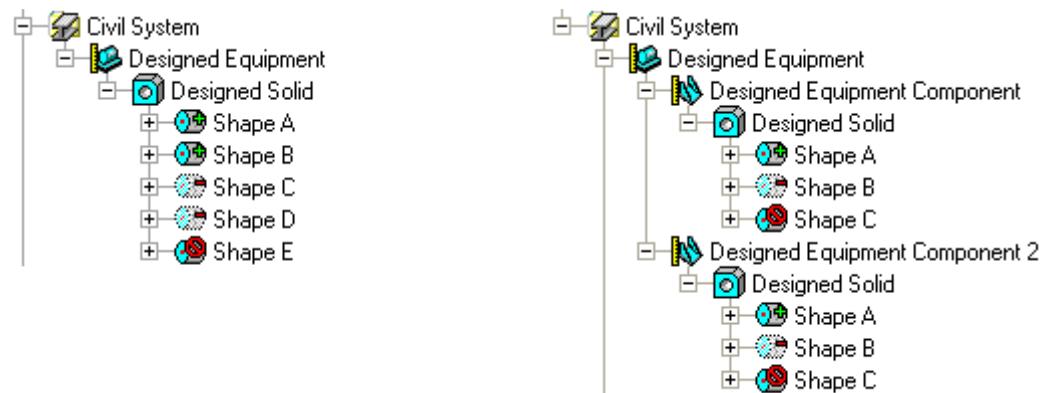
Solid Modeling

Solids are a container for a collection of shapes. Solids have surface area and volume properties, which allow you to compute the solid's weight and center of gravity (CG). In order to compute the weight and CG, you must define a material and a material density. Specify a **Material Type** and a **Material Grade** to extract the material density from the catalog.

NOTE Material properties only apply to designed solids placed in the **Simple physical** or **Detailed physical** aspects.

To place a solid, first place a designed equipment or a designed equipment component in the model. Then, place the solid as a child of the designed equipment or the designed equipment component. At this point, you can add shapes underneath the solid.

NOTE You can have multiple solids under one designed equipment or designed equipment component. You can also have multiple designed equipment components under one designed equipment.



A shape must be a child of a solid in order to compute its weight and CG. The weight and CG values of a solid are determined by the summation of the weight and CG values of all shapes in

the solid. Similarly, the weight and CG values of a designed equipment or a designed equipment component are determined by the summation of the weight and CG values of all solid children.

To define how the shape is used for a designed solid, the following functions are available on the **Place Shape** ribbon:

-  **Add Shape** - Select to have the shape add its material to the parent designed solid.
-  **Subtract Shape** - Select to have the shape subtract its material from the parent designed solid.
-  **Suppress Shape** - Select to have the shape added to the parent designed solid in the hierarchy, but have the shape's material ignored--neither added to nor subtracted from the parent designed solid.

By default, **Add Shape** is performed on a shape at placement time.

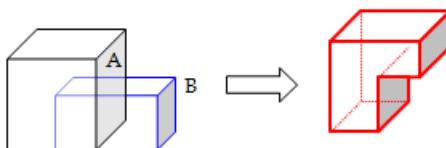
To understand the functionality of **Add Shape** and **Subtract Shape**, consider the following two shapes:



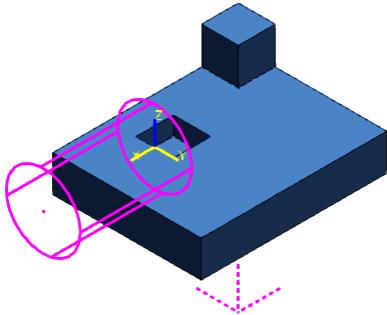
If you perform **Add Shape** on these two shapes, the shapes are merged together:



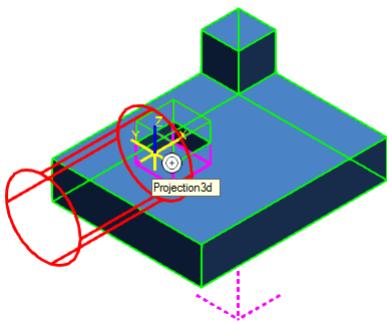
If you perform **Subtract Shape** on shape B to remove it from shape A, shape B is removed from the newly created shape:



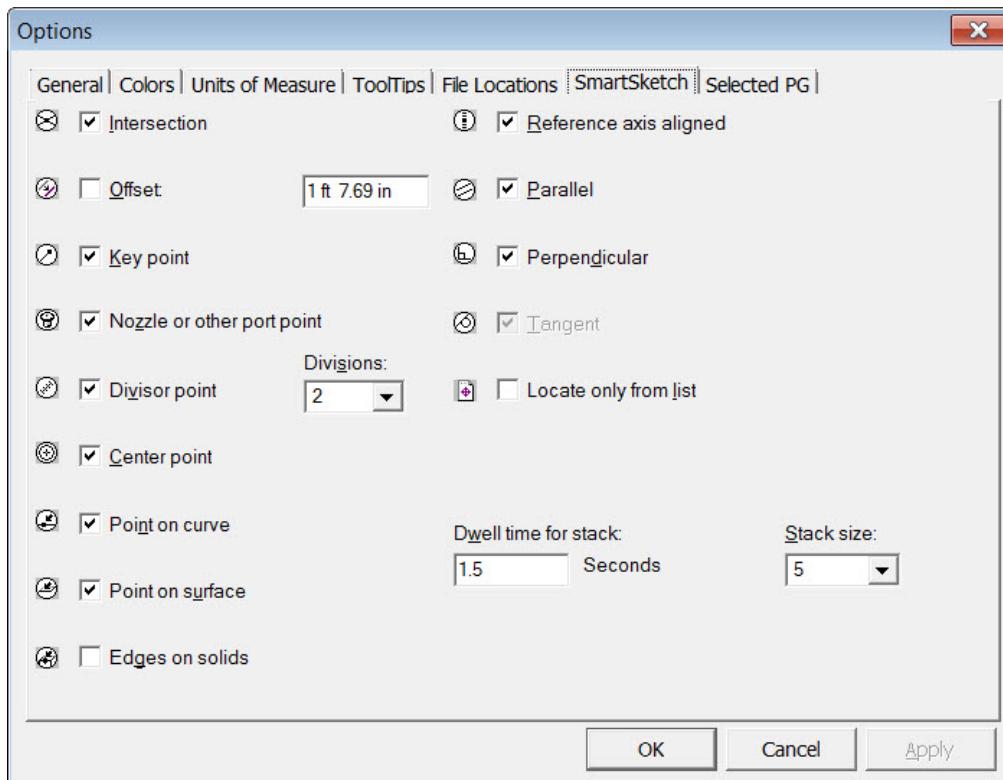
Suppress Shape allows you to create construction geometries for reference when placing other shapes. The shape itself is not included in the solid, and does not effect weight and CG calculations. In the following example, the cylinder is suppressed, and it can only be seen when it is selected.



The center point of the cylinder is used as a reference point for placing the cube.



NOTE The center point glyph seen above is one of many SmartSketch glyphs that are very useful when positioning shapes. You can turn glyphs on and off by selecting **Tools > Options** and opening the SmartSketch tab.



In the following example, shapes A and B are added to the solid, shapes C and D are subtracted from the solid, and shape E is suppressed from the solid:



To calculate the surface area, volume, weight, and CG of the solid, you must add the values for shapes A and B, and subtract the values from shapes C and D:

$\text{Shape A} + \text{Shape B} - \text{Shape C} - \text{Shape D} = \text{Total surface area, volume, weight, and CG of the designed solid}$

For more information related to equipment and furnishings, see *Equipment and Furnishings: An Overview* in the *Smart 3D Equipment User's Guide*.

Quiz

1. How do you display a picture showing the meaning of the catalog equipment dimensions?
2. What command do you use to define the geometry of designed equipment?
3. What are "aspects" of equipment?
4. What type of port do you use to connect equipment with piping?

SECTION 2

Placing Catalog Equipment

Objective

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

- Select equipment from catalog for placement.
- Modify occurrence properties of equipment before placement.
- Position and orient catalog equipment in a model by using PinPoint and other positioning methods.
- Rotate equipment by using **Rotate Object** .

Before Starting this Procedure

- Smart 3D Overview
- Smart 3D Common Sessions
- *Equipment: An Overview* (on page 5)

Before going through this and the subsequent Smart 3D Equipment sessions, define your workspace to include all objects in the SP3Dtrain model database:

1. Select **Start > Programs > Intergraph Smart 3D > Smart 3D**.
2. In the **New** dialog box, select either template and click **OK**.
3. Select **File > Define Workspace**.

The **Define Workspace** dialog box displays.

4. In the **Filter** list, click **More** .

The **Select Filter** dialog box displays.

5. Select **Plant Filters > All** and click **OK**.
6. In the **Define Workspace** dialog box, click **OK**.
7. Select **View > Fit**.

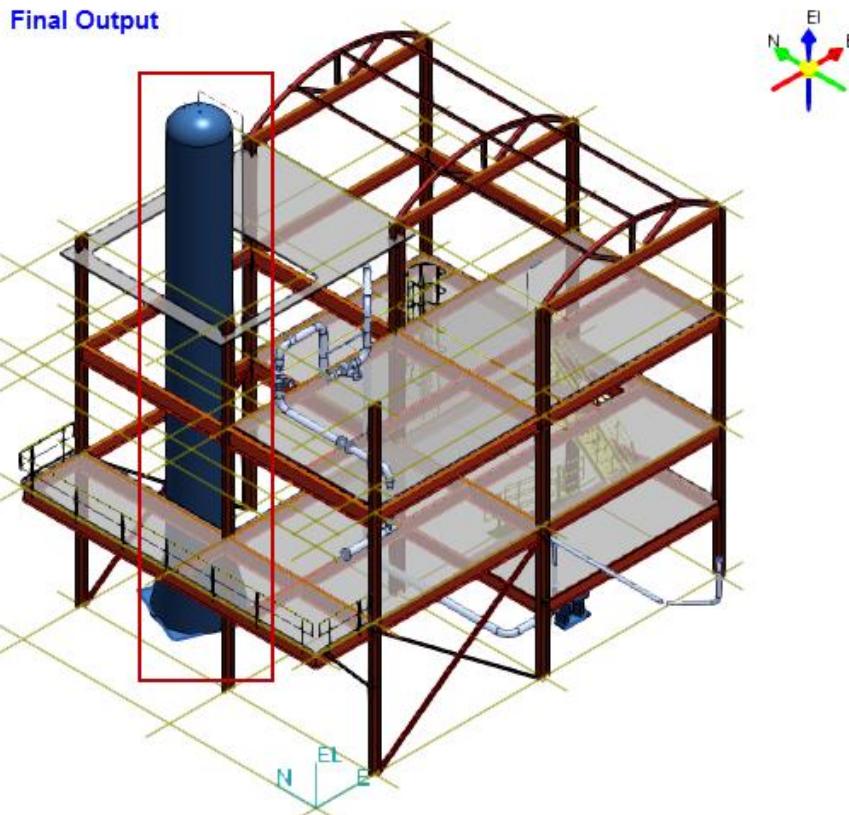
Now, you are going to delete some existing modeled objects from the workspace before starting the session.

8. Select **Tools > Select by Filter**.
9. The **Select Filter** dialog box displays.
10. Select the **For Instructors Only > Equipment Tutorial Session – Select and Delete** filter and click **OK**.
11. Select **Edit > Delete**.

The selected objects are deleted.

Place Equipment from the Catalog

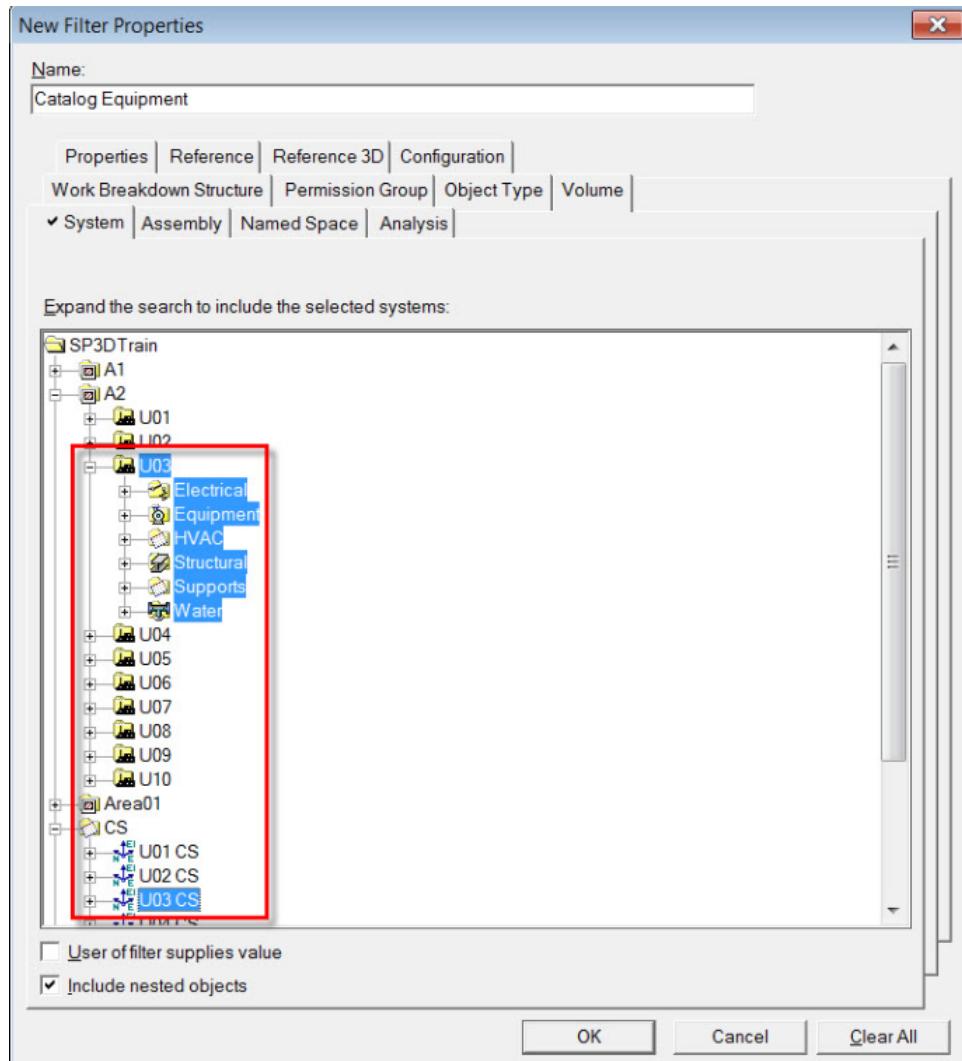
In the following exercise, you will place a vertical vessel T-101 from the catalog in Unit U03 of Area A2. The result should look like the highlighted vessel below:



1. Select **File > Define Workspace**.

*The **Define Workspace** dialog box displays.*

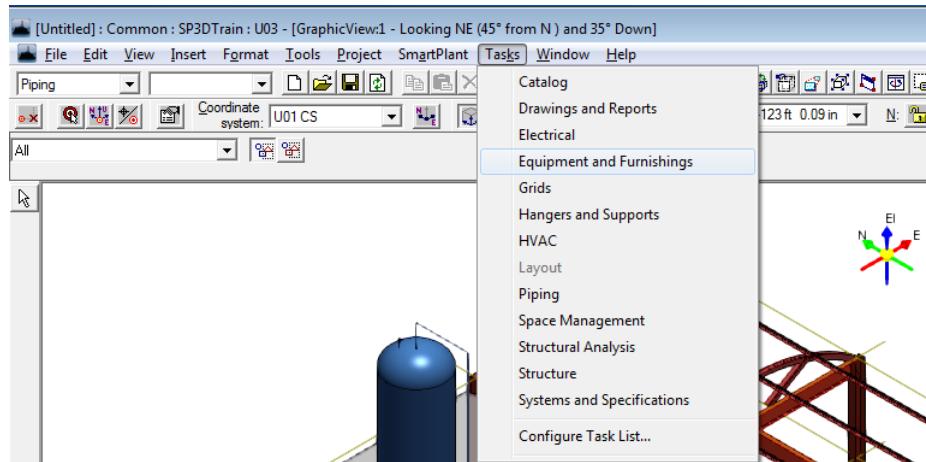
2. Create a new filter to display Unit U03 and coordinate system U03 CS, and click **OK**.



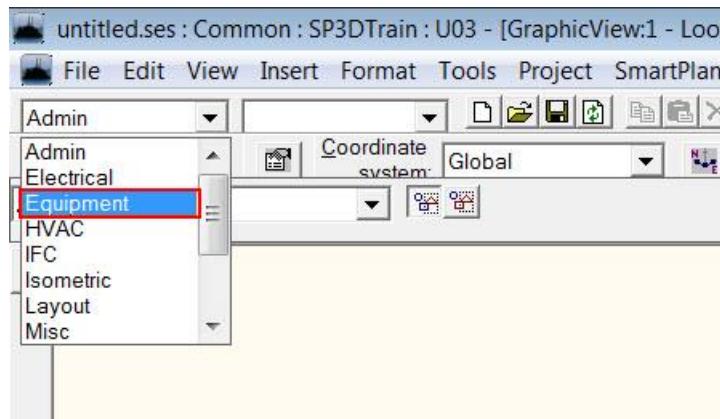
3. Select **Tools > Select by Filter**.
The **Select Filter** dialog box displays.
4. Select **Plant Filters > Training Filters > U03**, and click **OK**.

Placing Catalog Equipment

5. If you are not in the **Equipment and Furnishings** environment, select **Tasks > Equipment and Furnishings**.



6. Select **Equipment** from the **Active Permission Group** list.



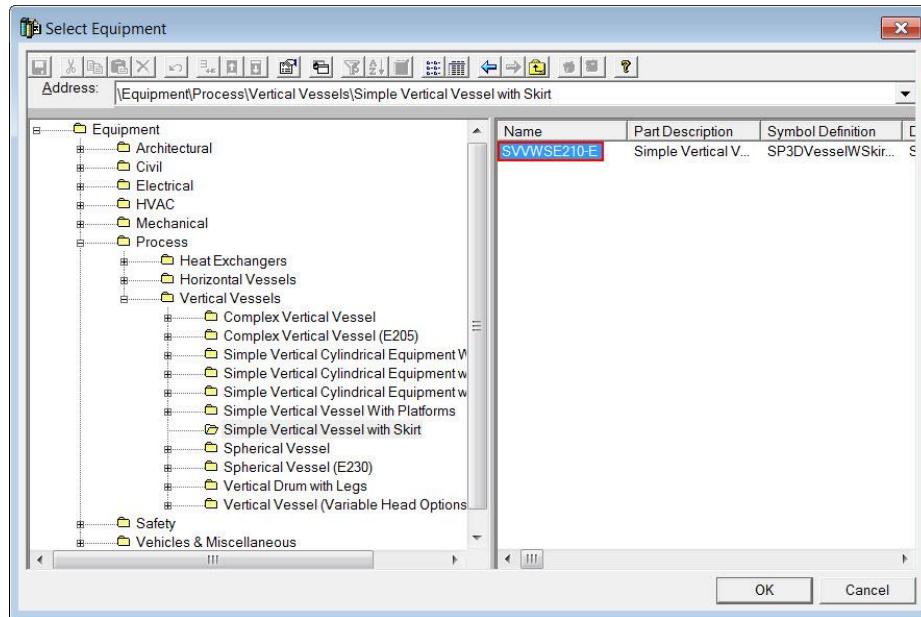
7. Select **Tools > PinPoint**.
8. On the **PinPoint** ribbon, select **Global** from the **Coordinate System** list, and click **Set Target to Origin**.



9. Click **Place Equipment** .

The **Select Equipment** dialog box displays.

10. Select **Equipment > Process > Vertical Vessels > Simple Vertical Vessel with Skirt > SWWSE210-E** and click **OK**.



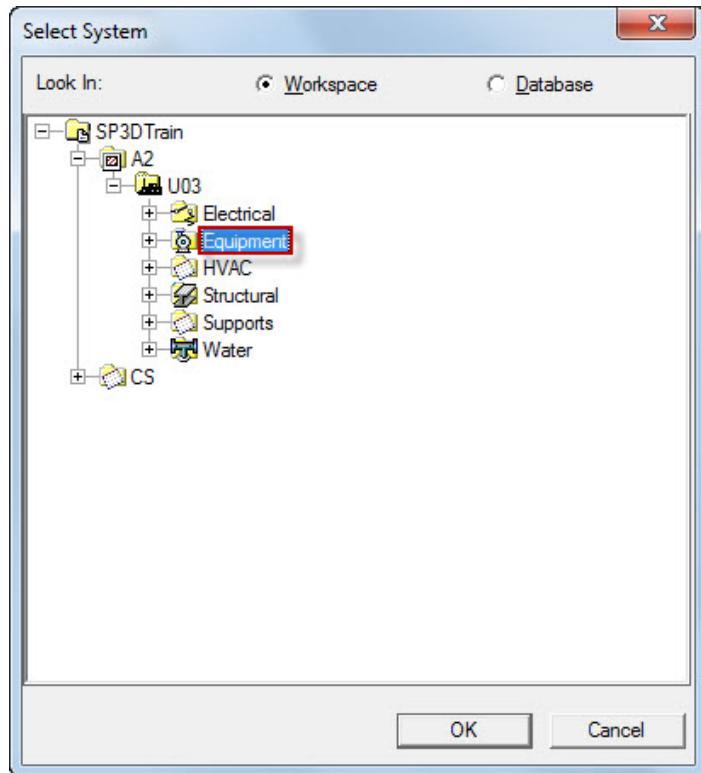
The **Equipment Properties** dialog box displays. For more information about this dialog box, see **Equipment Properties Dialog Box** in the *Smart 3D Equipment User's Guide*.

11. In the **Name** field, type **T-101**.
12. In the **System** field, select **More....**

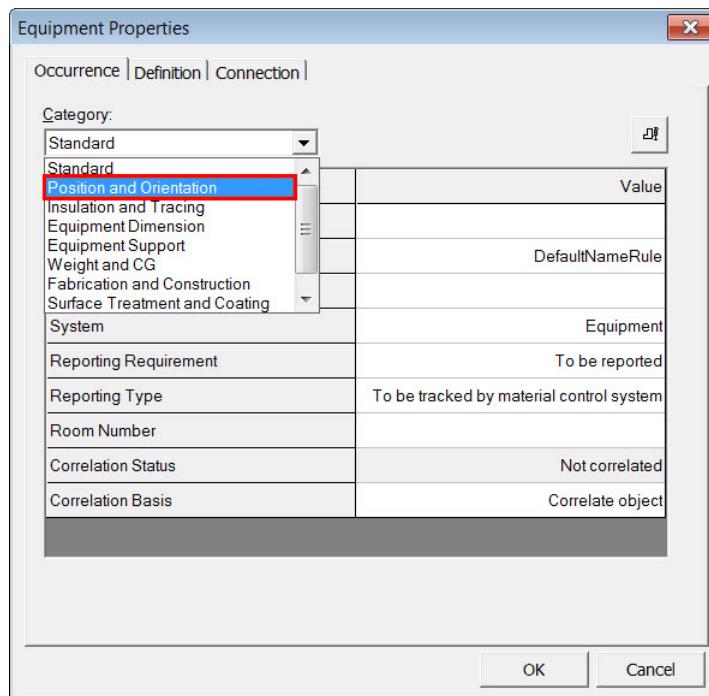
The **Select System** dialog box displays.

Placing Catalog Equipment

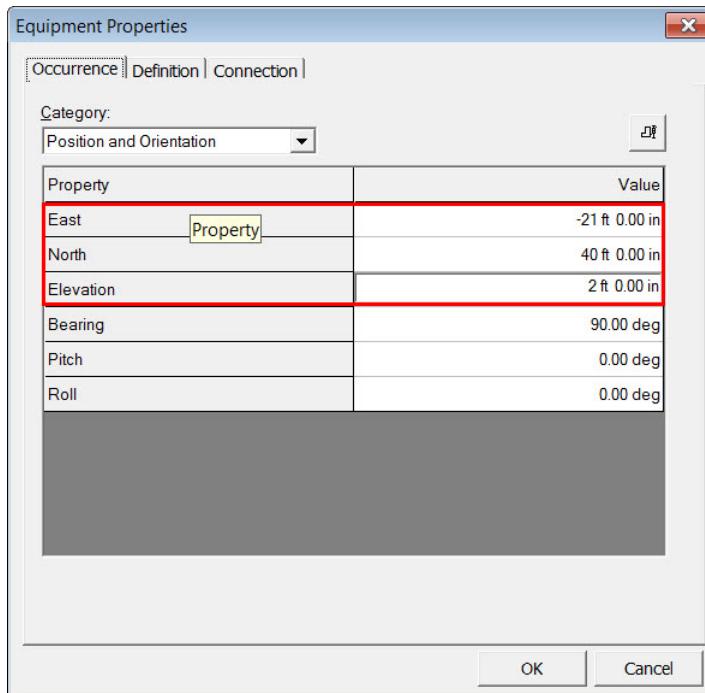
13. Select A2 > U03 > Equipment, and click OK.



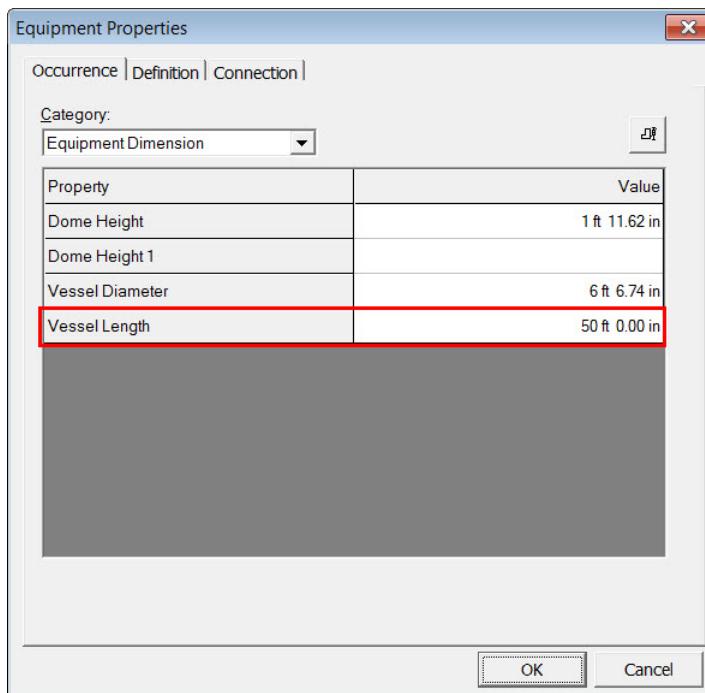
14. From the Category list, select Position and Orientation.



15. Specify the values for **East**, **North**, and **Elevation**, as shown below:

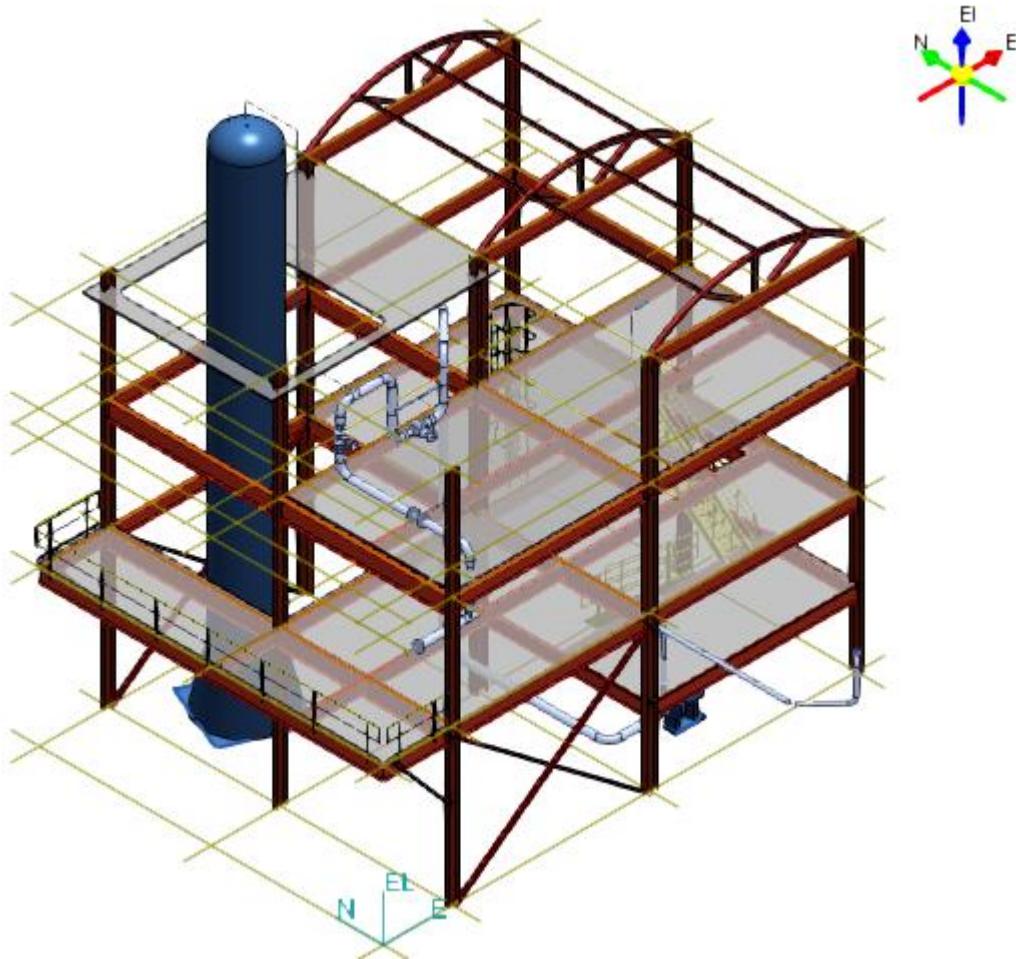


16. Change the **Category** to **Equipment Dimension**, and type **50 ft** in the **Vessel Length** field:



17. Click **OK**.

The model displays.



18. In the **Locate Filter** list, select **Pipe Nozzle**.
19. In the **Workspace Explorer**, right-click **A2 > U03 > Equipment > T-101 > C** and select **Properties**.

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

20. Under **Occurrence**, set the value for **Behavior Controlled by user** to **True**.
21. Under **Location**, Set the value for **N1** to **59 ft**.
22. Click **OK**

Nozzle C is now repositioned.

23. In the **Locate Filter** list, select **Equipment**.

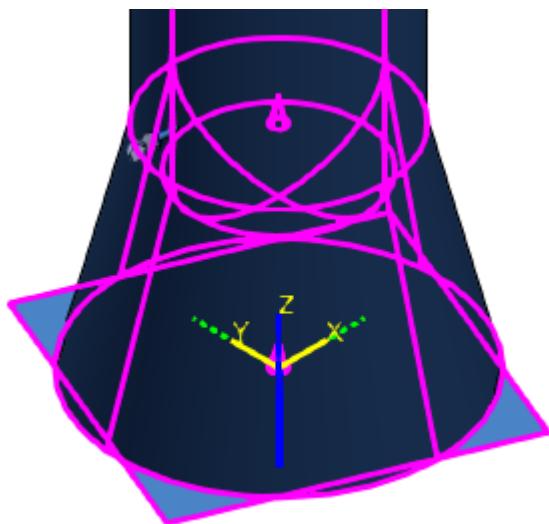
Rotating Equipment: An Overview

You can rotate and reposition any placed equipment in a model, as long as the equipment is not fully constrained or controlled by positioning relationships. If you place the equipment with a mate relationship to a surface, you can only rotate the equipment about the axis that is normal to the surface. A mate relationship is the relationship applied between the surface of one piece of equipment to another equipment surface, structural surface, elevation plane, or grid plane.

The default point of rotation is the first foundation port of the equipment. If no foundation port exists, the origin of the equipment becomes the default point of rotation.

The axis of rotation can be one of the axes of the current PinPoint coordinate system, one of the equipment's local coordinate system axes, a foundation port axis, or a nozzle axis.

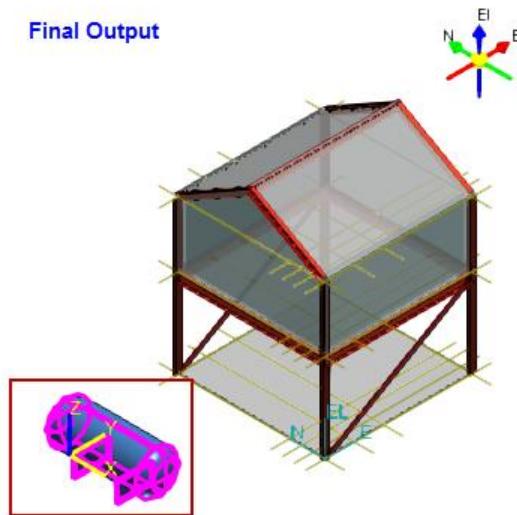
The following example shows an axis normal to the foundation port. This, therefore, is the default axis of rotation.



NOTE **Rotate Object**  encompasses the functionality of **Rotate Equipment** . In future releases, **Rotate Object**  will replace **Rotate Equipment** , so the following exercise will use **Rotate Object** .

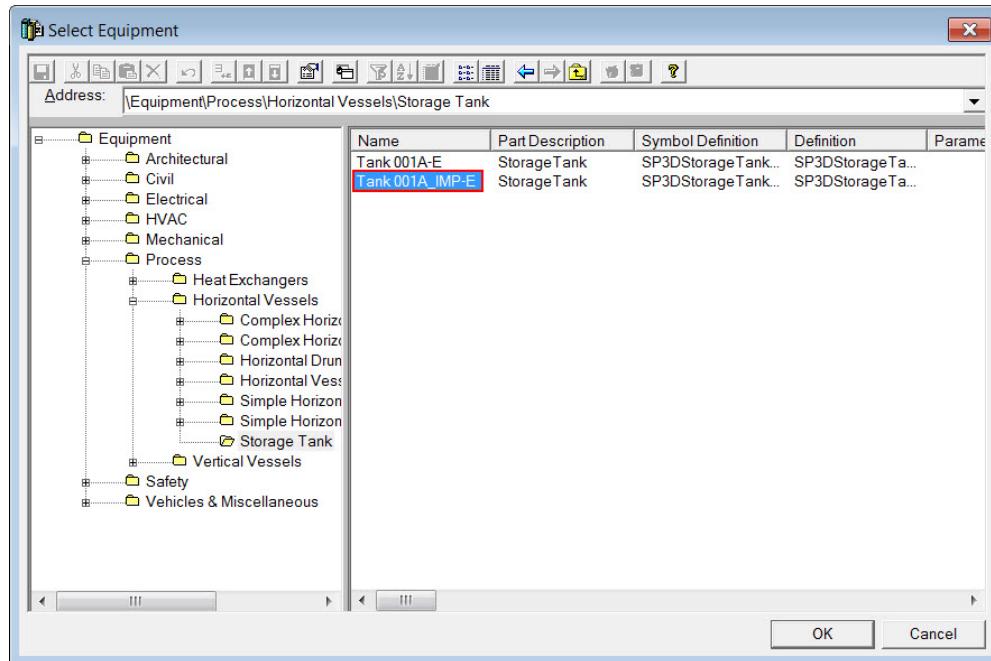
Rotate Equipment

Rotate the horizontal vessel 40V-101 storage tank in Unit U04 of Area 2 by an angle of 90 degrees using **Rotate Object**  and U03 CS as the active coordinate system.



1. Click **File > Define Workspace**.
*The **Define Workspace** dialog box displays.*
 2. Define the workspace to display **Unit U04** and the coordinate system **U04 CS**, and click **OK**.
 3. Select **Tools > PinPoint**.
 4. Click **Place Equipment** .
- The **Select Equipment** dialog box displays.*

5. Select **Equipment > Process > Horizontal Vessels > Storage Tank > Tank_001AIMP-E**, and click **OK**.



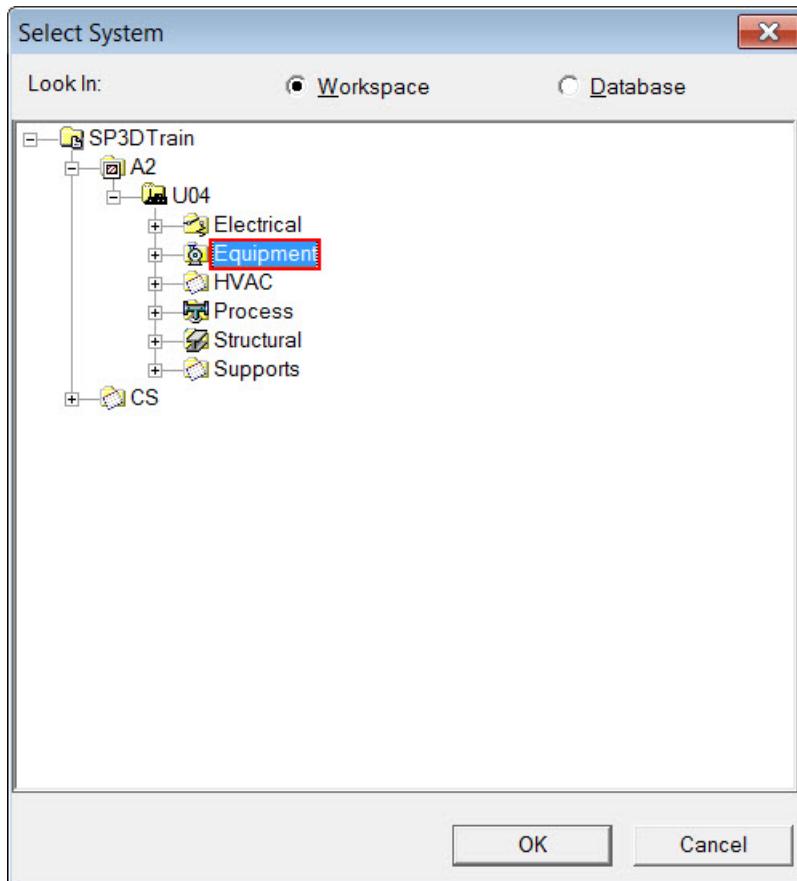
The **Equipment Properties** dialog box displays.

6. In the **Name** field, type **40V-101**.
7. Under **System**, select **More....**

The **Select System** dialog box displays.

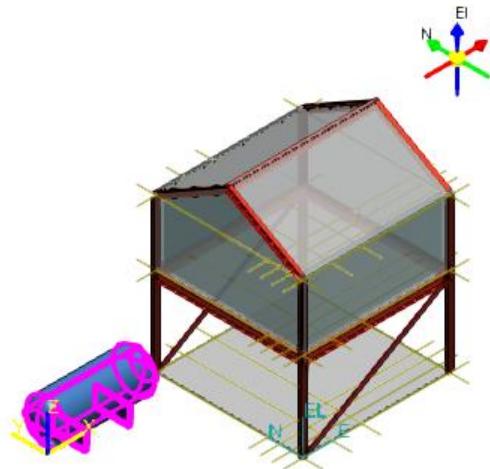
Placing Catalog Equipment

8. Select **A2 > U04 > Equipment**, and click **OK**.

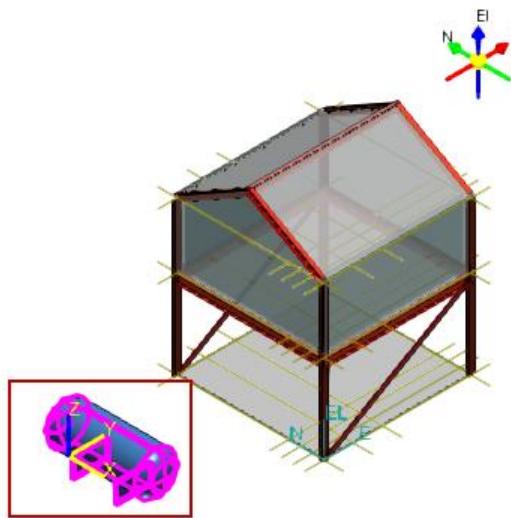


9. Click **OK** on the **Equipment Properties** dialog box.
10. On the **PinPoint** ribbon, enter the following values for the **East**, **North**, and **Elevation** coordinates by using the function keys F6, F7, and F8:
 - East:** 98 ft
 - North:** 100 ft 6 in
 - Elevation:** 6 ft
11. With the left and right arrow keys, rotate the equipment around the tank axis running north/south.
12. Click the position point to lock the equipment object in place.

13. Click in the graphic view to place the equipment.



14. To rotate the equipment after it is placed, select **Rotate Object**  from the **Common** toolbar. Using the up/down axis as the rotation axis, enter **270 deg** in the **Rotation Angle** field.



TIPS

- You can manually select a different rotation axis by clicking the new axis or by specifying a new **Axis Direction** option.
- To specify the rotation angle, you can either manually drag the equipment around the axis of rotation or specify an **Angle** value in the **Equipment Properties** dialog box. This value is measured with respect to the global coordinate system.

Placing Catalog Equipment

- When rotating an object, you can specify a **Step** value that represents the incremental angle value used by the software in rotating the equipment. This value is used during dynamic rotation.

For more information about rotating equipment, see *Rotate Object Command* in the *Smart 3D Common User's Guide*.

SECTION 3

Placing Equipment by Positioning Relationships

Objective

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

- Position equipment relative to geometry in the model.

Before Starting this Procedure

- Smart 3D Overview
- Smart 3D Common Sessions
- *Placing Catalog Equipment* (on page 17)

Overview:

The **Place Equipment** ribbon allows you to graphically position the equipment relative to other geometry in the model. You can define one or more positioning relationships between geometry on the equipment and geometry in the model. The positioning relationships can be used to initially place the equipment or to modify the position of existing equipment. These positioning relationships are maintained as you edit your design.

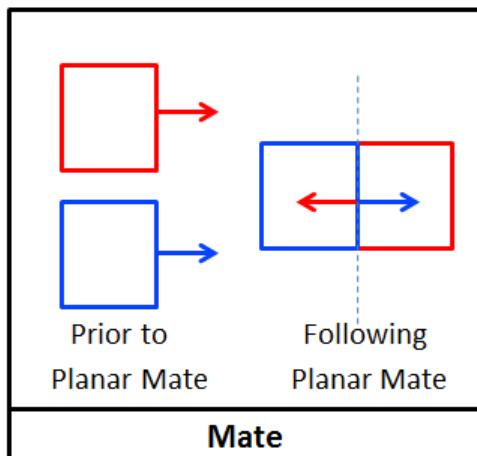
Positioning relationships only control equipment positions. You can only move the equipment subject to the constraints defined by the positioning relationships.

To add a relationship to an equipment, select **New Relationship** and its relationship type. Adding a relationship moves the currently selected equipment according to its current existing relationships. You can edit existing relationships by selecting it in the relationship control. Select and edit the geometry of the relationship with **Equipment Reference**  and **Second Part Reference** . You can use **Delete Relationship**  on the equipment edit ribbon to remove the relationship.

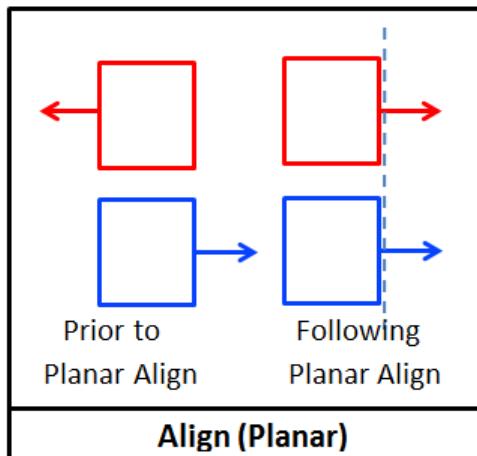
The geometric relationships available for positioning the equipment are:

Placing Equipment by Positioning Relationships

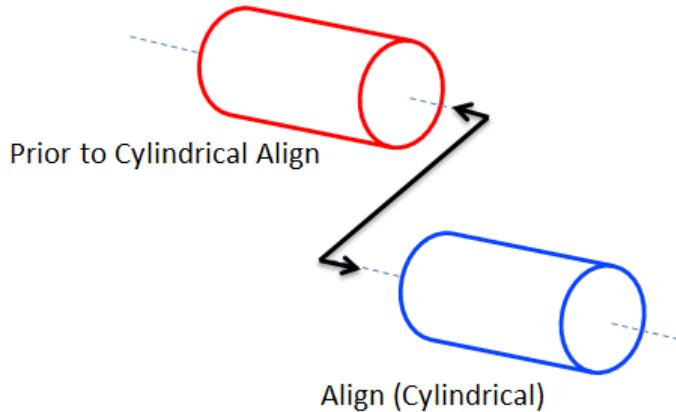
- **Mate** - The relationship between a surface on the equipment and a surface or reference plane in the model. **Mate** orients the objects so that the outer surface of the first object is placed against or offset from the outer surface of the second object. The offset distance between the surfaces is defined by the **Offset** value on the **Place Equipment** ribbon. When placing catalog equipment with **Mate**, the foundation port of the equipment is used as the mating surface by default.



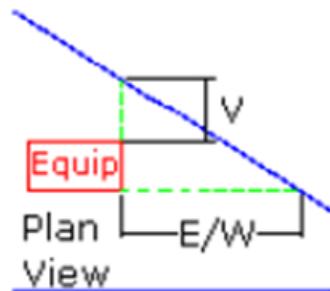
- **Align** - If planar faces are selected, **Align** positions the faces on the same plane with their surface normal pointing in the same direction. This is opposite of a **Mate** relationship.



If cylindrical surfaces are selected, their axes are positioned coincident to each other, and **Offset** specifies the offset distance between the two axes.

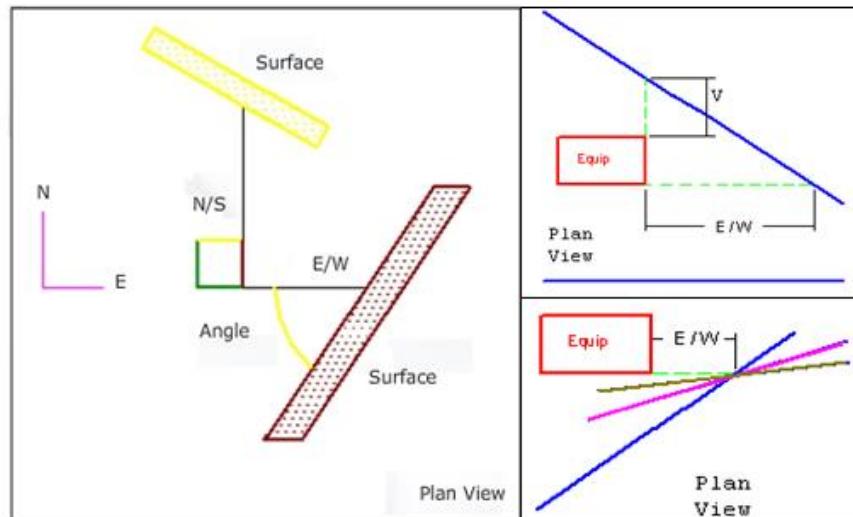
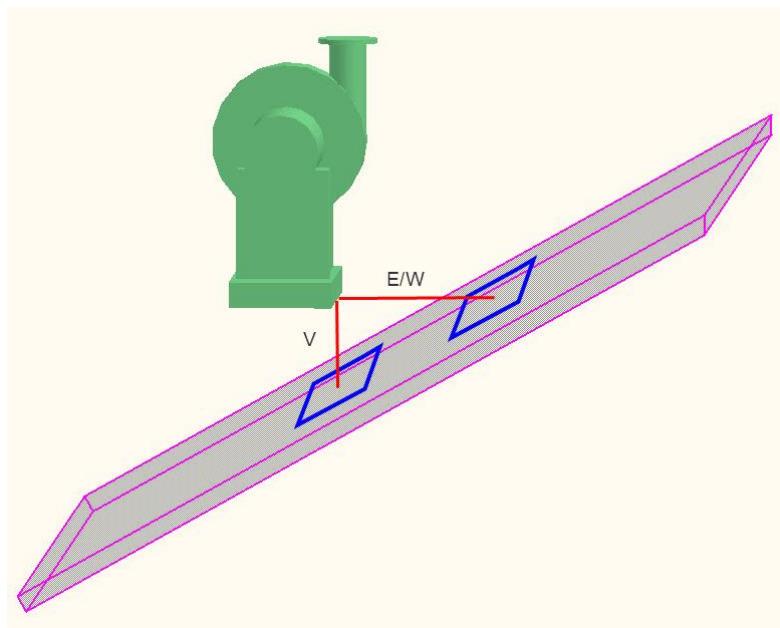
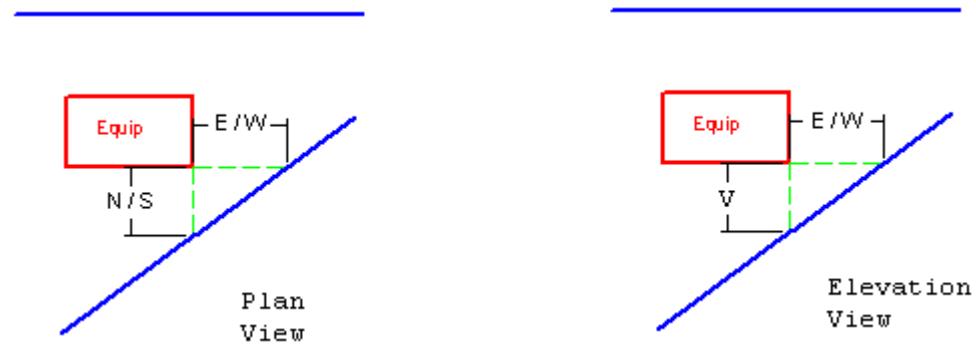


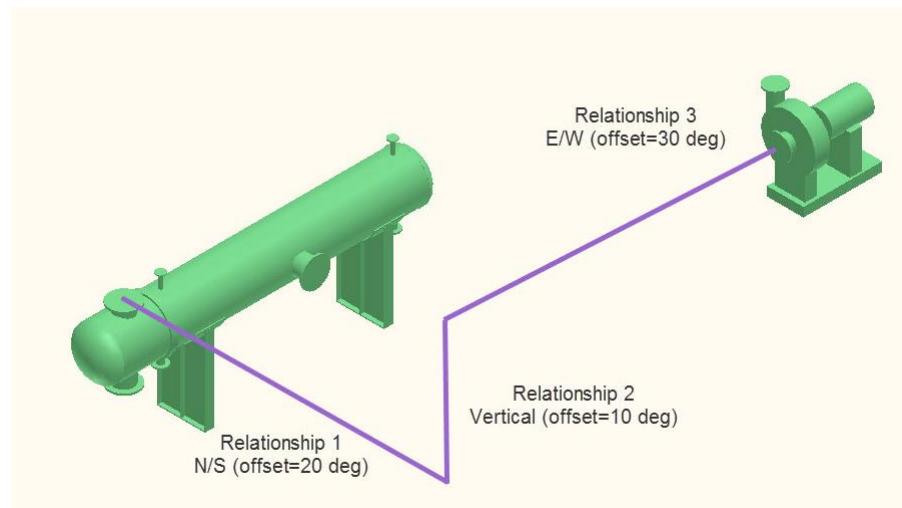
- **Connect** - The relationship between two points. The first point is relative to the selected equipment to be moved, even if the point is not on the geometry. The second point is relative to another object by virtue of the SmartSketch relation, or fixed relative to the global coordinate system if given as a point in space. If the two points found by SmartSketch are nozzles, then **Connect** establishes an **Align** axis relationship using the axis of the port and a point to point relationship.



- **E/W Distance** - The horizontal relationship along the east/west axis. Select one point on the equipment and the other point on a reference surface, edge, or point in the model. You can use any selectable point on the equipment, such as a SmartSketch point, port, or connect point. The reference surface can be at any orientation to the equipment. Multiple relationships are required to maintain minimum distances in more than one dimension. A temporary graphic indicates the relationship direction. When the angle between the reference surface and the horizontal minimum distance between the equipment is less than 1 degree, the constraint is broken and a message is sent to the **To Do List**.

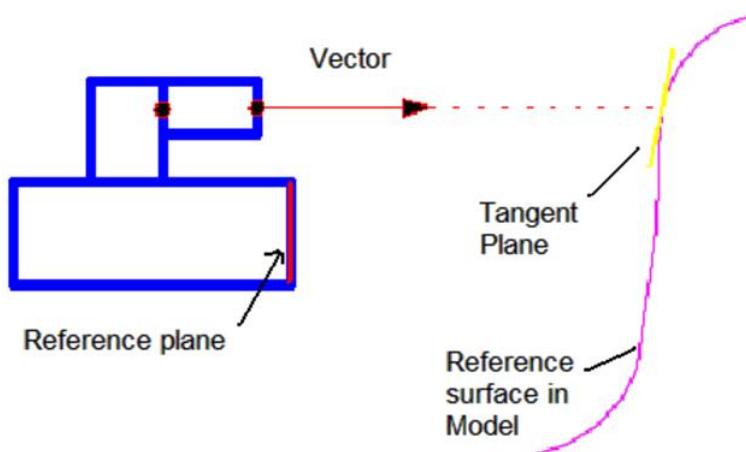
Placing Equipment by Positioning Relationships





- **N/S Distance** - The horizontal relationship along the north/south axis. For more information, see the description for the **E/W Distance** relationship.
- **Vertical Distance** - The vertical relationship along the up/down axis. For more information, see the description for the **E/W Distance** relationship.
- **Mate to Tangent Plane** - The relationship between a planar surface on the equipment and the reference surface, a plane tangent to a curved surface at a point defined by the intersection of a vector with the surface. The vector and reference surface can only be changed by selecting **Surface in model** smartstep when you select the **Mate to Tangent Plane** relationship. If the reference surface is updated, the intersection point with the vector and the tangent plane are recomputed.

NOTE The vector locates an intersection point on the surface in the model. A plane tangent to the surface at the vector intersection point is then created and used as the mating surface. After the relationship is applied, the reference plane is mated to the tangent plane.



- **Parallel** - A relationship similar to the **Align** relationship. The significant difference is that **Align** rotates and translates an object, while **Parallel** only rotates the objects to make them parallel. You cannot edit the **Offset** value in a **Parallel** relationship.

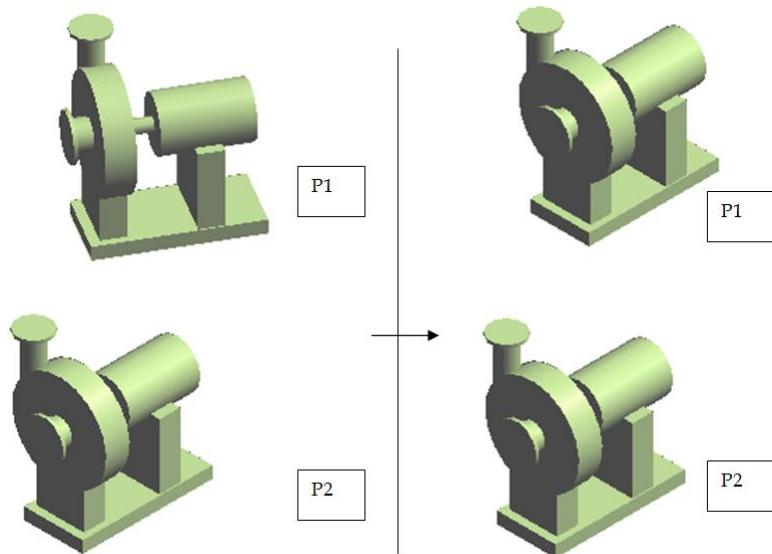
You can form a **Parallel** relationship between the following geometries:

Placing Equipment by Positioning Relationships

- Edge to Planar Surface
- Surface to Surface
- Edge to Edge
- Edge to Axis (Implied axis of cylindrical objects)
- Axis (Implied axis of cylindrical objects) to Axis (Implied axis of cylindrical objects)

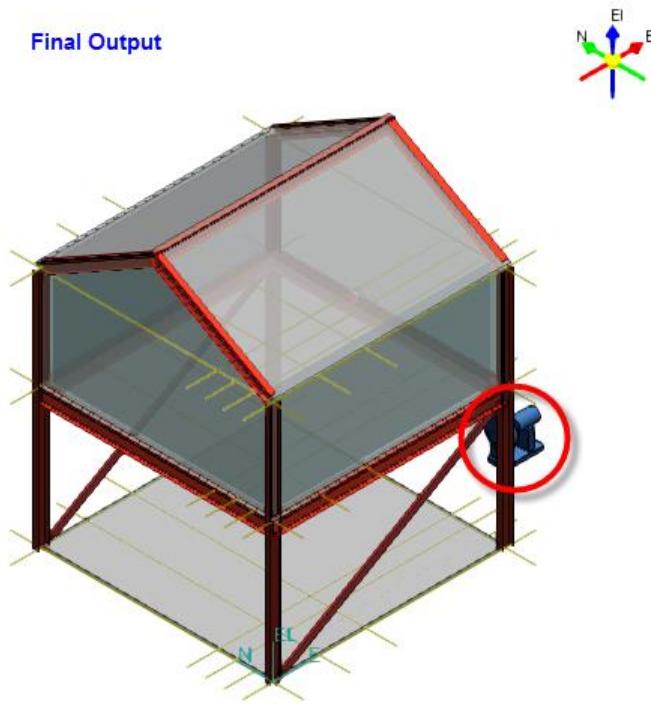
For example, you can orient a pump by setting a particular nozzle axis parallel to a nozzle axis on a different equipment item or parallel to a pipe feature.

When a cylindrical object is selected for the **Parallel** constraint, the behavior is similar to the **Align** constraint behavior with the exception that the selected object is only rotated, and not translated.

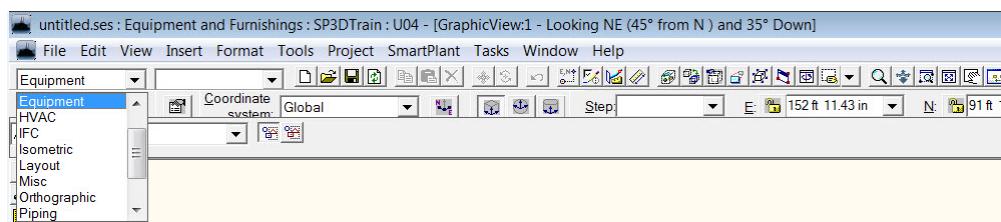


Place Catalog Equipment with a Mate Relationship

Place the pump **Pump 001A_IMP-E** from the Smart 3D catalog in Unit U04 using the **Mate** relationship to the elevation plane. The end result of this procedure should resemble the highlighted object below.



1. Define the workspace to display **Unit U04** and coordinate system **U04 CS**.
2. Switch to the **Equipment and Furnishings** task.
3. Set the **Active Permission Group** to **Equipment**.

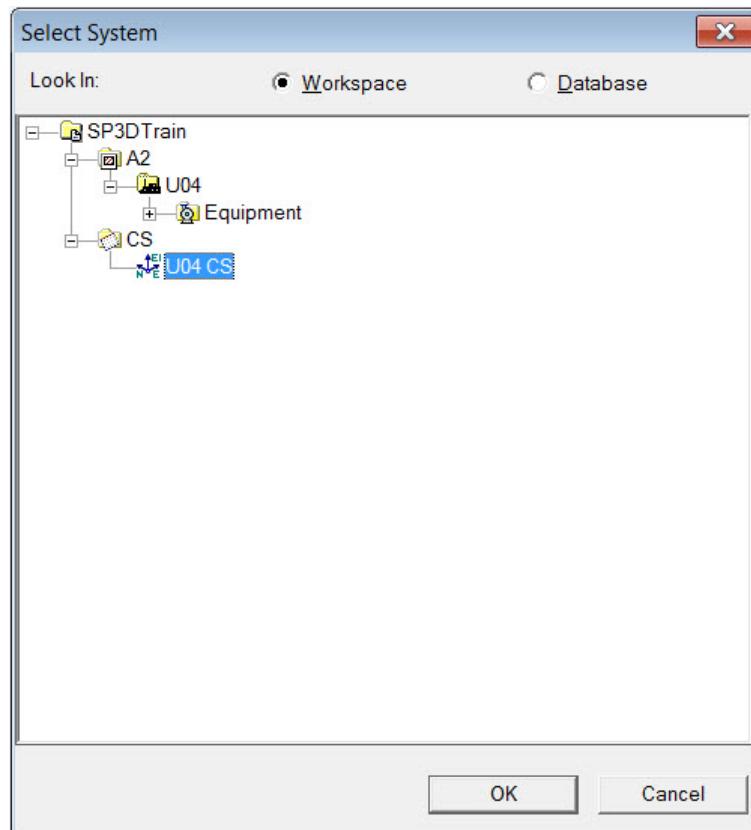


4. Select **Tools > PinPoint**.

*The **PinPoint** ribbon displays.*

Placing Equipment by Positioning Relationships

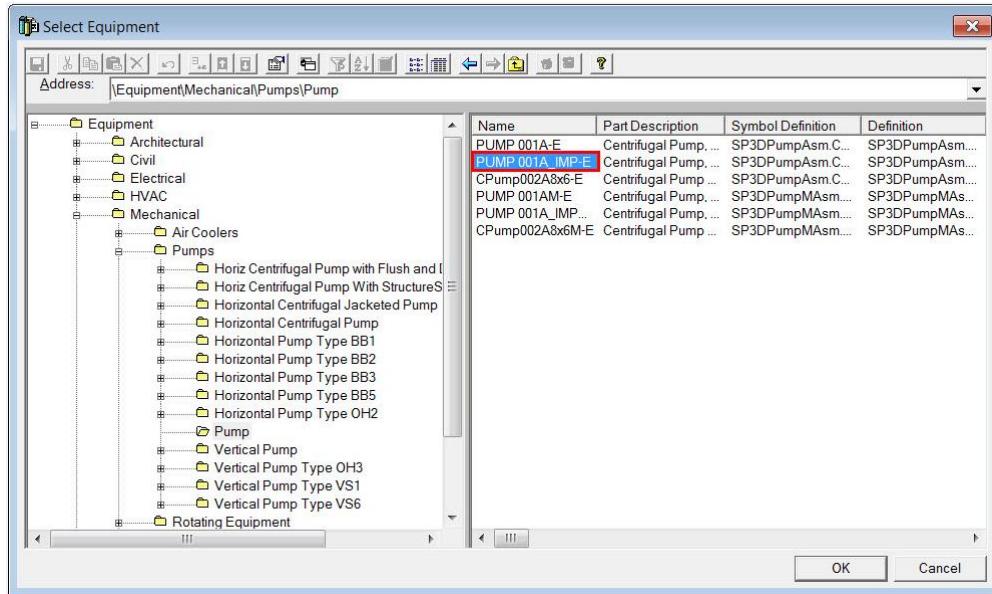
5. On the **PinPoint** ribbon, set the active coordinate system to **U04 CS** and click **Set Target to Origin**.



6. Click **Place Equipment**.

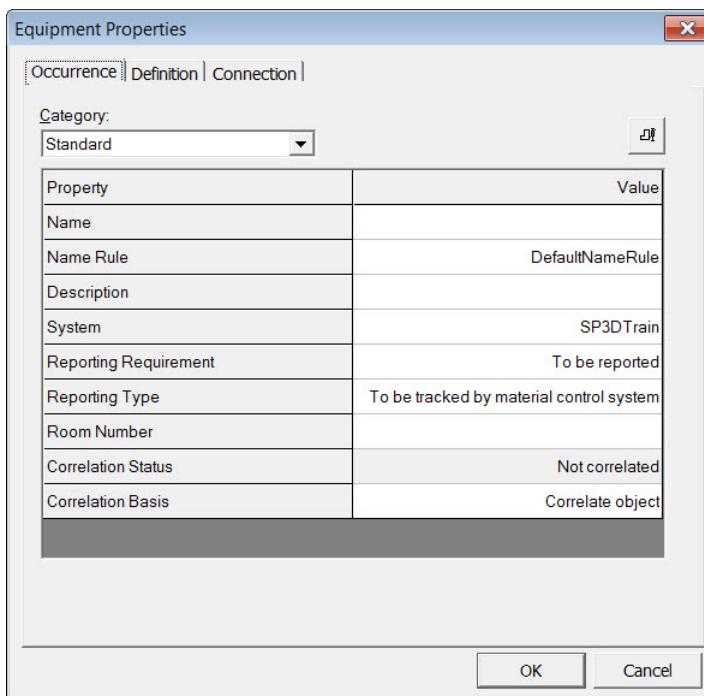
The **Select Equipment** dialog box displays.

7. Select **Equipment > Mechanical > Pumps > Pump > Pump 001A_IMP-E** and click **OK**.



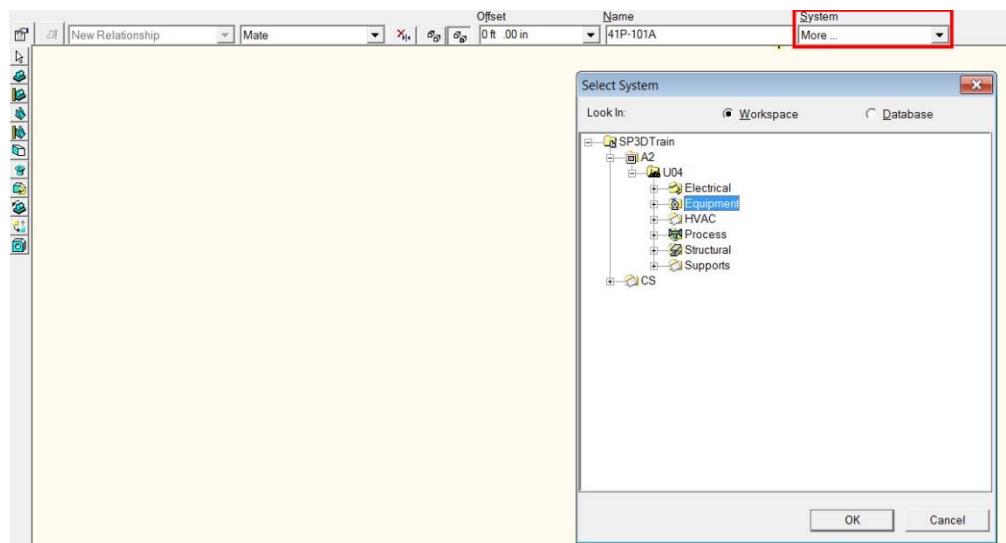
The **Equipment Properties** dialog box displays.

8. Click **OK** to retain the default properties.



Placing Equipment by Positioning Relationships

9. On the **Equipment** ribbon, set **Name** to **41P-101A** and set **System** to **A2 > U04 > Equipment**.

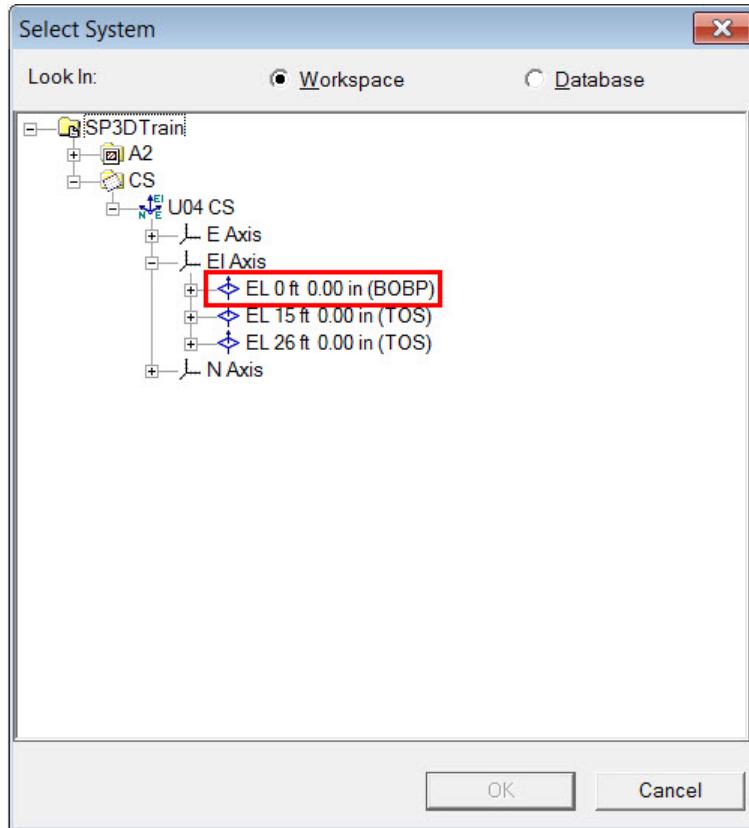


10. On the **PinPoint** ribbon, set **East** to **30 ft** and **North** to **5 ft**.
11. In the **Workspace Explorer**, select **Coordinate System > U04 CS > EL Axis**.

NOTES

- After the **Equipment Properties** dialog box is closed, you need to specify a location and a mating surface with the **Select System** dialog box to create the **Mate** relationship.
- The default relationship type is **Mate**. However, the ribbon shows the last relationship type used in that session. Ensure that the relationship type is set to **Mate**.

12. Select **EL 0 ft-0.00 in (BOBP)** to mate the pump with elevation 0 ft.



NOTES

- If a slab exists, you can simply select the surface of the slab.
- You can select the reference planes graphically by selecting **View > Rulers** to display the grid ruler. The reference planes are indicated as check marks on the reference lines in the graphic view.

13. Click anywhere in the graphic view to place the equipment.

14. On the **Equipment** ribbon, set **Offset** to **2 ft**.

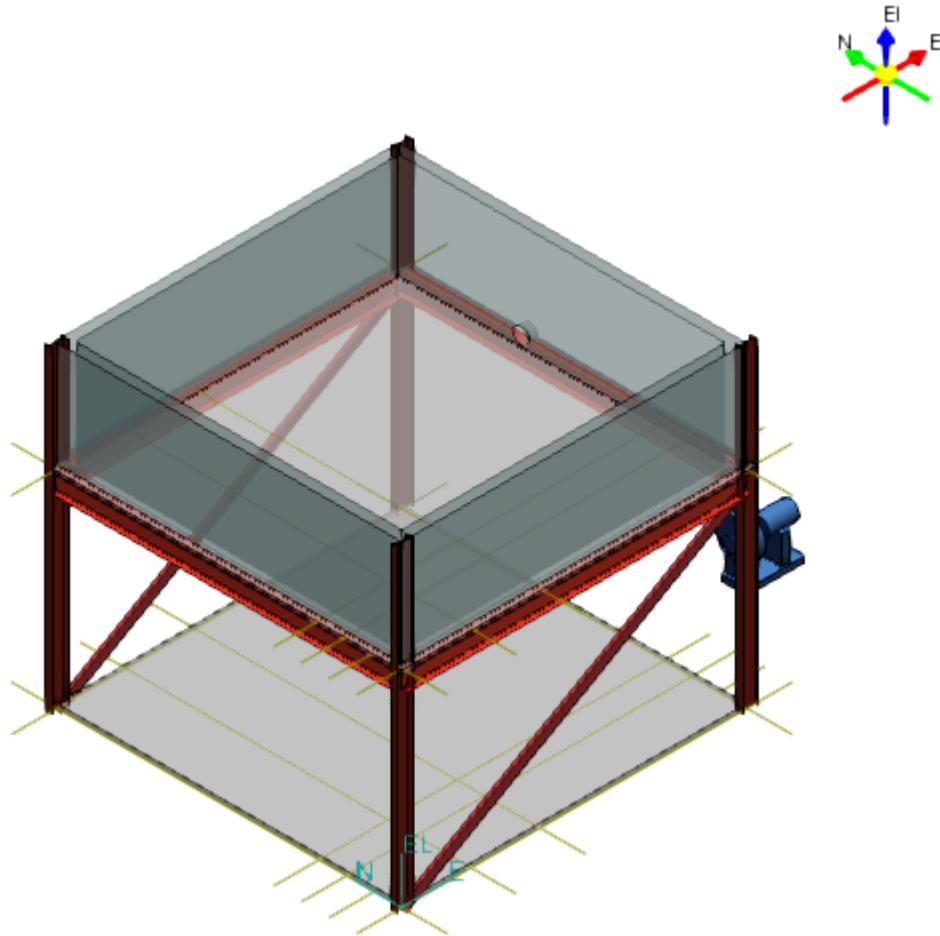


NOTES

- The default **Offset** value for any new piece of equipment is **0** or the most recent offset value used in the current session.
- **Offset** can represent different things, such as the height of a concrete pad below the pump or a foundation thickness.

Placing Equipment by Positioning Relationships

15. Click in the graphic view to accept the equipment position, and right-click in the graphic view to clear the equipment selection.

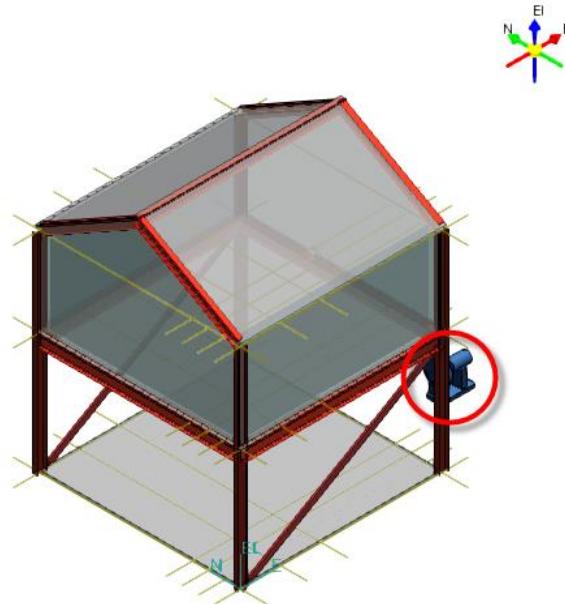


Add, Edit, and Delete Positioning Relationships

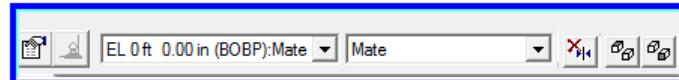
In the following exercise, you will first add a **Mate** relationship between the pump 41P-101A and the beam in Unit U04 of the System A2. Then, you will edit the relationship type to **Align** and move the equipment. Create a relationship between the member, the column, and the pump 41P-101A, and then delete the relationship.

When you select the equipment that has positioning relationships, the first relationship is selected by default. You can edit the geometry used in the relationship by selecting either **Equipment Reference** or **Second Part Reference** .

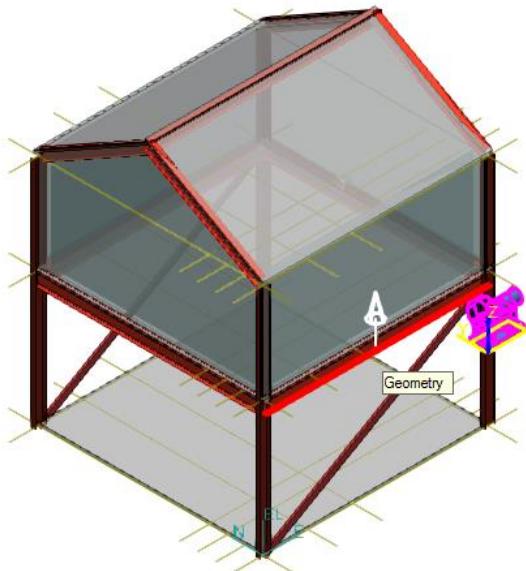
1. Select the pump 41P-101A.



The pump's relationship information displays on the ribbon.

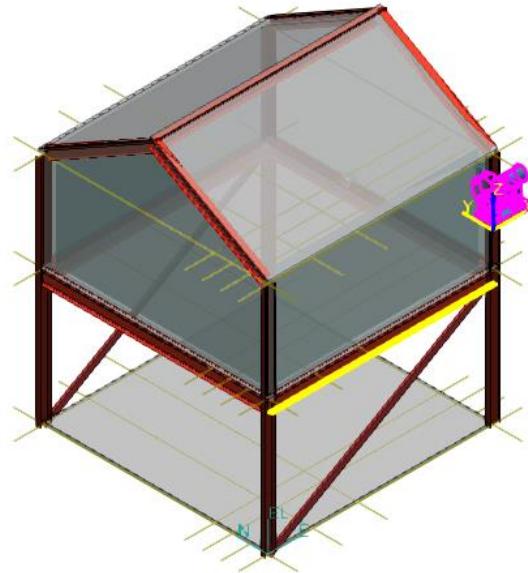


2. Click **Second Part Reference** and select the surface of a member beam.



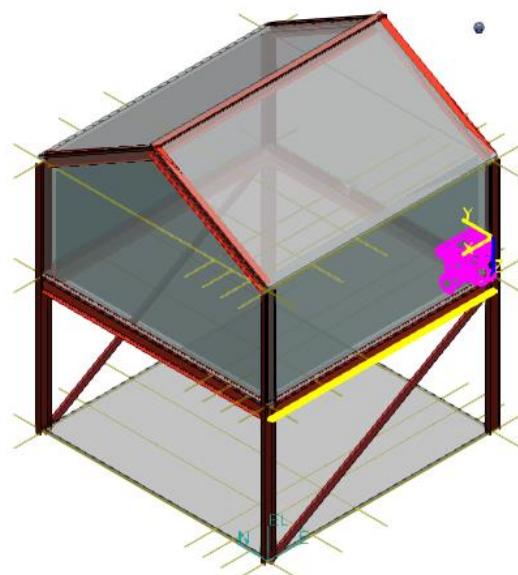
Placing Equipment by Positioning Relationships

The equipment moves to the new elevation defined by the beam surface.



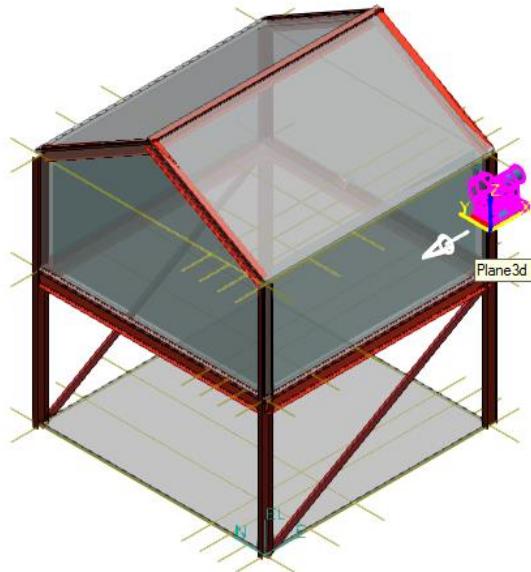
3. Set the relationship type to **Align**.

The equipment flips to align with the beam surface.



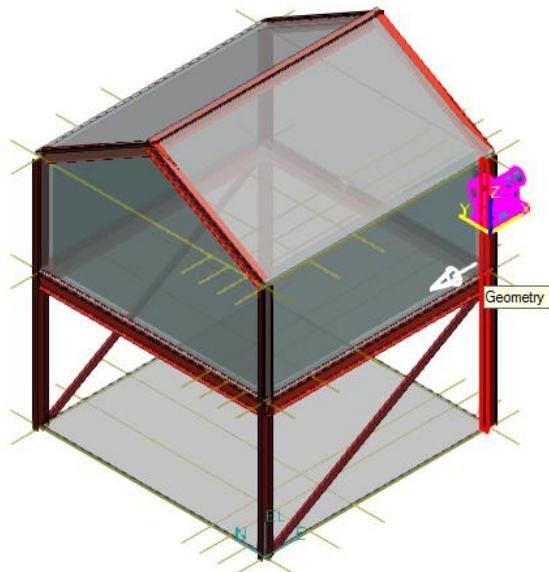
4. Undo the last edit, and select the equipment.

- Set the relationship type to **Mate**, and click the side surface of the equipment.

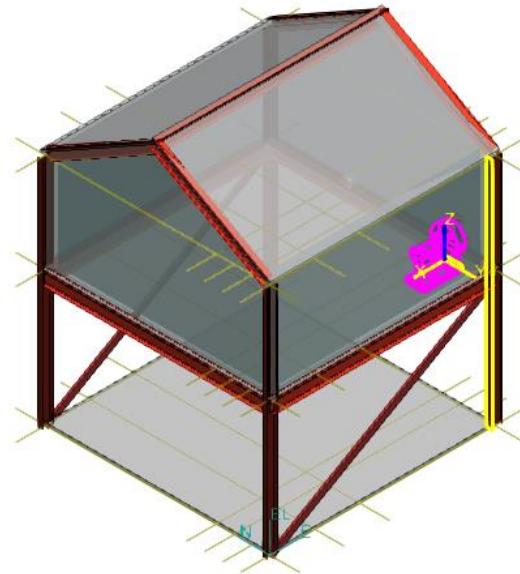


NOTE You can add additional relationships to control the position and orientation of the pump.

- Click **Second Part Reference** , and then select surface of the column as shown:



The equipment is relocated.



7. Click **Delete Relationship** .

*The **Mate** relationship is deleted from the pump.*

8. Attempt to drag the pump around the model.

Dragging of equipment is now prevented.

For more information related to relationships and placing catalog equipment with **Mate** relationships, see *Place Equipment from the Catalog*, *Positioning Relationships: An Overview*, and *Set Positioning Relationships for Equipment* in the *Smart 3D Equipment User's Guide*.

SECTION 4

Placing Designed Equipment and Components

Objective

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

- Model equipment by defining its properties, the position and properties of connection ports, and geometric shapes.

Before Starting this Procedure

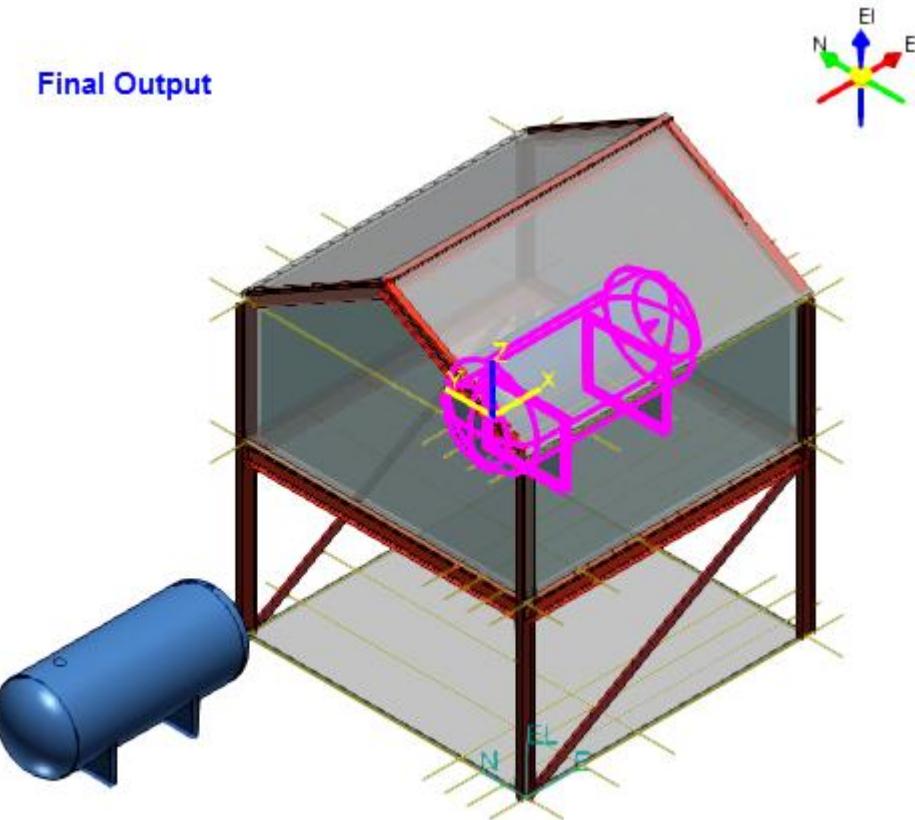
- Smart 3D Overview
- Smart 3D Common sessions
- *Placing Catalog Equipment* (on page 17)

Overview:

You can model equipment that do not have a parametric catalog definition in the **Equipment and Furnishings** task. To do so, select the type of equipment that you want to design from the catalog, set its properties, and click **Place Designed Equipment**  to create the designed equipment object. This is the reportable object that appears on your equipment lists. You can then model the equipment by placing primitive geometric shapes, imported geometry, nozzles, electrical ports, and equipment components as system children of the designed equipment.

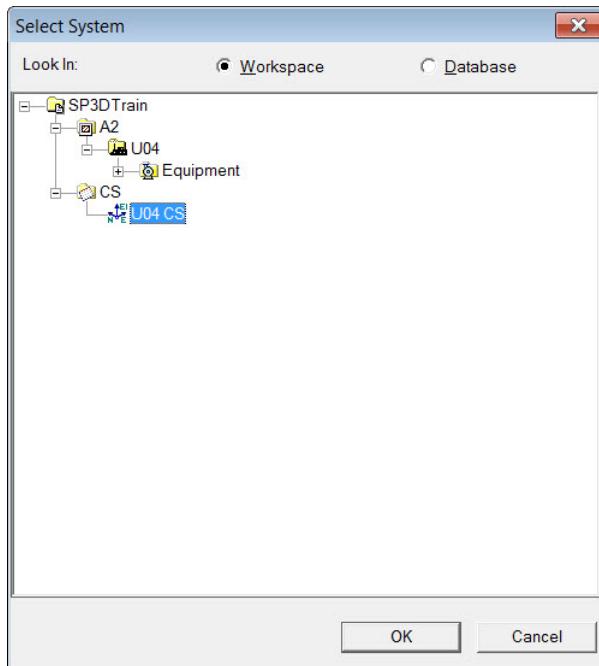
Place Designed Equipment and Equipment Components

Place a simple horizontal cylindrical vessel 41 V-101 from the Smart 3D catalog in Unit U04.



1. Define the workspace to display Unit U04 and coordinate system U04 CS.
2. If the **PinPoint** ribbon is not already active, select **Tools > PinPoint**.
3. In the **Coordinate Systems** list, select **More...**

The **Select System** dialog box displays.

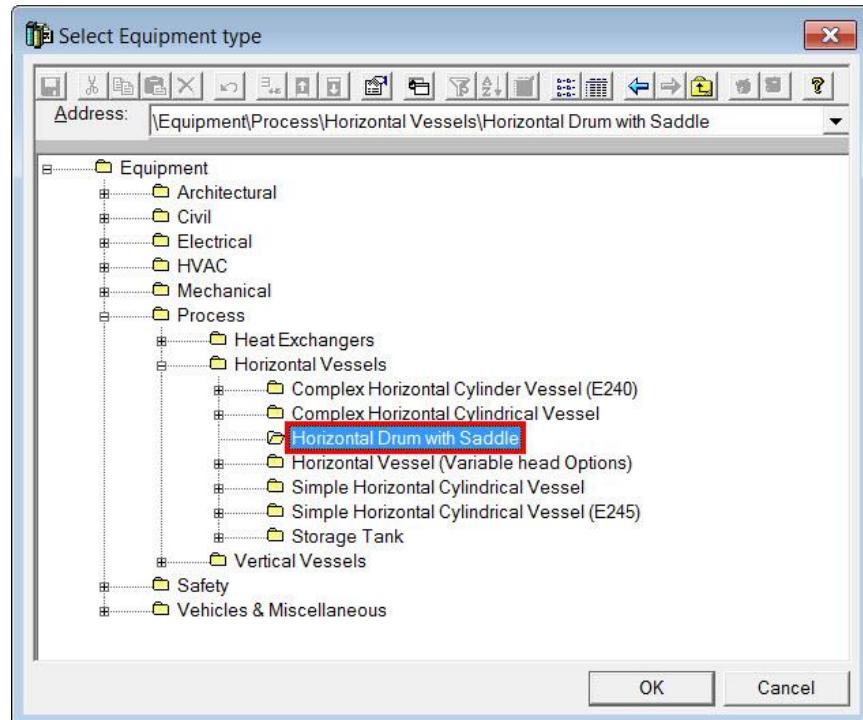


4. Select **U04 CS** and click **OK**.
5. Click **Set Target to Origin** .
The target position for the equipment is now the origin of the active coordinate system U04 CS.
6. Click **Place Designed Equipment** .

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

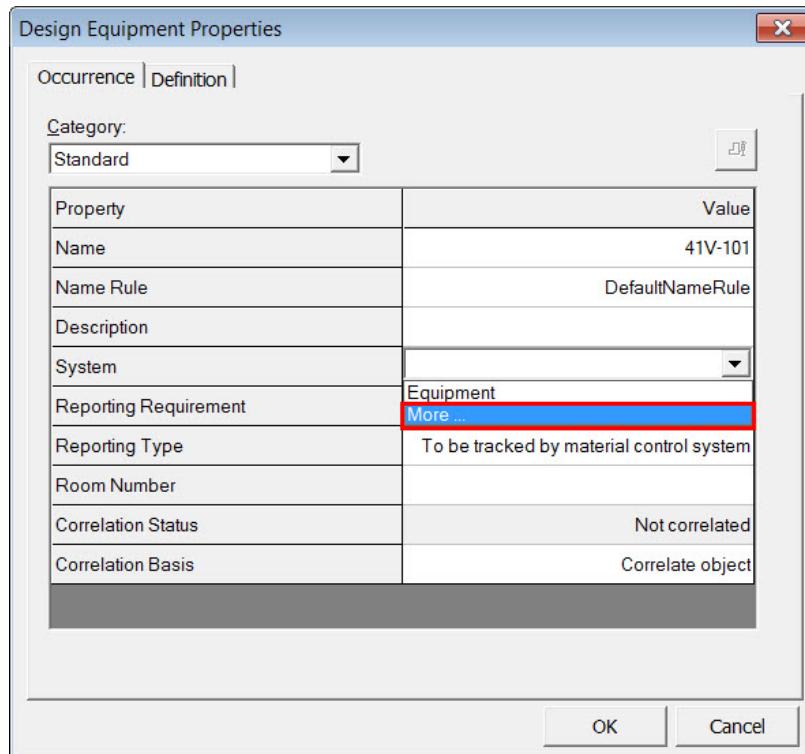
Placing Designed Equipment and Components

7. Select **Equipment > Process > Horizontal Vessels > Horizontal Drum with Saddle** and click **OK**.



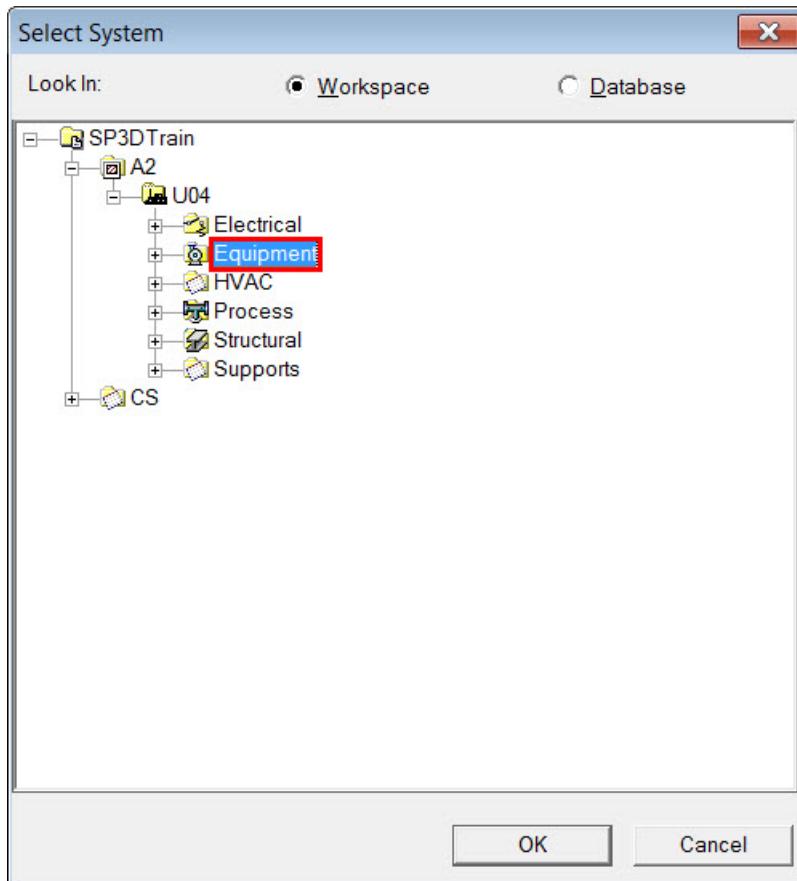
The **Designed Equipment Properties** dialog box displays.

8. Set the **Name** to **41V-101**, and under **System**, select **More....**



The **Select System** dialog box displays.

9. Select **A2 > U04 > Equipment** and click **OK**.



10. Under **Occurrence**, change the **Category** to **Position and Orientation**.

11. Specify the following values for **East**, **North**, and **Elevation**:

East: 5 ft 0.00 in

North: 8 ft 0.00 in

Elevation: 23 ft 0.00 in

12. Click **OK** to close the **Designed Equipment Properties** dialog box.

13. Click **Place Equipment Component** .

14. In the **Workspace Explorer**, select 41V-101.

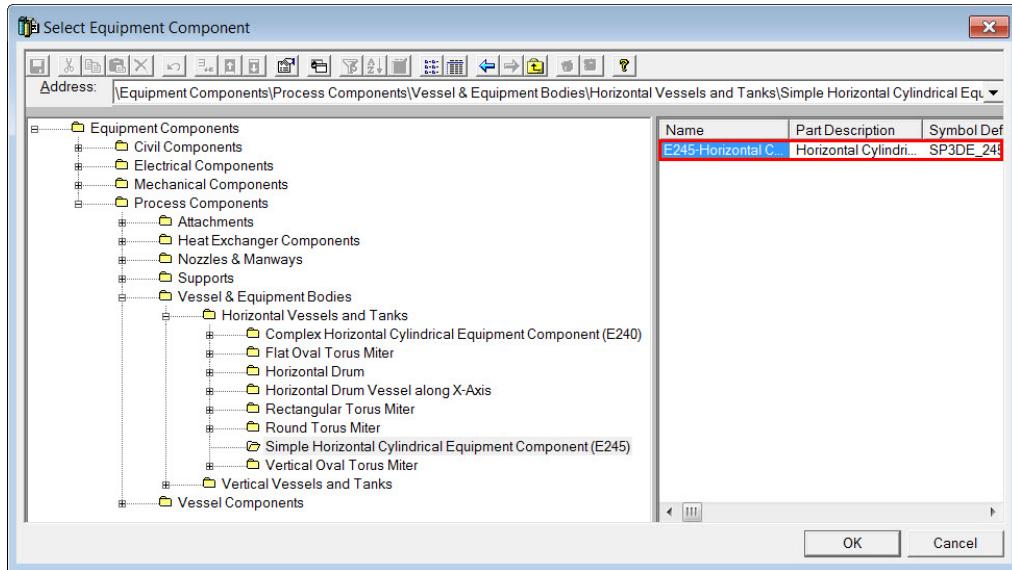
The **Select Equipment Component** dialog box displays.

NOTES

- If the designed equipment or the designed equipment component is not selected, you are prompted to select the designed equipment parent for the equipment component.

- If the designed equipment is already selected when you click **Place Equipment Component** , then the equipment is automatically used as the system parent without a prompt.
- If the equipment component is selected when you click **Place Equipment Component** , then the designed equipment of that equipment component will be used by default.

15. Select **Equipment Components > Process Components > Vessel & Equipment Bodies > Horizontal Vessels and Tanks > Simple Horizontal Cylindrical Equipment Component (E245) > E245-Horizontal Cylindrical Tank-EC** and click **OK**.



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

16. Set the **Name** to **Tank**, and then change the **Category** to **Position and Orientation**.

17. Specify the following values for **East**, **North**, and **Elevation**:

East: 5 ft 0.00 in

North: 8 ft 0.00 in

Elevation: 23 ft 0.00 in

18. Change the **Category** to **Equipment Dimension**, and specify the following values:

Vessel Center Height: 5 ft 6.00 in

Vessel Diameter: 8 ft 0.00 in

Vessel Length: 14 ft 0.00 in

19. Change the **Category** to **Equipment Support**, and specify the following values:

First Support Location: 3 ft 0.00 in

Second Support Location: 9 ft 0.00 in

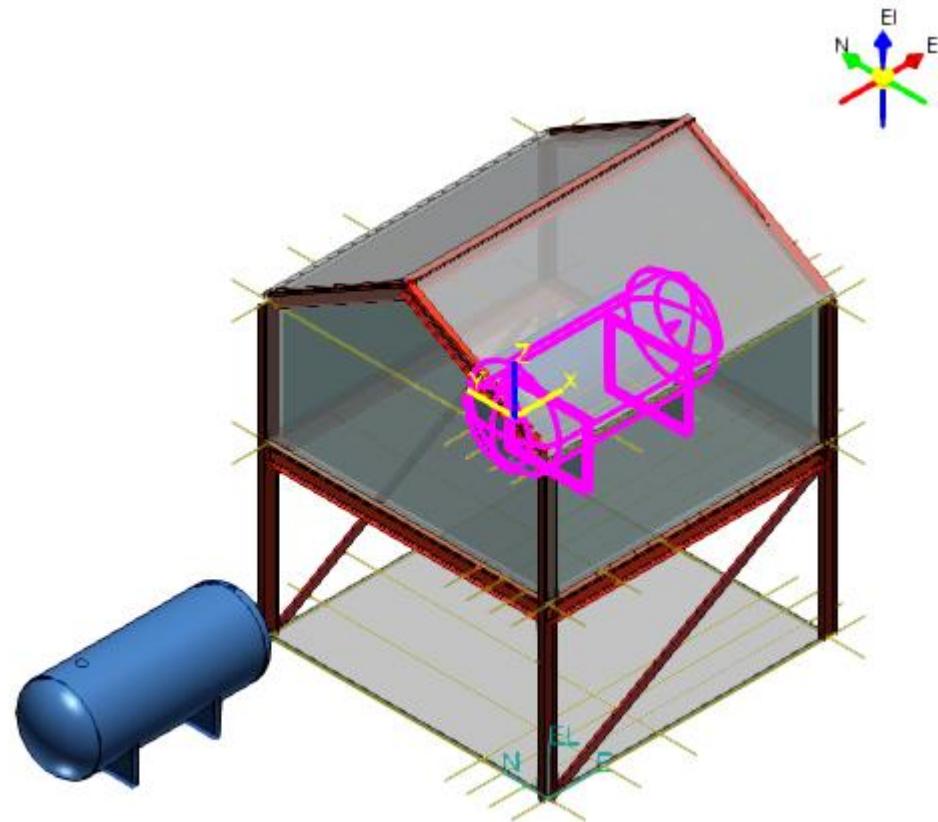
Support Thickness: 0 ft 6.00 in

Support Length: 7 ft 0.00 in

20. Click **OK**.

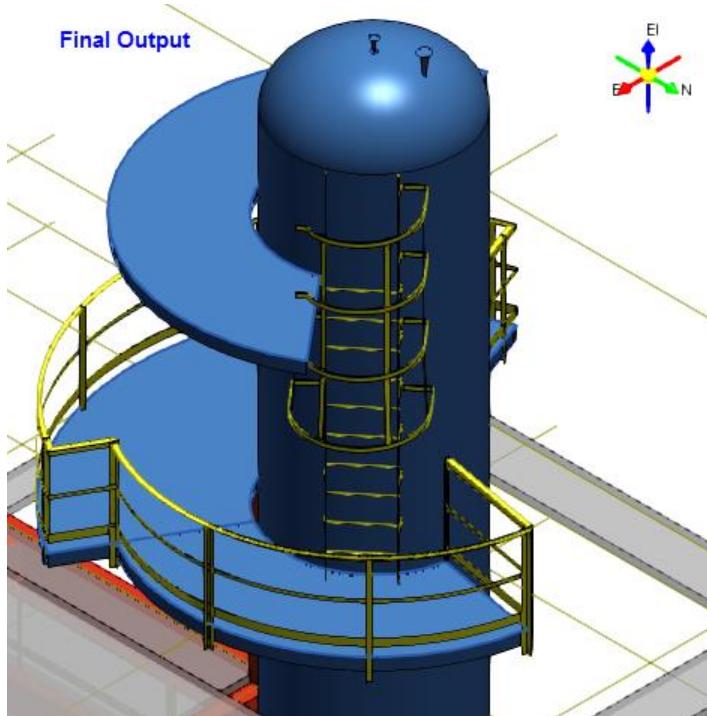
Placing Designed Equipment and Components

The equipment is placed in the model as show



Place Vessel Platforms, Ladders, and Handrails

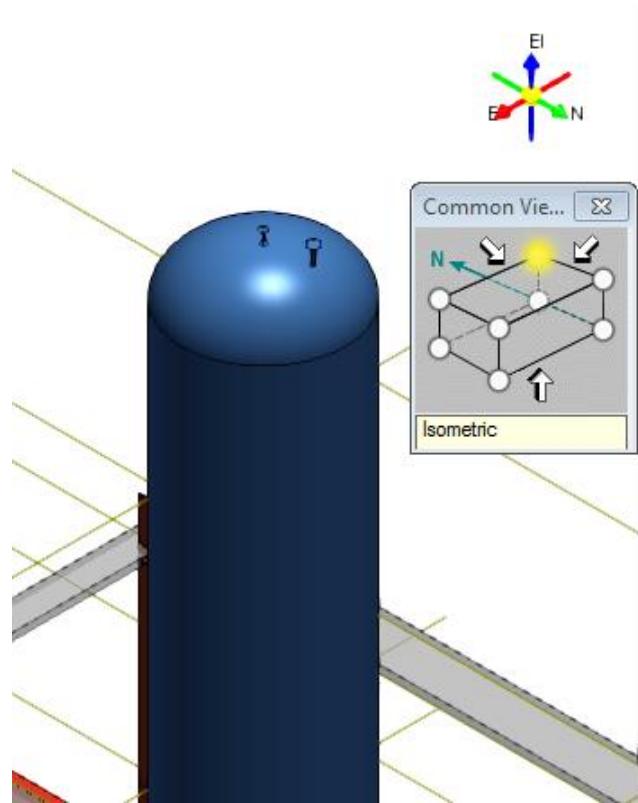
Place two vessel platforms, a ladder and handrails from the Smart 3D catalog in Unit U03.



1. Define the workspace to display **Unit U03** and coordinate system **Plant Filters > Training Filters > U03 CS**.
2. On the **Common** toolbar, click **Common Views** .

*The **Common Views** dialog box displays.*

Select the isometric view and use **Fit** and **Zoom Area** to magnify the vertical vessel.

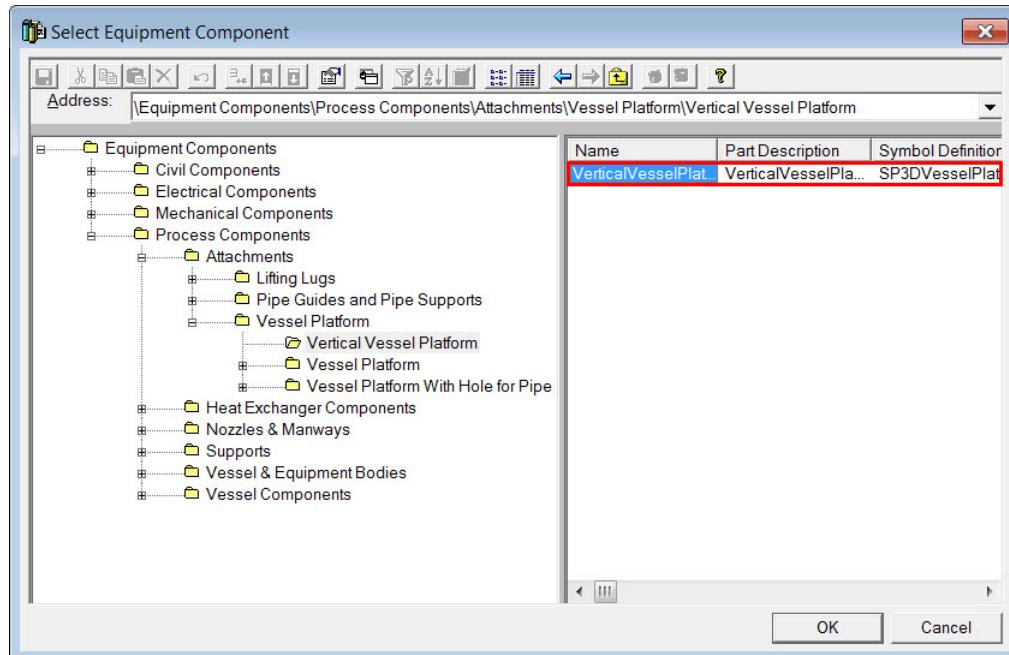


3. On the **PinPoint** ribbon, set the **Active Coordinate System** to **Global** and click **Set Target to Origin** .
4. Switch to the **Equipment and Furnishings** task and set the **Active Permission Group** to **Equipment**.
5. Click **Place Equipment Component** .
6. If prompted, select T-101 from **Workspace Explorer** or in the active view.

NOTE If the designed equipment or an equipment component of a designed equipment is already selected when you click **Place Equipment Component** , then the designed equipment is used by default. Otherwise, you are prompted to select the designed equipment.

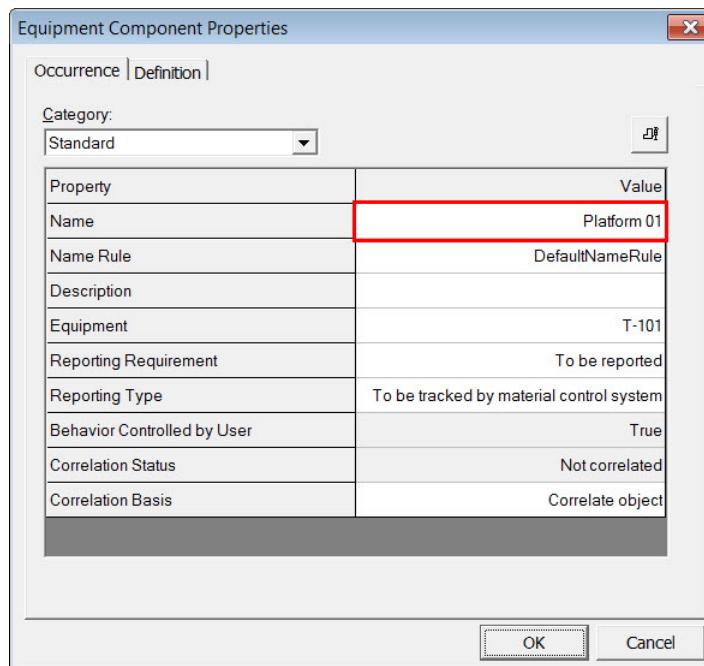
The **Select Equipment Component** dialog box displays.

- Select **Equipment Components > Process Components > Attachments > Vessel Platform > Vertical Vessel Platform > VerticalVesselPlatform-001-EC** and click **OK**.



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

- Set **Name** to **Platform 01**.



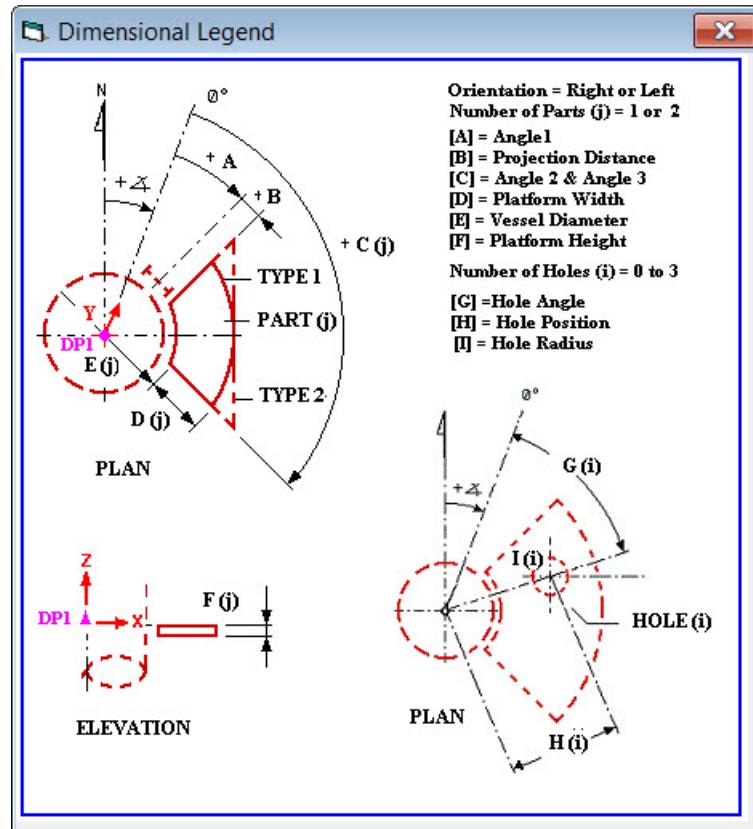
- Change the **Category** to **Position and Orientation**, and specify the following values:

Placing Designed Equipment and Components

East: -21 ft 0.00 in
North: 40 ft 0.00 in
Elevation: 55 ft 0.00 in

10. Click **Preview**.

A preview of the equipment component geometry displays.

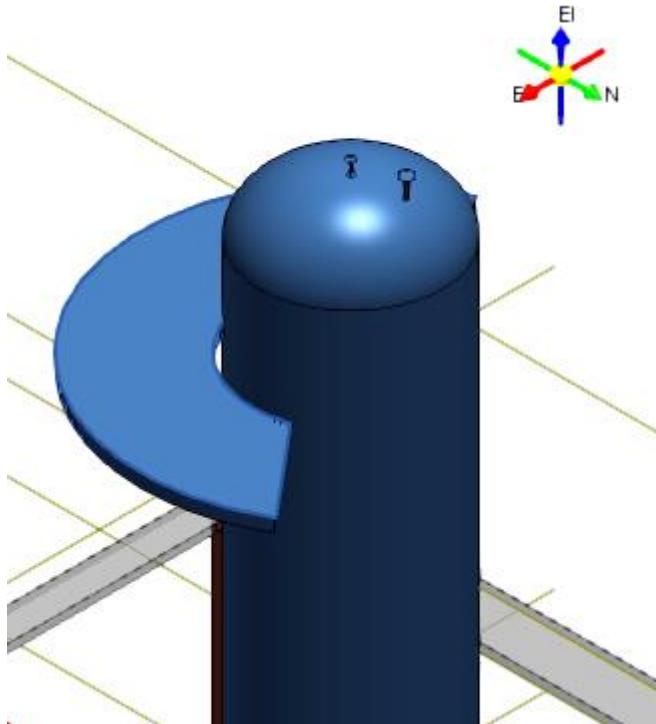


11. Close the preview.
12. Change the **Category** to **Equipment Dimension** and specify the following values:

Projection Distance: 1 ft 3.00 in
Angle 1: 50.00 deg
Angle 2: 250.00 deg
Platform Width 1: 4 ft 0.00 in
Vessel Diameter: 7 ft 0.00 in

13. Click **OK**.

The platform is now placed on the model.



14. Click **Place Equipment Component** .
15. If prompted, select T-101 from **Workspace Explorer** or in the active view.
NOTE If the designed equipment or an equipment component of a designed equipment is already selected when you click **Place Equipment Component** , then the designed equipment is used by default. Otherwise, you are prompted to select the designed equipment.

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

16. Select **Equipment Components > Process Components > Attachments > Vessel Platform > Vertical Vessel Platform > VerticalVesselPlatform-001-EC** and click **OK**.

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

17. Set **Name** to **Platform 02**.
18. Change the **Category** to **Position and Orientation**, and specify the following values:
East: -21 ft 0.00 in
North: 40 ft 0.00 in
Elevation: 45 ft 0.00 in
19. Change the **Category** to **Equipment Dimension** and specify the following values:
Number of Sections: 2
Projection Distance: 0 ft 0.00 in
Angle 1: 0 deg
Angle 2: 120.00 deg

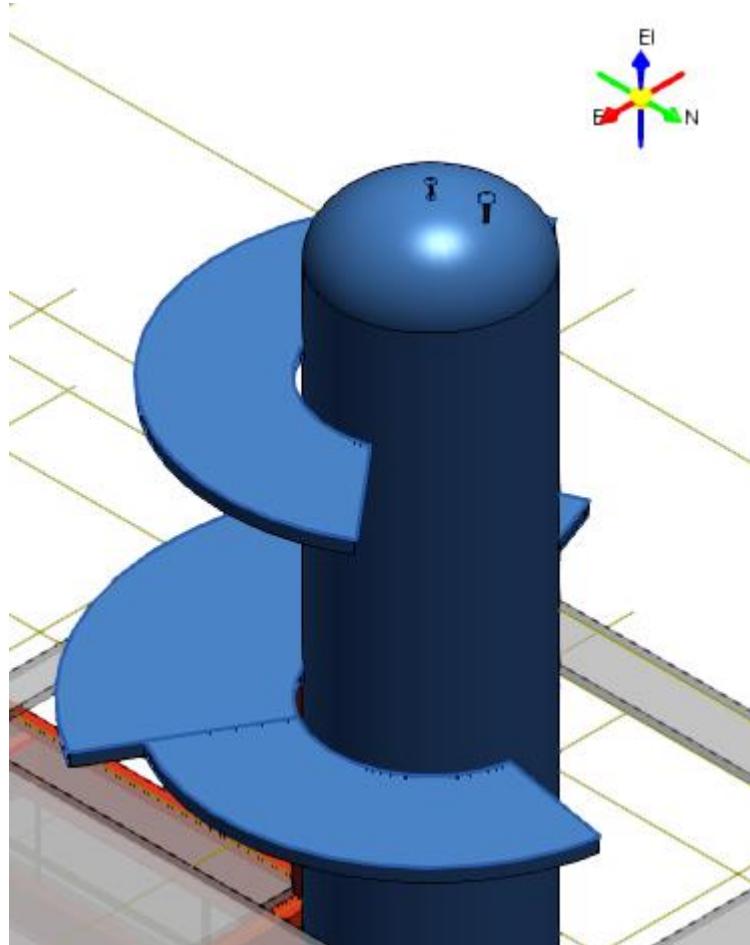
Angle 3 - Section 2 only: 250.00 deg

Platform Width 1: 4 ft 0.00 in

Vessel Diameter: 7 ft 0.00 in

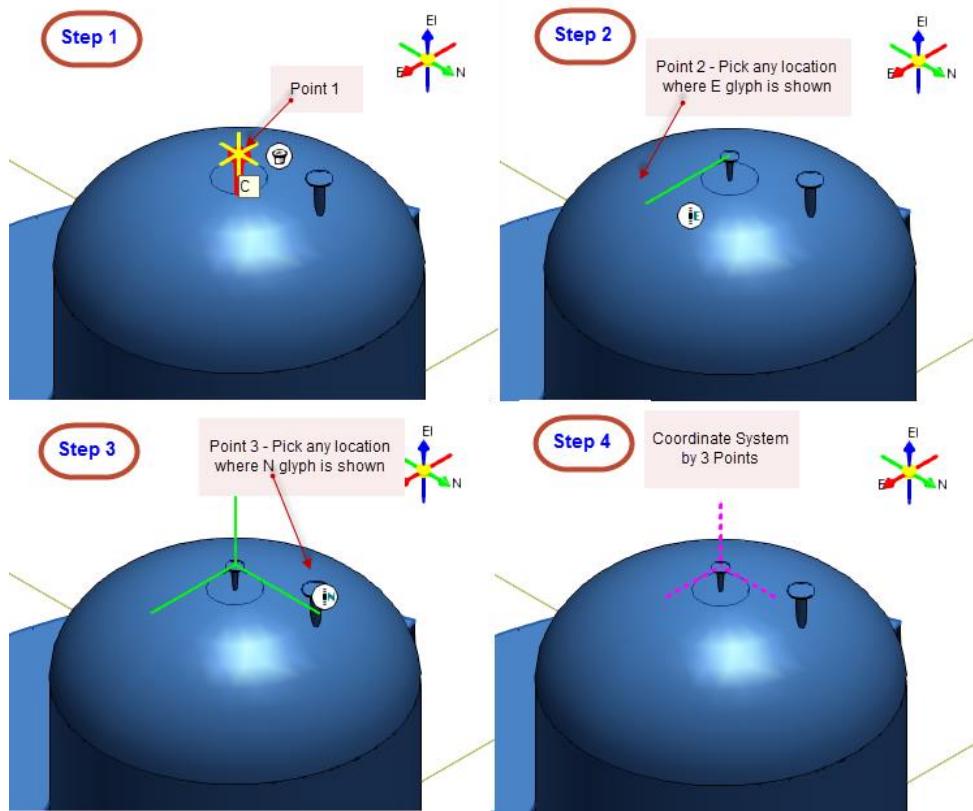
20. Click **OK**.

The platform is now placed on the model.



21. Select **Tasks > Structure**.

22. Click **Define Coordinate System by 3 Points**  to place a temporary coordinate system on the equipment nozzle C as shown:

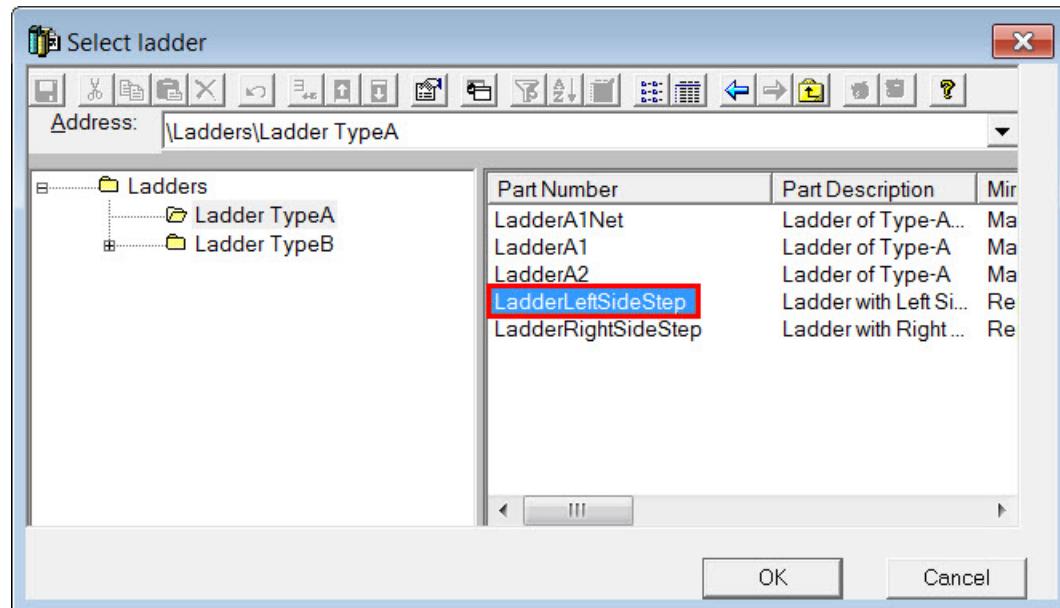


NOTE Point 1 defines the origin of the coordinate system. Point 2 defines the end of the local E-axis. Point 3 defines the end of the local N-axis.

23. Click **Place Ladder** .

The **Select Ladder** dialog box displays.

24. Select **Ladders > Ladder TypeA > LadderLeftSideStep** and click **OK**.

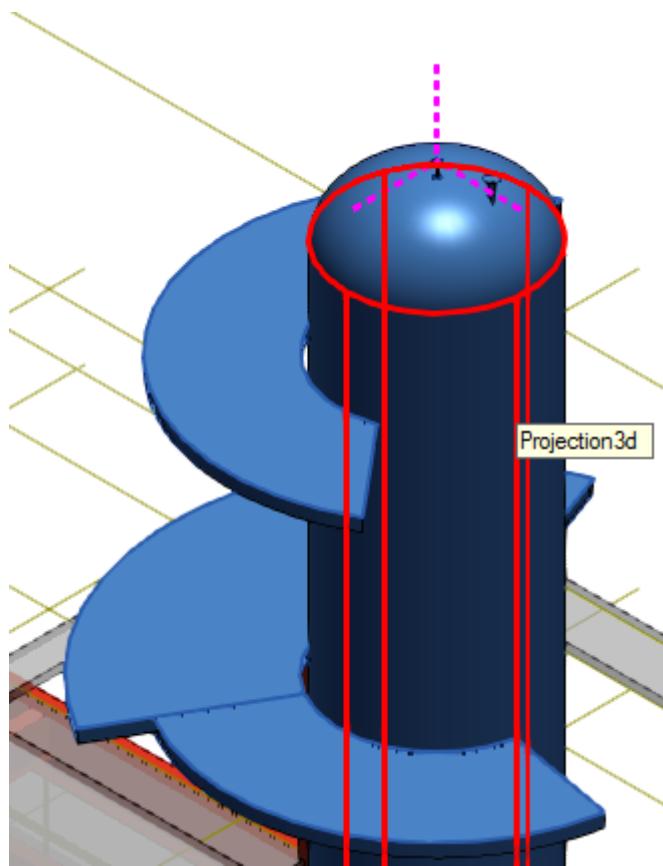


NOTE The selected part number becomes the default selection for the next time you place a ladder. You can change the default option by selecting a different **Type** option on the **Place Ladder** ribbon. Your company can create standard sizes in your catalog.

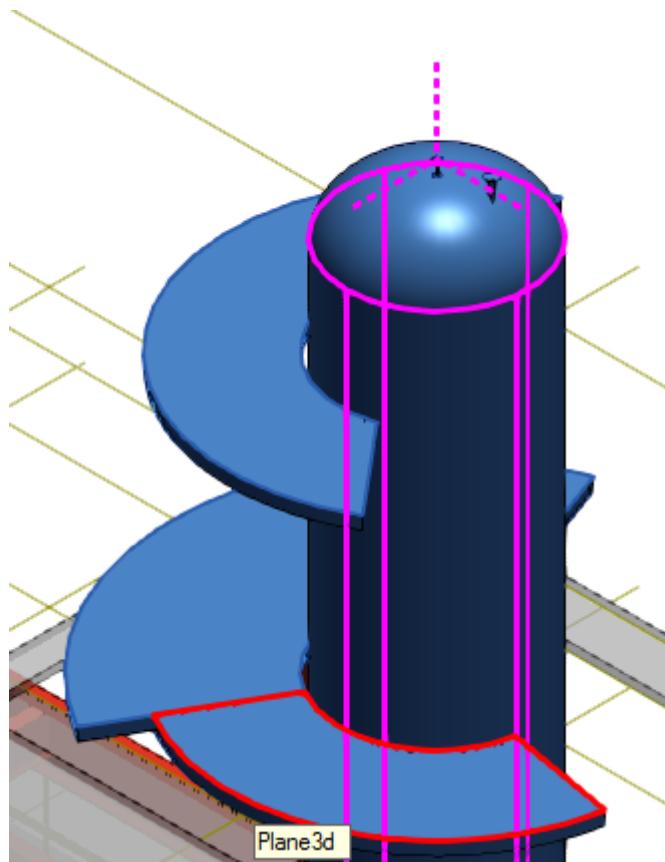
25. On the **Place Ladder** ribbon, set the **System** to **A2 > U03 > Equipment > T-101**.

26. On the **PinPoint** ribbon, click **Cylindrical Coordinates** .

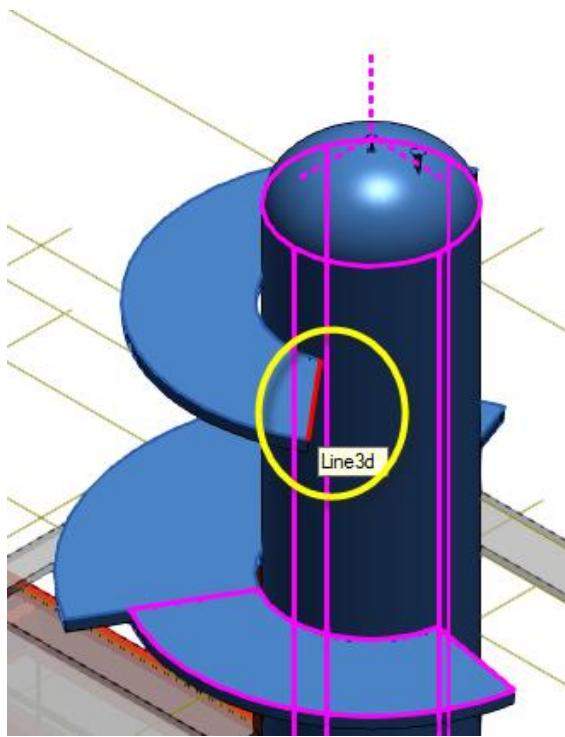
27. Select the projection surface of the vertical vessel to define the top edge of the ladder.



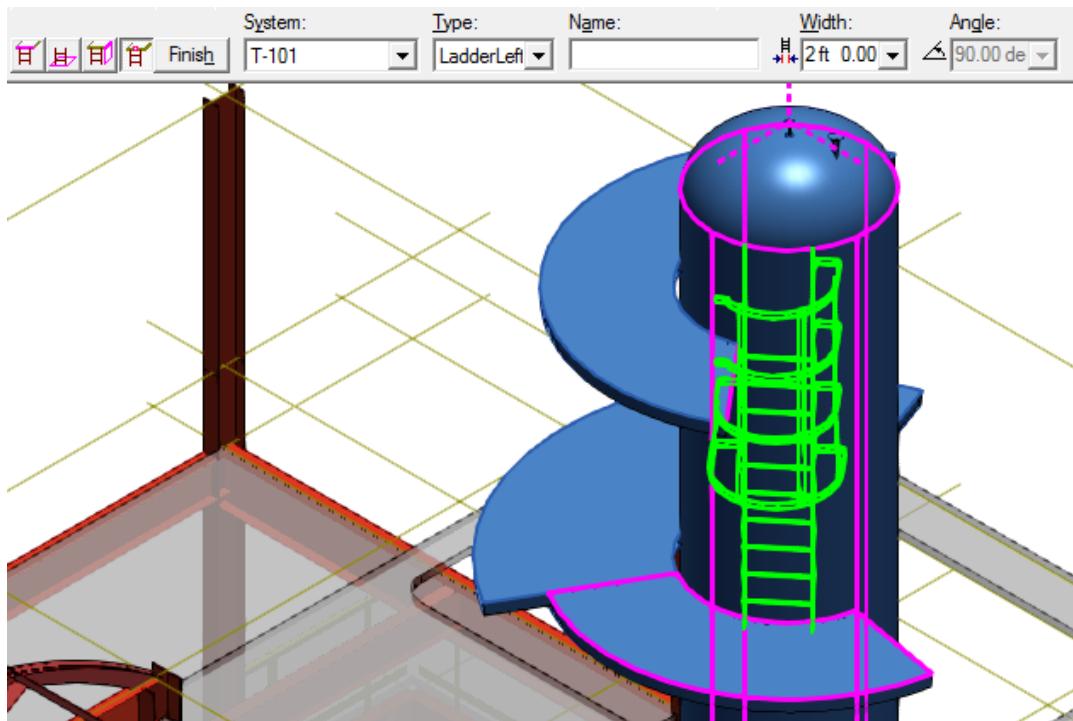
28. Select the top 3D plane of the second platform to define the bottom edge of the ladder.



29. Select the edge of the first platform to define the reference edge of the ladder.



NOTE When you select the reference edge of the ladder, an outline of the ladder displays. As you select the top edge, bottom plane, and reference edge in the model, the appropriate primary parameter options are displayed on the **Place ladder** ribbon.



30. On the **PinPoint** ribbon, specify the following values to position the ladder perpendicular to the platform step-off area:

Radius: 7 ft 0.00 in

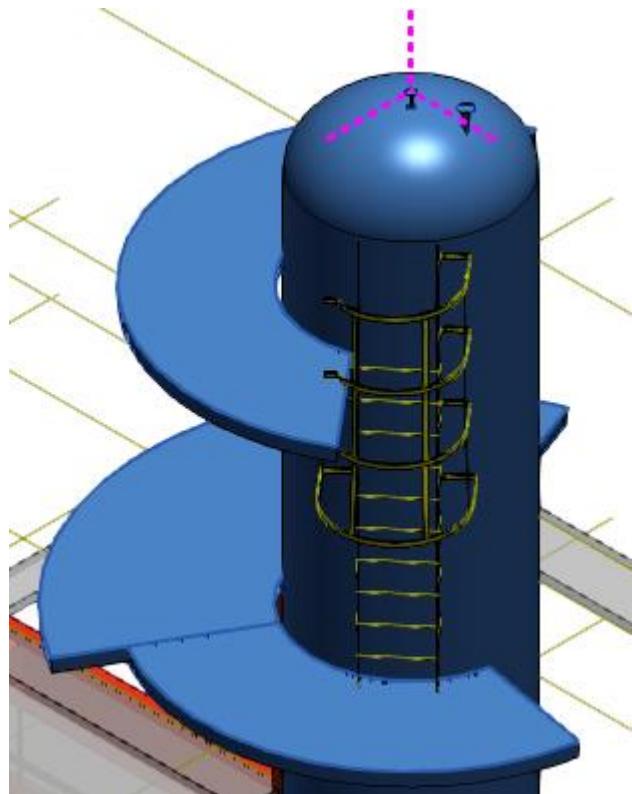
Theta: NE 38.67 deg

31. On the **Place Ladder** ribbon, click **Finish** and then click **Properties** .

*The **Ladder Properties** dialog box displays.*

32. Set **With Wall Support** to **False** and **Wall Offset** to **6.5 in**, then click **OK**.

The ladder is placed on the vessel.



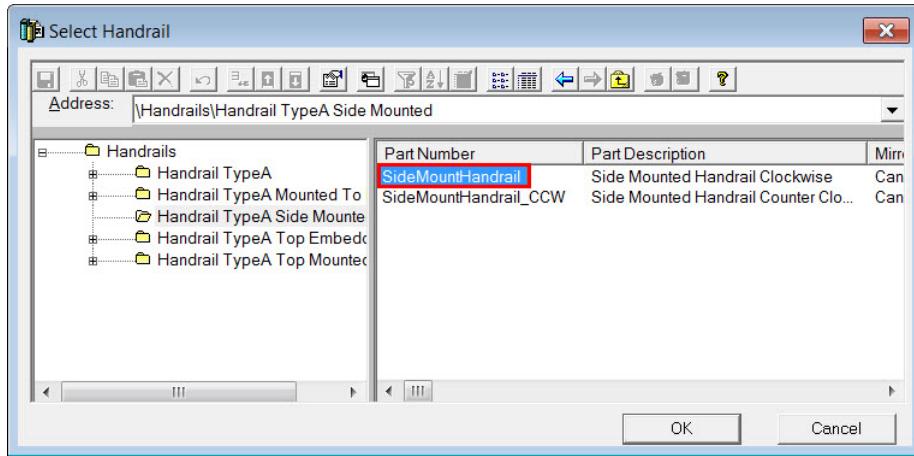
33. Click **Rectangular Coordinates**  and set the active coordinate system to Global.

34. Click **Set Target to Origin**  and close the **PinPoint** ribbon.

35. Click **Place Handrail** .

*The **Select Handrail** dialog box displays.*

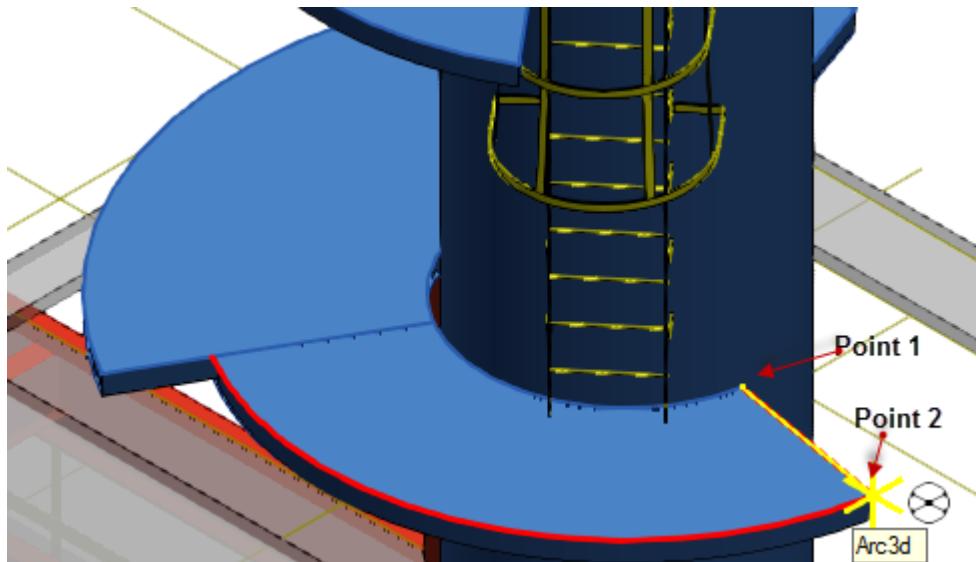
36. Select Handrails > Handrails Type A Side Mounted > **SideMountHandrail** and click **OK**.



The **Sketch 3D Path** ribbon displays.

NOTE The selected part number becomes the default selection for the next time you place a handrail. You can change the default option by selecting a different **Type** option on the **Place Handrail** ribbon.

37. Sketch the path of the handrail as shown:



38. Click **Finish**.

The **Place Handrail** ribbon displays.

39. Specify the following values, and then click **Finish**:

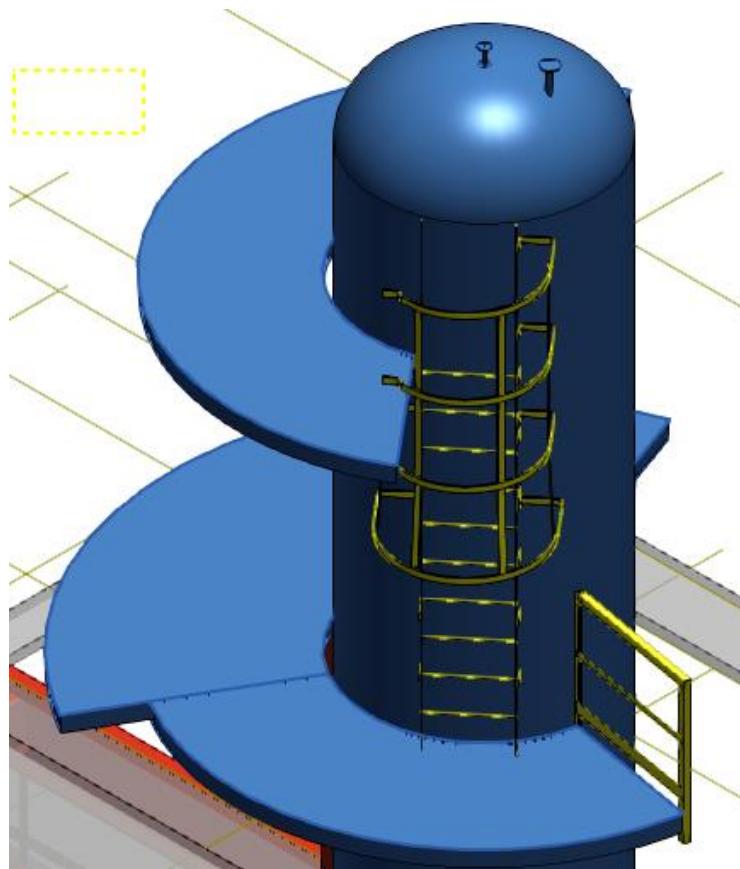
System - A2 > U03 > Equipment > T-101
Begin Treatment - None
End Treatment - None

40. Click **Properties**

The **Handrail Properties** dialog box displays.

41. Set **Post Section Cardinal Point** to **1-Bottom Left**, and click **OK**.

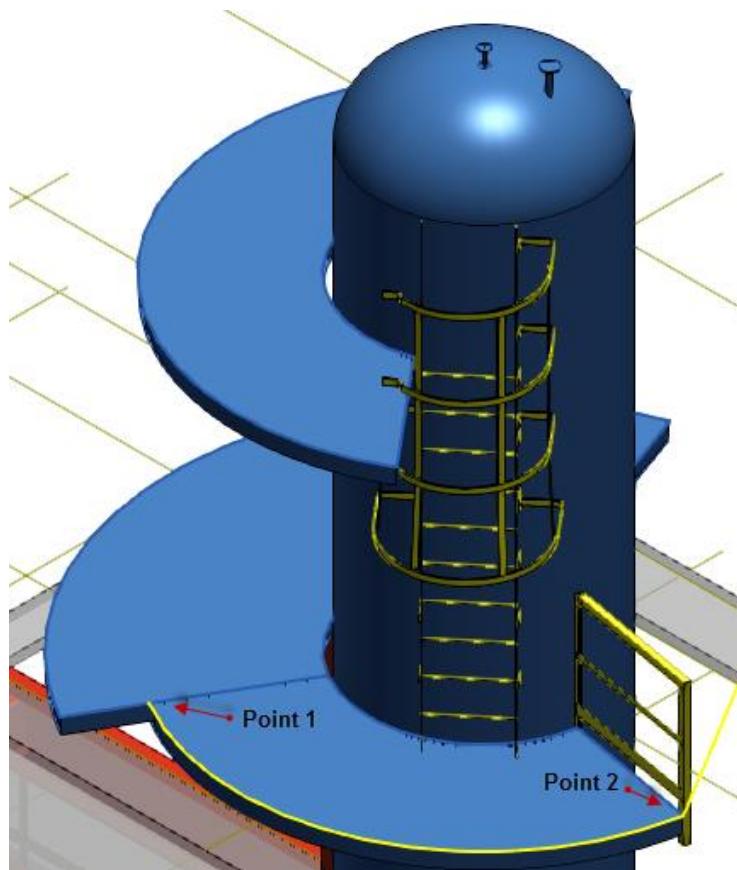
The handrail is placed onto the platform.



42. Click **Place Handrail** .

*The **Sketch 3D Path** ribbon displays.*

43. In the **Path Type** list, use **Arc by 3 Points** to sketch the handrail path as shown:



44. Click **Finish**.

The **Place Handrail** ribbon displays.

45. Specify the following values, and then click **Finish**:

System - A2 > U03 > Equipment > T-101

Type - SideMountHandrail_CCW

Begin Treatment - None

End Treatment - None

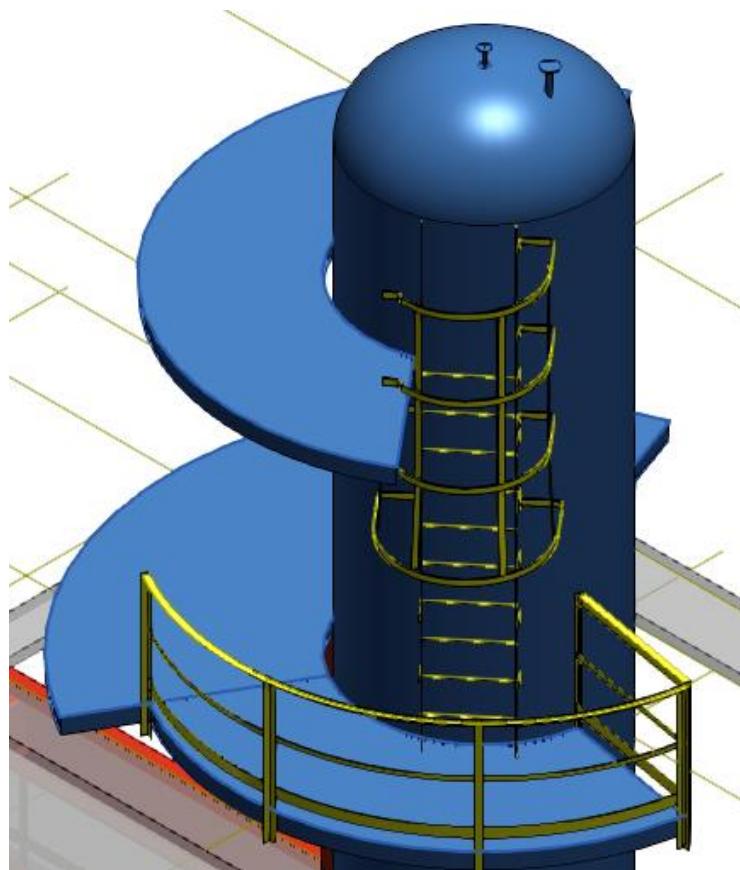
46. Click **Properties**

The **Handrail Properties** dialog box displays.

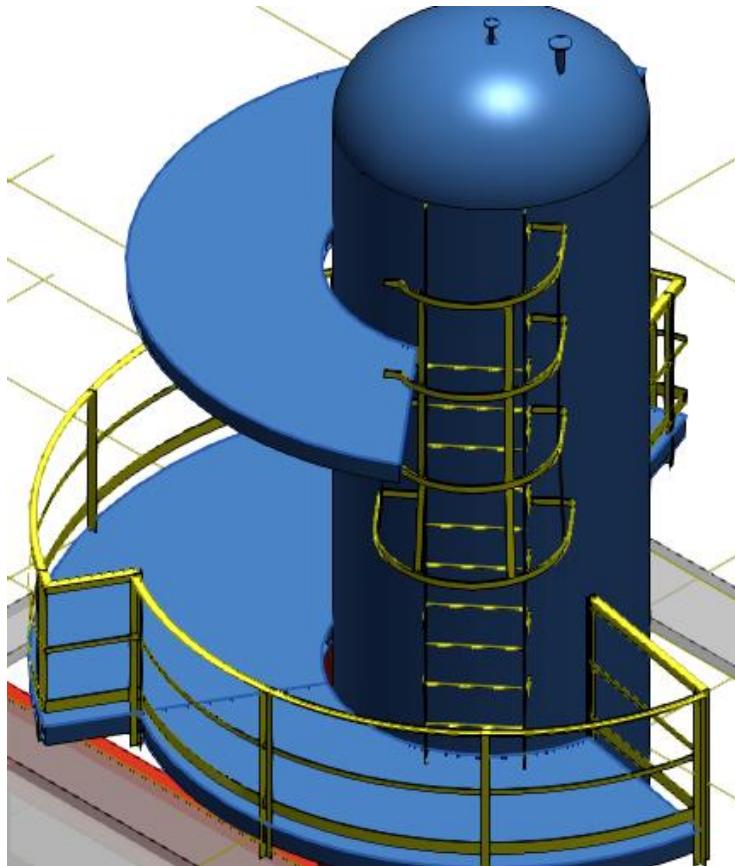
47. Set **Post Section Cardinal Point** to **1-Bottom Left**, and click **OK**.

Placing Designed Equipment and Components

The handrail is placed onto the platform.



48. Use **Arc by 3 Points** and **Line**  to place the handrails on the remaining sections of the second platform.



For more information about placing designed equipment and equipment components, see *Placing Designed Equipment* in the *Smart 3D Equipment User's Guide*.

For more information about placing stairs and ladders, see *Providing for Traffic: An Overview* in the *Smart 3D Structure User's Guide*.

SECTION 5

Modeling Designed Equipment with Shapes

Objective

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

- Model designed equipment geometry with **Place Shape** .

Before Starting this Procedure

- Smart 3D Overview
- Smart 3D Common Sessions
- *Equipment: An Overview* (on page 5)
- *Placing Designed Equipment and Components* (on page 47)

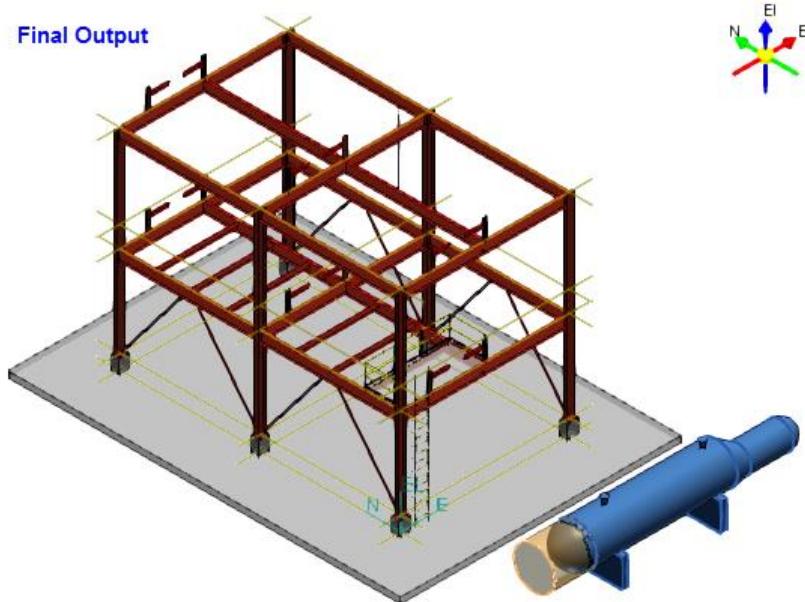
Overview

You can add shapes to existing designed equipment or equipment components with **Place Shape** . A shape object is a parametric volume, such as a cylinder, a cone, or a rectangle, defined in the catalog. The default catalog delivers a set of shapes commonly used to represent equipment geometry. Your catalog administrator can add custom shapes to the catalog.

You can use **Place Shape**  to add datum points on the equipment. The datum point geometry is a cone in the reference aspect, with a SmartSketch keypoint at the origin of the cone.

Place a Shape

In the following exercise, place a kettle heat exchanger E-102 from the Smart 3D catalog in Unit U01 as designed equipment in the model. Then, place a cylinder and an eccentric cone on E-102. Finally, place two rectangular boxes on which to mount the heat exchanger, and add caps on both sides **Place Shape** .



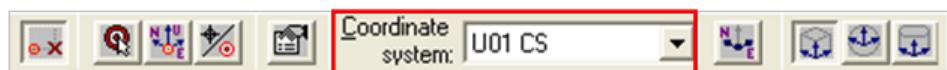
1. Define your workspace to display Unit U01 and coordinate system U01 CS.

2. Select **Tasks > Equipment and Furnishings**.

3. Select **Tools > PinPoint**.

*The **PinPoint** ribbon displays.*

4. Set the active coordinate system to U01 CS.

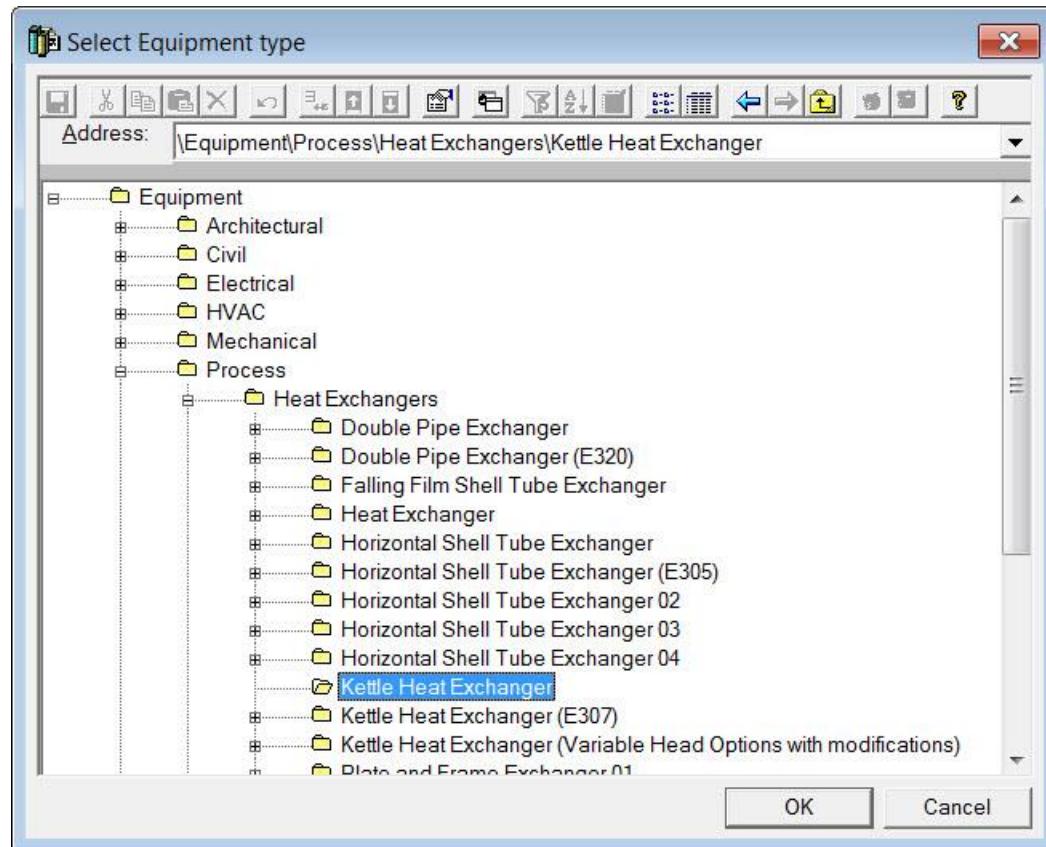


5. Click **Set Target to Origin**  to move the target to the origin of the current coordinate system.

6. Click **Place Designed Equipment** .

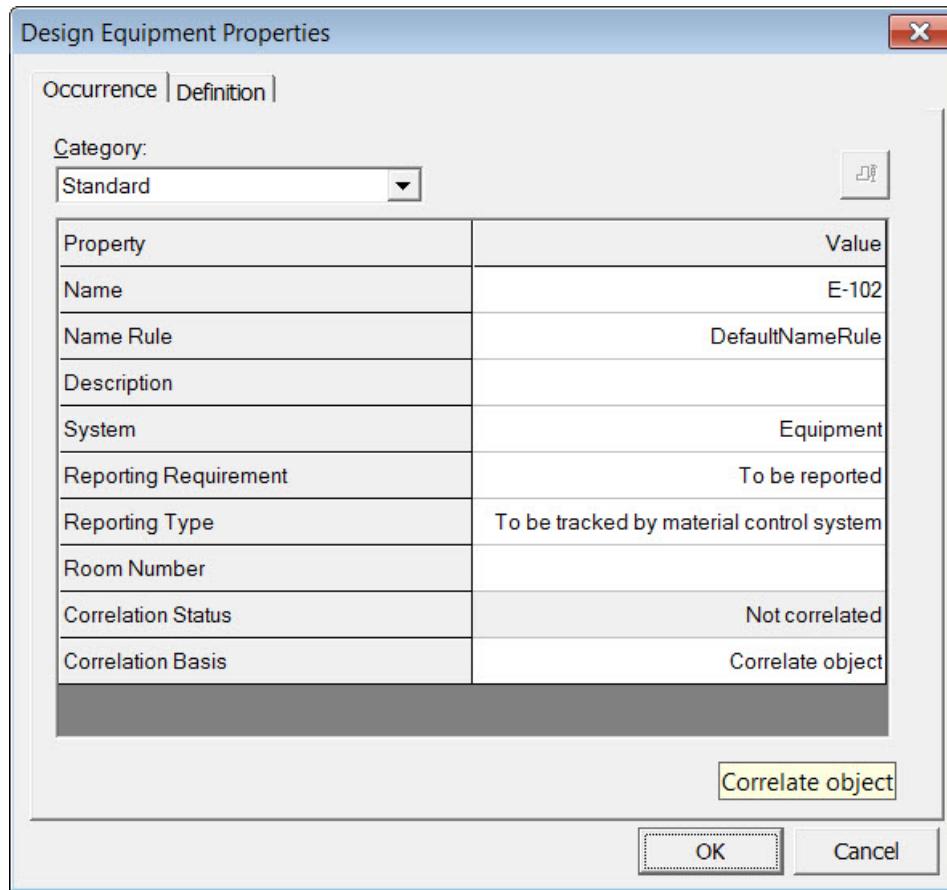
*The **Select Equipment Type** dialog box displays.*

7. Select **Equipment > Process > Heat Exchangers > Kettle Heat Exchanger** and click **OK**.



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

8. Set **Name** to E-102 and **System** to A2 > U01 > Equipment.



9. Change the **Category** to **Position and Orientation**, and specify the following values:

East: 5 ft 0.00 in

North: -20 ft 0.00 in

Elevation: 6 ft 0.00 in

10. Under **Definition**, specify the following values:

Equipment Classification 0 - Process Equipment

Equipment Classification 1 - Heat Transfer Equipment

Equipment Classification 2 - Shell and Tube Heat Exchanger

Equipment Classification 3 - Tubular Reactor

11. Click **OK**.

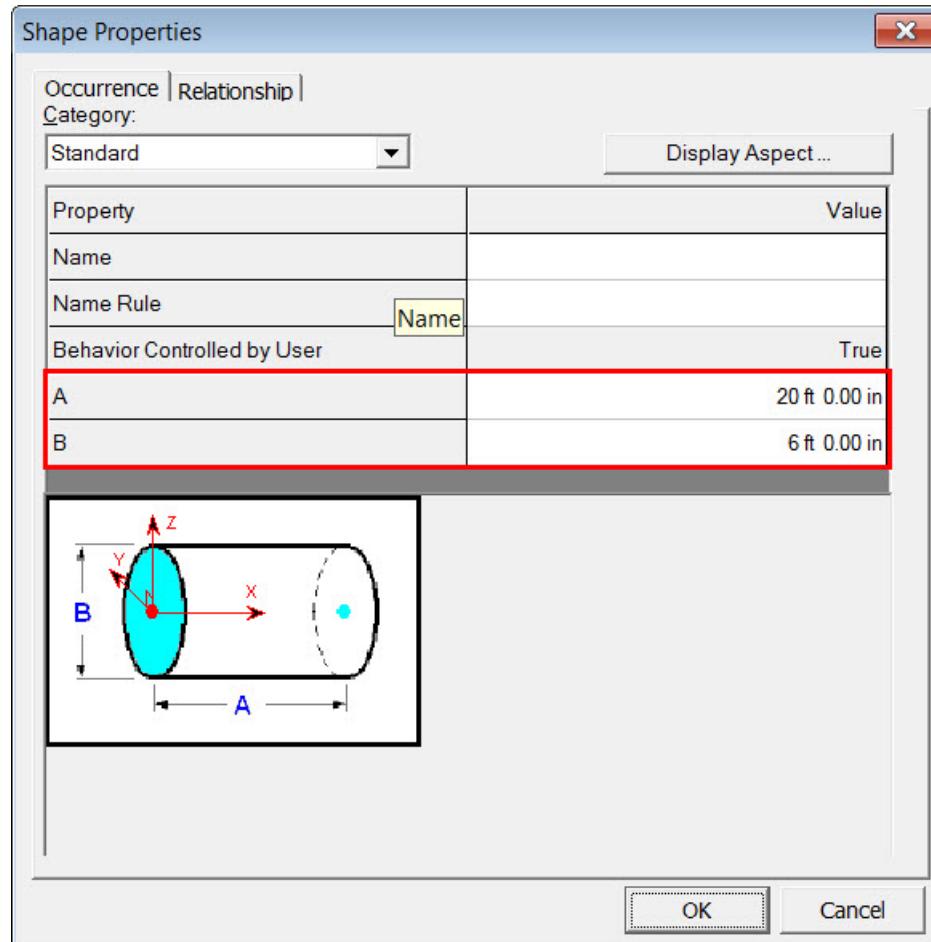
12. Click and hold **Place Shape**  to bring up the flyout, then select the right circular cylinder .

13. If prompted, select **Equipment E-102** in the **Workspace Explorer**.

The **Shape Properties** dialog box displays.

14. Specify the following values:

A: 20 ft 0.00 in
 B: 6 ft 0.00 in



NOTES

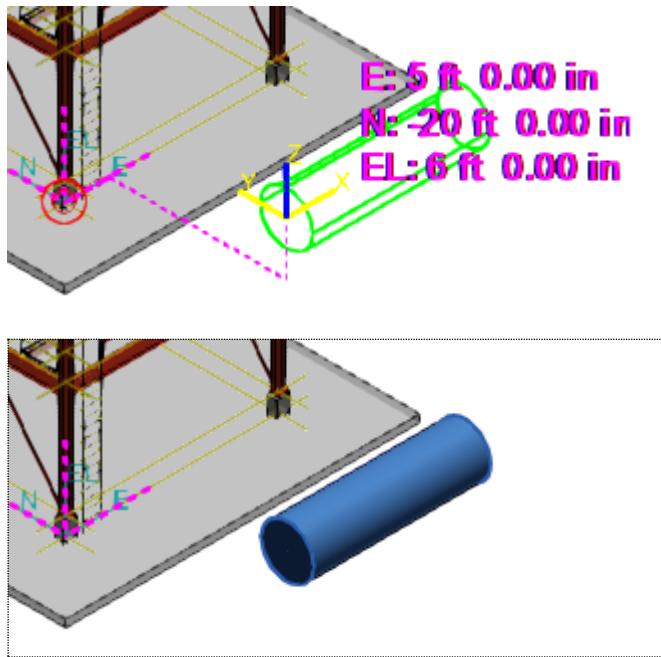
- Shapes have a local coordinate system. By default, the x-axis of the shape is aligned with the East-axis of the active coordinate system during placement. The y-axis and z-axis are aligned with North and Elevation, respectively. You can rotate the shape during placement using the arrow keys.
- The coordinates are measured relative to the Active coordinate system.

- Click **OK**.
- On the **PinPoint** ribbon, ensure that the **Rectangular CS** is active and specify the following coordinate values:

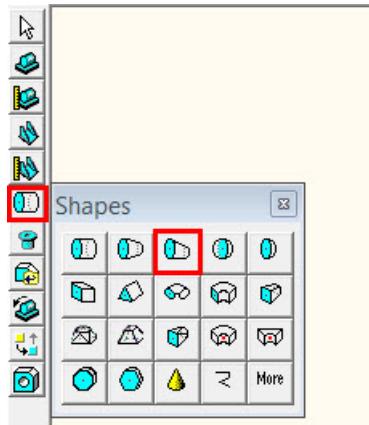


- Click in the graphic view.

The cylinder is placed at the specified coordinates.



18. Click and hold **Place Shape**  to select the eccentric cone shape:

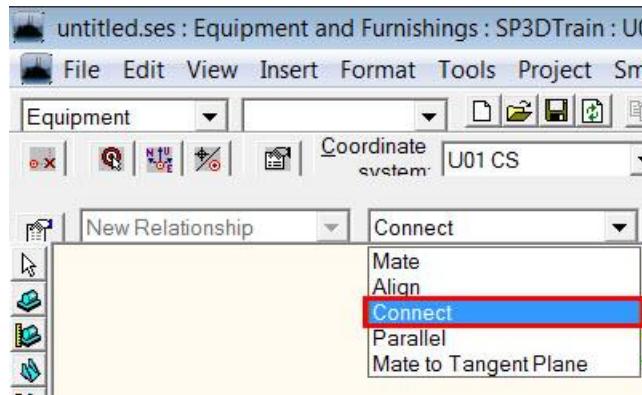


The **Shape Properties** dialog box displays.

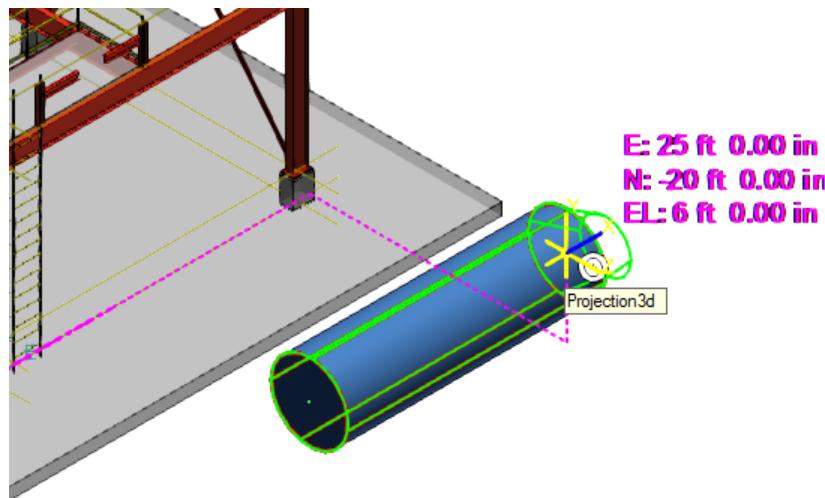
19. Specify the following values and click **OK**:

- A: 3 ft 0.00 in
- B: 6 ft 0.00 in
- C: 4 ft 0.00 in

- On the **Place Shape** ribbon, set **Positioning Relationship** to **Connect**.



- Select a point at the east end of the cylinder, and click on the end point to place the cone with the flat side on the bottom:



NOTES

- You can use the arrow keys to rotate the cone to make the bottom of the cone flat.
- The connect relationship option does not create a persistent associative relationship between the points used for positioning except if the points are nozzles. If you want the cone to adjust positions when you edit the length of the cylinder, you can place it with a **Mate** relationship.

- Click and hold **Place Shape** and select a cylinder .

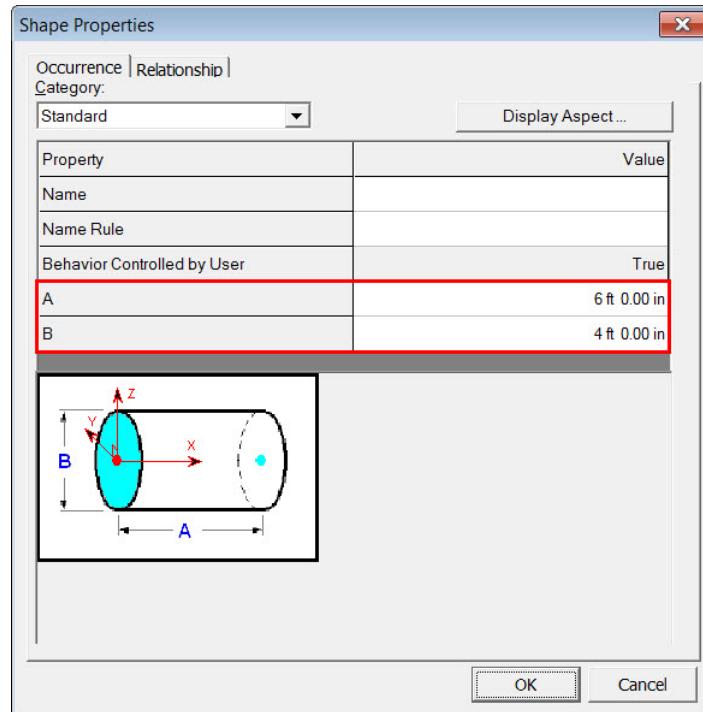
- In the **Workspace Explorer**, select **Equipment E-102**.

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

- Specify the following values:

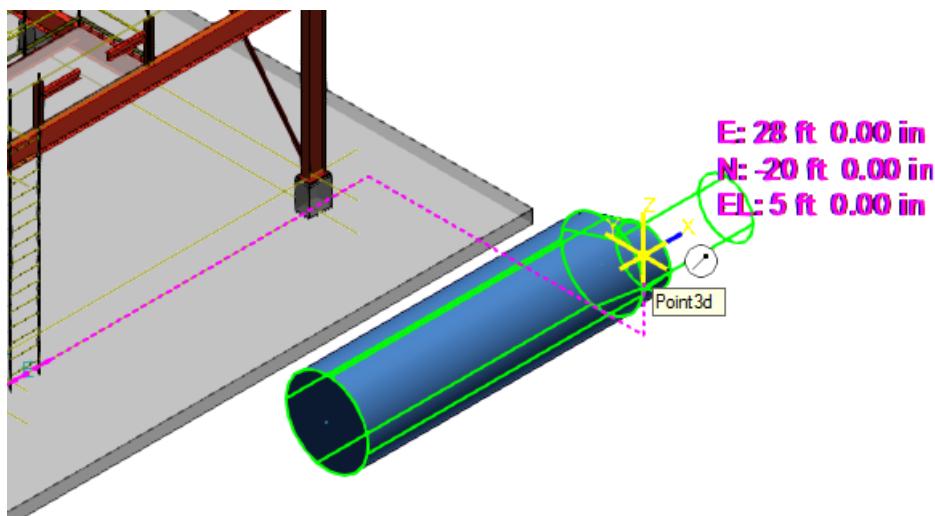
Modeling Designed Equipment with Shapes

A: 6 ft 0.00 in
B: 4 ft 0.00 in



25. On the **Place Shape** ribbon, set **Positioning Relationship** to **Connect**.

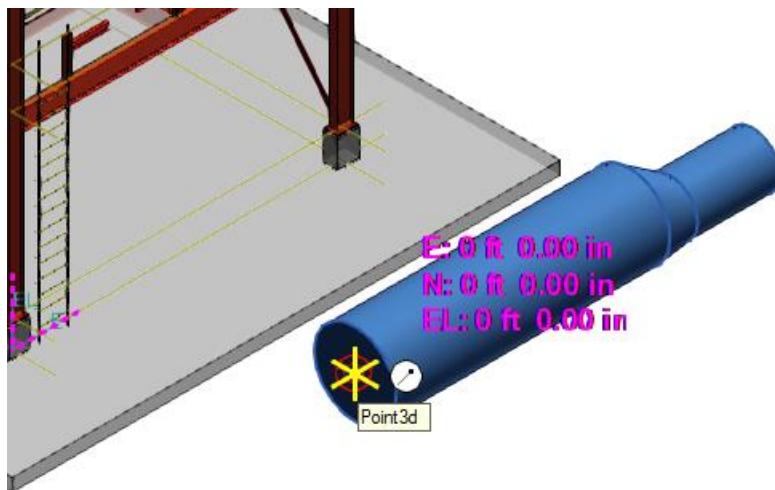
26. Place the cylinder at the end of the eccentric cone:



NOTE If the point is difficult to locate, you can toggle the surface locate off with the F3 function key. Pressing F3 again toggles the surface locate back on.

27. On the **PinPoint** ribbon, click **Reposition Target** to change the target to the end of the cylinder.

The new coordinate system is now relative to the end of the designed equipment.



28. Click and hold **Place Shape**  and select a rectangular solid shape.

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

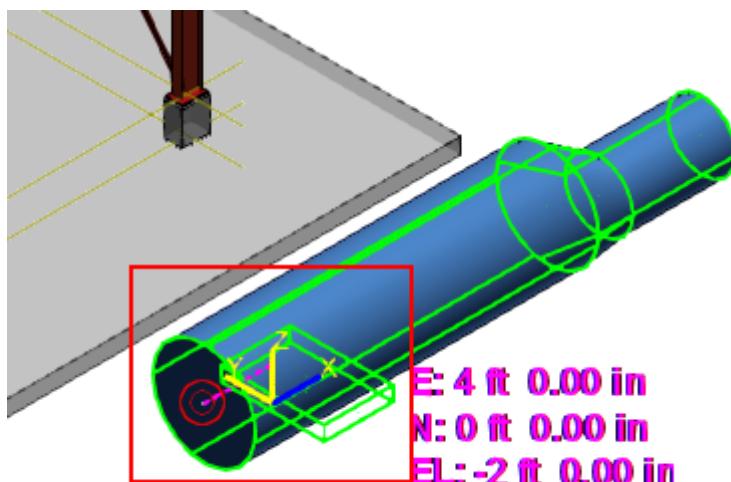
29. Specify the following values, and click **OK**:

- A:** 4 ft 0.00 in
- B:** 6 ft 0.00 in
- C:** 0 ft 10.00 in

30. On the **PinPoint** ribbon, specify the coordinate values:

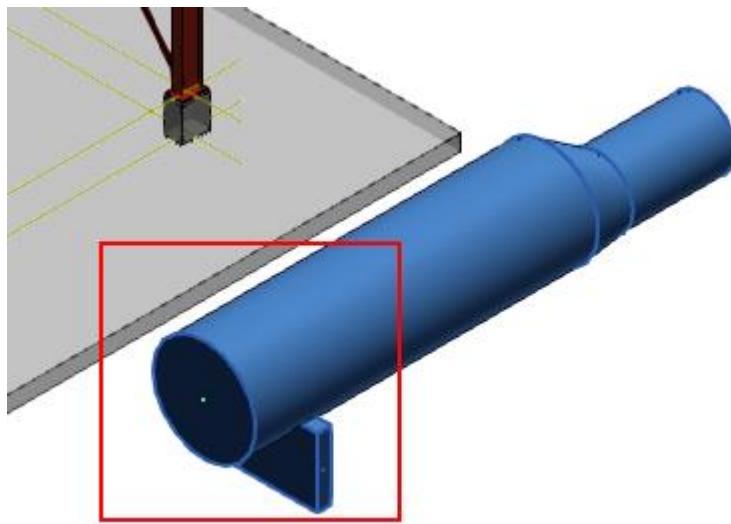
- E:** 4 ft 0.00 in
- N:** 0 ft 0.00 in
- EL:** -2 ft 0.00 in

The rectangle is placed below the cylinder equipment object.



Modeling Designed Equipment with Shapes

31. Use the arrow keys to rotate the rectangle as shown below, and click in the graphic view to lock the rectangle in place:

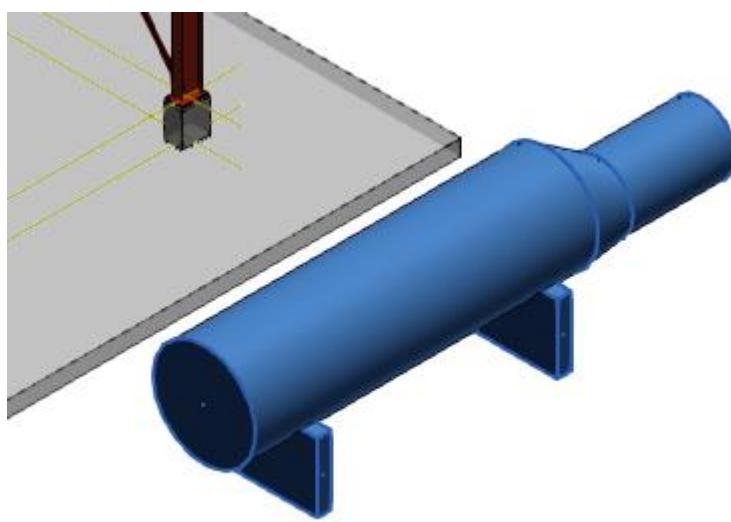


32. Repeat the above steps to create a second rectangle shape. Specify the following values for its coordinates:

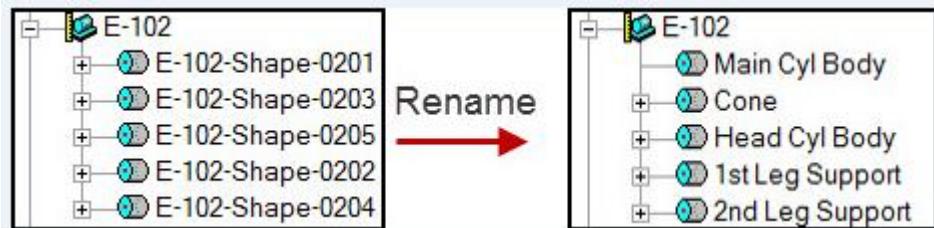
E: 18 ft 0.00 in

N: 0 ft 0.00 in

El: -2 ft 0.00 in



33. In the **Workspace Explorer**, rename all the shapes under **E-102**:



34. To place the first cap of the equipment object, click **Place Shape** and select the semi-elliptical head shape.

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

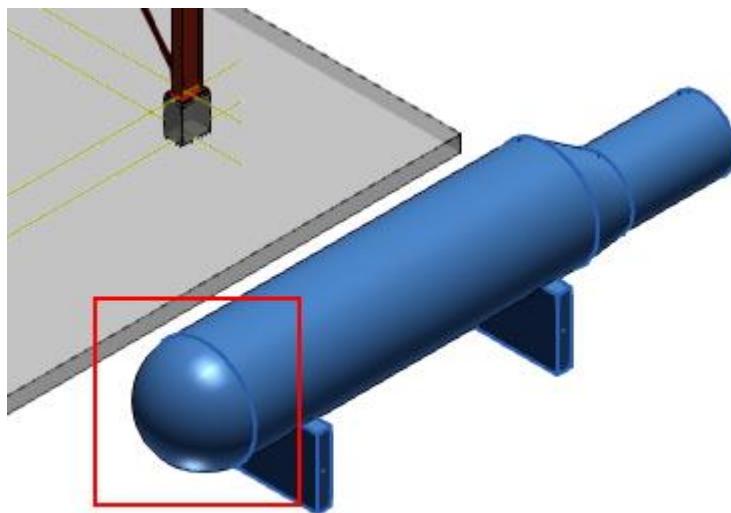
35. Specify the dimension values:

A: 6 ft 0.00 in

B: 3 ft 0.00 in

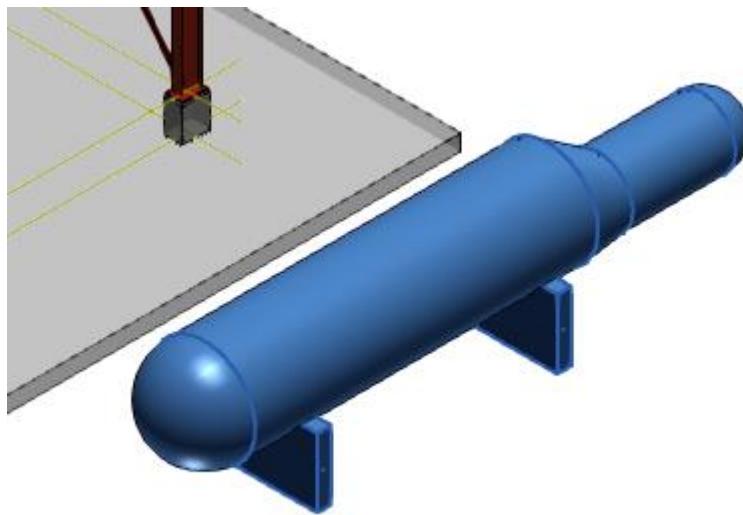
36. On the **Place Shape** ribbon, set **Positioning Relationship** to **Connect**.

37. Connect the cap to the equipment as shown:

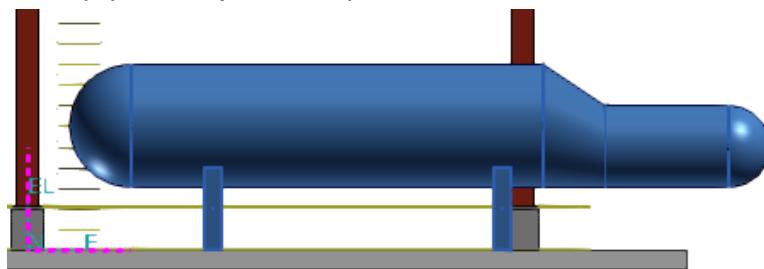


38. Repeat the above steps to create and place a second cap with the following dimensions:

A: 4 ft 0.00 in
B: 2 ft 0.00 in



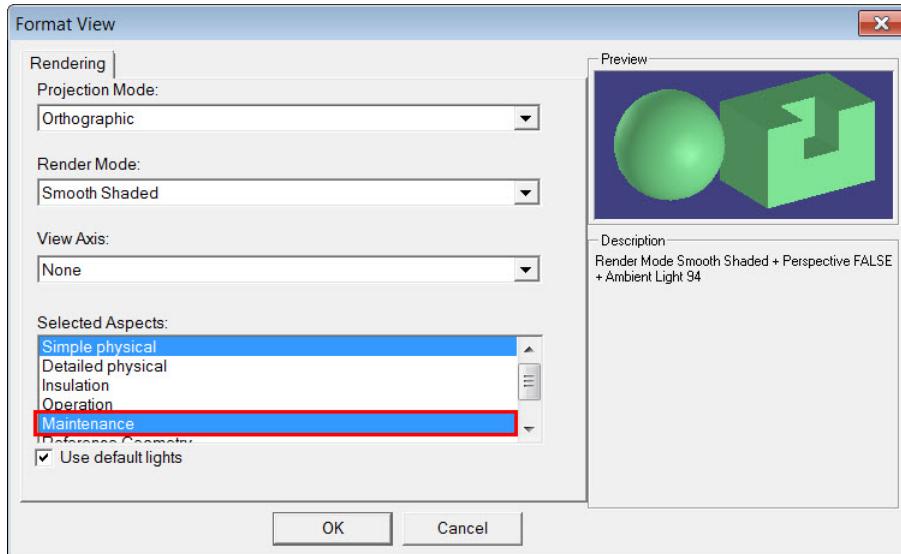
The equipment object is complete.



39. Select **Format > View**.

*The **Format View** dialog box displays.*

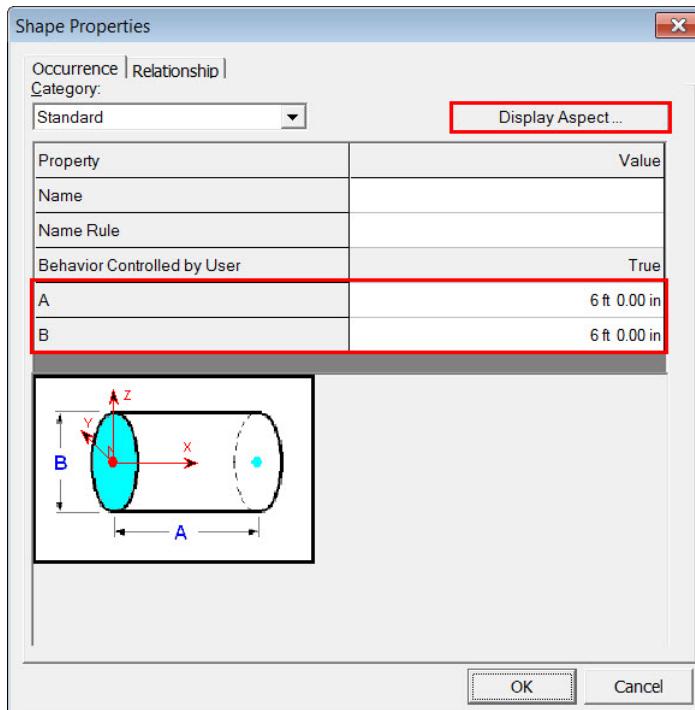
40. Under **Selected Aspects**, select **Maintenance**, and click **OK**.



41. Click **Place Shape** and select the cylinder shape.

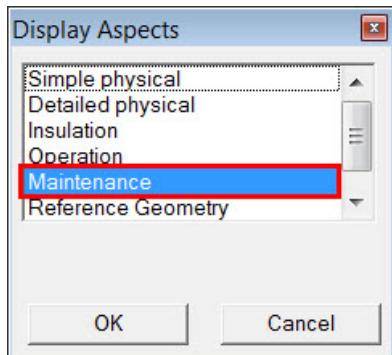
The Shape Properties dialog box displays.

42. Specify the following values for **A** and **B**, and then click **Display Aspect....**

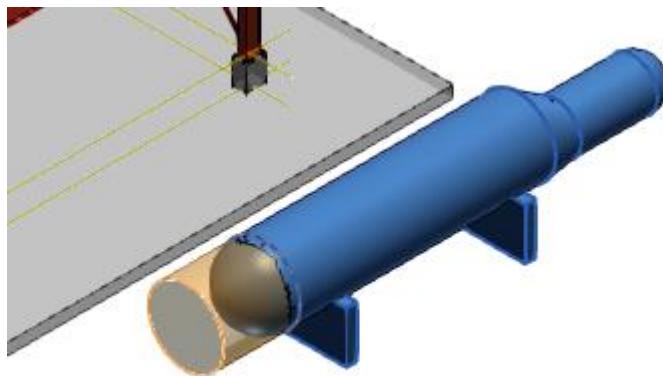


The Display Aspects dialog box displays.

43. Clear the selection for **Simple physical** and select **Maintenance**.



44. Click **OK**, and click **OK** to close the **Shape Properties** dialog box.
45. Use the arrow keys to rotate the shape, and place it at the west end of the equipment object.



NOTE If the **Surface Style Rule** is set to **Equipment Maintenance - Delivered**, the above maintenance envelope displays.

46. Select **Format > View**, and clear the **Maintenance** display aspect.

For more information, see *Place Shape Command* in the *Smart 3D Equipment User's Guide*.

SECTION 6

Placing Shapes Using Imported Geometry

Objective

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

- Place shapes using imported geometry from a file.

Before Starting this Procedure

- Smart 3D Overview
- Smart 3D Common Sessions
- *Placing Designed Equipment and Components* (on page 47)
- *Modeling Designed Equipment with Shapes* (on page 73)

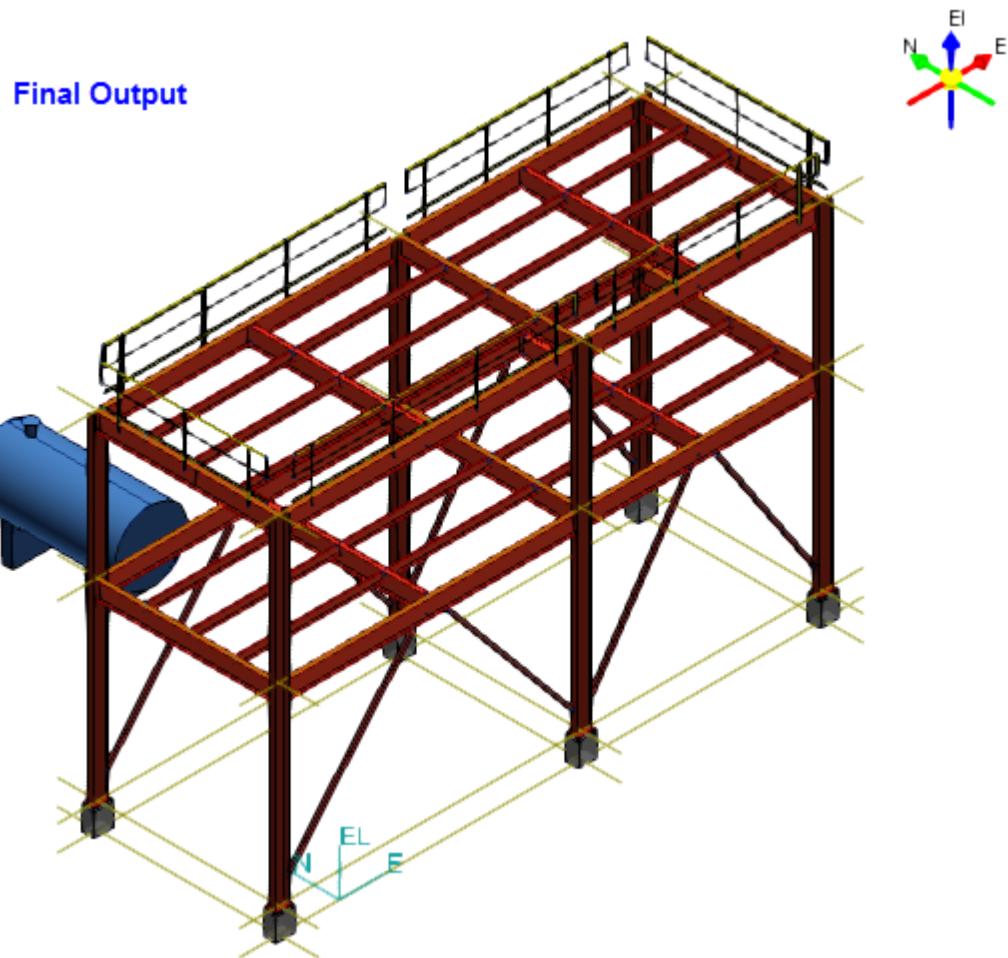
Overview

Place Imported Shape from File  creates a shape that contains the geometry from a SAT or DGN file. SAT file geometry can be created from solids modeling softwares, such as Solid Edge or Solid Works. You can place the imported shape in a designed equipment or an equipment component.

The local coordinate system of the shape is the SAT file coordinate system. After it is imported, the geometry from the SAT or DGN file is stored in the Smart 3D model database. The file on the disk is not referenced by Smart 3D.

Place Equipment Using Imported Shapes from a File

Place a designed equipment, **Horizontal Drum with Saddle**, from the Catalog, and then place a tank **DR-100** in **U02** by importing it from the **Tank_shape.sat** file.



1. Define your workspace to display Unit U02 and coordinate system U02 CS.

2. Select **Tools > PinPoint**.

*The **PinPoint** ribbon displays.*

3. Change the active coordinate system to **U02 CS**.

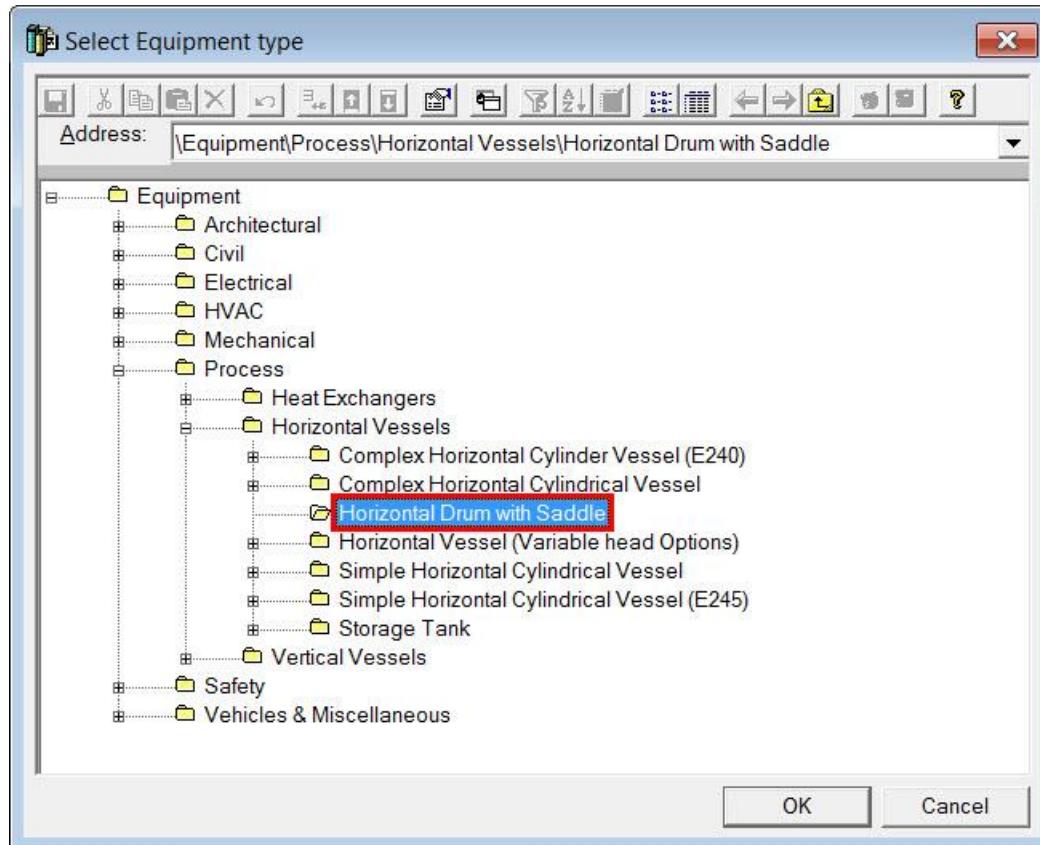


4. Click **Set Target to Origin**  to place the equipment at the origin of the current coordinate system.

5. Click **Place Designed Equipment** .

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

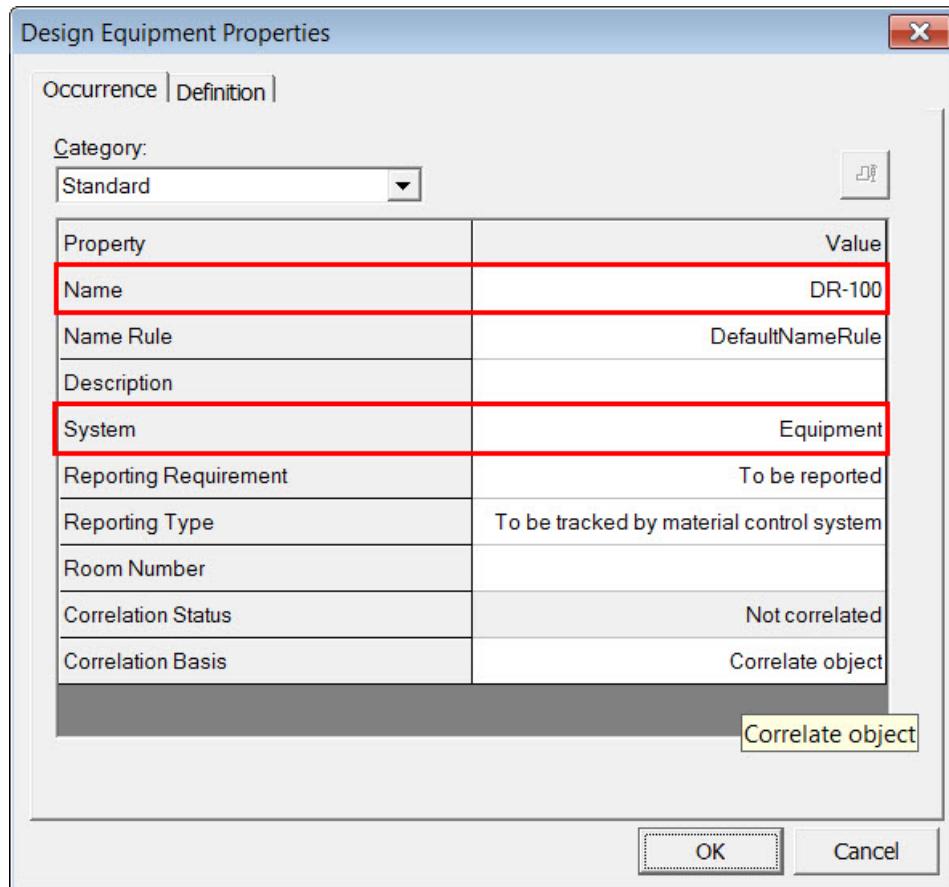
6. Select Equipment > Process > Horizontal Vessels > Horizontal Drum with Saddle and click **OK**.



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

Placing Shapes Using Imported Geometry

7. Set **Name** to DR-100 and **System** to A2 > U02 > Equipment.

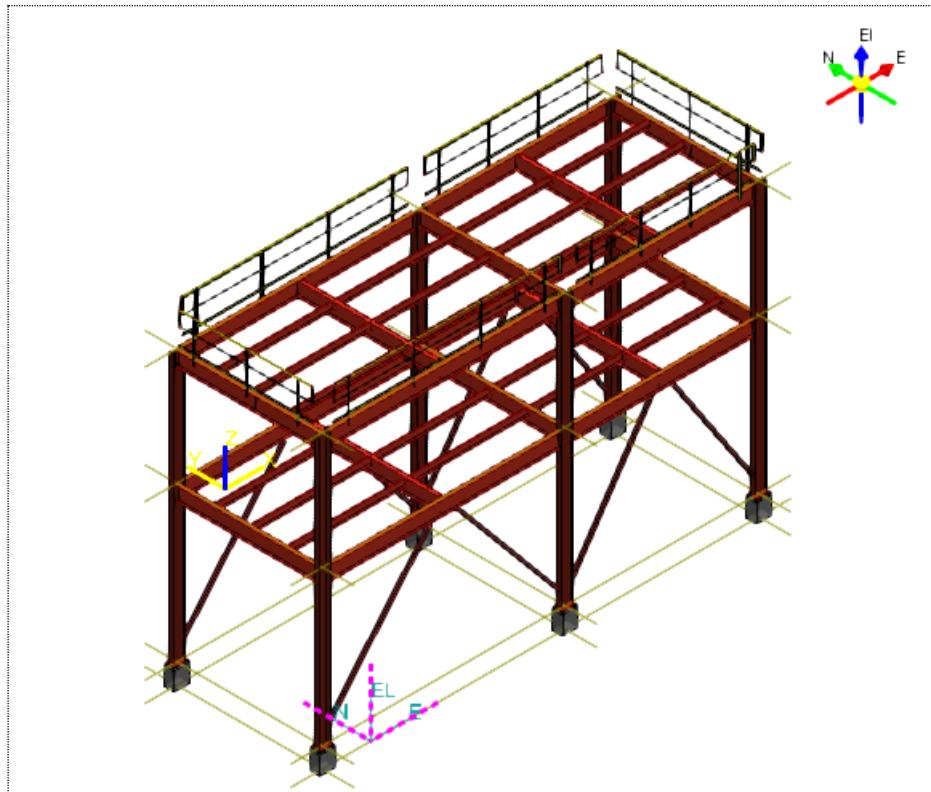


8. Change the **Category** to **Position and Orientation**, and specify the following values:

East: 15 ft 0.00 in
North: 30 ft 0.00 in
Elevation: 0 ft 0.00 in

9. Click **OK**.

The designed equipment is placed on the model with the local coordinate system.



10. Click **Place Imported Shape from File** .

The **Select Shape File** dialog box displays.

NOTE If the designed equipment is not selected, select it in the model or in the **Workspace Explorer**.

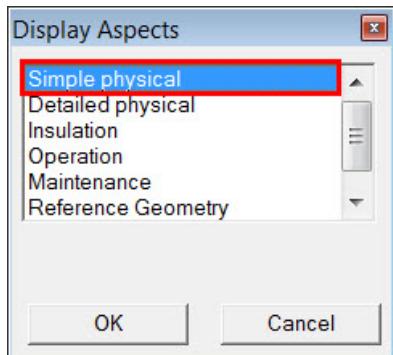
11. Browse to [SharedContent]\Sat files\Tank_Shape.sat and click **Open**.

The **Display Aspects** dialog box displays.

NOTES

- For the appropriate file path, ask the training instructor.
- The **Select Shape File** dialog box specifies the .SAT file that contains the shape to be imported. You can browse through the folders containing the available .SAT or .DGN files to locate the appropriate file.

12. Select **Simple physical** and click **OK**.



NOTES

- In the **Display Aspects** dialog box, you can select the aspect for the imported shape. You can also right-click the new shape and select **Properties** to further define the specifications for the object.
- You can select **Format > View** and change the **Render Selected Aspects** option to display the aspect in the active graphic view.

13. On the **PinPoint** ribbon, specify the following coordinate values:

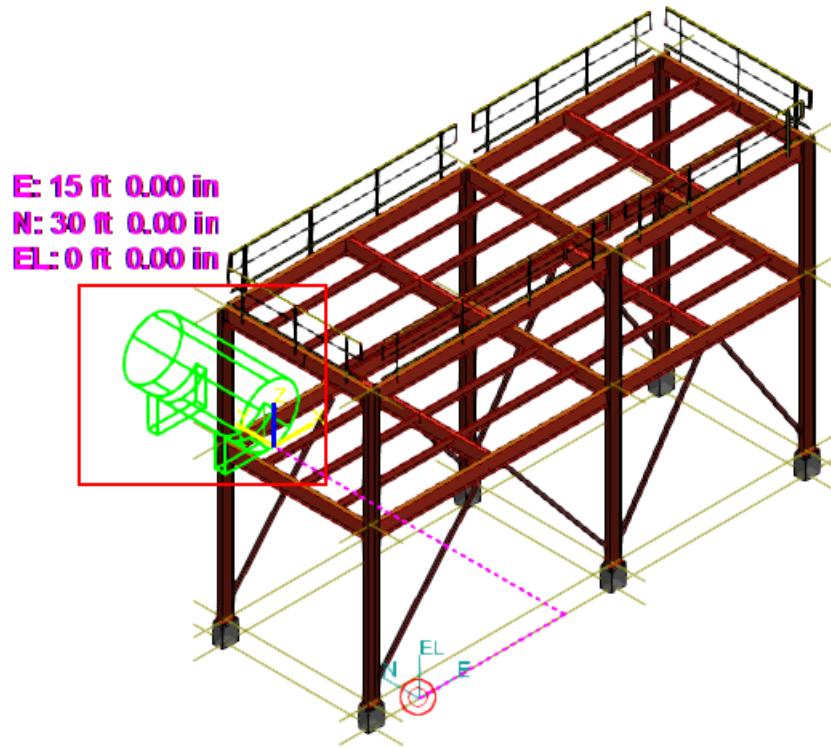
East: 15 ft 0.00 in

North: 30 ft 0.00 in

Elevation: 0 ft 0.00 in

14. Click in the graphic view.

The tank is placed in the model.



For more information on placing equipment using imported shapes, see *Place Imported Shape from File Command* in the *Smart 3D Equipment User's Guide*.

SECTION 7

Placing Nozzles and Other Ports

Objective

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

- Add nozzle and a foundation port on equipment with **Place Nozzle** .
- Insulate a nozzle.
- Apply a different surface style rule to a nozzle than its parent equipment.

Before Starting this Procedure

- Smart 3D Overview
- Smart 3D Common Sessions
- *Placing Designed Equipment and Components* (on page 47)
- *Modeling Designed Equipment with Shapes* (on page 73)

Overview

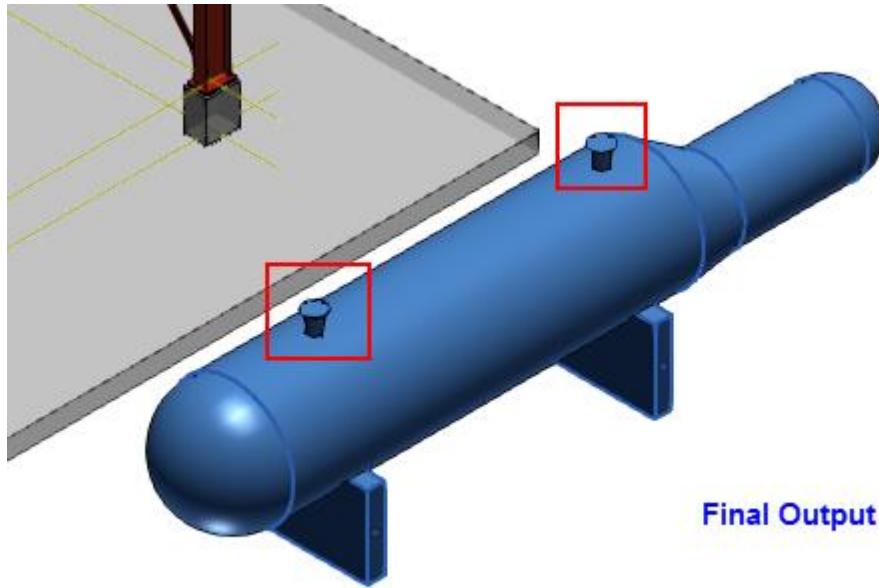
Place Nozzle  allows you to add any port to designed equipment or an equipment component. Ports define the connection point and descriptive information needed to connect routing application objects, such as piping, ducting, cableways, conduits, and cable and structural foundations, to the equipment. For example, the piping port, commonly referred to as a nozzle, defines the information necessary to connect piping, such as the piping standard, pipe diameter, and end preparation. This information allows the software to select the appropriate connection parts from the Catalog.

The foundation port defines the mounting bolt hole pattern, size, position, and orientation. This information is used in the **Structure** task to position and size equipment foundations.

The ports can be positioned relative to the equipment origin in several ways, such as using the absolute position and orientation. The placement options are listed and described in the **Placement** dialog box.

Place a Piping Nozzle

In the following exercise, place a nozzle on a heat exchanger at the specified location relative to the coordinate system U01 CS.

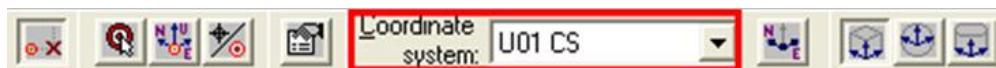


1. Define your workspace to display unit **U01** and coordinate system **U01 CS**.

2. Click **Tools > PinPoint**.

The **PinPoint** ribbon displays.

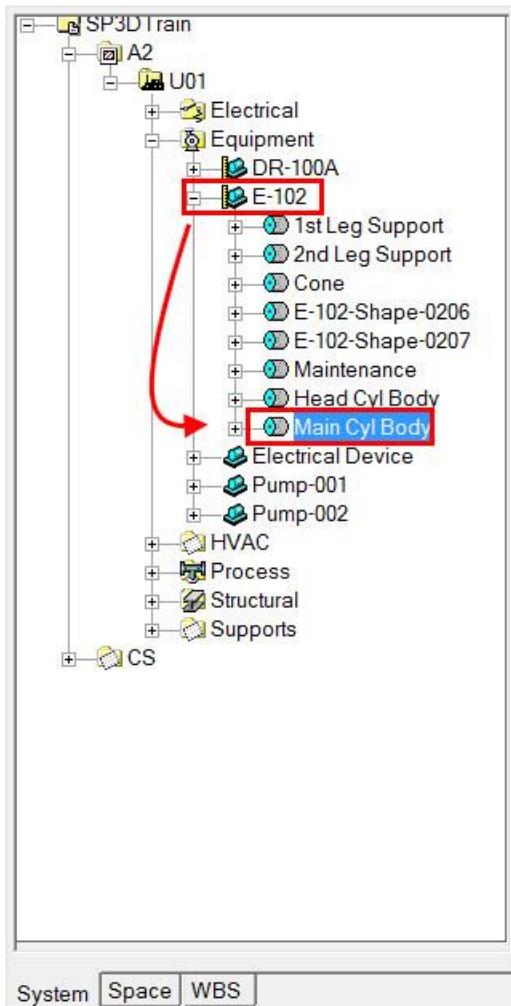
3. Set the active coordinate system to **U01 CS**.



4. Click **Set Target to Origin** to move the target to the active coordinate system's origin.

5. Click **Place Nozzle** .

- In the **Workspace Explorer**, select **Equipment > E-102 > Main Cyl Body**.



The **Nozzle Properties** dialog box displays.

NOTE Nozzles are placed relative to the local coordinate system of the shape. If the shape moves, the nozzle moves with the shape.

- Set the **Port Type** to **Piping Straight Nozzle**, and specify the following values:

Port Index: 1

Nominal Size: 8

Npd Unit Type - in

Termination Class - Bolted

Termination Sub Class - Flanged

End Preparation - Raised-face-flanged end

End Practice - United States Standards

Schedule Practice - Universal Wall Thickness Values

End Standard - Default

Rating Practice - United States of America Standards

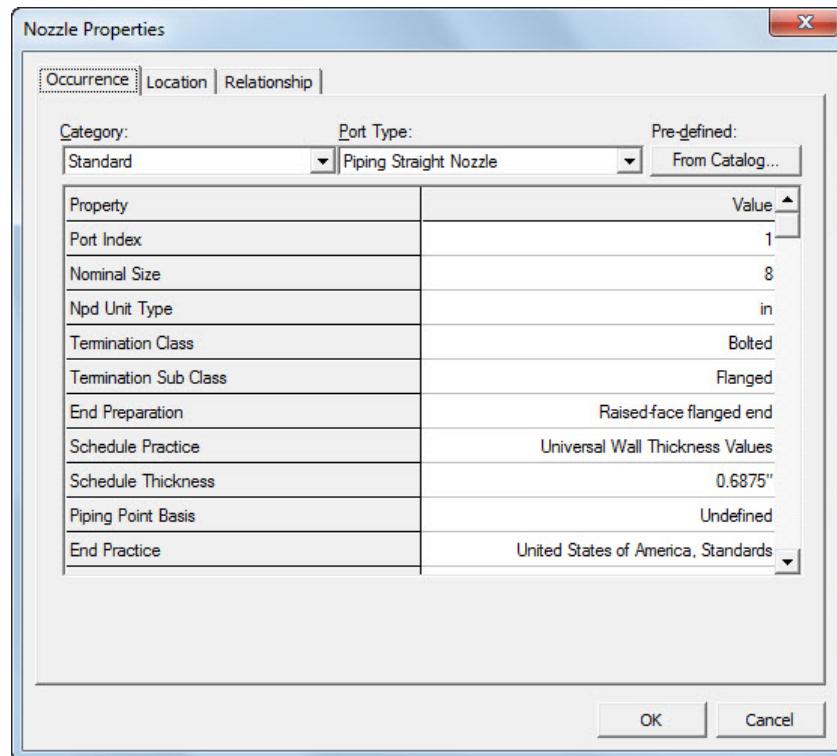
Pressure Rating - CL150

Flow Direction - Flow leaves this port

Placing Nozzles and Other Ports

Nozzle Length: 1 ft

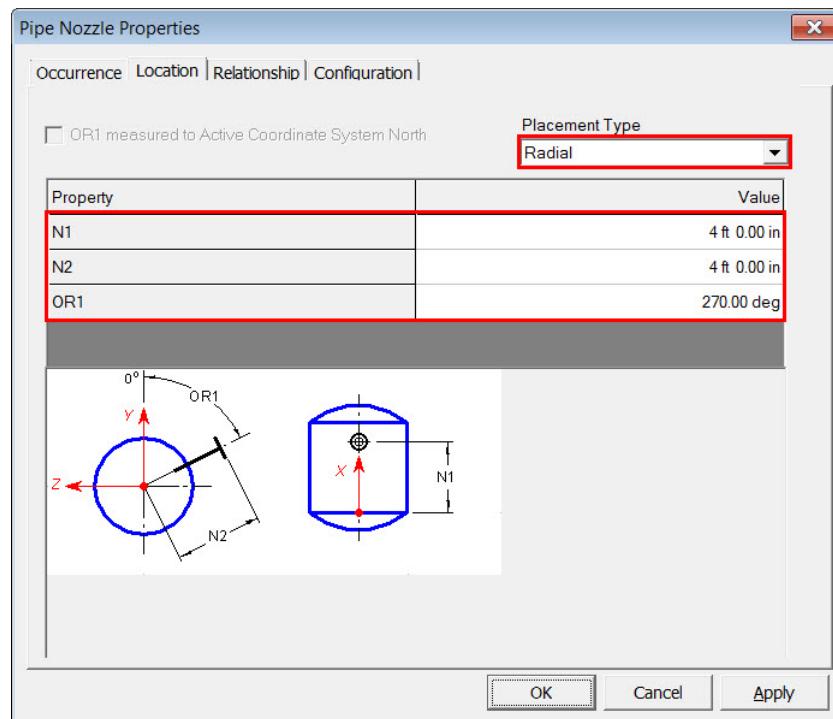
Name - N1



NOTES

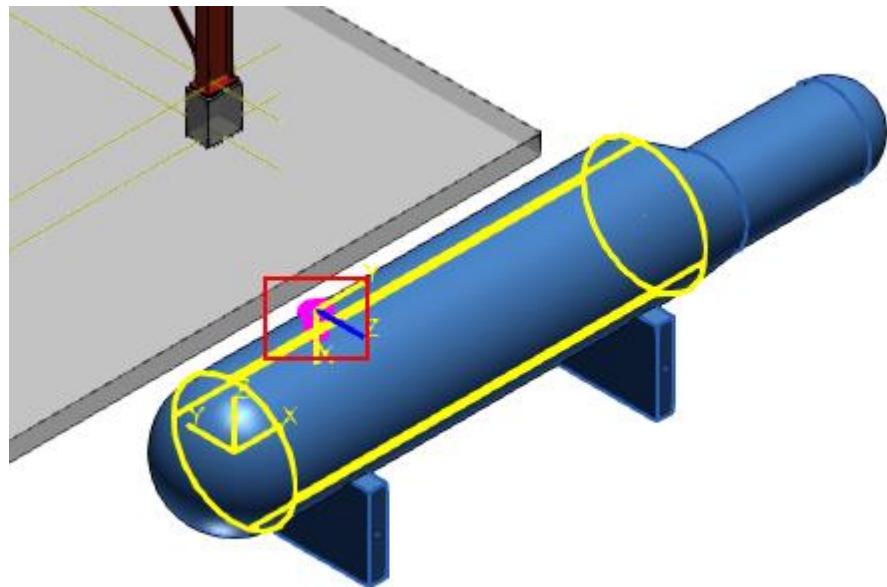
- Your Catalog administrator can predefine the set of standard nozzle configurations you normally use in your designs. You can select one of these nozzles from the Catalog, rather than enter all the pipe nozzle properties individually.
 - Using standard nozzle configurations can help reduce the cost of dealing with a large number of nozzle design permutations.
 - You can select a standard nozzle and then modify any of the individual properties.
8. Under **Location**, set **Placement Type** to **Radial**, and specify the following values:

N1: 4 ft 0.00 in
N2: 4 ft 0.00 in
OR1: 270.00 deg



9. Click **OK**.

The nozzle is placed on the equipment.



Placing Nozzles and Other Ports

10. Repeat the steps above to add a second nozzle to the equipment, and specify the following values:

Under **Occurrence**:

Port Index: 2

NominalSize: 8

Npd Unit Type - in

Termination Class - Bolted

Termination Sub Class - Flanged

End Preparation - Raised-Face Flanged End

End Practice - United State of America, Standards

End Standard - Default

Rating Practice - United State of America, Standards

Pressure Rating - CL150

Flow Direction - Flow leaves this port

Nozzle Length: 1 ft

Name - N2

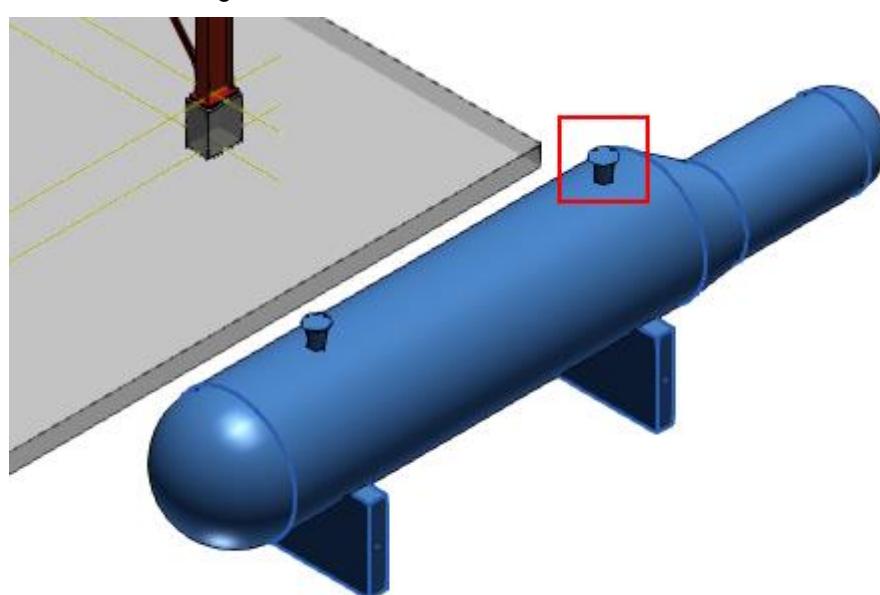
Under **Location**:

Placement Type - Radial

N1: 18 ft 0.00 in

N2: 4 ft 0.00 in

OR1: 270.00 deg



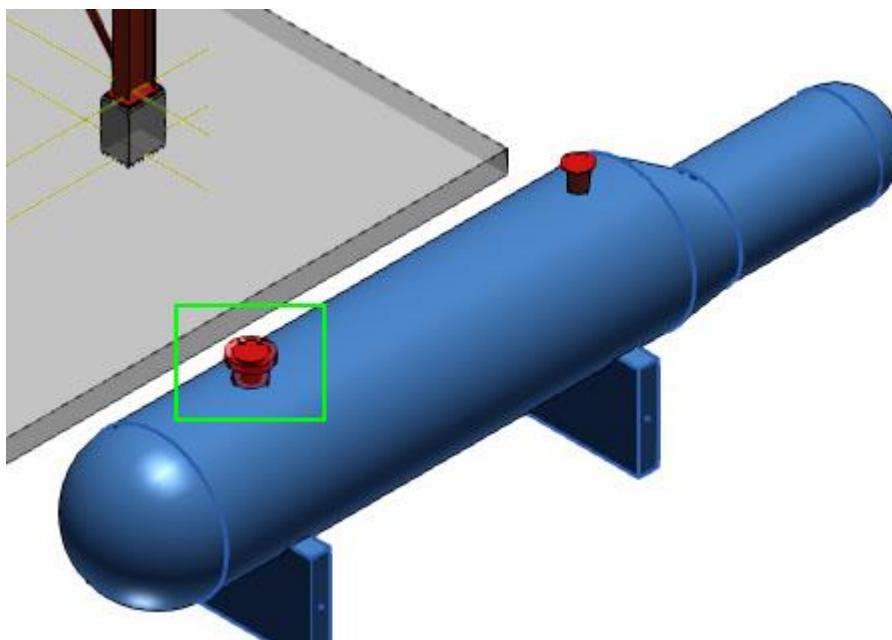
Insulate a Nozzle and Apply Style Rules

1. Change the **Locate Filter** to **Piping Nozzles**.
2. Select the nozzle **N1** placed in the previous exercise and click **Nozzle Properties** .

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

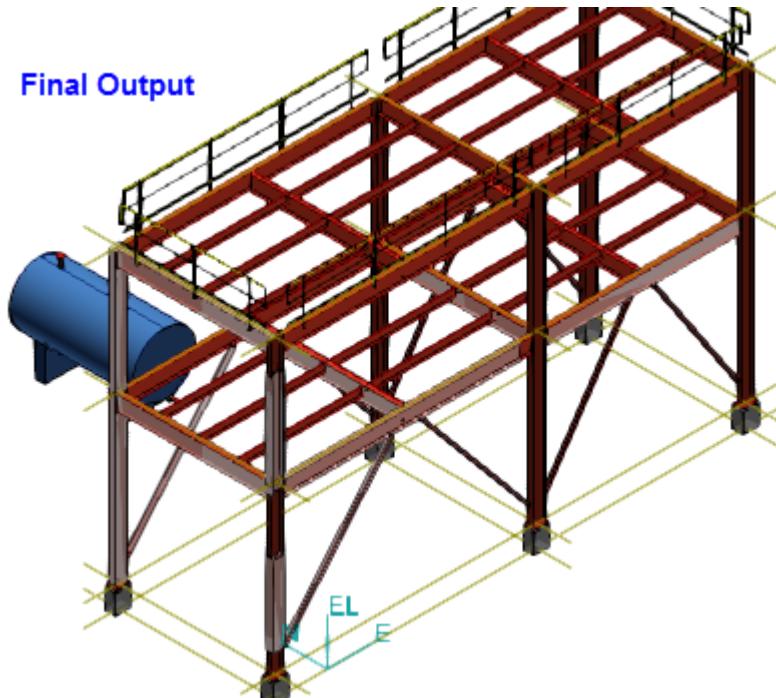
3. Under Occurrence, specify the following **Insulation and Tracing** values:
Is Insulated - True
Insulation Criteria - Complete
Insulation Requirement - External
Insulation Material - MW (Mineral Wool)
Insulation Thickness: 3 in
4. Select **Format > View**.
*The **Format View** dialog box displays.*
5. Under **Selected Aspects**, select **Insulation**, and click **OK**.
6. Select **Format > Surface Style Rules**.
7. Browse to the **Nozzle** and **Nozzle Insulation** rules in the library and add them to your workspace. Click **OK** to apply the style rules.

The nozzle has been modified.



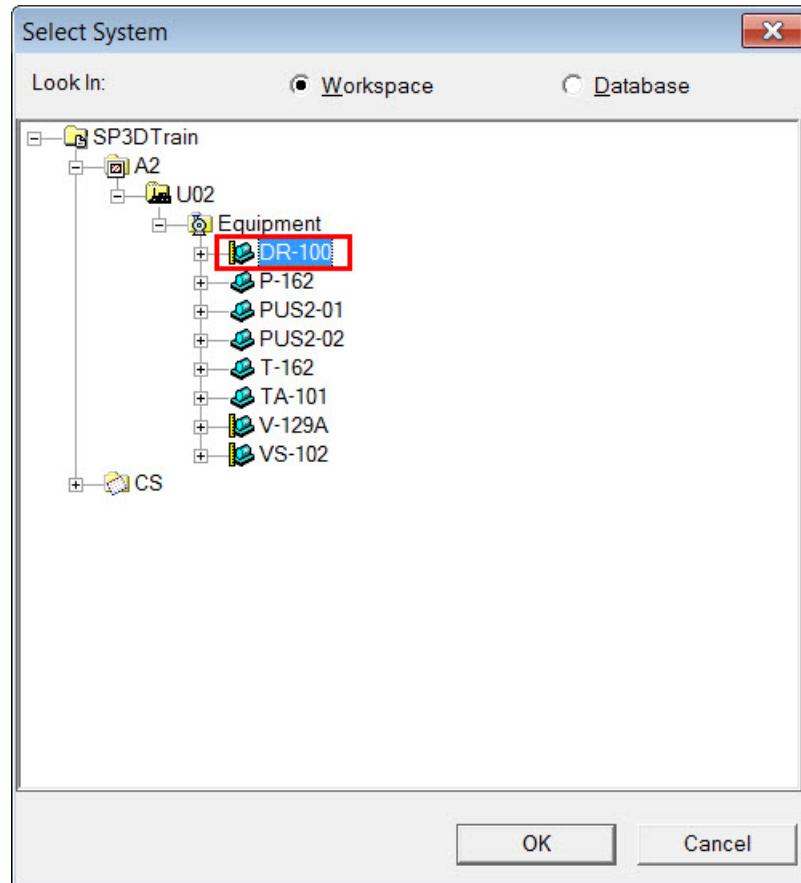
Place a Nozzle by Point

Place a nozzle on the existing tank. This tank has a shape defined by a SAT file. In this case, the nozzle port connection point location is known relative to the coordinate system of the tank.



1. Define your workspace to display unit U02 and coordinate system U02 CS.
2. If the **PinPoint** ribbon is not already active, select **Tools > Pinpoint**.

3. Change the active coordinate system to the local coordinate system of the equipment DR-100.



4. Click **Set Target to Origin**  to move the target position to the origin of the current coordinate system.

5. Click **Place Nozzle** , and then select the drum body equipment.



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

6. Under **Occurrence**, specify the following values:

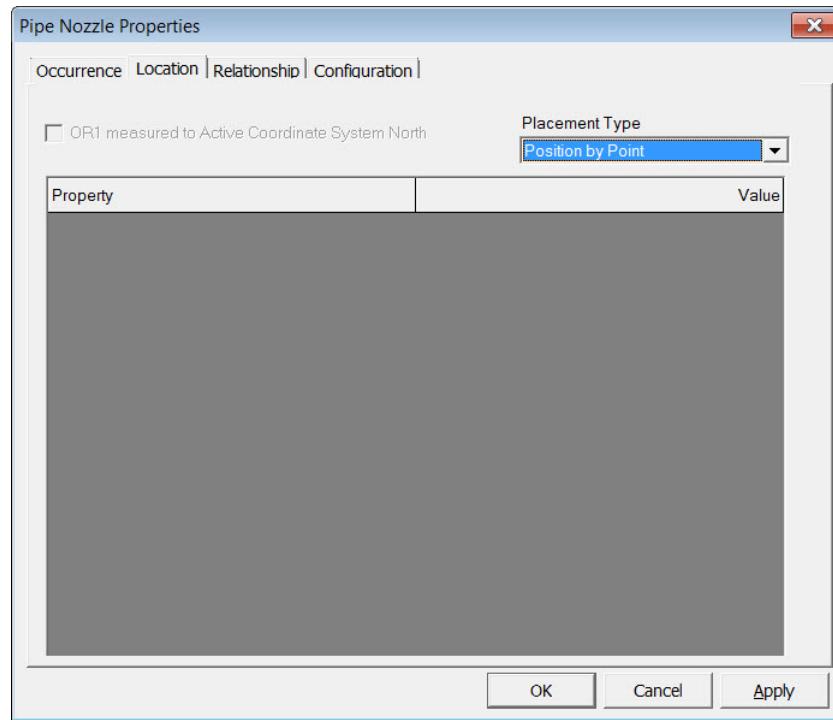
Port Type - Piping Straight Nozzle

Length: 1 ft

Name - N1

All Other Nozzle Properties - see *Insulate a Nozzle and Apply Style Rules* (on page 101).

7. Under **Location**, set **Placement Type** to **Position by Point** and click **OK**.



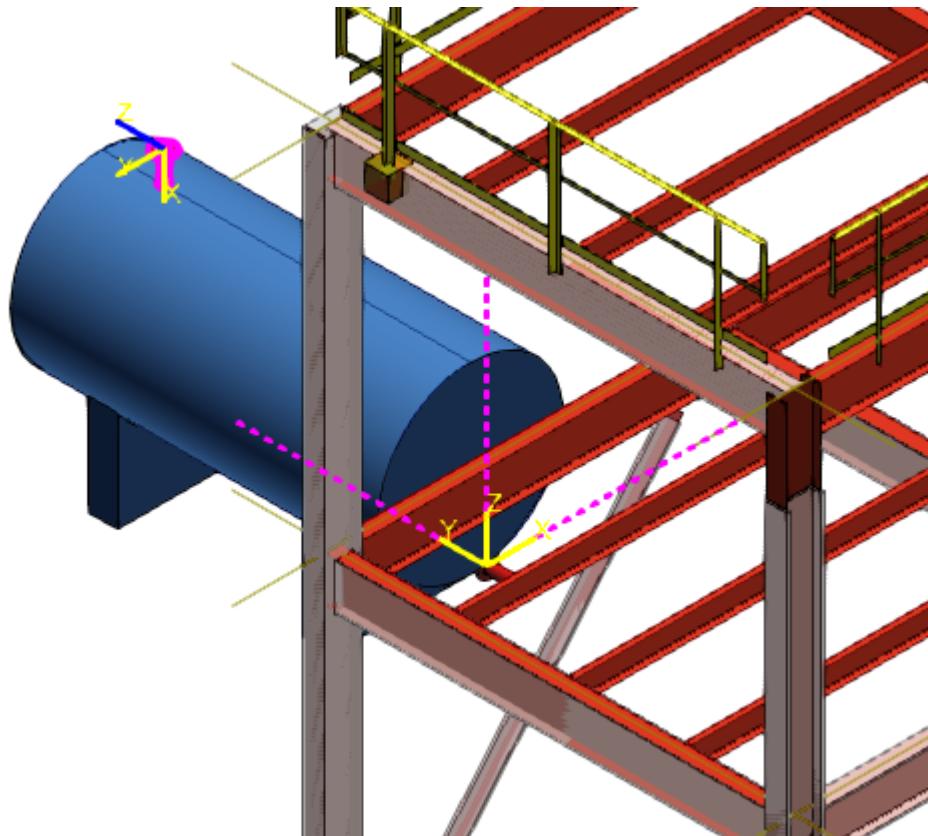
8. On the **PinPoint** ribbon, specify the following coordinates:

East: -2.5 ft

North: 8 ft

Elevation: 9 ft

9. Use the arrow keys to rotate the nozzle so that the flange is vertical, then click to place the nozzle. You may also place the nozzle first and then rotate it.



10. Define the workspace to display **Unit U03** and coordinate system **U03 CS**.
11. Select **Tools > PinPoint**.
12. Set the active coordinate system to **U03 CS**.
13. Click **Set Target to Origin**  to move the target position to the origin of the current coordinate system.
14. Click **Place Nozzle** , and then select the equipment **DP1**.

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

15. Under **Occurrence**, specify the following values:

Port Type - Piping Straight Nozzle

Port Index: 10

Nominal Size: 2

NPD Unit Type - in

Termination Class - Bolted

Termination Sub Class - Flanged

End Preparation - RFFE

End Practice - US Practice

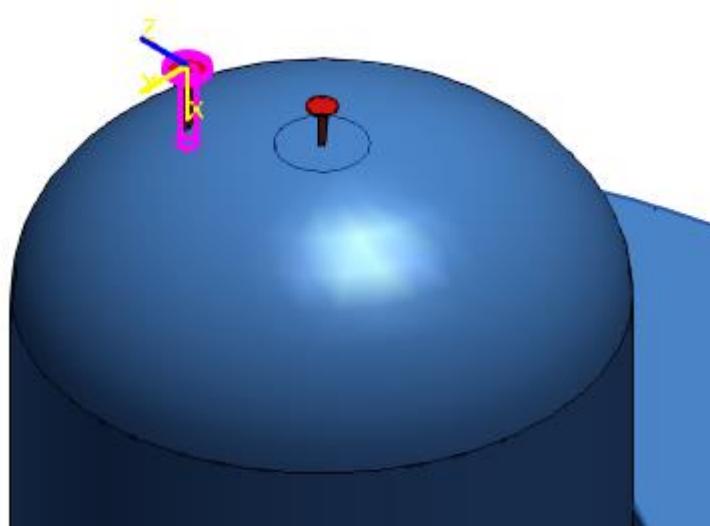
End Standard - Default

Pressure Rating - CL150

Flow Direction - Flow leaves this port

Nozzle Length: 1 ft
Name - F

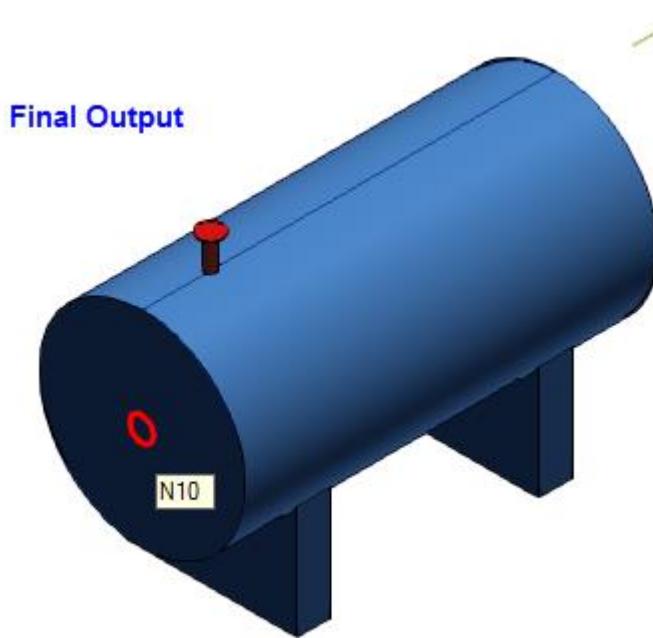
16. Under **Location**, set **Placement Type** to **Position by Point** and click **OK**.
 17. On the **PinPoint** ribbon, specify the following coordinates:
East: 13 ft 6.00 in
North: 31 ft 6.00 in
Elevation: 61 ft 0.00 in
 18. Use the arrow keys to rotate the nozzle so that the flange is vertical, then click to place the nozzle.
- The nozzle is placed on the tower.*



Place a Nozzle Without Geometry

When you use **Place Imported Shape from File**  to import an equipment model, the geometry can include the necessary physical details, such as the nozzle shapes. Even though the geometry of the nozzle is visible after you import the SAT file, you must add the nozzle port information to allow connections to the nozzle.

Place a nozzle port without geometry by positioning the port relative to the nozzle geometry of the imported shape. This nozzle port can be located graphically as a circle with the diameter of the port after it is placed.



NOTES

- You can also place nozzles with graphics that overlap or cover the nozzle geometry provided in the SAT file. This makes the nozzle port easier to locate because it has more graphics.
 - Interference is not reported between shapes and nozzles you add to a designed equipment.
1. Define the workspace to display **Unit U02** and coordinate system **U02 CS**.
 2. Click **Place Nozzle** , and select the drum body of equipment part **DR-100** used in the example above.

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

3. Under **Occurrence**, specify the following values, and click **OK**:

Port Type - PipePort (No Added Graphic)

Port Index: 2

Nominal Size: 8

Npd Unit Type - in

Termination Class - Bolted

Termination Sub Class - Flanged

End Preparation - RFFE (Raised-face flanged end)

End Practice - United States of America, Standards

End Standard - Default

Rating Practice - United States of America, Standards

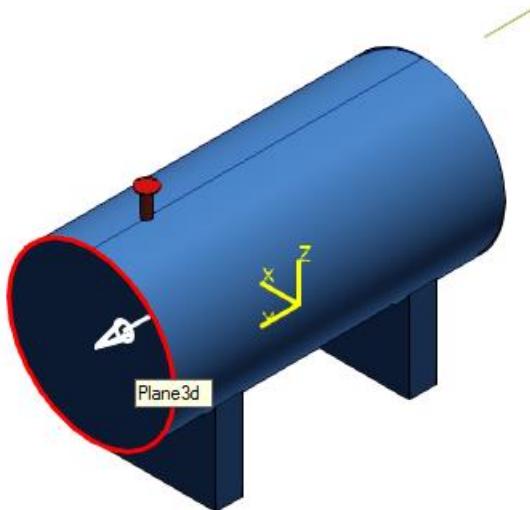
Pressure Rating - CL150

Flow Direction - Flow leaves this port

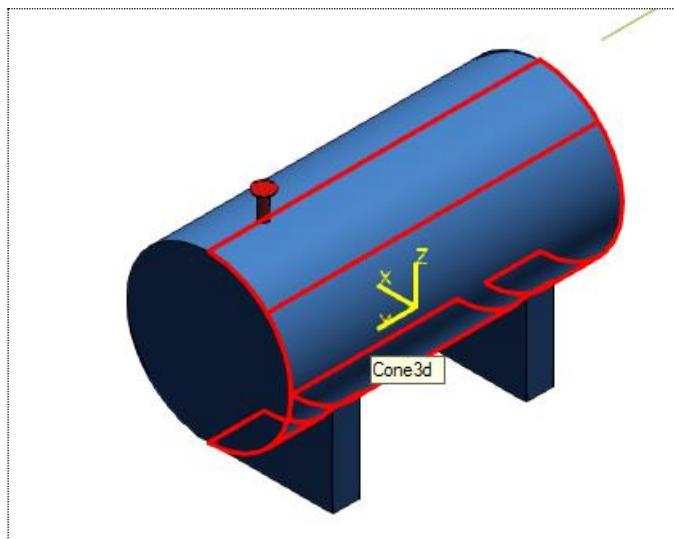
Nozzle Length: 1 ft

Name - N10

4. Select the **Location** tab
5. Select Placement Type to be **Position by Plane and Axis**
6. Select the plane representing the nozzle port location. For this exercise, assume the nozzle geometry was included in the SAT file and use the end of the tank as the imagined nozzle face.



7. Select the cylinder body to define the axis on which to center the nozzle port.



The nozzle is placed on the equipment.

Place a Foundation Port

1. Click **Place Nozzle** , and select the equipment **DR-100** as the shape on which to add a foundation port.

NOTE You can select the parent object in the graphic view or in the **Workplace Explorer**.

The **Nozzle Properties** dialog box displays.

2. Under **Occurrence**, set the **Port Type** to **Foundation Port**.

The properties now show the Foundation Port properties.

3. Specify the following values:

Type - Rectangular Foundation Port

Name - Foundation Port3

Liner Thickness: 0 ft

Footprint Offset: 0 ft

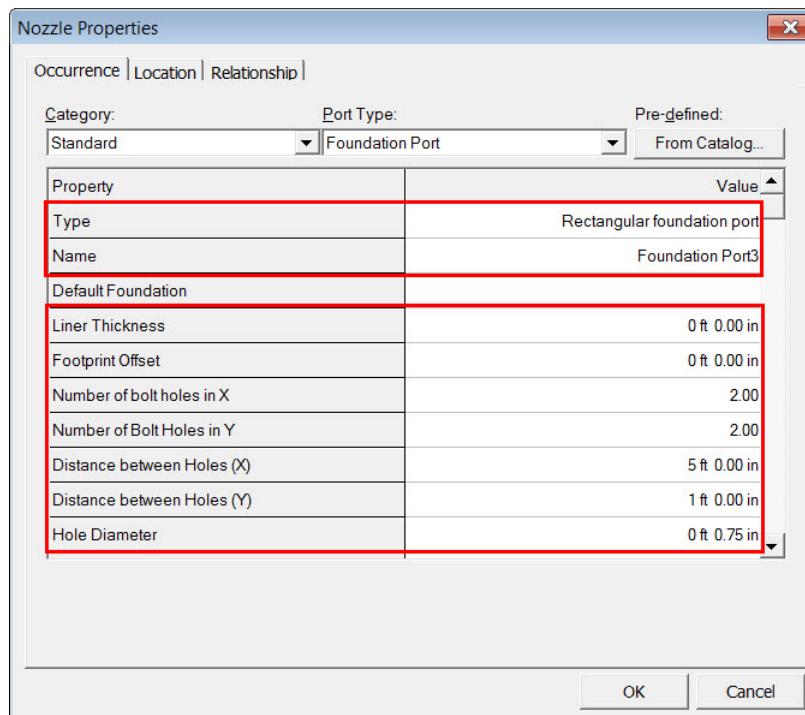
Number of Bolt Holes in X: 2.00

Number of Bolt Holes in Y: 2.00

Distance between Holes (X): 5 ft

Distance between Holes (Y): 1 ft

Hole Diameter: 0 ft 0.75 in

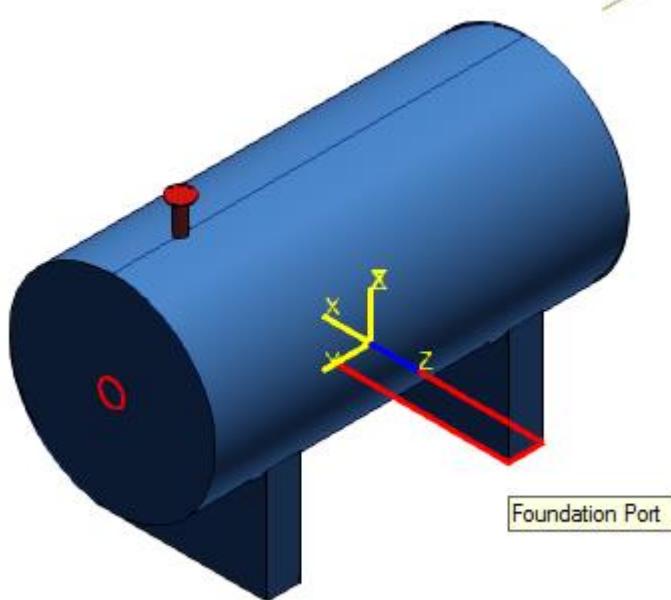


4. Under **Location**, set the **Placement Type** to **Tangential**, and specify the following values:

OR1: 90.00 deg

OR2: 90.00 deg

5. Click **OK** to place the foundation port.



NOTES

- **Place Foundation** uses the foundation port to help size and position foundations.
- If the local coordinate system of the shape is not positioned to easily use this example positioning method, you can position the port by point and then move and rotate the port to place it.
- If you place a port by point, you can use the arrow keys to rotate the foundation port at any time during the placement operation.
- To edit the properties of the new foundation port after it is placed, right-click the foundation port and select **Properties**.
- You can use the bolt hole pattern definition to create a rectangular or circular foundation shape, even if the equipment does not actually have bolt holes. The available bolt hole patterns are **Circular**, **Rectangular**, **Single Hole**, and **No Holes**.

For more information, see *Place Imported Shape from File Command* and *Place Nozzle Command* in the *Smart 3D Equipment User's Guide*.

Placing Nozzles and Other Ports

SECTION 8

Placing Equipment and Nozzles from P&ID

Objective

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

- Place equipment and nozzles using information from P&ID.

Before Starting this Procedure

- Smart 3D Overview
- Smart 3D Common Sessions
- *Placing Designed Equipment and Components* (on page 47)
- *Placing Nozzles and Other Ports* (on page 95)

Overview

SmartPlant Foundation is a central repository for data and the hub through which information is shared among other tools, such as SmartPlant Instrumentation, SmartPlant P&ID, and Smart 3D. SmartPlant Foundation defines a data schema for the design objects used in the course of designing, constructing, and operating a plant. Each software application that publishes or retrieves data from SmartPlant Foundation maps the data that is shared to the SmartPlant Foundation schema.

Authorized users extract the desired design data from SmartPlant Foundation into the Smart 3D database. For example, P&ID drawings can use SmartPlant Foundation design objects. After the SmartPlant Foundation data is stored for reference in a portion of the model database called the Design Basis, all Smart 3D users can access the information. When an Smart 3D model object is created or edited, it can be correlated with a specific Design Basis object. This declares that the model object is intended to represent the exact same thing as the Design Basis object. Once correlated, the properties of the model object can be automatically updated to match the properties of the Design Basis object.

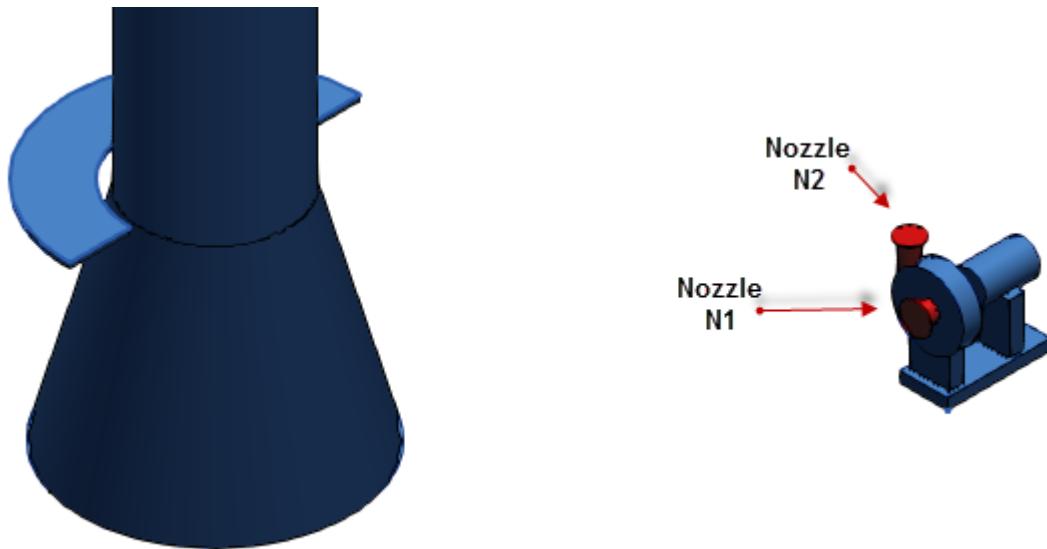
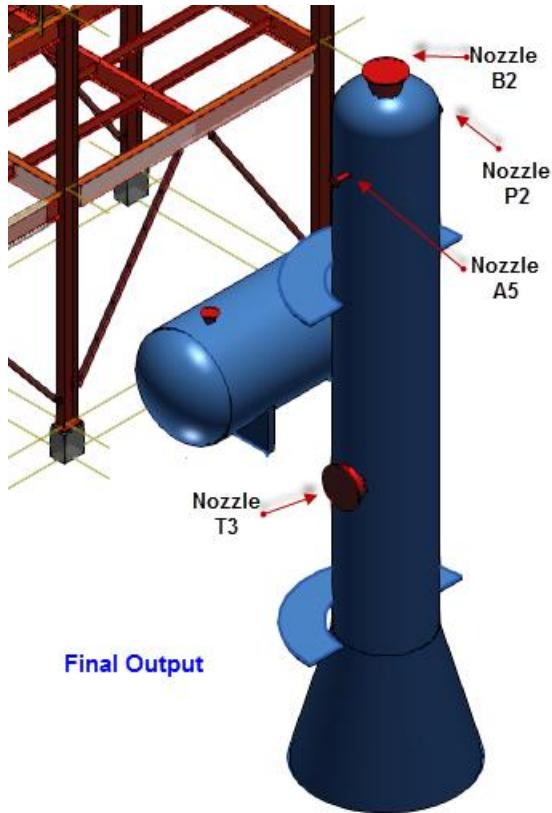
In this session, you will use Design Basis information from P&IDs to place equipment and nozzles in your model.

For more information, see *Design Basis Explanation* in the *SmartPlant 3D Integration Reference Guide*.

Place Equipment Objects and Nozzles from P&ID

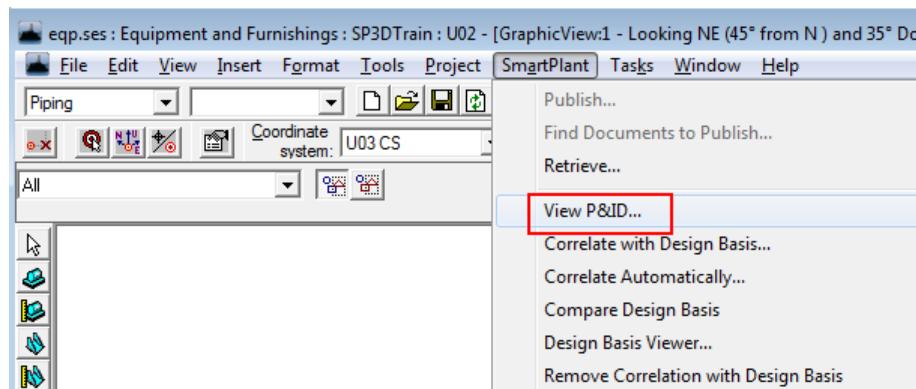
In the following exercise, place an equipment object with three vessel nozzles in the model. Update these nozzles by placing three nozzles from P&ID, and place a new nozzle from P&ID.

Also, place another equipment object in the model, and update the nozzles from P&ID.



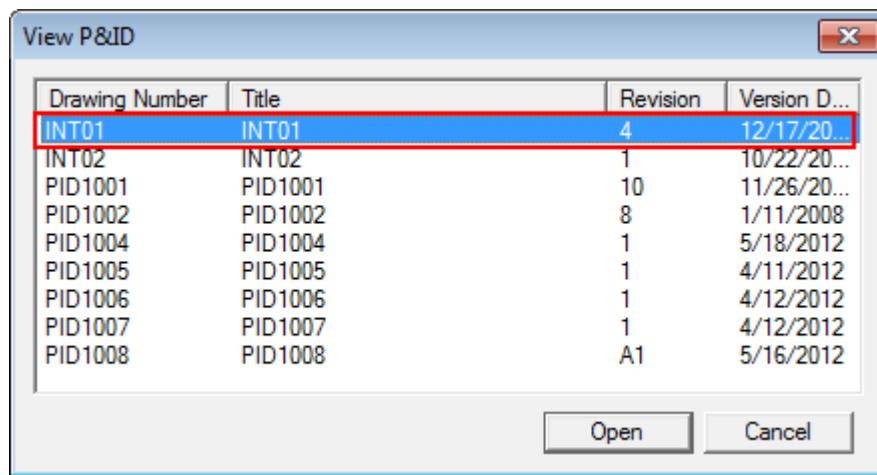
Place Equipment Object T-162

1. Define your workspace to display **Unit U02** and coordinate system **U02 CS**.
 2. Switch to the **Equipment and Furnishings** task and set the **Active Permission Group** to **Equipment**.
 3. Click **Tools > PinPoint**.
- The **PinPoint** ribbon displays.*
4. Set the active coordinate system to **U02 CS**.
 5. Click **Set Target to Origin**  to move the target to the origin of the current coordinate system.
 6. Click **Smart 3D > View P&ID...**

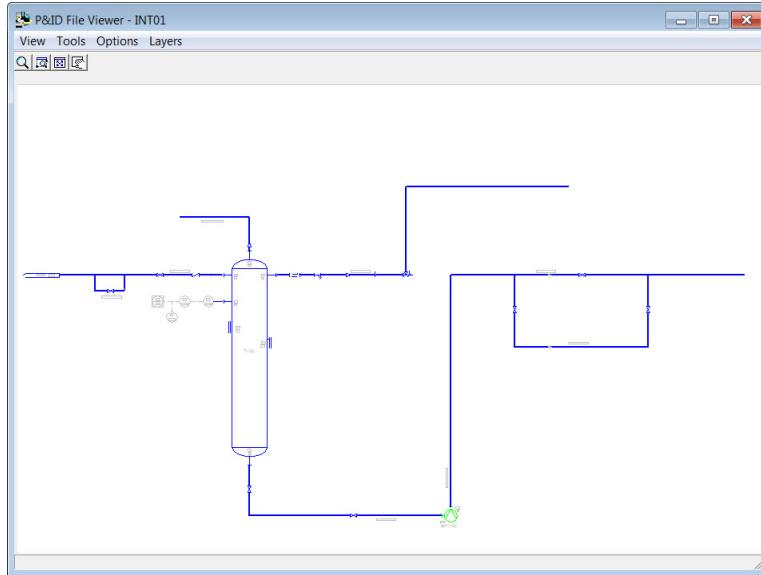


The **View P&ID** dialog box displays.

7. Select **INT01** and click **Open**.

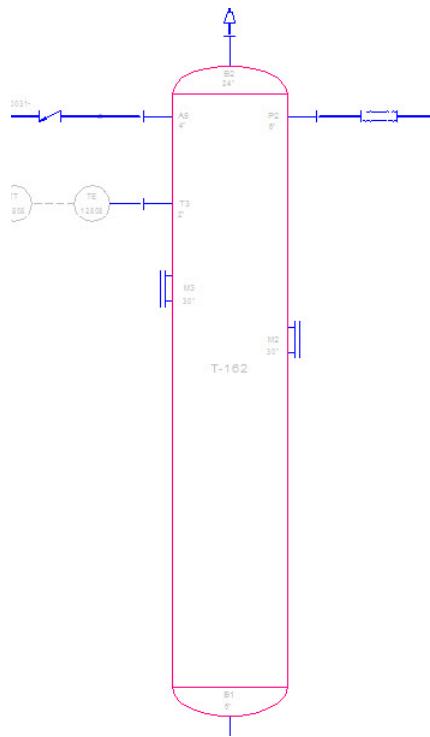


The **P&ID File Viewer** displays the selected drawing.



NOTE The graphical objects in the **P&ID File Viewer** are represented in different colors to display the correlation status between the Smart 3D model design objects and the design basis information from the P&ID. For example, an object in P&ID that is not correlated with an object in the Smart 3D model is displayed in blue. Mismatches between the properties of the correlated objects in the P&ID and the Smart 3D model are highlighted in red. When the properties of the objects match, the objects are displayed in green. You can change the color settings by selecting **Options > Set Correlation Status Colors** in the **P&ID File Viewer**. For more information, see *Viewing P&IDs: An Overview* in the *Smart 3D Integration Reference Guide*.

8. Select the equipment object **T-162**.



The selected equipment object is highlighted pink.

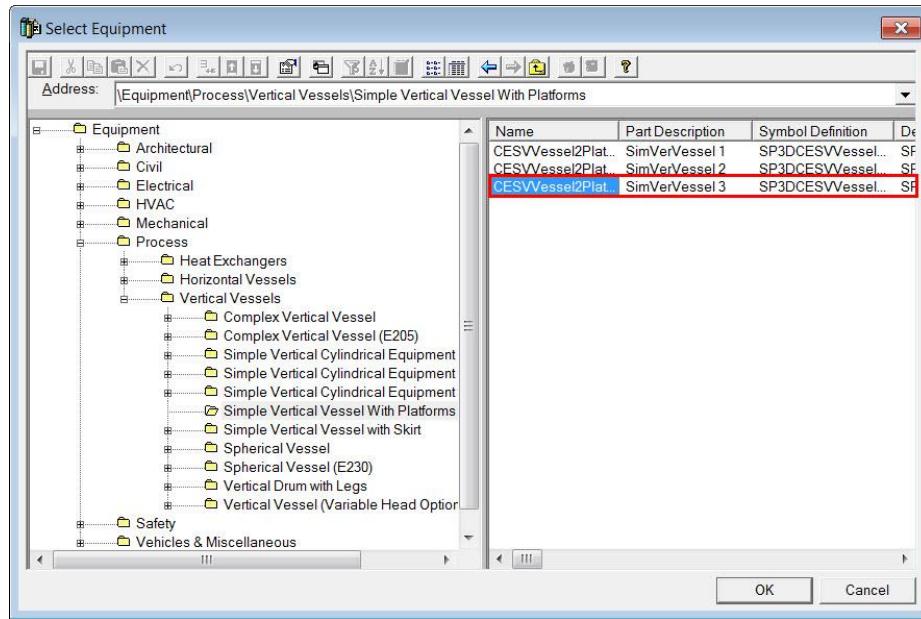
- ### 9. Click Place Equipment .

The *Select Equipment* dialog box displays.

NOTE If a design basis equipment is selected in the **P&ID File Viewer** when you click **Place Equipment** , the equipment you create is correlated to the selected design basis object. If a design basis equipment is not selected and the **P&ID File Viewer** is displayed when you click **Place Equipment** , you must select the equipment to correlate in the **P&ID File Viewer**.

Placing Equipment and Nozzles from P&ID

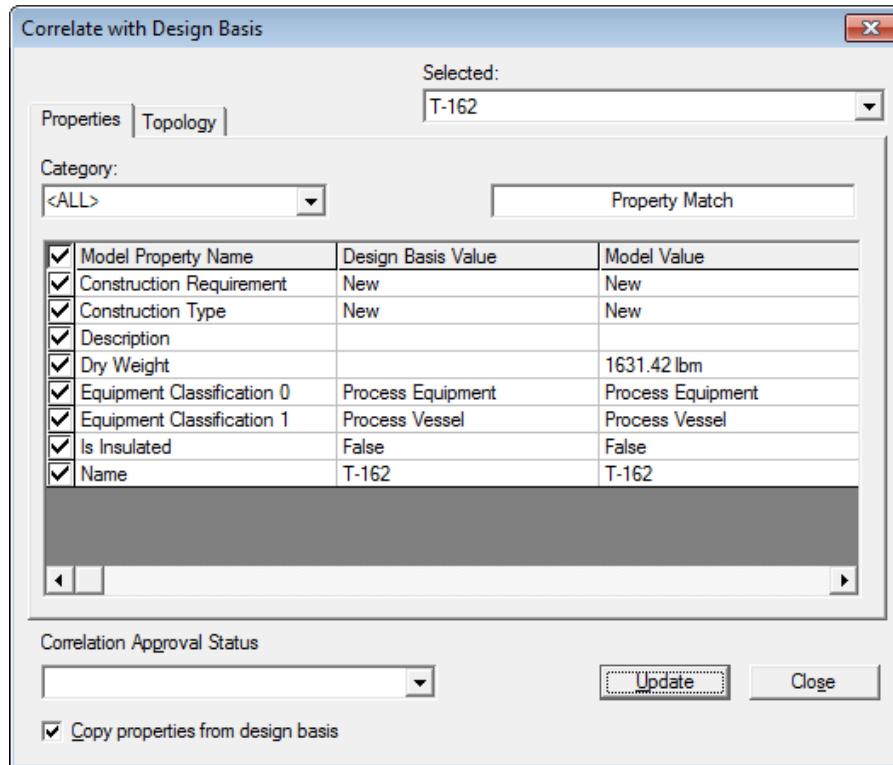
10. Select **Equipment > Process > Vertical Vessels > Simple Vertical Vessel With Platforms > CESVessel2Plat3-E** and click **OK**.



The **Correlate with Design Basis** dialog box displays.

11. Check the **Copy Properties from design basis** check box

12. Click **Update** to update the properties of the equipment T-162 to match the correlated design basis object, and then click **Close**.



NOTES

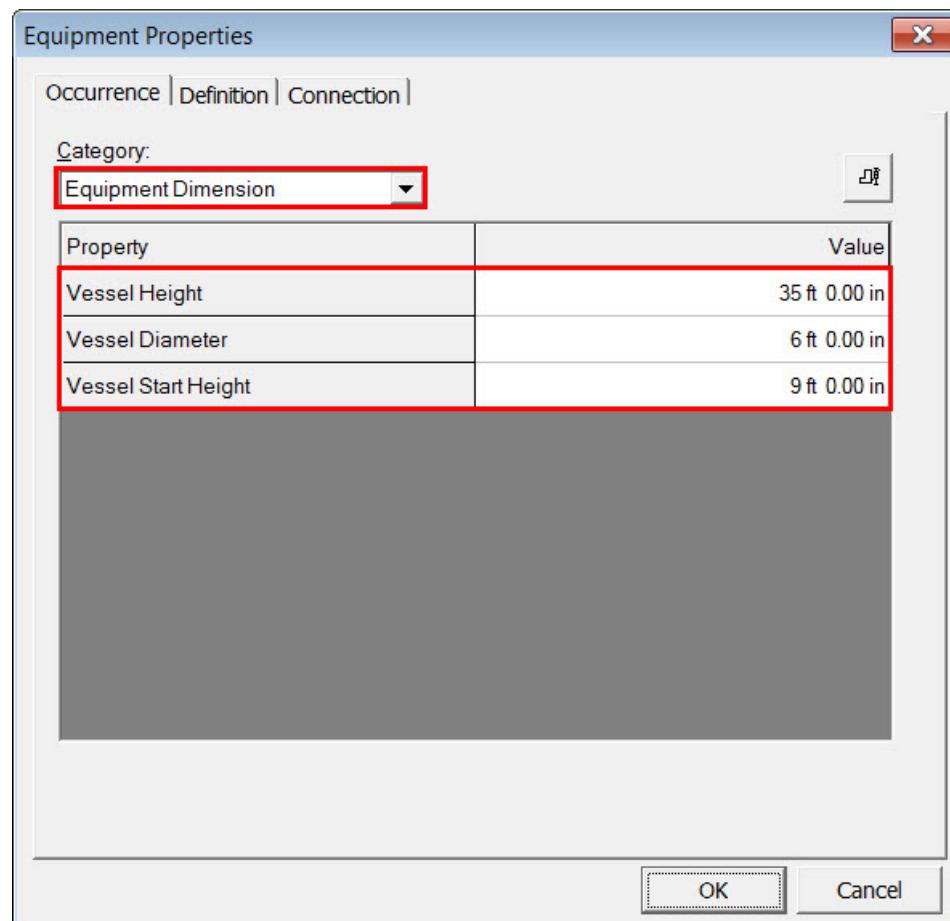
- When you select equipment from the Catalog, the properties of the equipment in the Catalog may or may not match with the properties of the SmartPlant Foundation P&ID equipment. **Compare with Design Basis** shows you the differences and allows you to update the properties of the model equipment to match the design basis equipment.
- When you update, all mapped properties are updated. You cannot update only selected properties.

The **Equipment Properties** dialog box displays.

13. Change the system to **A2 > U02 > Equipment**, and then set the **Category** to **Equipment Dimension**. Set the equipment dimensions as follows:

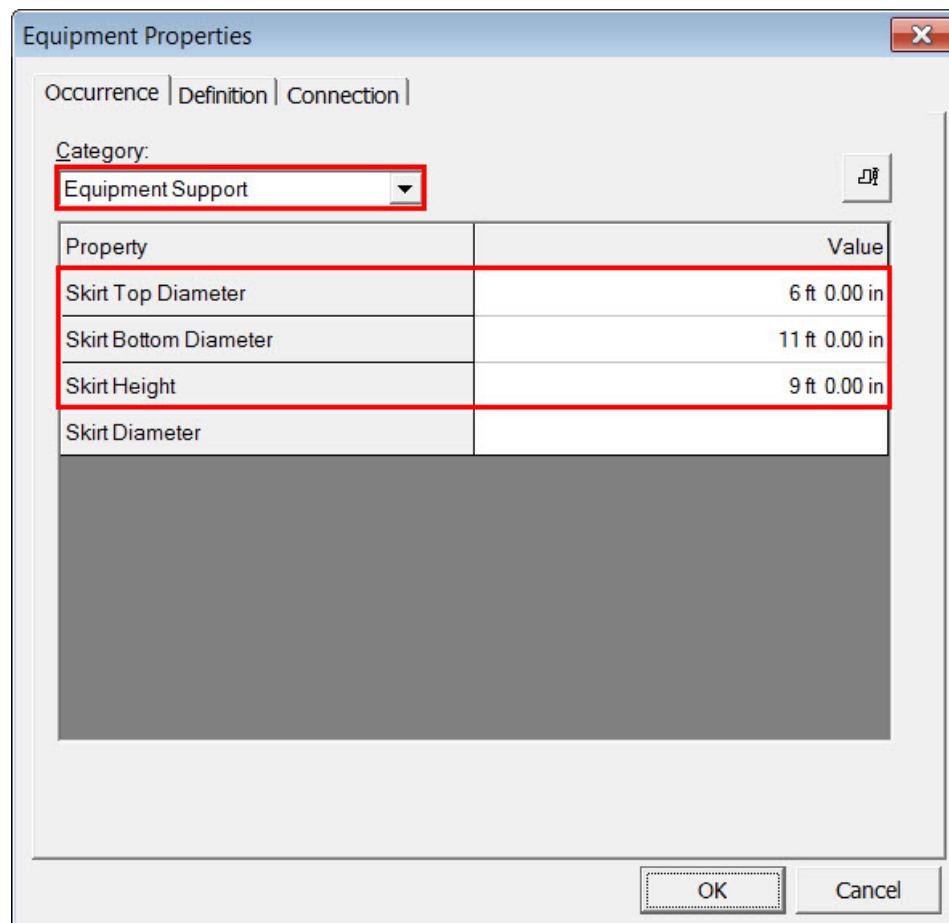
Placing Equipment and Nozzles from P&ID

Vessel Height: 35 ft 0.00 in
Vessel Diameter: 6 ft 0.00 in
Vessel Start Height: 9 ft 0.00 in



14. Change the **Category** to **Equipment Support**, and specify the following values:

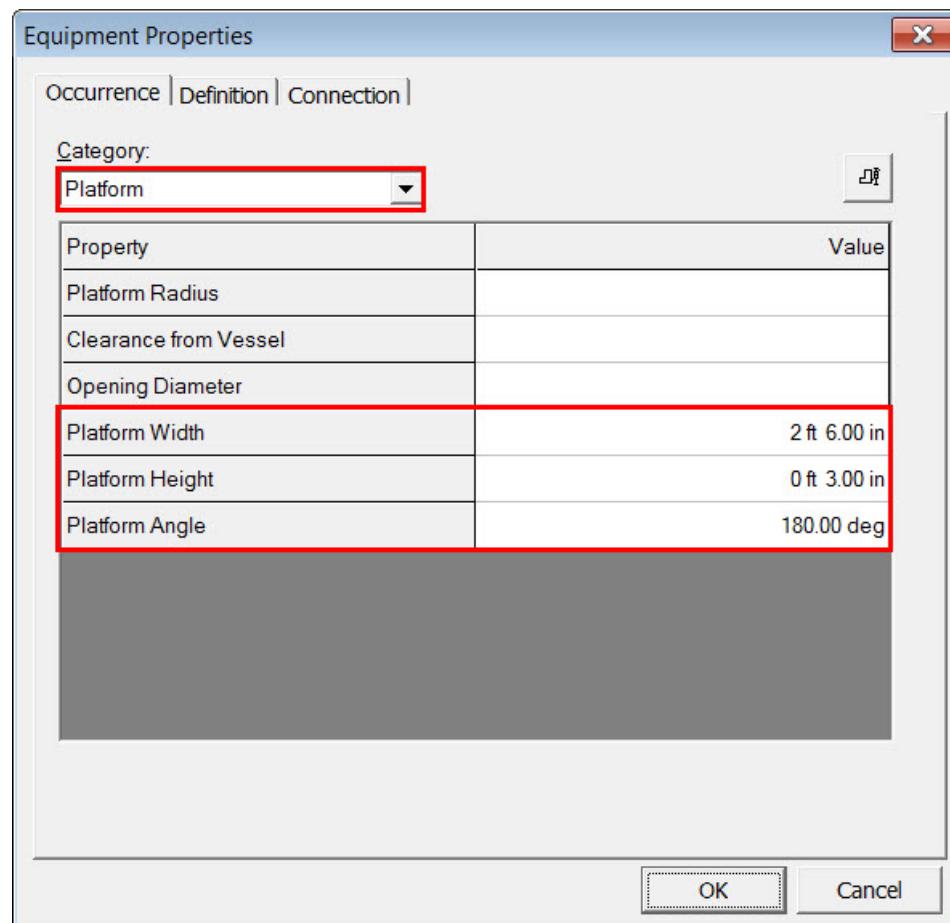
Skirt Top Diameter: 6 ft 0.00 in
Skirt Bottom Diameter: 11 ft 0.00 in
Skirt Height: 9 ft 0.00 in



15. Change the **Category** to **Platform**, and specify the following values:

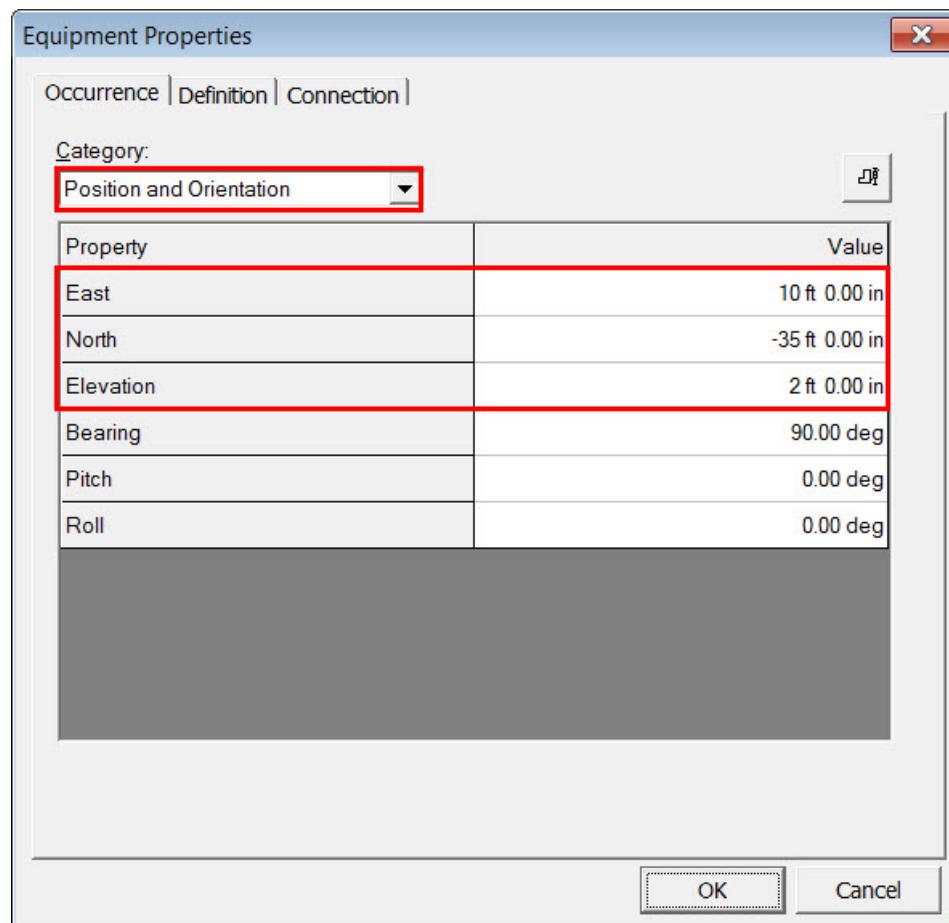
Placing Equipment and Nozzles from P&ID

Platform Width: 2 ft 6.00 in
Platform Height: 0 ft 3.00 in
Platform Angle: 180.00 deg



16. Change the **Category** to **Position and Orientation**, and specify the following values:

East: 10 ft 0.00 in
North: -35 ft 0.00 in
Elevation: 2 ft 0.00 in



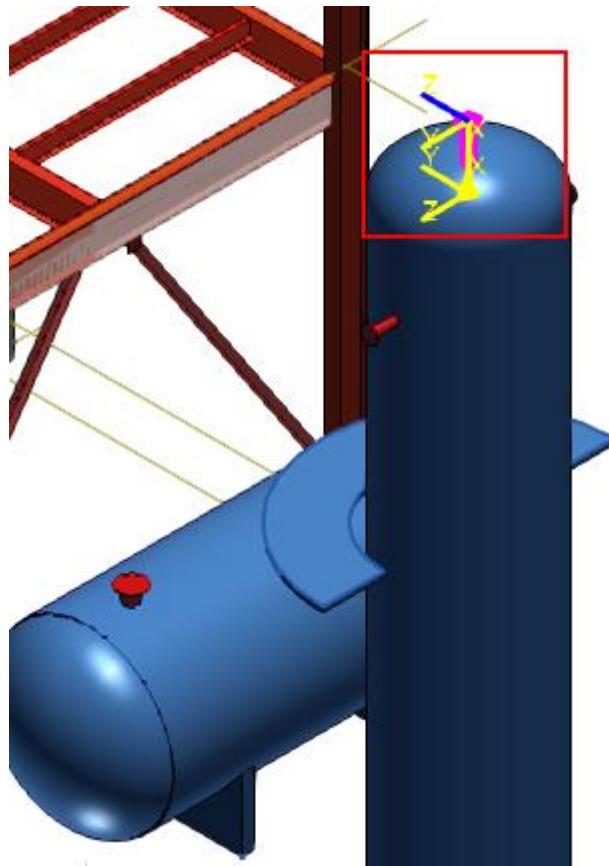
17. Click **OK**.

The equipment object T-162 is placed in the model.

Correlate Nozzle B2 and Edit the Nozzle Geometry

1. Set the filter to **Pipe Nozzle**.

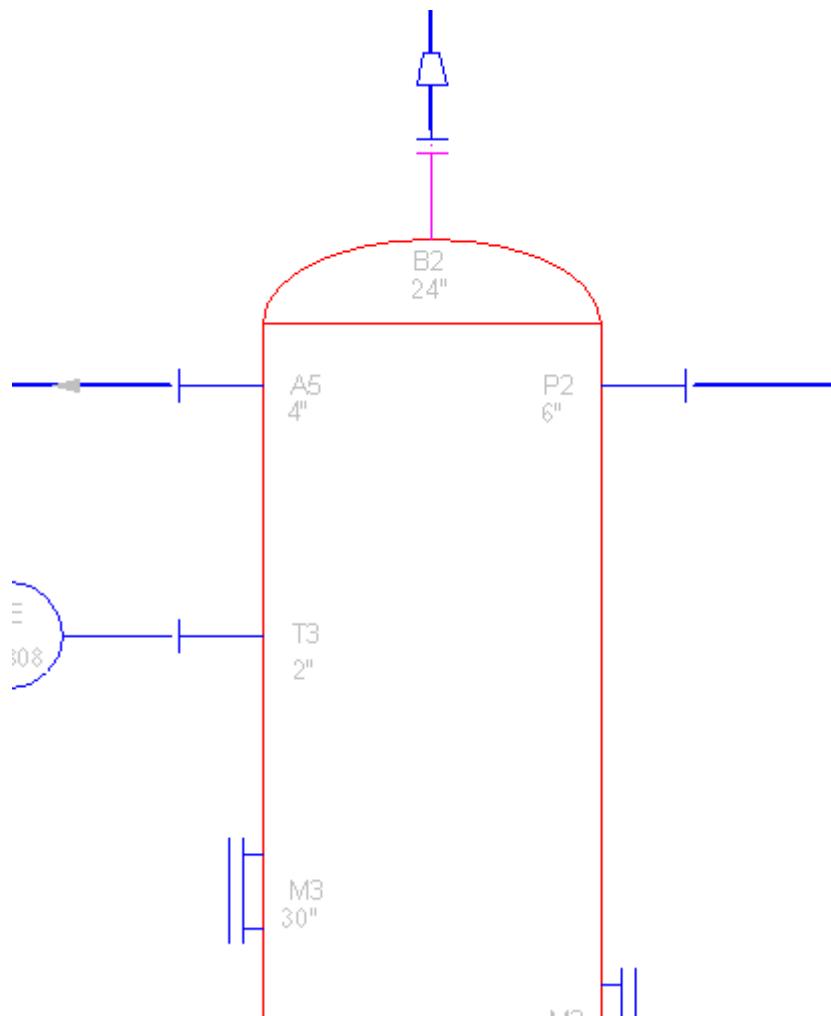
2. Select the nozzle **Vessel Noz1** at the top of the equipment in the model.



3. Select **Smart 3D Correlate with Design Basis....**

The **P&ID File Viewer** dialog box displays.

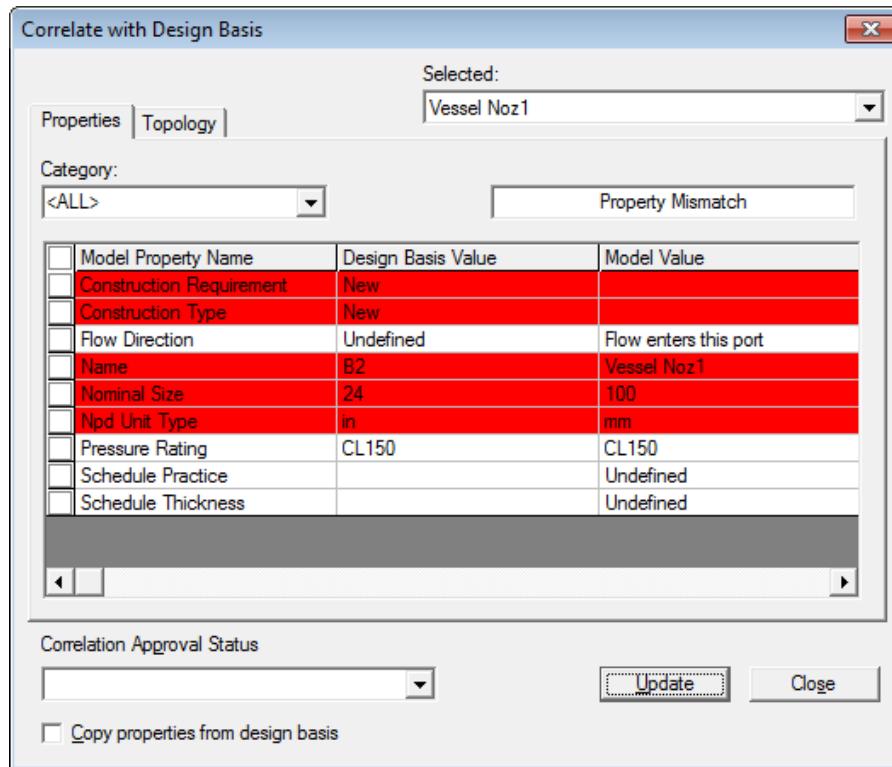
4. Select the nozzle B2.



The **Correlate with Design Basis** dialog box displays.

Placing Equipment and Nozzles from P&ID

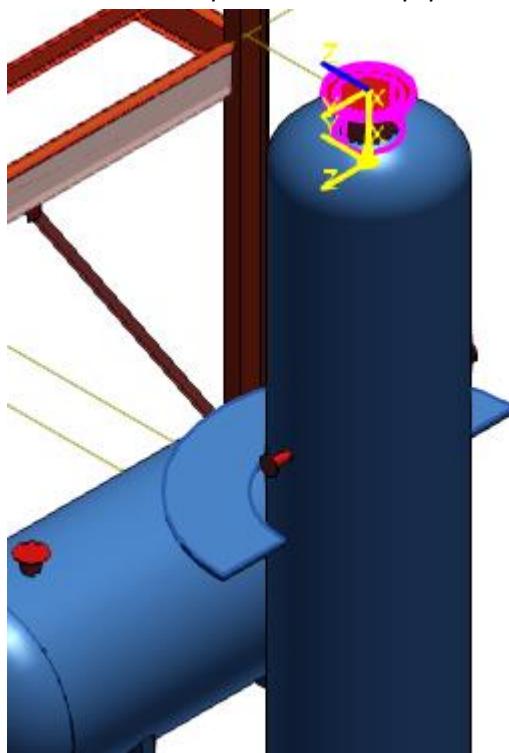
5. Click **Update**.



The properties of the nozzle **Vessel Noz1** are changed to those of nozzle **B2**.

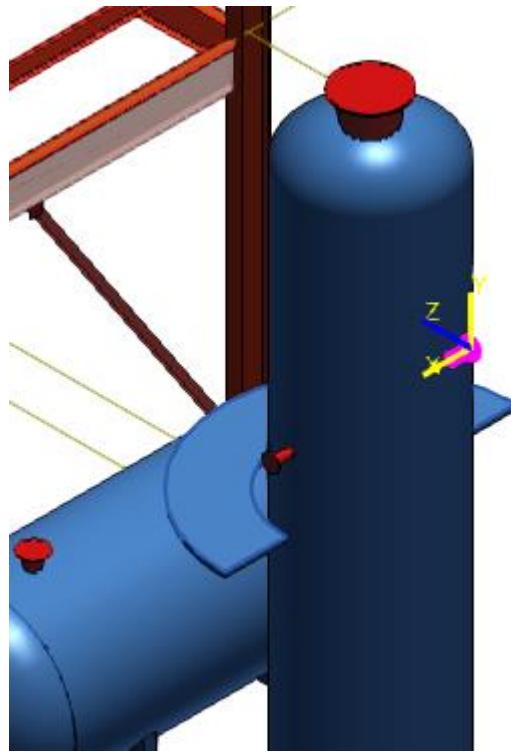
6. Click **Close**.
7. On the **Place Nozzle** ribbon, set the **Nozzle Length** to 1 ft 6.00 in.
8. Click **Apply**, and then click **OK**.

The nozzle B2 is placed on the equipment.



Correlate Nozzle P2

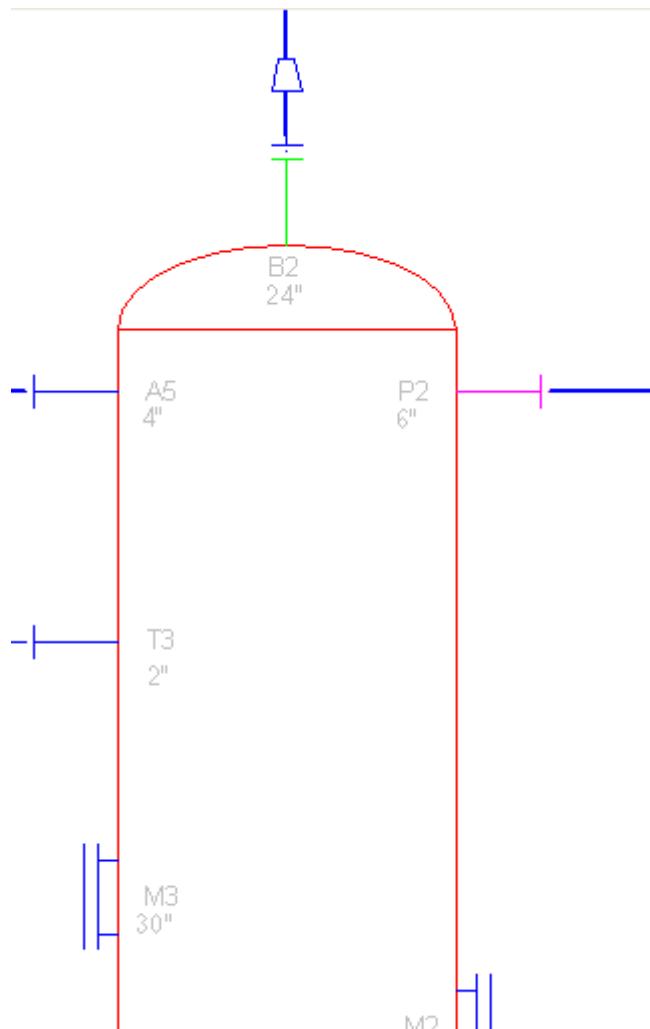
1. Select the nozzle **Vessel Noz2** on the equipment in the model.



2. Select **Smart 3D Correlate with Design Basis....**

The **P&ID File Viewer** dialog box displays.

3. Select the nozzle **P2**.



The **Compare with Design Basis** dialog box displays.

4. Click **Update**.

The properties of the nozzle **Vessel Noz2** are changed to those of nozzle **P2**.

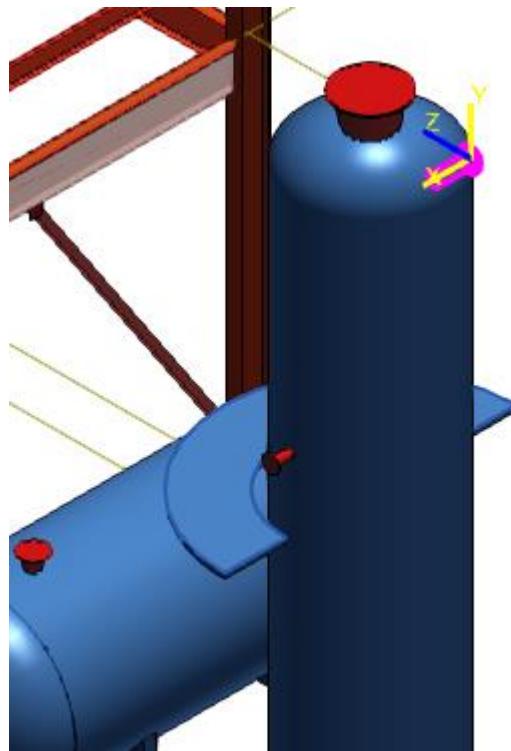
5. Click **Close**.

6. On the **Place Nozzle** ribbon, click **Properties**

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

7. Set the **Nozzle Length** to 1 ft 6.00 in, and set **Behavior Controlled by User** to **True**.
8. Under **Location**, change **N1** to 33 ft 0.00 in.
9. Click **Apply**, and then click **OK**.

The nozzle P2 is placed on the equipment.



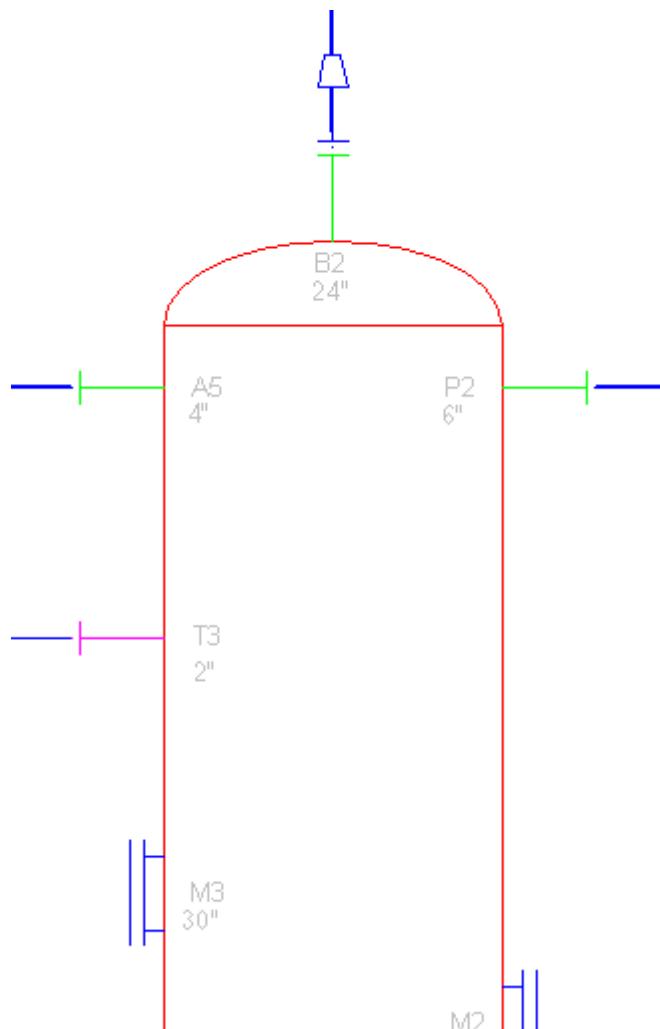
Repeat the above steps to correlate nozzle **Vessel Noz3** with **A5**.

Place Nozzle T3

1. Select **Smart 3D Correlate with Design Basis....**

*The **P&ID File Viewer** dialog box displays.*

2. Select nozzle **T3**.

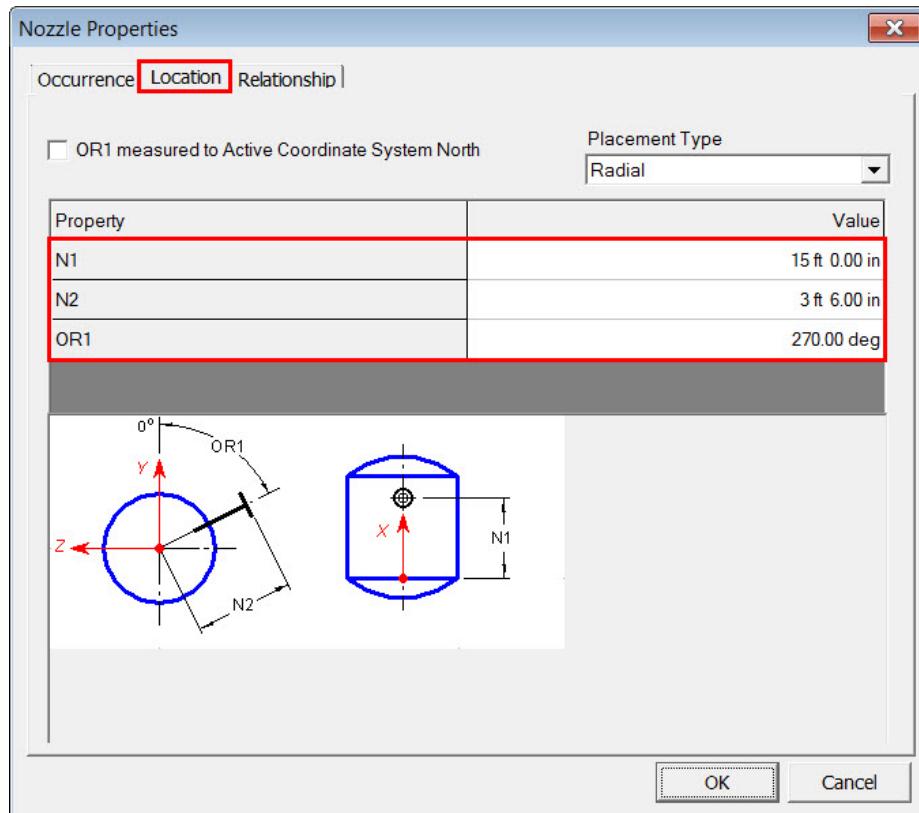


3. Click **Place Nozzle** , and select the shape **DP2** in the **Workspace Explorer**.

The **Nozzle Properties** dialog box displays.

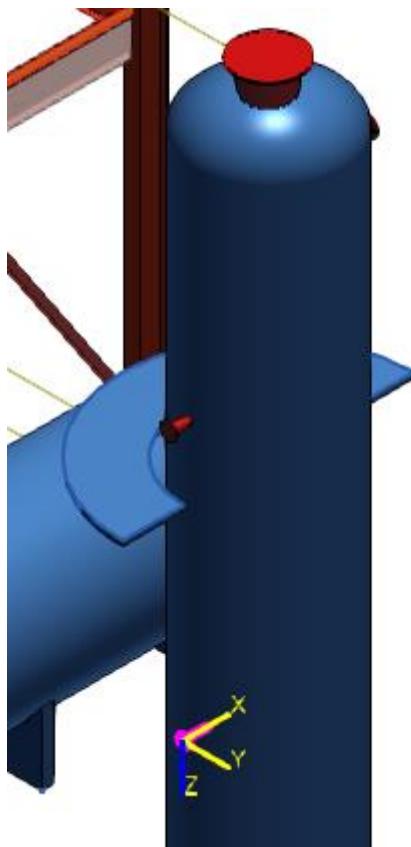
Placing Equipment and Nozzles from P&ID

4. Set **Nozzle Length** to 1 ft 0.00 in, and specify the following values under **Location**:



5. Click **OK**.

The nozzle is placed on the equipment.



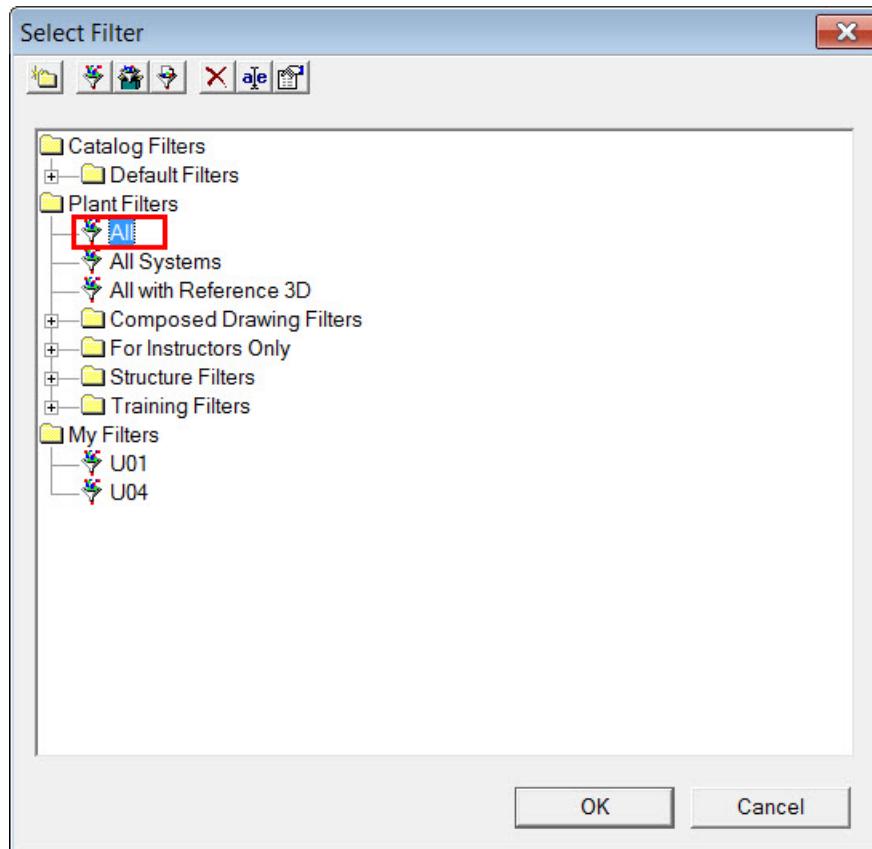
Place Equipment P-162

1. Select **File > Define Workspace**.

*The **Define Workspace** dialog box displays.*

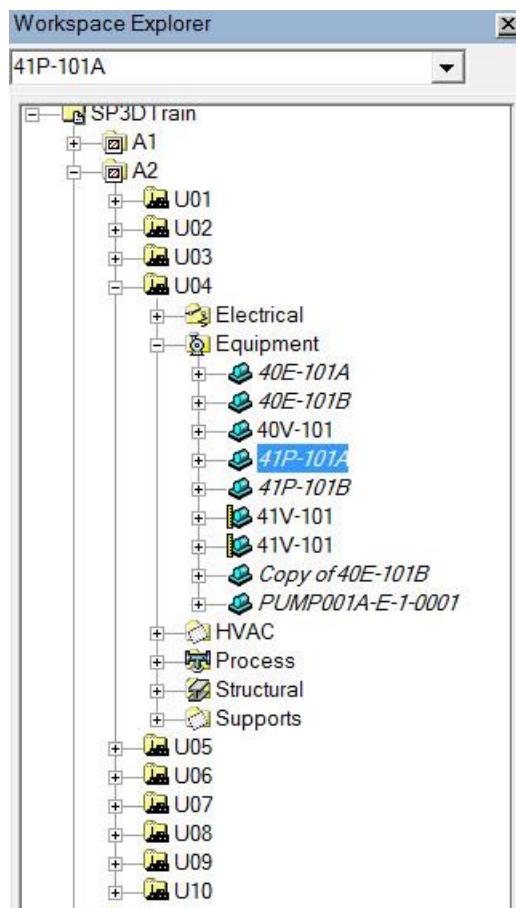
Placing Equipment and Nozzles from P&ID

2. Set the **Filter** to **Plant Filters > All** and click **OK**.



3. Click **OK** on the **Define Workspace** dialog box.
4. Set **Locate Filter** to **Equipment**.

- In the **Workspace Explorer**, select A2 > U04 > Equipment > 41P-101A.

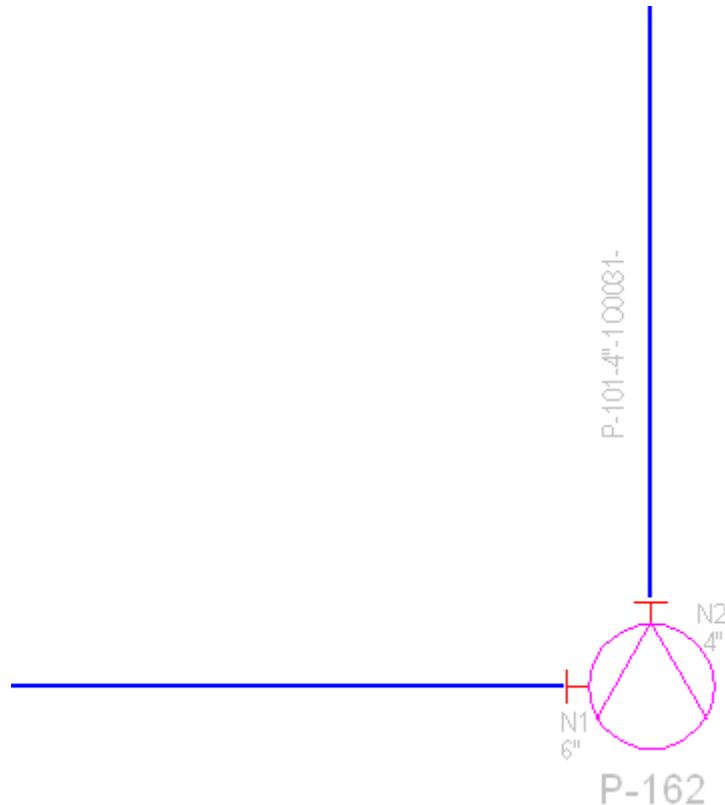


- Select **Edit > Copy**.
- Set the **From** reference point as the origin of the equipment.
- Click **Paste** .

The Paste dialog box displays.

- Select **U02 > Equipment** as the new system parent of the equipment.
- Clear **Paste in place** and click **OK**.
- Click **Move**
- Enter the following coordinates on the **PinPoint** ribbon.
East: 25 ft 0.00 in
North: -50 ft 0.00 in
Elevation: 3 ft 0.00 in
- Click in the graphic view.
The equipment is now copied to Unit U02.
- Select the copied equipment, and then select **Smart 3D > Correlate with Design Basis....**
The P&ID File Viewer dialog box displays.

15. Select pump **P-162**.



The **Correlate with Design Basis** dialog box displays.

16. Click **Update**.

The properties of the copied equipment are updated with the properties of pump **P-162** in the **P&ID File Viewer**. The new equipment is named **P-162** in the **Workspace Explorer**.

17. Set the **Locate Filter** to **Pipe Nozzle**.

18. Select **Smart 3D > Correlate with Design Basis....**

The **P&ID File Viewer** dialog box displays.

19. Select suction nozzle **N1**.

20. Select **Smart 3D Compare Design Basis**.

The **Compare with Design Basis** dialog box displays.

21. Click **Update** to update the properties of **N1**.

22. Repeat the above steps with the suction nozzle **N2**.

For more information, see *Correlate Existing Equipment for Use in an Integrated Environment* in the *Smart 3D Equipment User's Guide*.

SECTION 9

Manipulating Equipment

Objective

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

- Modify equipment and nozzle properties.
- Copy, move, mirror and rotate equipment.
- Delete nozzle(s) and equipment.

Before Starting this Procedure

- Smart 3D Overview
- Smart 3D Common Sessions
- *Placing Designed Equipment and Components* (on page 47)
- *Placing Nozzles and Other Ports* (on page 95)

Overview

Smart 3D provides generic commands, such as **Copy** , **Paste** , **Move** , and **Rotate** , for manipulation of design objects. These commands allow you to manipulate of design objects from multiple disciplines. When one or more objects are selected in the task where they were created, specialized functions for manipulating the design objects are provided on the **Edit** ribbon.

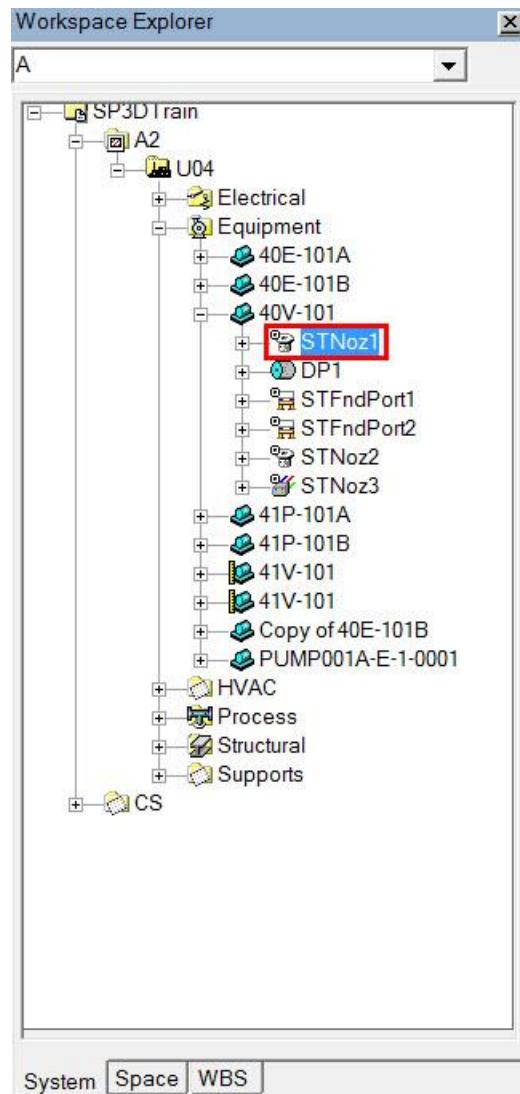
You must select a design object before you can perform any manipulations.

Modify Equipment and Nozzle Properties

1. Define your workspace to show **Unit U04** and coordinate system **U04 CS**.

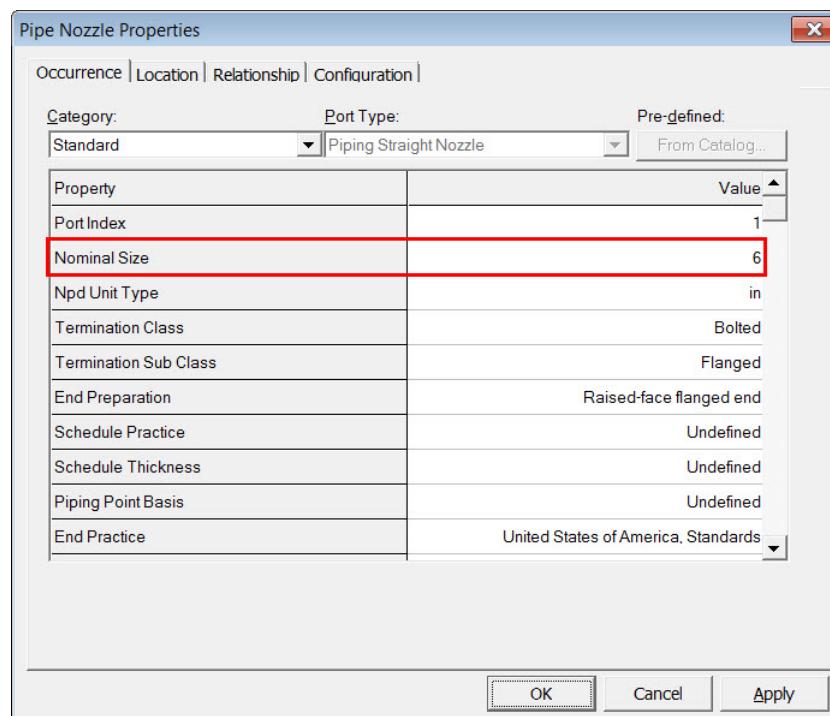
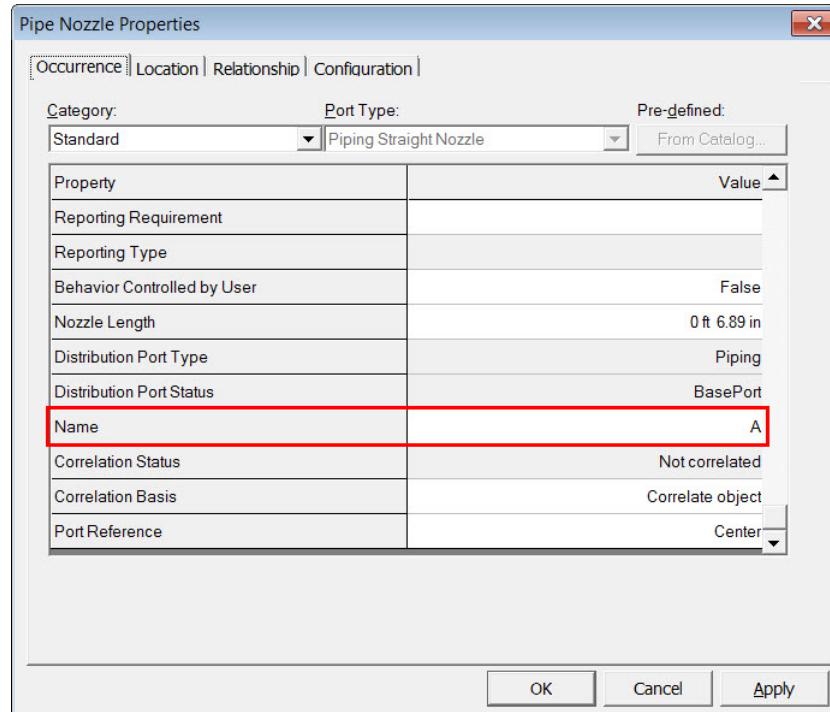
Manipulating Equipment

2. In the **Workspace Explorer**, right-click **40V-101 > STNoz1** and select **Properties**.



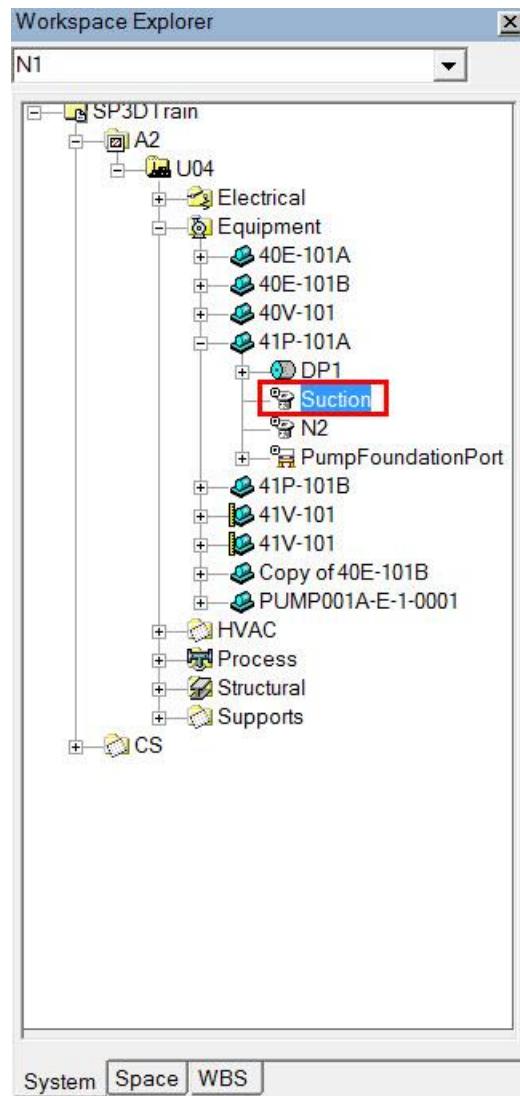
The **Pipe Nozzle Properties** dialog box displays.

3. Set **Name** to **A** and **Nominal Size** to **6**, and then click **Apply**.



Manipulating Equipment

4. In the **Workspace Explorer**, right-click **41P-101A > Suction** and select **Properties**.

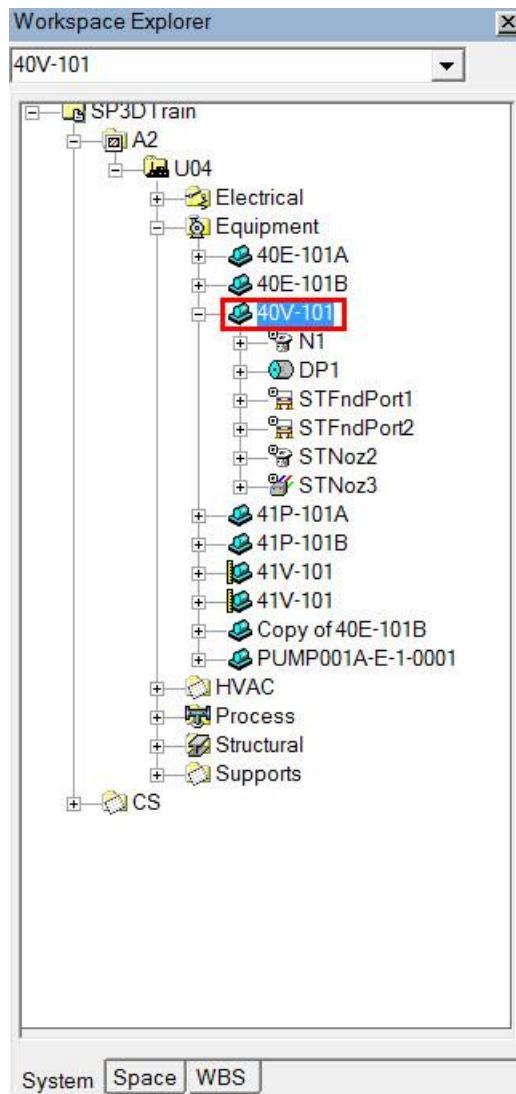


5. Set the **Name** to **N1** and the **Nominal Size** to **8**, and click **OK**.

The properties for the suction nozzle are updated.

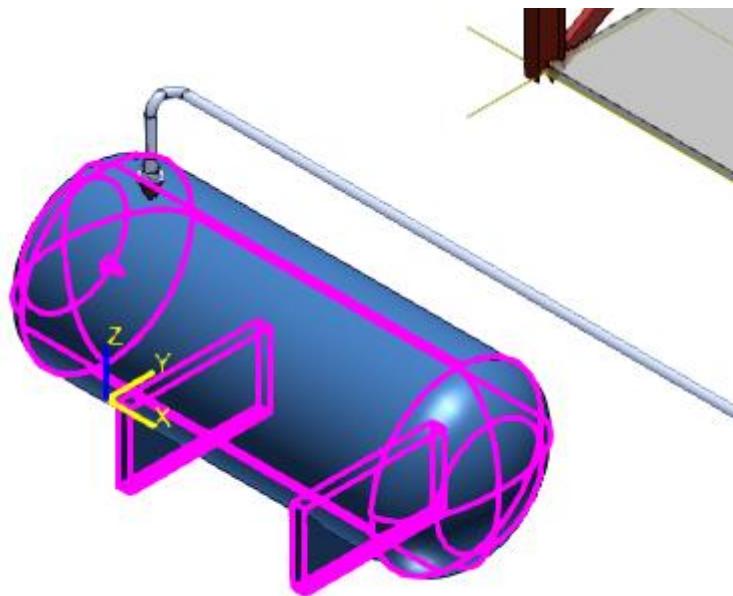
Move Equipment and Nozzles

1. Define your workspace to include **Unit U04** and coordinate system **U04 CS**.
2. Set the active coordinate system to **Global**.
3. Click **Set Target to Origin**  to move the target position for the equipment to the origin of the global coordinate system.
4. In the **Workspace Explorer**, select **A2 > U04 > Equipment > 40V-101**.



Manipulating Equipment

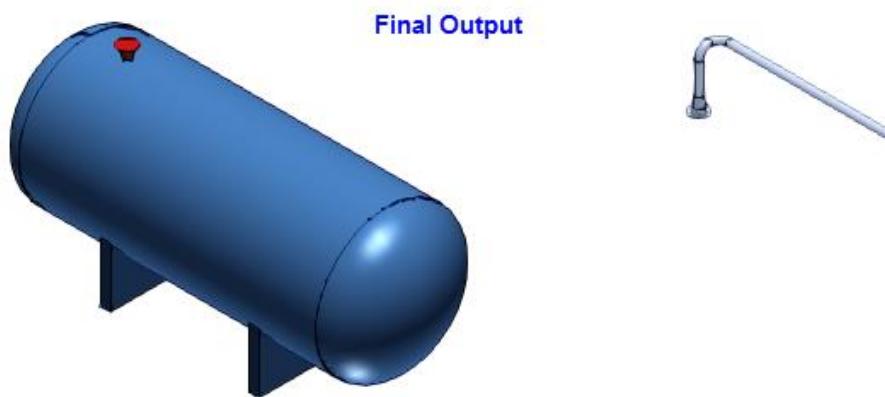
The equipment is highlighted in the model.



5. Click **Move**

Move automatically defaults the **From** point to the origin of the equipment.

6. On the PinPoint ribbon, specify the coordinates of the new origin location:
East: 85 ft 1.85 in
North: 117 ft 0.84 in
Elevation: 2 ft 4.76 in
7. Click in the graphic view to place the equipment at the new location.

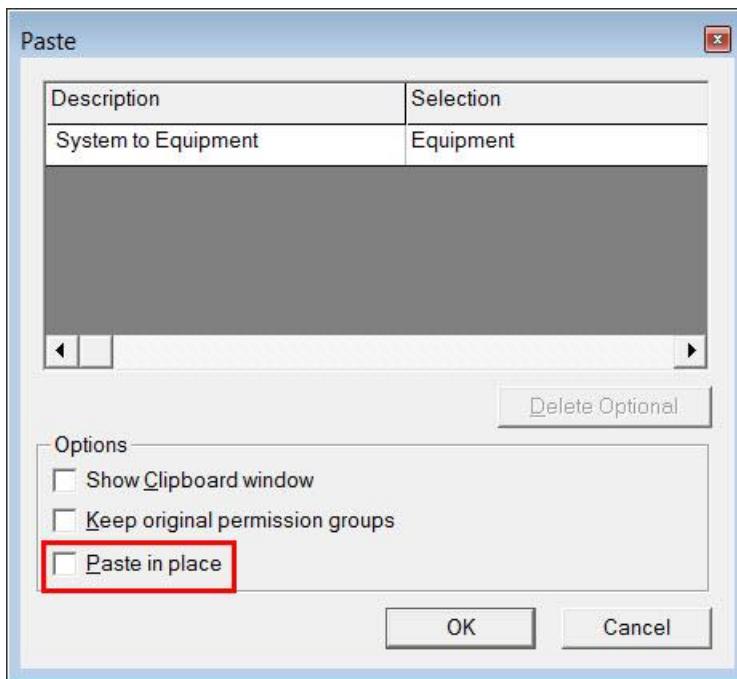


8. Click **Undo** .

The equipment moves back to its original location.

Copy and Paste Equipment and Nozzles

1. Set the active coordinate system to **U04 CS**.
2. Click **Set Target to Origin**  to move the target position for the equipment to the origin of the global coordinate system.
3. Select the pump 41P-101A in the model or in the **Workspace Explorer**.
4. Click **Copy** .
5. Select the control point at the bottom left corner of the pump to set the reference point.
6. Click **Paste** .
7. The Paste dialog box displays.
8. Clear **Paste in place** and click **OK**.



9. On the **PinPoint** ribbon, specify the following coordinates, and then click in the graphic view to paste the equipment in the model:

East: 30 ft 0.00 in

North: 11 ft 0.00 in

Elevation: 2 ft 0.00 in

The copied equipment is pasted in the model.

10. On the **Equipment Edit** ribbon, set the name to **41P-101B**.

Manipulating Equipment

For more information, see *Copy/Paste*, *Delete*, and *Edit* in the *Smart 3D Equipment User's Guide*.