

SmartPlant 3D

Tutorials for Equipment

Process, Power & Marine



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Session 1: Equipment: An Overview

Objective:

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

- Describe the functions available in SP3D for equipment modeling.

Prerequisite Session:

- SP3D Overview

Overview:

The equipment model in SP3D provides:

- Equipment properties for identification and engineering design and management purposes
- Precision port definition
- Other geometry in sufficient detail for interference detection and visual recognition

The position and properties of the ports on the equipment (nozzles, cable connections, duct, etc) are defined with precision to support the detail design of the connected routed systems. The equipment model does not contain all the details needed for fabrication of the equipment. The parameters of the equipment can be used along with standards as specifications for the detailed design though.

You can place two types of equipment, **Catalog Equipment** (sometimes just called equipment) and **Designed Equipment**. Both may be composed of equipment components, ports, and geometric shapes. The Catalog Equipment references a programmatic definition in the Catalog. The user defines the content of the designed equipment interactively.

Equipment from the Catalog is typically driven by properties. The properties can either be fixed to specific values in the Catalog (called **Definition Properties**) or may be changed after placement (called **Occurrence Properties**). In either case, a program (the **Catalog Part Definition**) controls how the equipment changes when the properties are modified.

Designed equipment is given a type when it is created to determine the property set. It is then modeled by placing standard equipment components from the Catalog, shapes, and ports. Equipment components are similar to equipment in that they are defined in the Catalog, but are required to be a direct system child of a piece of equipment or designed equipment. Shapes are simply parametric geometry with no other properties. The geometry of a shape can also be imported from SAT files or MicroStation files. For organizational purposes in complex equipment models, you can define Designed Equipment Component that consists of shapes and ports.

For example, the tank in the Figure 1 is a designed equipment that consists of a shape and a Catalog Equipment component. The equipment component consists of a basic shape whose graphics are associated with the equipment component, datum points, and ports (pipe nozzles).

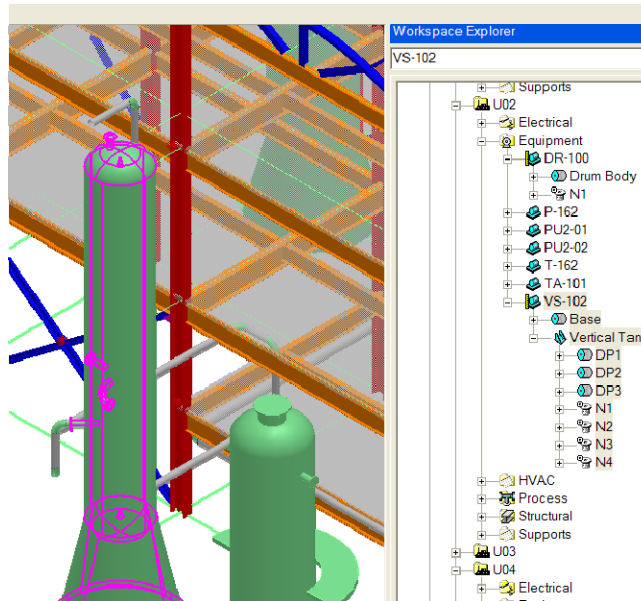


Figure 1: Designed Equipment in a Model

The key commands on the **Equipment and Furnishings** task vertical toolbar are:

- Place Equipment
- Place Designed Equipment
- Place Equipment Component
- Place Designed Equipment Component
- Place Shape
- Place Port
- Place Shape from File
- Place Designed Solid



Figure 2: Vertical Toolbar

To switch to the **Equipment and Furnishings** task, select the **Equipment and Furnishings**

command on the **Tasks** menu.

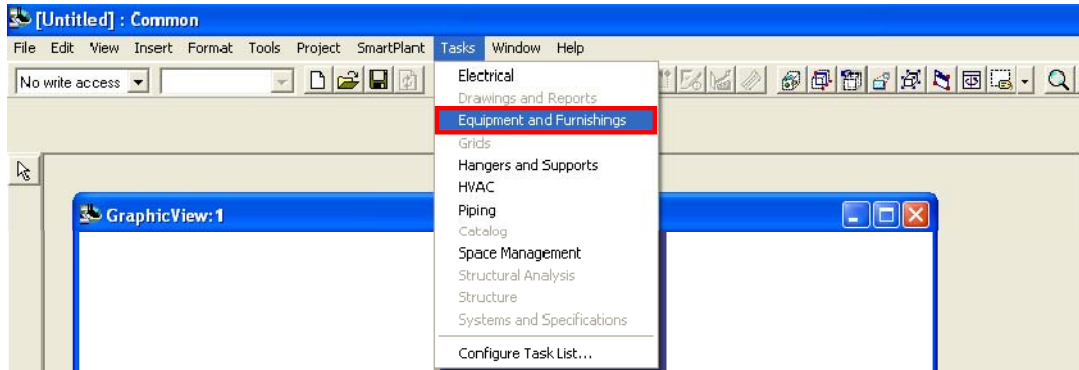


Figure 3: Tasks > Equipment and Furnishings Command

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

- **Place equipment from the Catalog:** You can interactively place equipment from the SP3D 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 selecting the **Place Equipment** command on the vertical toolbar. With a piece of equipment selected, click the **Preview** button in the **Select Equipment** dialog box to see a picture of the equipment geometry.

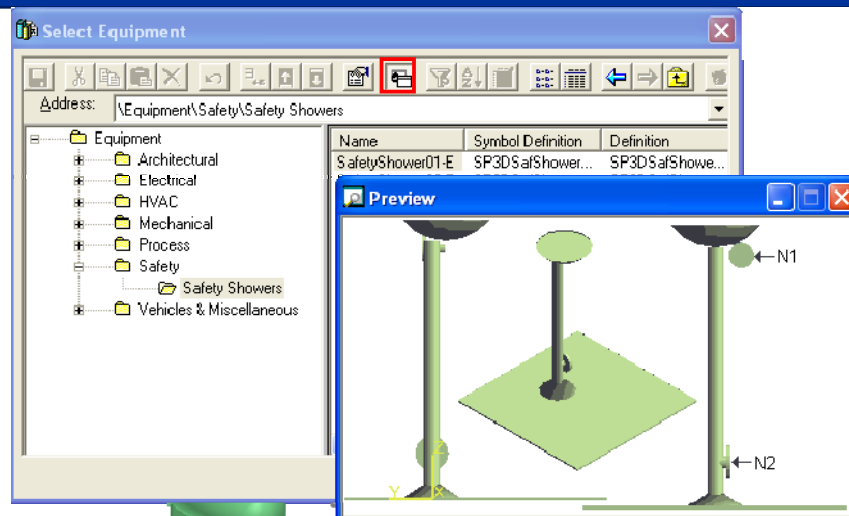


Figure 4: Preview Button on the Select Equipment Dialog Box

You can pick a piece of equipment from the **Select Equipment** dialog box and click the **Properties** button to view the properties of the selected equipment in the **Part Properties** dialog box. If the equipment has ports, you will see the **Connections** tab in the **Part Properties** dialog box. You then can view the properties of each port by selecting the port from a drop-down list.

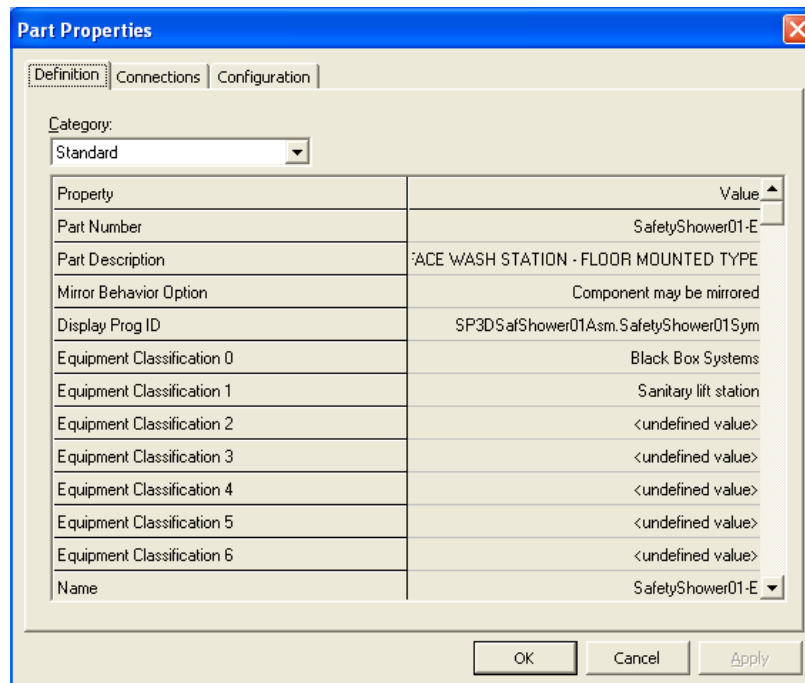


Figure 5: Part Properties Dialog Box

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

Designed Equipment

Any Catalog equipment type can be selected as **Type** for the designed equipment. You can see

the available types by selecting the **Place Designed Equipment** command. The properties of the designed equipment will be the same as the selected Catalog equipment. Again, you must supply the geometry by using the **Place Equipment Component**, **Place Shape**, and **Place Port** commands.

Equipment Components

You can browse the available Catalog equipment by selecting the **Place Equipment Component** command on the vertical toolbar. With an equipment component selected, click the **Preview** button 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 pictures.

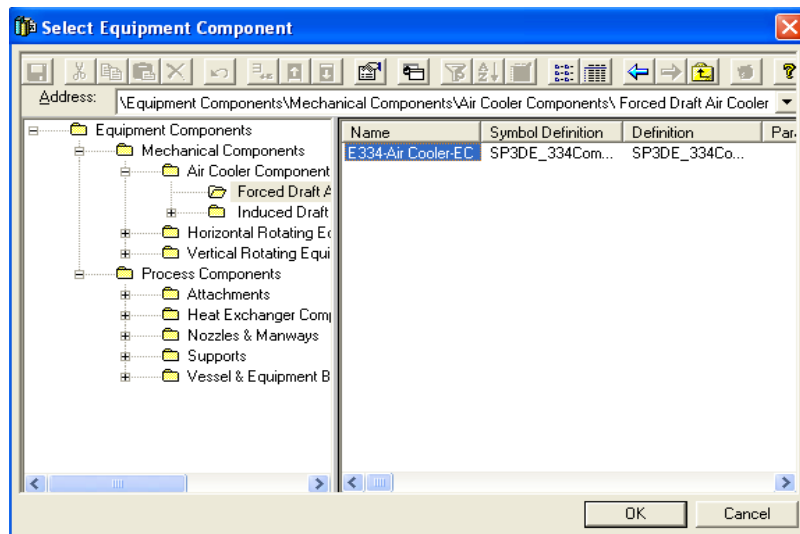


Figure 6: Select Equipment Component Dialog Box

Shapes

You can browse the available Catalog shapes by selecting the **Place Shape** command and picking the **More** option in the **Shapes** palette. With a shape selected, pick the **Preview** button on the **Select Shape** dialog box to see a picture of the shape geometry.

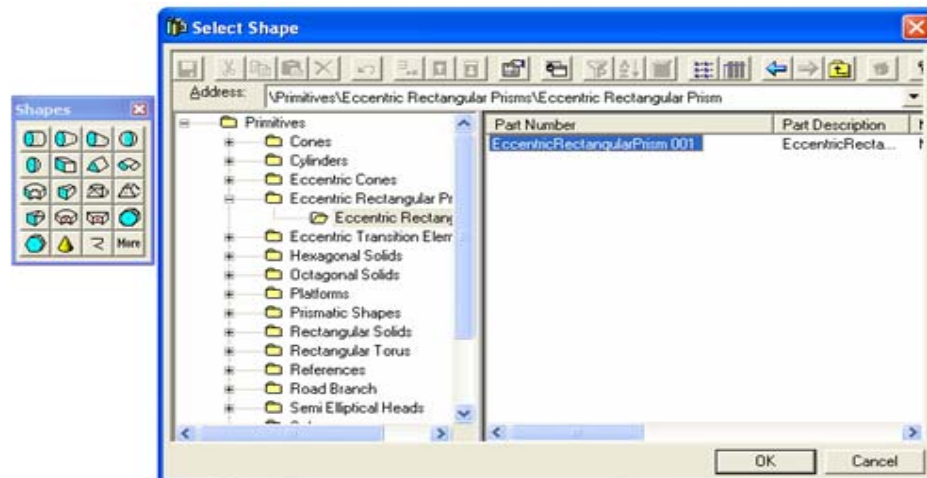


Figure 7: Shapes Palette and Select Shape Dialog Box

Aspects of Equipment

The geometry that is defined with equipment includes not only the physical geometry, but also the geometry representing spatial requirements, such as the space needed around the object to operate or maintain it. These additional geometric aspects of the equipment can exist as part of the equipment definition within the Catalog or can be added to the equipment after placement.

The standard equipment aspects you can define are:

- **Simple physical aspect:** This aspect includes equipment objects. This aspect represents the physical shape of the equipment during normal operation. It is also meant to represent 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 volume around a piece of equipment indicating space occupied if insulation is present.
- **Operation aspect:** This aspect includes the area or space around an object required for operation of the object. For example, space is needed for thermal expansion during an operation.
- **Maintenance aspect:** This aspect includes the area or space around an object required to perform maintenance on the object.
- **Reference aspect:** This aspect represents 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 provide the information needed to make the connection and generate the required detail connection parts. When you place a port on a piece of equipment, you specify details about the location, orientation, and properties of the port. The available ports are:

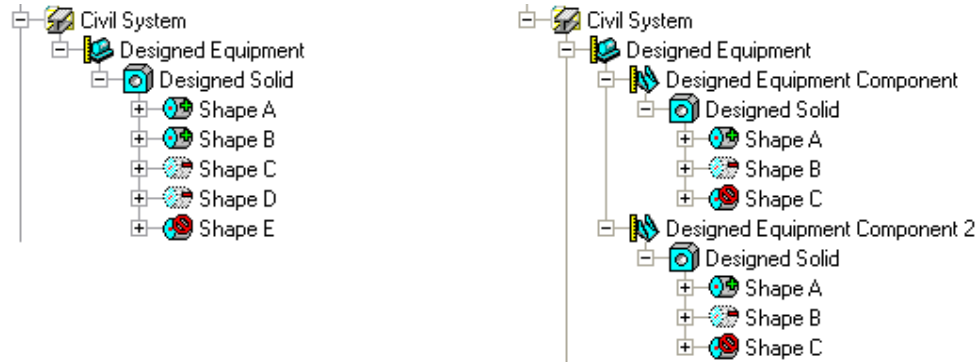
- **Pipe ports:** Used to connect piping and instruments to equipment. Also referred to as nozzle. Piping ports drive selection of appropriate piping components, such as the flange, based on port properties.
- **HVAC ports:** Used to connect ducting to equipment.
- **Conduit ports:** Used to connect conduits to equipment.
- **Cable tray ports:** Used to connect cable tray to equipment.
- **Foundation ports:** Used to define connection between foundation and equipment. Foundation ports drive selection of foundation type.

Solid Modeling

Solids are basically a container for a collection of Shapes. Solids have Surface Area and Volume properties, which will allow users to compute Weight and Center of Gravity (CG). However, in order to compute the Weight and CG, a material must be defined on the Occurrence tab of the Solid. Material density is required to compute the weight of the Solid. The density value for a

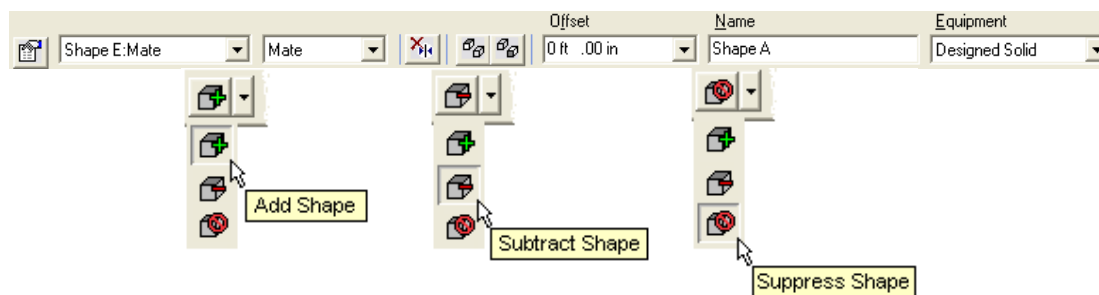
material can be extracted from the catalog when the user supplies a Material Type and a Material Grade. (Note: Material properties only apply to *Designed Solids* placed in the “Simple physical” or “Detailed physical” aspects.)

To place a Solid, a Designed Equipment or a Designed Equipment Component must first be placed in the model. Then, the Solid can be placed as a child of the Designed Equipment or the Designed Equipment Component. At this point, Shapes can be added 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).

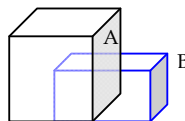


A Shape **must** be a child of a Solid in order to compute Weight and CG. The Weight and CG properties will be summed up for all Shapes underneath a Solid for a total Weight and CG of the Solid itself. For example, *Shape A + Shape B + Shape C + Shape D + Shape E = Total Surface Area, Volume, Weight and CG of the Designed Solid*. If there is more than one Solid underneath a Designed Equipment parent, these Solids can also be summed up to give a Total Weight and CG for the Designed Equipment. For example, *Solid A + Solid B + ... + Solid X = Total Weight and CG of the Designed Equipment*.

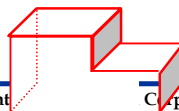
The icon shown on the Shape in Workspace Explorer will represent an Add, Subtract or Suppress operation. By default, the operation performed on a Shape at placement time is Add. During placement time or after placement, the user can change the operation to Subtract Shape or Suppress Shape using the horizontal ribbon bar.



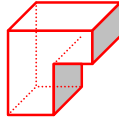
You can think of the *Add Shape* and *Subtract Shape* operations as Boolean operations. For example, see *A* and *B* below:



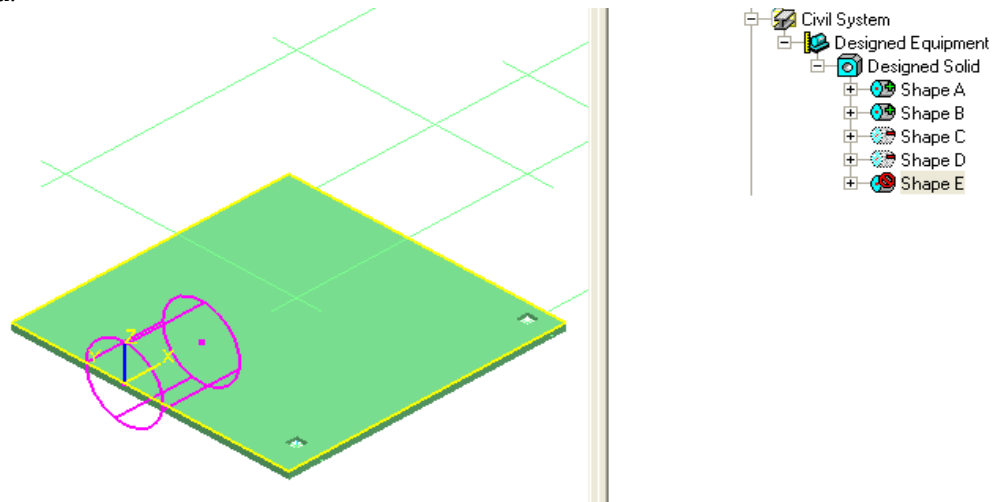
If we were to Add Shape *B* to Shape *A*, the result would be merging the two shapes into one as shown below:



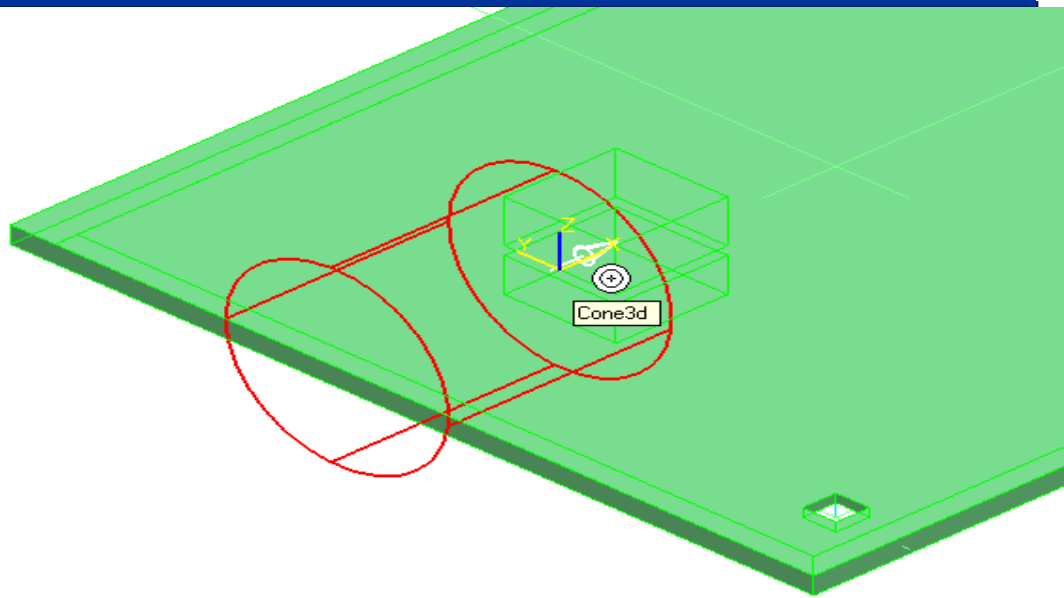
Similarly, if we were to Subtract Shape *B* from Shape *A*, the result would be removing the cross-section of Shape *B* from Shape *A* as shown below:




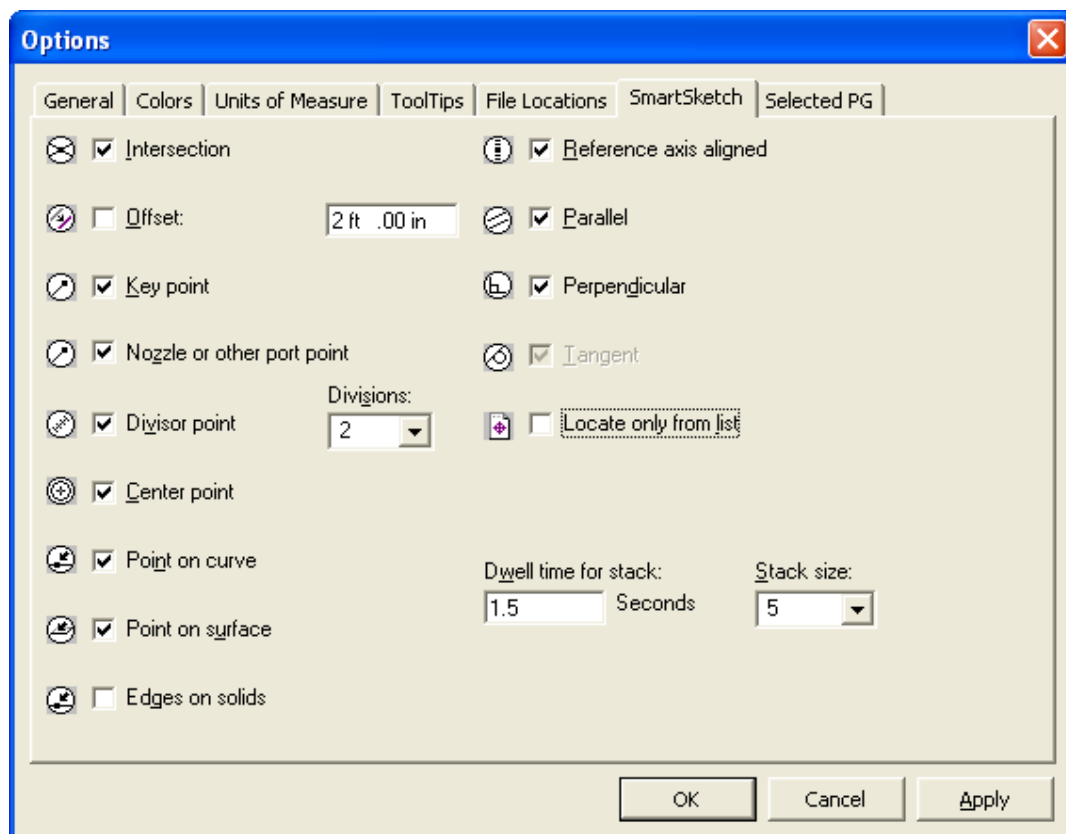
The *Suppress Shape* operation is unique from the *Add Shape* and *Subtract Shape* operations. This operation is used for creating construction geometries for reference when placing other Shapes. The Shape itself is not included in the Solid. Therefore, it will not affect Weight and CG calculations. In the screenshot below, the cylinder is suppressed, and it can only be seen when it is selected.



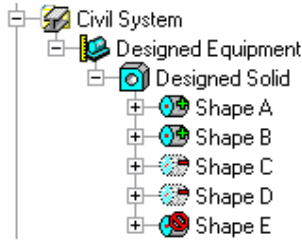
In the next screenshot, the center point of the cylinder is used as a reference for placing the cube.



The  glyph that you see is the SmartSketch Center point glyph. There are many more glyphs like this one that are very useful when positioning Shapes. These glyphs can be turned on and off through Smart Sketch tab on the Tools -> Options dialog.



Therefore, a Shape that is a child of a Solid is unique. *Add Shape*, *Subtract Shape* and *Suppress Shape* operations can be performed on them, and they are used to calculate Surface Area, Volume, Weight and CG of a Solid. In the image shown below $\text{Shape A} + \text{Shape B} - \text{Shape C} - \text{Shape D} = \text{Total Surface Area, Volume, Weight and CG of Designed Solid}$.



For more information related to equipment and furnishings, refer to the *Equipment and Furnishings: An Overview* topic in the user guide *EquipmentUsersGuide.pdf*.

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?

Session 2: Placing Catalog Equipment

Objectives:

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 the **Rotate Object** command.

Prerequisite Sessions:

- SP3D Overview
- SP3D Common Sessions
- Equipment: An Overview

Before going through this and the subsequent SP3D Equipment sessions, define your workspace to include all objects in the SP3Dtrain model database:

1. Start **SP3D** software by using the command **Start > Programs > Intergraph SmartPlant 3D > SmartPlant 3D**.
2. In the **New** dialog box, select the **EnglishUnits** or **MetricUnits** template and then, click **OK**.
3. Click the **File** menu and select the **Define Workspace** command.
4. In the **Filter** drop-down list of the **Define Workspace** dialog box, select the **More...** option.
5. In the **Select Filter** dialog box, select **All** under **Plant Filters** and click **OK**.
6. In the **Define Workspace** dialog box, click **OK**.
7. Select the **View > Fit** command.

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

8. Select the **Tools > Select by Filter** command to open the **Select Filter** dialog box.
9. Select and expand the **For Instructors Only** folder.
10. Select the **Equipment Tutorial Session – Select and Delete** filter and click **OK**.
11. Click the **Edit > Delete** command to delete the selected objects.

Steps for Placing Equipment from the Catalog:

Place a vertical vessel **T-101** from the SP3D catalog in Unit **U03** of **Area A2**. The result should look like the highlighted vessel in Figure 1.

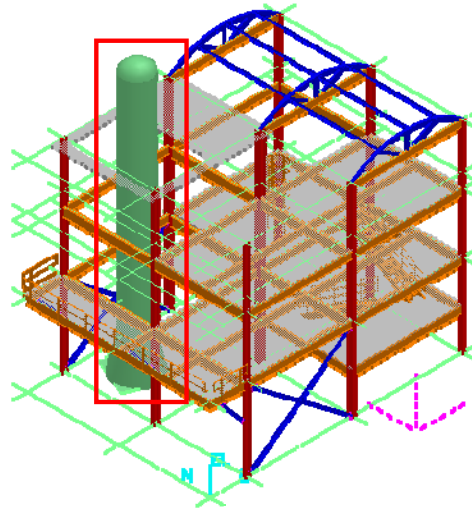


Figure 1: Output of Placing Equipment from the Catalog

1. Define your workspace to display Unit **U03** and coordinate system **U03 CS**.

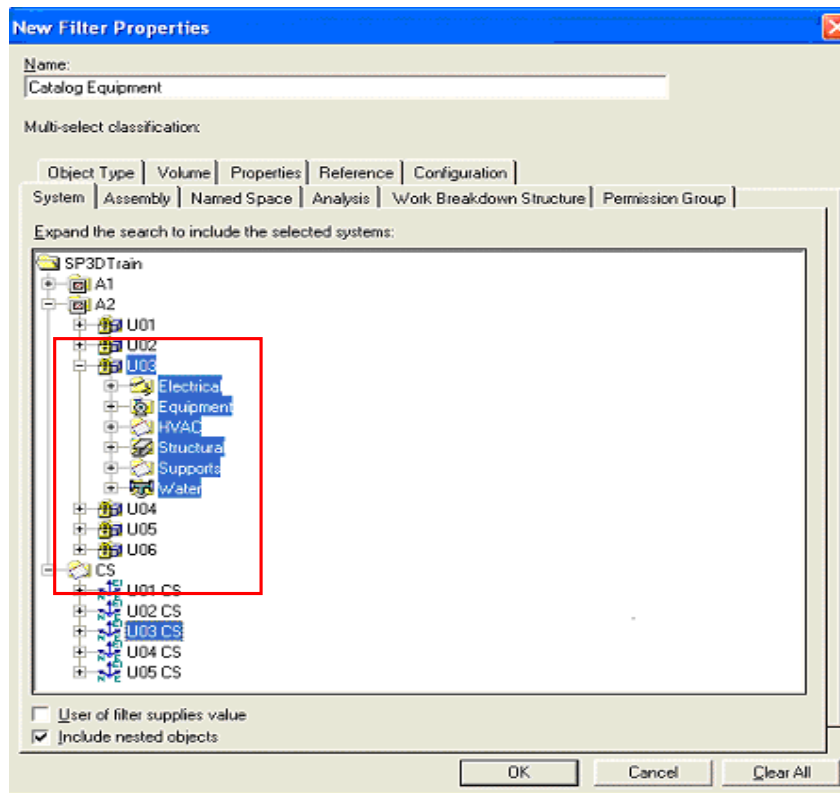


Figure 2: New Filter Properties Dialog Box

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

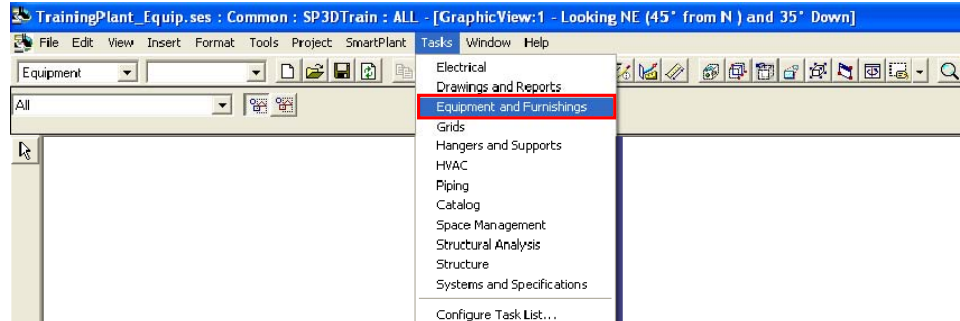


Figure 3: Tasks > Equipment and Furnishings Command

3. In the **Active Permission Group** drop-down list, select the **Equipment** option.

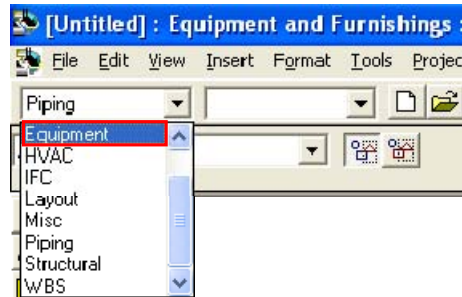


Figure 4: Active Permission Group: Equipment

4. Activate the **PinPoint** ribbon by using the **Tools > PinPoint** command.

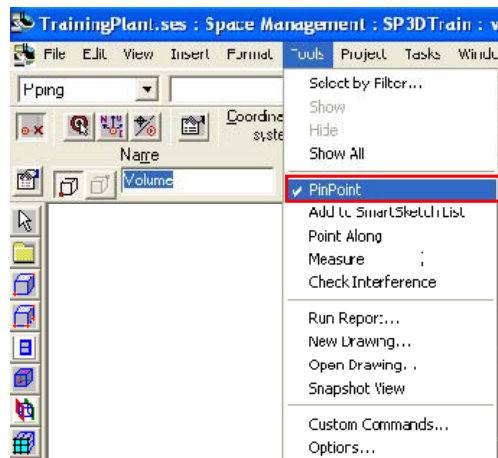


Figure 5: Tools > PinPoint Command

5. Set the active coordinate system to **Global** in the **Coordinate system** drop-down list on the **PinPoint** ribbon and activate the **Set Target to Origin** option.



Figure 6: Coordinate System Drop-Down List on the PinPoint Ribbon

6. Click the **Place Equipment** button on the vertical toolbar.

Figure 7: Place Equipment Button on the Vertical Toolbar

7. In the **Select Equipment** dialog box, expand the folder **Equipment\Process\Vertical Vessels\Simple Vertical Vessel with Skirt** until you see the part **SWWSE210-E**. Select the part and click **OK**.

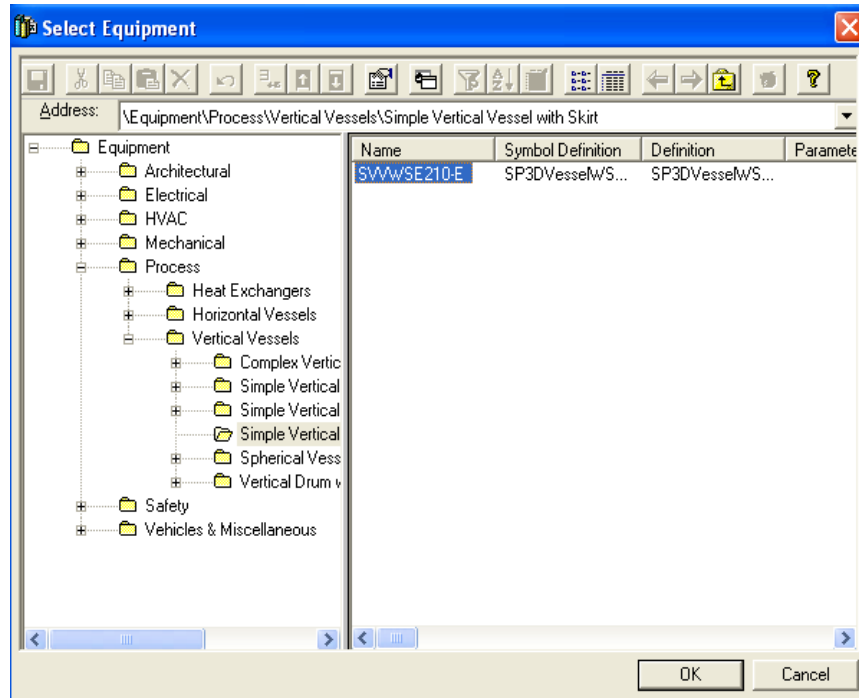


Figure 8: Select Equipment Dialog Box

8. The **Equipment Properties** dialog box appears as soon as you select the **SWWSE210-E** part, as shown in Figure 9.

Note:

- In the **Equipment Properties** dialog box, you can specify or change the properties of the selected equipment object, as required. Properties are grouped into categories such as **Standard**, **Position and Orientation**, and **Equipment**

Dimension. Examples of these properties are:

- Name of the equipment
- Name Rule
- Description of the equipment
- System
- Reporting Requirement
- Reporting Type
- Correlation Status

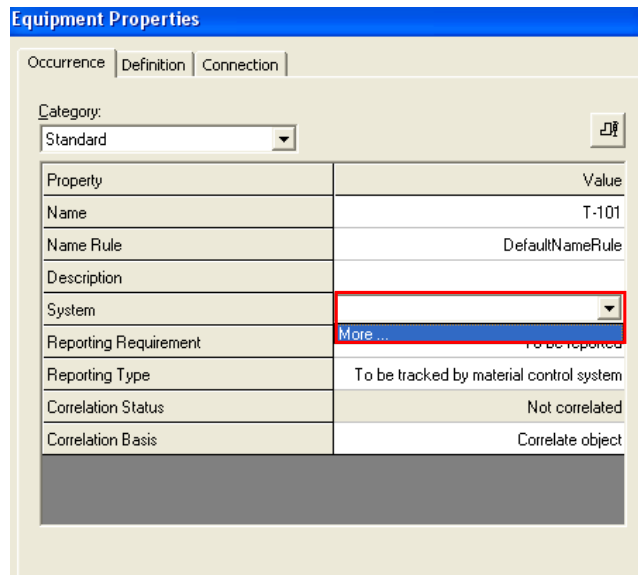
To learn about these properties, refer to the *Equipment Properties Dialog Box* topic of the [EquipmentUsersGuide.pdf](#).

9. Key in **T-101** in the **Name** field.

Note:

- When a **Name Rule** is selected, the name will be automatically generated using a custom program defined in the reference data by your catalog administrator. If you key in the name, then the **Name Rule** property will automatically change to **User Defined** when the **Equipment Properties** dialog box is closed.

10. Click the **System** field and select the **More...** option to specify the system to which the equipment belongs.



The image shows the 'Equipment Properties' dialog box with the 'Definition' tab selected. The 'Category' is set to 'Standard'. The 'System' field is highlighted with a red box, and the 'More...' option is visible in the dropdown menu. The 'Name' field contains 'T-101' and the 'Name Rule' is 'DefaultNameRule'.

Property	Value
Name	T-101
Name Rule	DefaultNameRule
Description	
System	More ...
Reporting Requirement	To be reported
Reporting Type	To be tracked by material control system
Correlation Status	Not correlated
Correlation Basis	Correlate object

Figure 9: Equipment Properties Dialog Box

11. Select **A2 > U03 > Equipment** system, as shown in Figure 10, to indicate where the object will be placed. Then, click **OK**.

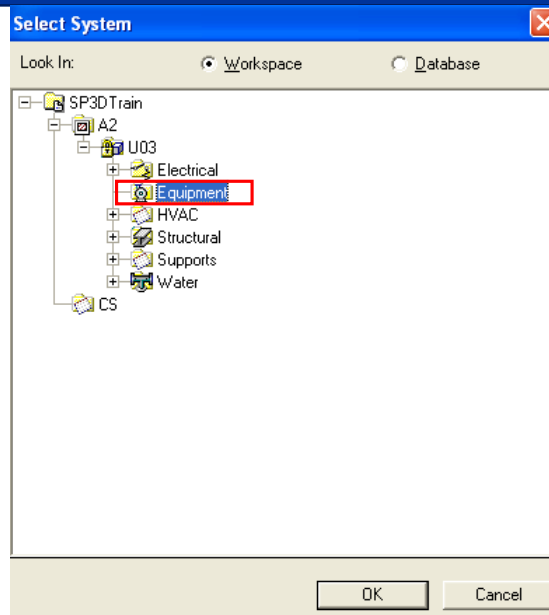


Figure 10: Select System Dialog Box

12. To define the position of the object, select the **Position and Orientation** category in the **Category** drop-down list.

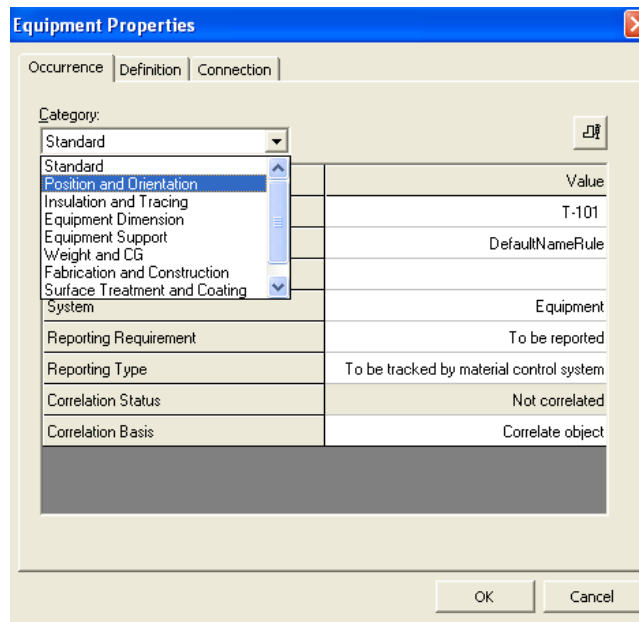
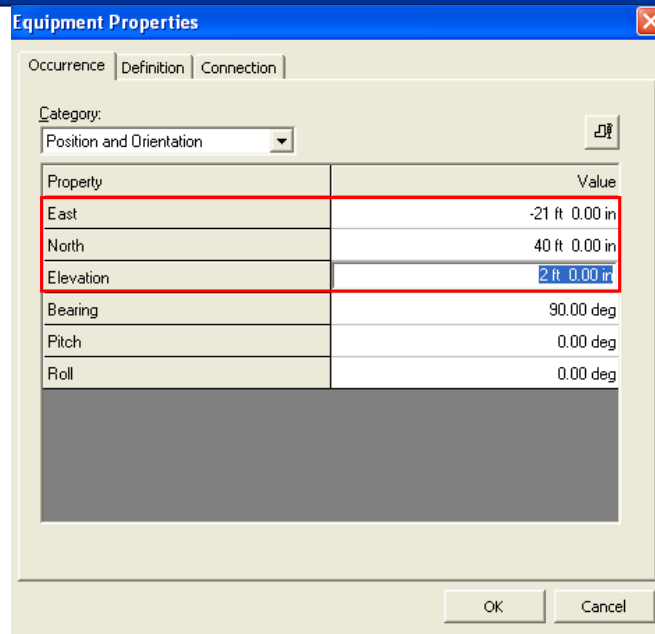


Figure 11: Position and Orientation Category

13. Key-in the following properties:
 - **East: -21 ft**
 - **North: 40 ft**
 - **Elevation: 2 ft**

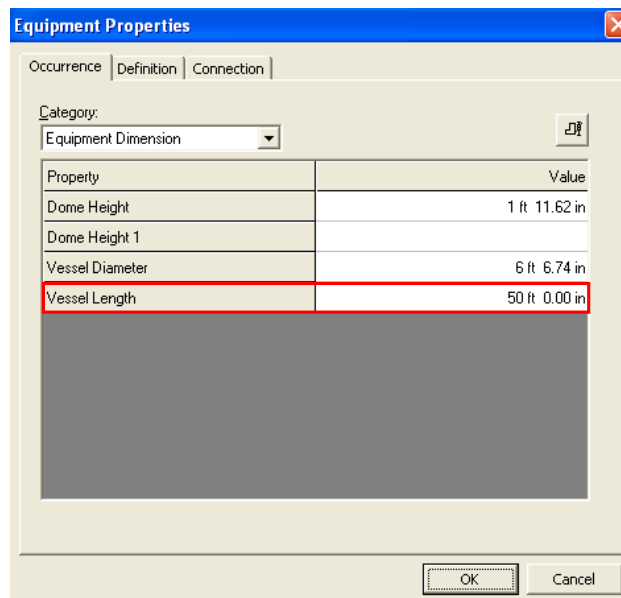


The dialog box shows the 'Position and Orientation' category selected. The table below lists the properties and their values:

Property	Value
East	-21 ft 0.00 in
North	40 ft 0.00 in
Elevation	2 ft 0.00 in
Bearing	90.00 deg
Pitch	0.00 deg
Roll	0.00 deg

Figure 12: Position and Orientation Category

14. Switch to the **Equipment Dimension** category in the **Category** drop-down list.
15. Change the **Vessel Length** field value to **50 ft** as shown in Figure 13.



The dialog box shows the 'Equipment Dimension' category selected. The table below lists the properties and their values:

Property	Value
Dome Height	1 ft 11.62 in
Dome Height 1	
Vessel Diameter	6 ft 6.74 in
Vessel Length	50 ft 0.00 in

Figure 13: Equipment and Dimension Category

Note:

- The **Preview** button displays a picture or drawing of the equipment showing the equipment dimensions. If you click **OK** on the **Equipment Properties** dialog box with the **Preview** window displayed, the **Preview** window will display automatically along with the **Equipment Properties** dialog box the next time you place the equipment.

16. Click **OK** on the **Equipment Properties** dialog box to place the equipment in the model.

The view of your model should resemble Figure 14.

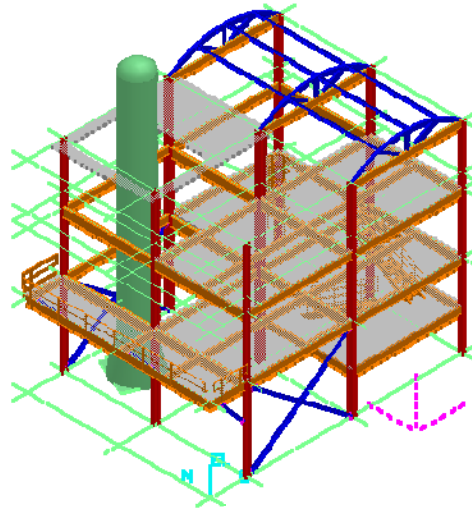


Figure 14: Output of Placing Equipment from the Catalog

17. Set the filter to **Pipe Nozzle** in the **Locate Filter** drop-down list.
18. Select the **Nozzle C** graphically or in the **Workspace Explorer** under **A2\U03\Equipment\T-101\C**.
19. Right-click and select the **Properties** option to open the **Properties** page.
20. Click the **Location** tab and change **N1** field value to **59 ft**.
21. Click **OK** in the **Pipe Nozzle Properties** dialog box to re-position Nozzle C.
22. Set the filter to **Equipment** in the **Locate Filter** drop-down list.

Rotating Equipment: An Overview:

You can rotate and reposition the equipment you placed in a model at any time, as long as the equipment is not fully constrained or controlled by positioning relationships. If you placed the equipment with a mate relationship to a surface, you can only rotate the equipment about the axis that is normal to the surface. Mate relationship is the relationship applied between a surface of the equipment and 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 may 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.

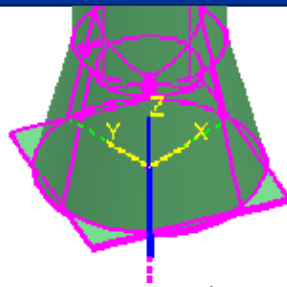


Figure 15: Axis of Rotation

In Figure 15, the axis pointing downwards is the default axis of rotation because it is axis normal to the foundation port.

Steps for Rotating Equipment:

Rotate the horizontal vessel **40V-101 storage tank** in Unit **U04** of **Area 2** by an angle of 90 deg using the **Rotate Object** command and **U03 CS** as the active coordinate system. Refer to Figure 16 to see how the equipment will appear after being rotated.

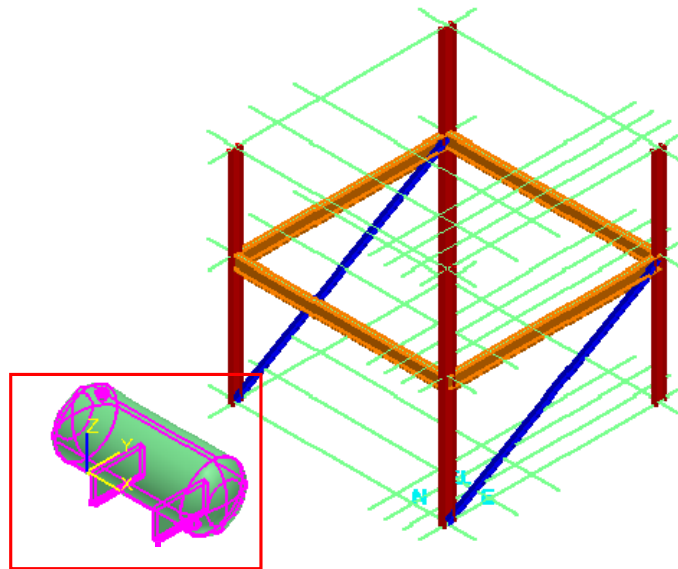


Figure 16: Final Output: Rotation of Equipment

1. Define your workspace to display the Unit **U04** and coordinate system **U04 CS**. Display the **PinPoint** ribbon.
2. Click the **Place Equipment** button on the vertical toolbar.



Figure 17: Place Equipment Button on the Vertical Toolbar

3. In the **Select Equipment** dialog box, expand the folder **Equipment\Process\Horizontal Vessels\Storage Tank** until you see the part **Tank_001A IMP-E**. Select the part and click **OK**.

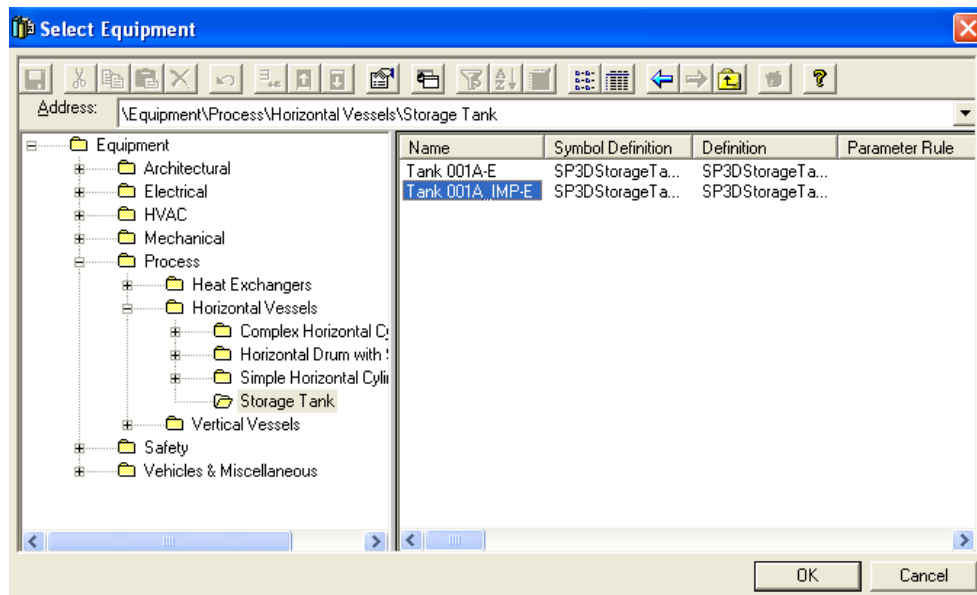


Figure 18: Select Equipment Dialog Box

4. The **Equipment Properties** dialog box appears as soon as you select the **Tank_001A IMP-E** part.
5. Key in **40V-101** in the **Name** field.
6. Click the **System** field and select the **More...** option to specify the system to which the equipment belongs.

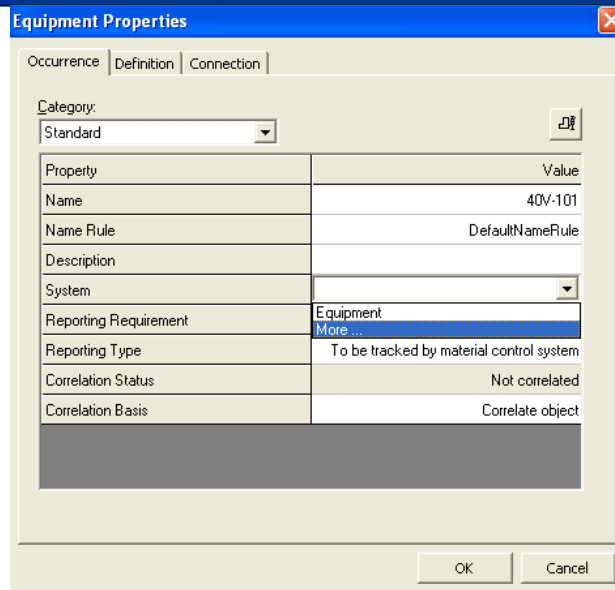


Figure 19: Equipment Properties Dialog Box

7. Select **A2 > U04 > Equipment** system as shown in Figure 20 to indicate where the object will be placed. Then, click **OK**.

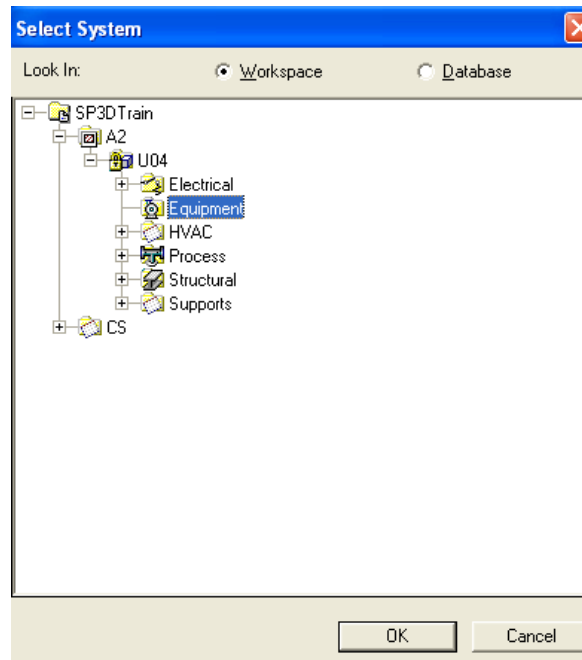


Figure 20: Select System Dialog Box

8. Click **OK** on the **Equipment Properties** dialog box.
9. Enter coordinates on the **PinPoint** ribbon by using the function keys F6, F7, and F8:
 - **East: 98 ft**
 - **North: 100 ft 6 in**
 - **Elevation: 6 ft**

10. Rotate the equipment to the indicated orientation (tank axis running North/South) before you click the position point by using the left/right arrow keys.
11. Click in the graphic view to place the equipment. Your view should resemble Figure 21.

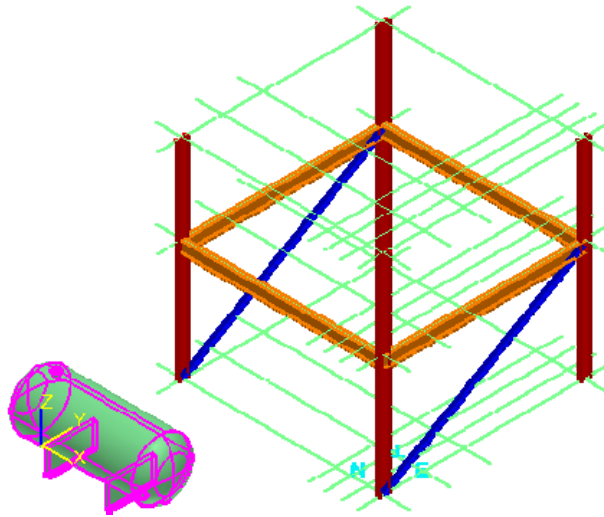


Figure 21: Placed and Selected Equipment

12. Another choice to rotate the equipment after placement, select the **Rotate Object** command from the **Common** toolbar. **Up/Down** axis is selected as the rotation axis. Enter **90 deg** in the **Rotation Angle** field.

Tips:

- The **Rotate Equipment** command on the vertical toolbar is similar to the **Rotate Object** command on the horizontal toolbar. With improvements in the functions of the **Rotate Object** command in recent releases, the **Rotate Equipment** command is superfluous.
- To select a different rotation axis, pick from the **Axis Direction** combo or click on a different rotation axes.
- You can either enter a value in the **Angle** field to define the rotation or you can drag the equipment around the axis of rotation. When you drag the equipment, it rotates dynamically about the axis of rotation and the value in the **Angle** field for the equipment is automatically updated. The same rotation angle can be achieved by changing the **Angle** value to **180** while placing the equipment. This angle is different from angle keyed in above. Angle defined in the **Position & Orientation** category of the **Equipment Properties** dialog box is measured with respect to the global coordinate system.
- When rotating an object, you can specify a **Step** value that represents the incremental angle value used by the software in rotating the equipment. **Step** value is used during dynamic rotation mentioned above.

Your final output should resemble Figure 22.

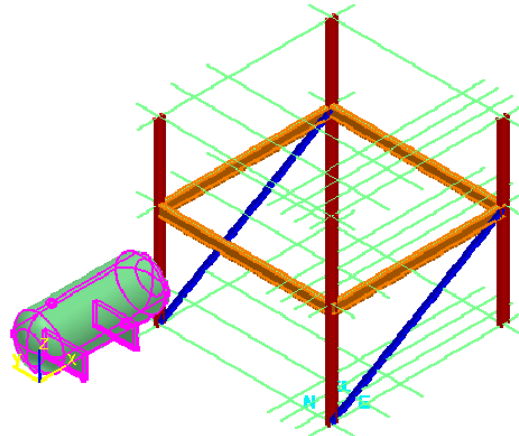


Figure 22: Final Output: Rotated Equipment

For more information related to the rotation of equipment in a model, refer to *Rotate Object Command* topic in the user guide *CommonUsersGuide.pdf*.

Session 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.

Prerequisite Sessions:

- SP3D Overview
- SP3D Common Sessions
- Placing Catalog Equipment

Overview:

The **Place Equipment** ribbon has controls to help you graphically position the equipment relative to other geometry in the model. You do this by defining one or more positioning relationships between geometry on the equipment and geometry or position in the model. The positioning relationships can be used during initial placement or to modify the position of existing equipment. These positioning relationships are maintained as you edit your design.

When a relationship is made between equipment and other environment objects, the relationship only controls the position of the equipment. However, if the relationship is created between equipment, then the positions of both are controlled by the relationship. You can move the equipment subject to the constraints on the movement defined by the positioning relationships. The **Delete Relationship** button on the equipment edit ribbon removes the relationship.

When you add a relationship, the currently selected equipment will move subject to other existing positioning relationships. You add a relationship by picking the **New Relationship** option and select the relationship type. You can edit existing relationships by selecting it in the relationship control. Figure 1 shows the different types of relationships.

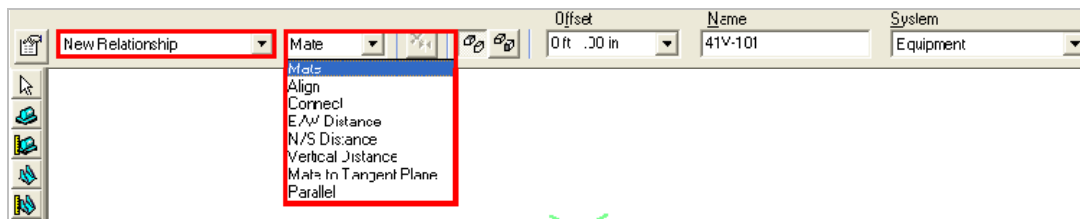


Figure 1: Relationships Controls

You then select the geometry required by the relationship using the **Equipment Reference** and **Second Part Reference** buttons. You can pick these buttons to edit the geometry used for existing relationships.

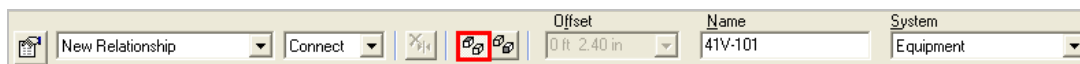


Figure 2: Equipment Reference Button

Relationships that allow an offset will enable the **Offset** field.

The geometric relationships available for positioning the equipment are:

- Mate
- Align
- Connect
- E/W Distance
- N/S Distance
- Vertical Distance
- Mate to Tangent Plane
- Parallel

Mate:

The Mate relationship is applied between a surface on the equipment and a surface or reference plane in the model. The Mate relationship orients the objects such 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 on the **Offset** field on the **Place Equipment** ribbon.

While placing catalog equipment using the mate relationships, the foundation port of the equipment is used as the mating surface by default.

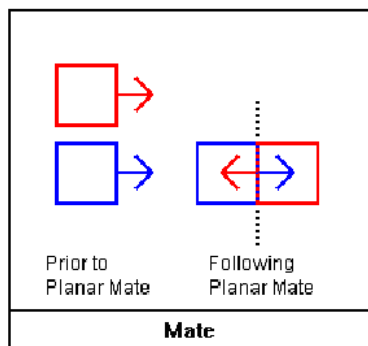


Figure 3: Mate Type Relationship

Align:

The Align relationship is contextual. If planar faces are selected, Align is performed such that the faces lie on the same plane with their surface normal pointing in the same direction. This is opposite of a Mate relationship.

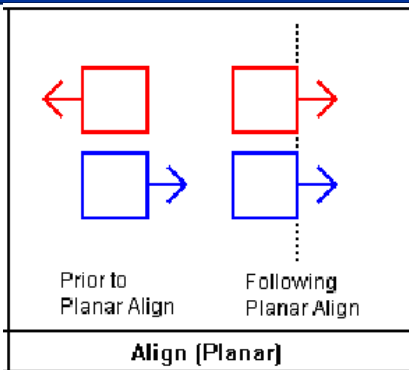


Figure 4: Align Type Relationship

If the surface selected is cylindrical, then an axial align between their implicit axes is performed by making the axes coincident.

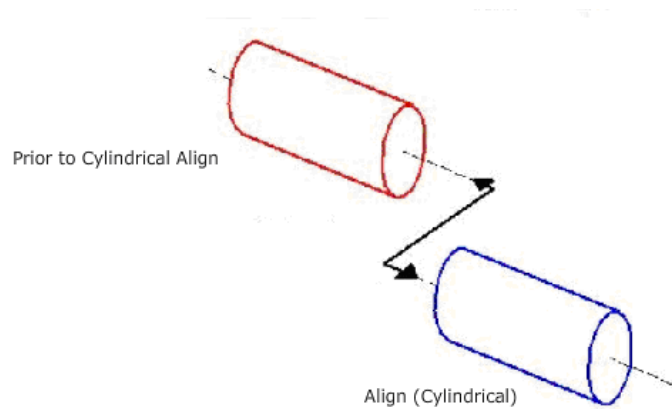


Figure 5: Align Type Relationship Between Cylindrical Surfaces

The **Offset** field on the ribbon defines an offset distance between the axes of the cylinders.

Connect:

The Connect relationship matches two points. The first point is remembered 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 simply fixed relative to the global coordinate system if given as a point in space.

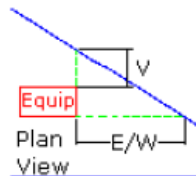


Figure 6: Connect Relationship

If the two points found by SmartSketch are nozzles (ports), then Connect will establish an Align

axis relationship using the axis of the port and a point to point relationship.

E/W Distance, N/S Distance, and Vertical Distance:

A Horizontal/Vertical minimum distance or Offset relationship is used to locate a point on a piece of equipment at a specified distance, horizontal or vertical from a sloped surface, edge, or point. There are three options:

- E/W Distance (horizontal along East/West-axis)
- N/S Distance (horizontal along North/South-axis)
- Vertical Distance (vertical along Up/Down-axis)

The axes are the axes of the active coordinate system.

You select a point on the equipment and a reference surface, edge, or point in the model. Any selectable point on the equipment like a SmartSketch point, port, or connect point may be used in the relationship. The reference surface may 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. The following figures illustrate the behavior of the relationships.

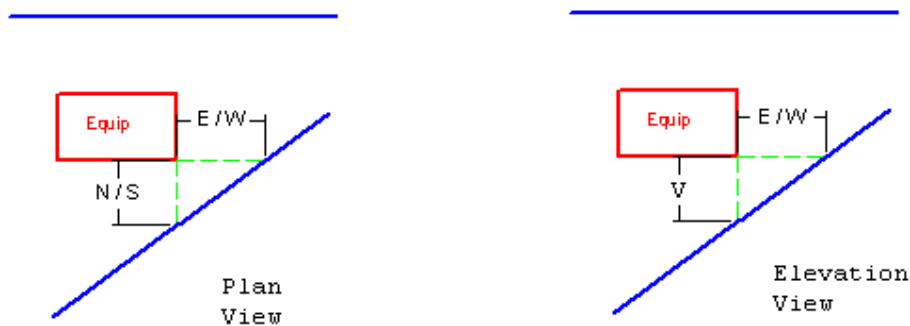


Figure 7: Plan and Elevation Views of the E-W Relationship

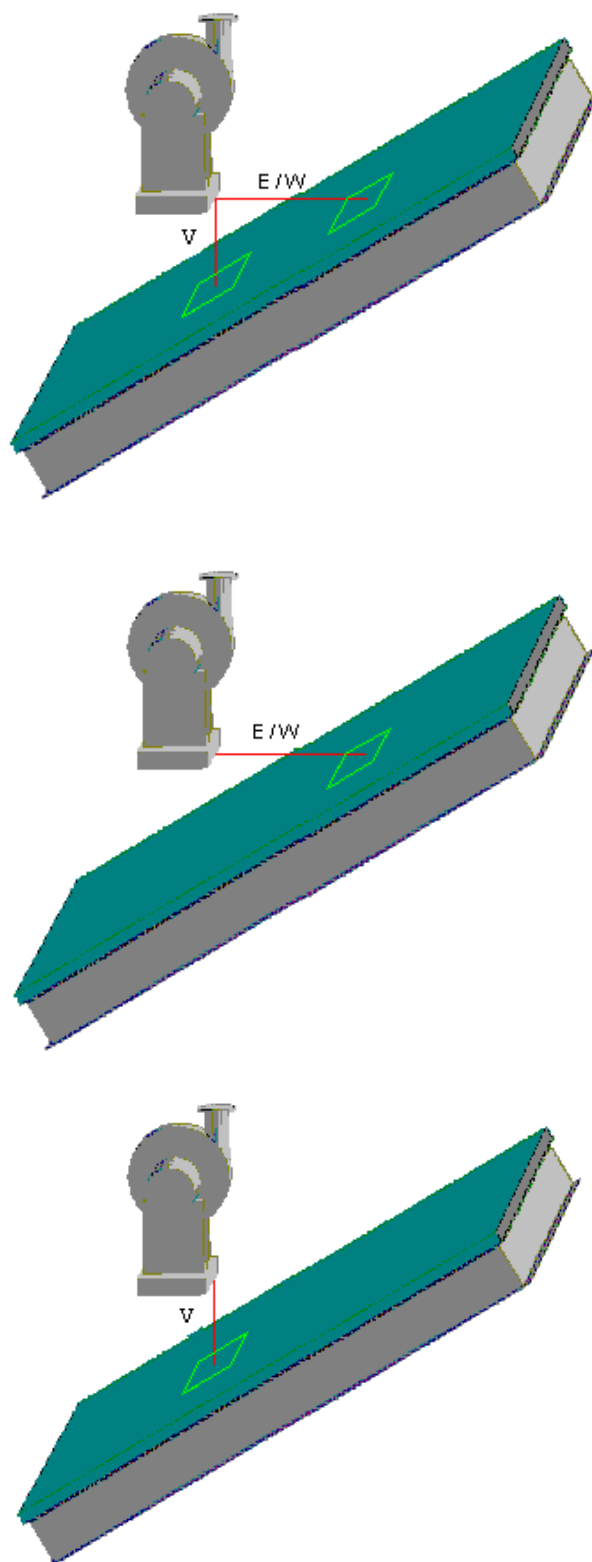


Figure 8: Example of E-W Relationship in the Elevation View

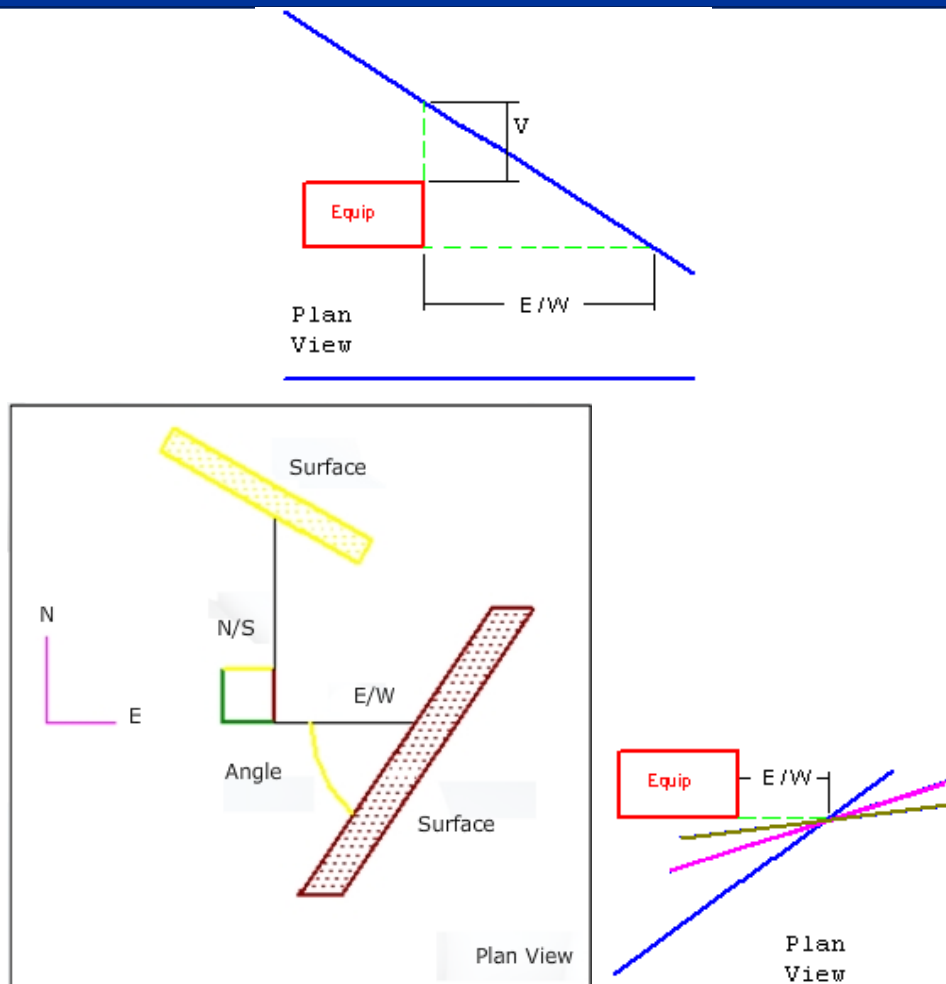


Figure 9: Angle Between the Reference Surface and the Distance Between the Equipment

When the angle between the reference surface used by the constraint and the horizontal minimum distance between the equipment approaches 0 degrees, the constraint becomes difficult to control. When the angle is less than 1 degree, the constraint is broken and a message is sent to the **To Do List**.

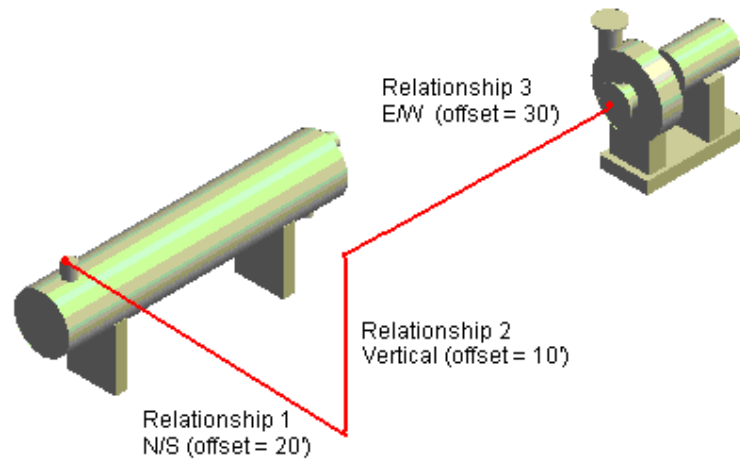


Figure 10: Relationships Between the Points of Two Equipment

The example above illustrates the use of three separate relationships between the points on different equipment to fully constrain the two items.

Mate to Tangent Plane

The Mate to Tangent Plane relationship mates a planar surface on the equipment with a plane created 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 re-entry of both by picking the "surface in model" smartstep when the "Mate to Tangent Plane" relationship is selected. If the referenced (non-planar) surface is updated, the intersection point with the vector is recomputed and then the tangent plane is recomputed.

Notes:

- The vector is used only to locate 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.

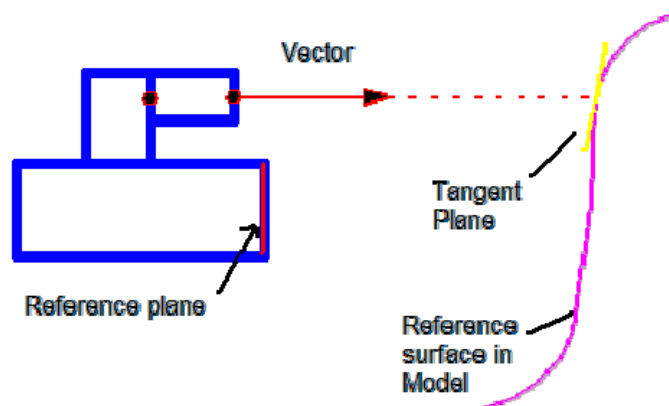


Figure 11: Mate to Tangent Plane Relationship

After application of the relationship, the reference plane will be mated to the tangent plane.

Parallel

The Parallel relationship is similar to Align. The significant difference is that Align rotates and translates an object, while Parallel only rotates the objects to make them parallel. The Parallel relationship does not support the offset property. The **Offset** field is disabled when the Parallel relationship is selected.

The following geometries can be selected for the Parallel relationship:

- 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.

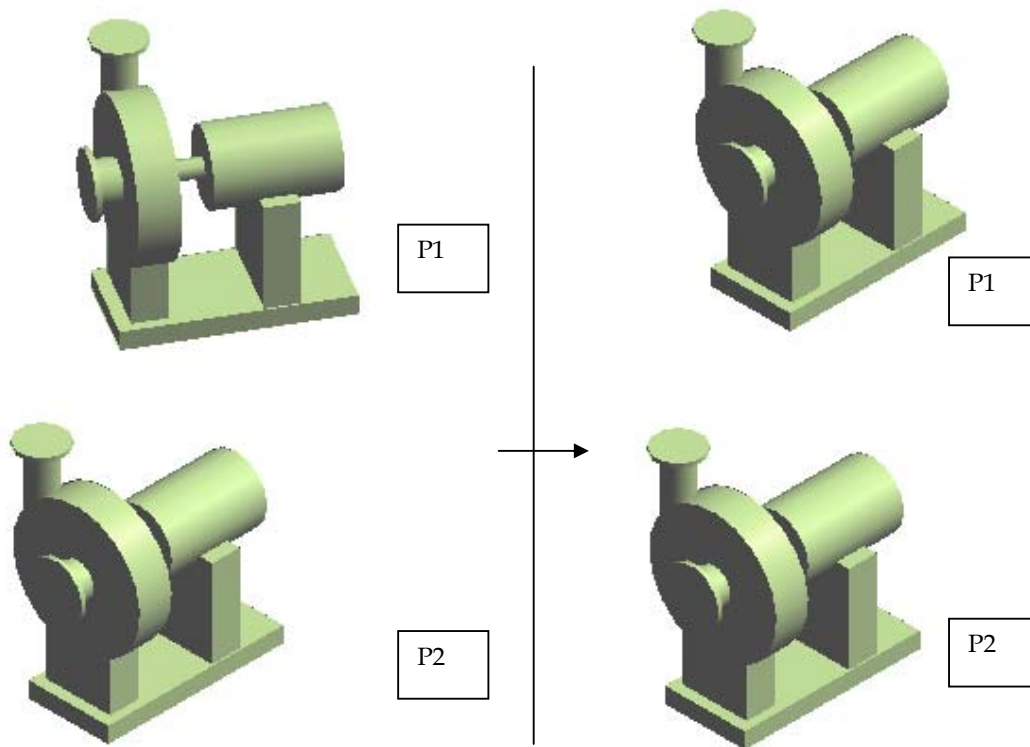


Figure 12: Parallel Relationship

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.

Steps to Place Catalog Equipment with a Mate Relationship

Place the pump **Pump 001A_IMP-E** from the SP3D catalog in Unit **U04** using the Mate relationship to the elevation plane. The end result of this procedure should resemble the highlighted object in Figure 13.

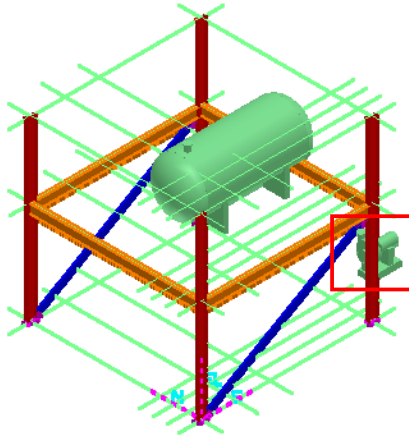


Figure 13: The Placed Pump 001A_IMP-E

12. Define the workspace to display Unit **U04** and coordinate system **U04 CS**.
13. Switch to the **Equipment and Furnishing** task.
14. Set the Active Permission Group to **Equipment** as shown in Figure 14.

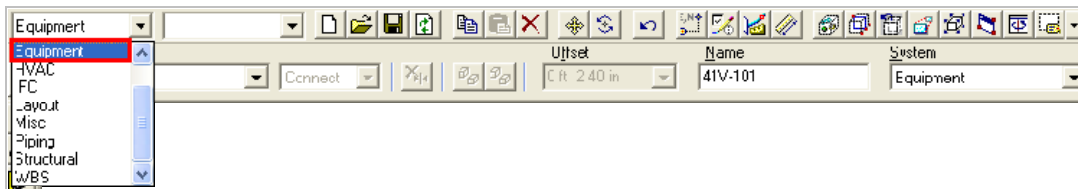


Figure 14: Active Permissions Group Selected

15. Activate **Tools > PinPoint**.
16. Set the active coordinate system to **U04 CS** on the **PinPoint** ribbon and activate the **Set Target to Origin** option.

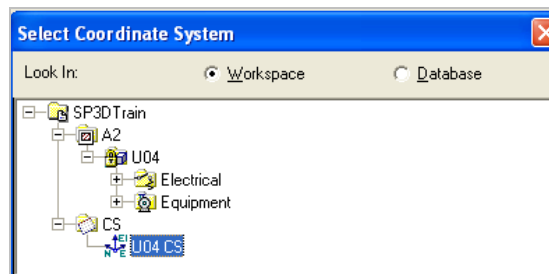


Figure 15: Select Coordinate System Dialog Box

17. Click the **Place Equipment** button on the vertical toolbar.



Figure 16: Place Equipment Button Highlighted

18. In the **Select Equipment** dialog box, expand the folder **Equipment\Mechanical\Pumps\Pump** until you see the part **Pump 001A_IMP-E**. Select the part and click **OK**. Figure 16 shows the required part selected.

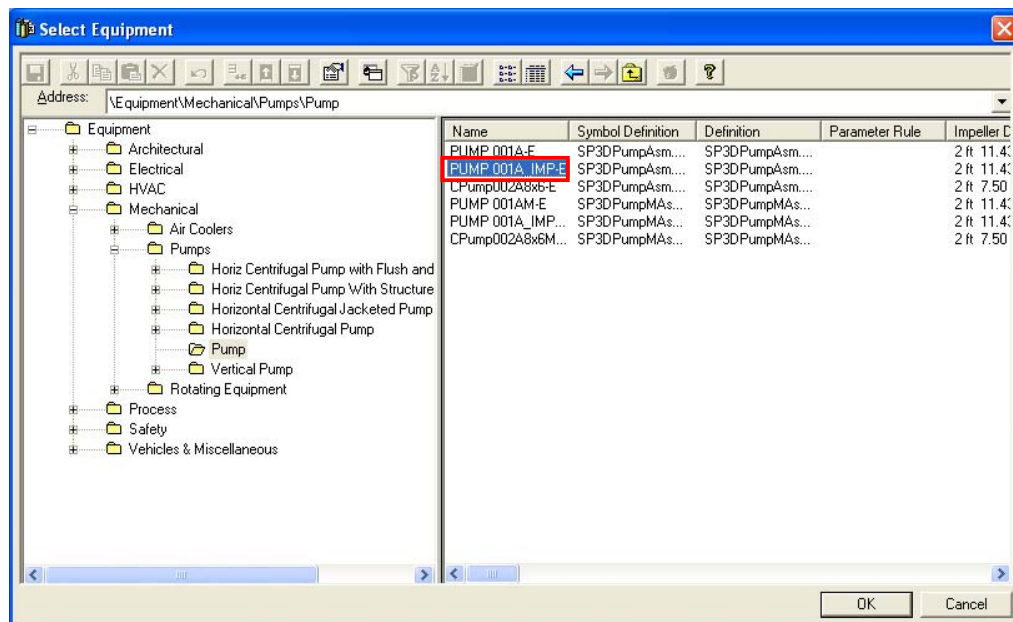


Figure 17: Part Selected in the Select Equipment Dialog Box

The **Equipment Properties** dialog box appears after you select the **Pump 001A_IMP-E** part.

19. In the **Equipment Properties** dialog box, click **OK** to retain the default properties.

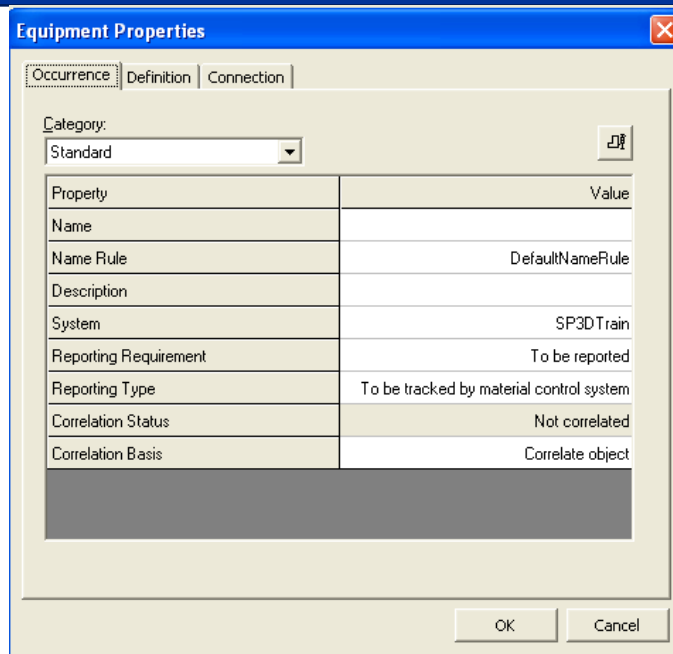


Figure 18: Equipment Properties Dialog Box

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



Figure 18: Equipment Ribbon

21. On the **PinPoint** ribbon, key-in **30 ft** for East and **5 ft** for North.
22. In the **Workspace Explorer**, expand **Coordinate System** and select **U04 CS > EL Axis**.

Note:

- After the **Equipment Properties** dialog box is closed, the **Place Equipment** command expects a location and also expects a mating surface to create a Mate relationship. By selecting an elevation **0'-0"** in the next step, equipment will be mated with the elevation plane.
- The default relationship type is Mate, however, the ribbon will show last relationship type used in that session. If relationship type is not Mate, use the drop-down menu to select Mate.

23. Click **EL-0'-0"** to mate the pump with elevation **0 ft**.

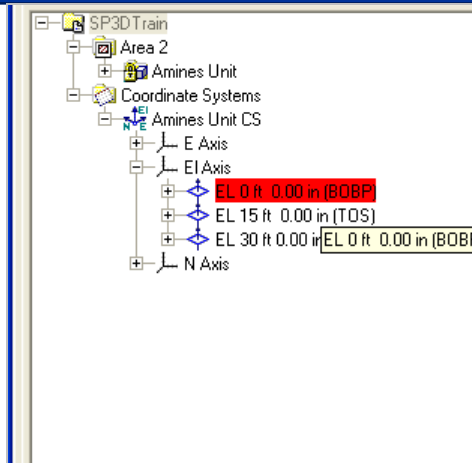


Figure 19: The Required Elevation Selected

Notes:

- If a slab exists, you can just select the surface of the slab.
- You can select the reference planes graphically by displaying the grid ruler with the **View > Rulers** command. The reference planes are indicated as check marks on reference lines displayed in the graphic view.

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

25. On the **Equipment** ribbon, key in **2 ft** in the **Offset** field and then press Enter.

Notes:

- The default offset distance for any new piece of equipment is zero or the last offset used in the current session.
- The Offset could represent different things like the height of a concrete pad below the pump or foundation thickness.

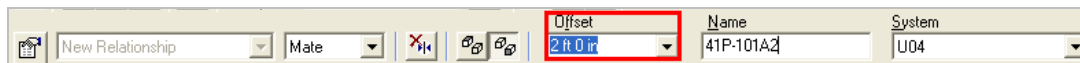


Figure 20: The Offset Field Highlighted on the Ribbon

26. Left -Mouse Click in the graphic view to accept position and then Right Mouse -click in the graphic view to deselect the equipment.

Your view should now resemble Figure 21.

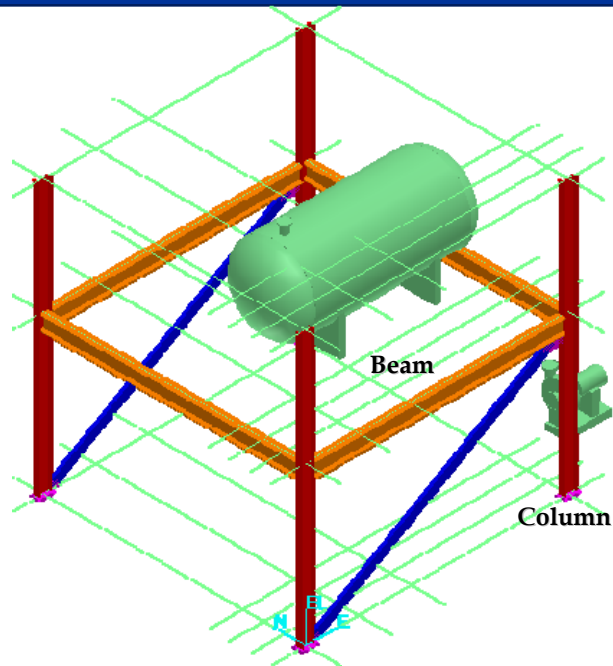


Figure 21: The Equipment Placed Using Mate Relationship

Steps to Add, Edit, and Delete Positioning Relationships:

Add a Mate type relationship between the pump **41P-101A** and the beam (Shown Above in **Figure 21**) in Unit **U04** of the System **A2**. Edit the relationship type to align and move the equipment. Create a relationship between the member, **Column** ((Shown Above in **Figure 21**) and the pump, **41P-101A** and finally delete the relationship.

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

1. Click to select the equipment **41P-101A**, to which a new positioning relationship is to be added as shown in Figure 22.

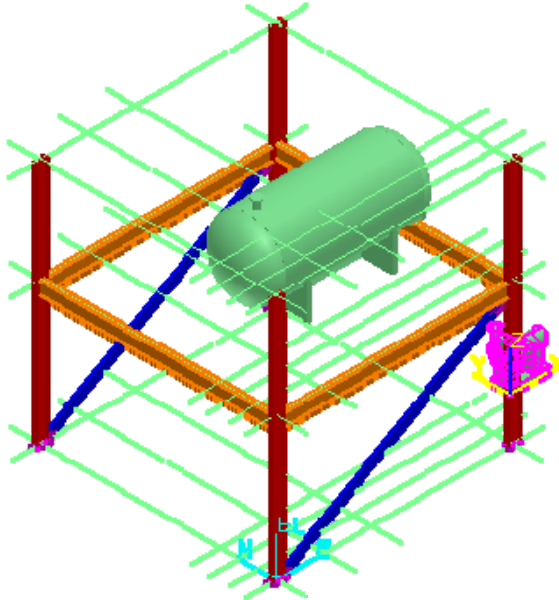


Figure 22: The Selected Equipment

2. The equipment gets highlighted and SP3D displays the current mate relationship on the ribbon, as shown in Figure 23.



Figure 23: Mate Relationship Type Selected

3. Click the **Second Part Reference** button and select the top surface of a member beam. Figure 24 shows the objects selected.

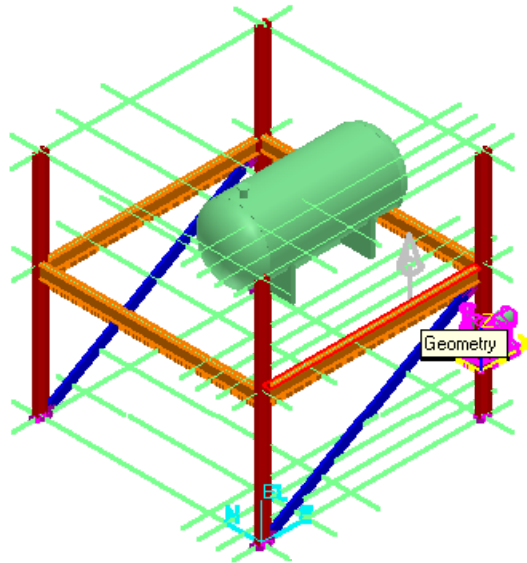


Figure 24: The Objects Selected For Adding a Positioning Relationship

The equipment will move to the new elevation defined by the beam surface. The Figure 25 shows

the repositioned equipment.

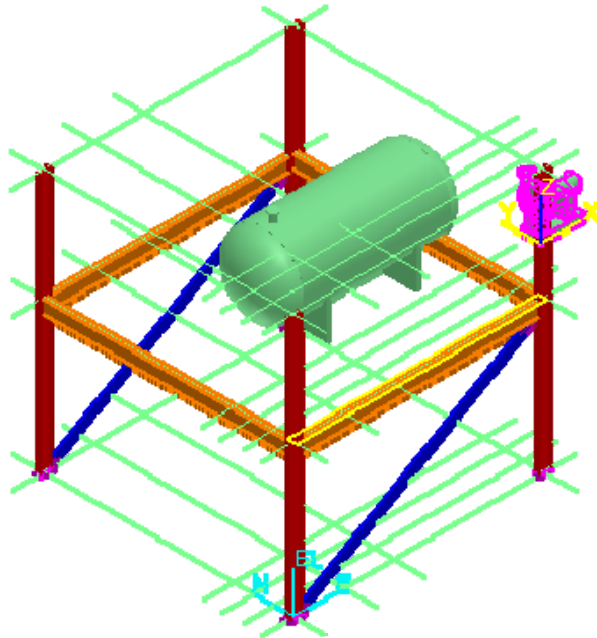


Figure 25: The Equipment Moved to a Different Elevation

4. In the relationship type drop-down list, select **Align**.
5. The equipment flips to meet the new relationship type as shown in Figure 26.

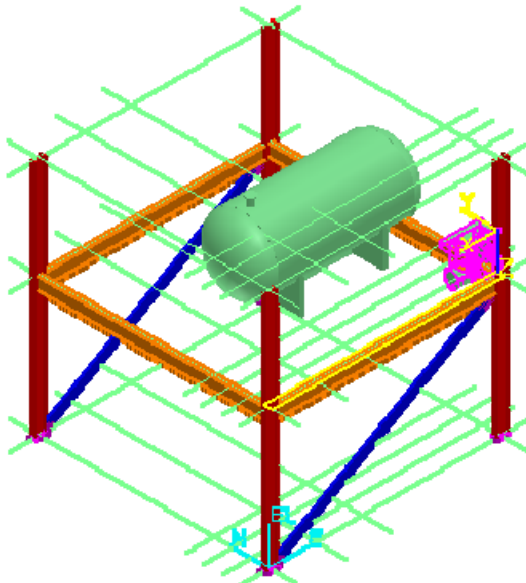


Figure 26: The Rotated Equipment with Align Type Relationship

6. Undo the last edit. Select the equipment again.
7. Select the **New Relationship** option on the equipment edit ribbon.

8. Select the **Mate** type and click the side surface of the selected pump.

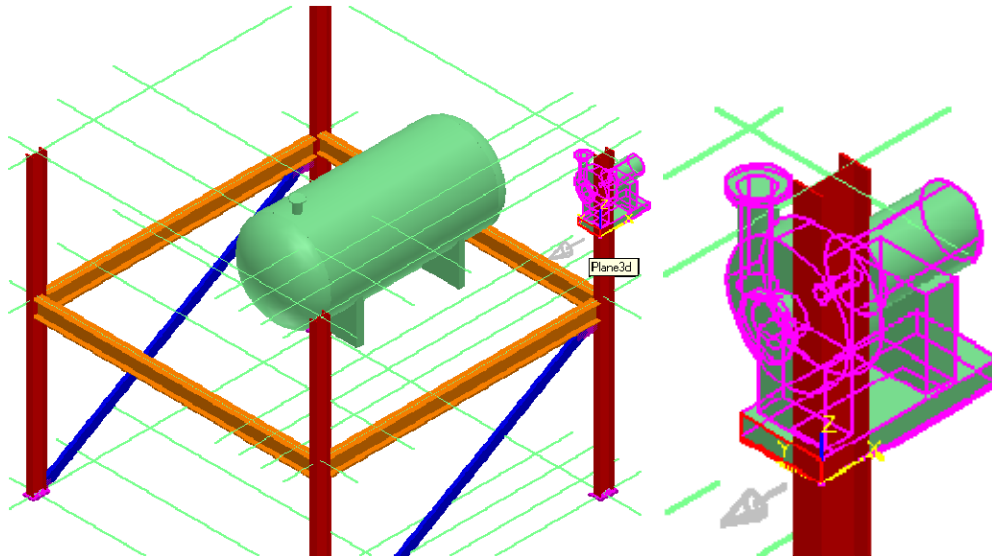


Figure 27: Selecting the Side Surface of the Pump and the Magnified View of the Selection

You can add other relationships to further control the position and orientation of the pump. For this example, we continue to edit the position of the pump.

9. On the second Part Reference step, select the indicated surface of the column.

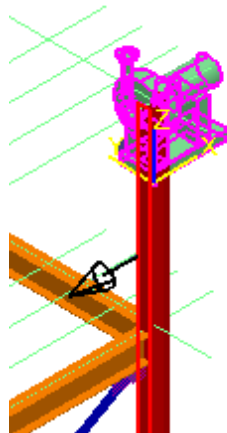


Figure 28: Surface of the Column for the Mate Relationship

This moves the equipment as shown in Figure 29.

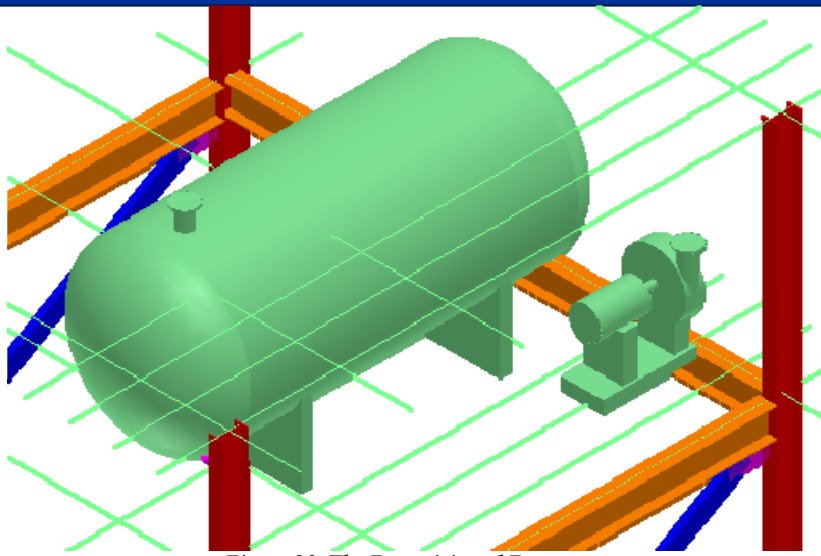


Figure 29: The Repositioned Pump

10. Click on the pump to drag it to a different position, away from the tank as shown in Figure 30.

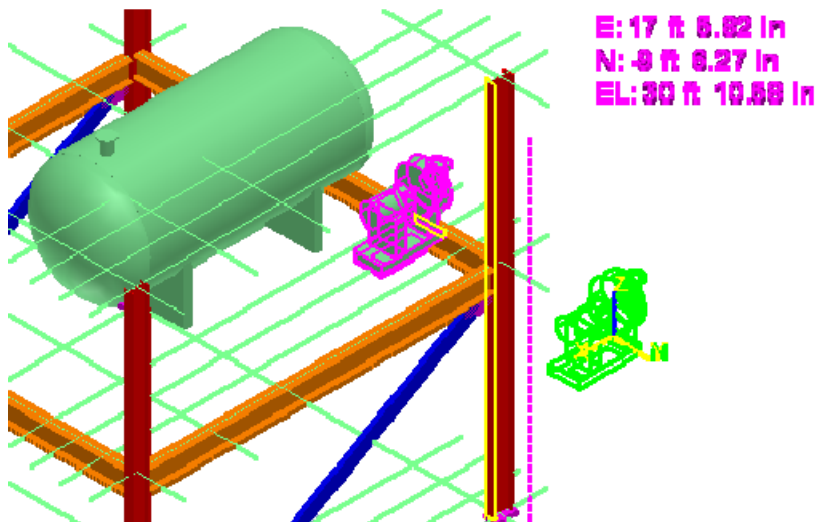


Figure 30: The Pump After Moving

11. Select the **Delete Relationship** button on the equipment edit ribbon as shown in Figure 31.



Figure 31: The Delete Relationship Button Highlighted

12. Click on the pump to drag the equipment. Notice that it now goes to any location in the Plan plane but stays at the elevation defined by the remaining relationship.

You will need to experiment with the positioning relationships to get comfortable with the behavior of one or more relationships.



SP3D Equipment Tutorial: Placing Equipment by Positioning Relationships

For more information related to relationships and placing catalog equipment with mate relationships, refer to the following topics in the user guide *EquipmentUsersGuide.pdf*:

- *Place Equipment from the Catalog*
- *Positioning Relationships: An Overview*
- *Set Positioning Relationships for Equipment*

Session 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.

Prerequisite Sessions:

- SP3D Overview
- SP3D Common sessions
- Placing Catalog Equipment

Overview:

You can model equipment for which you have no parametric catalog definition in the **Equipment and Furnishings** task. You first select the type of equipment you are designing from the catalog to define the set of properties and create the **Designed Equipment** object. This is the reportable object that will appear on your equipment lists. You then model the equipment by placing primitive geometric shapes, imported geometry, ports like nozzles, electrical ports, and equipment components as System children of the Designed Equipment.

The  **Place Designed Equipment** command on the vertical toolbar is used to create a designed equipment object.

Steps for Placing Designed Equipment and Equipment Components:

Place a **Simple Horizontal Cylindrical Vessel, 41 V-101** from the SP3D catalog in Unit **U04**. The position of the equipment should be **5 ft** Easting and **8 ft** Northing and its Elevation should be **23 ft**. The active coordinate system should be **U04 CS**. After the horizontal vessel is placed, it should look as shown in Figure 1.

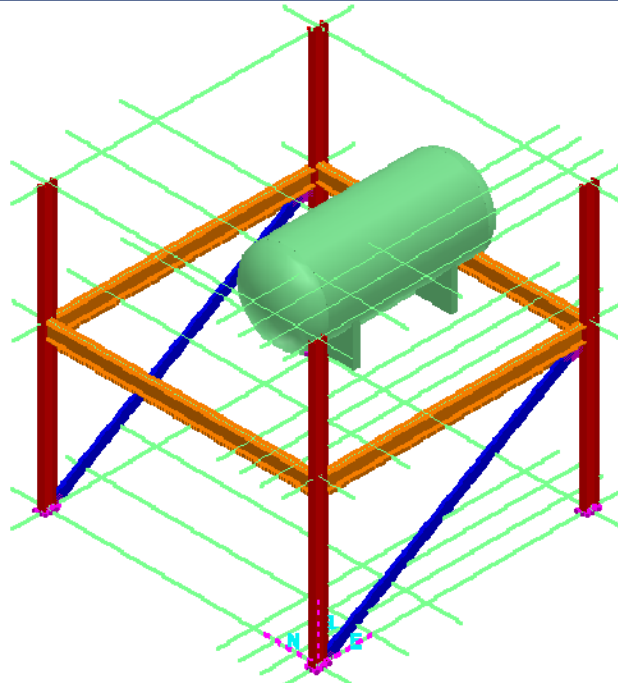


Figure 1: The Designed Equipment

Define the workspace to display Unit **U04** and coordinate system **U04 CS**.

1. Activate the **PinPoint** ribbon if it is not already active.
2. In the **PinPoint** ribbon, select the **More...** option in the **Coordinate Systems** drop-down list.
3. Select **U04 CS** in the **Select Coordinate System** dialog box to make it the active coordinate system and click **OK**. You can also double-click the coordinate system name for the same purpose.

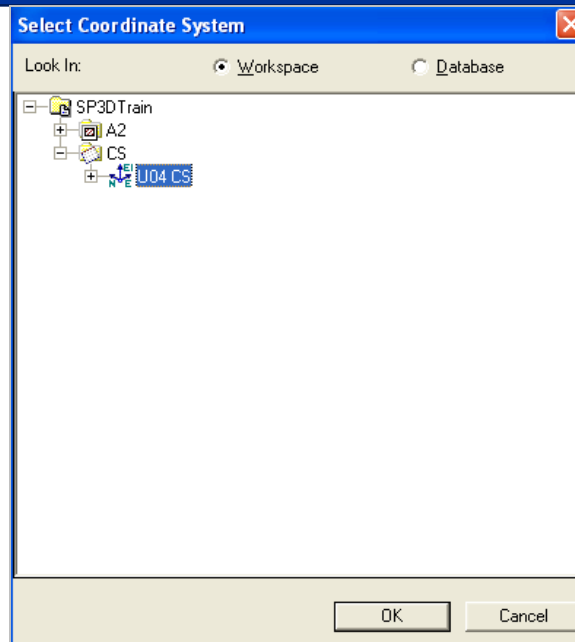


Figure 2: The Coordinate System Selected

4. Click the **Set Target to Origin** option on the ribbon to move the target position for placing the equipment to the origin of the active coordinate system. The option has been highlighted in Figure 3.



Figure 3: Set Target to Origin Option

5. Click the **Place Designed Equipment** button on the vertical toolbar. Figure 4 shows the vertical toolbar with the button highlighted.



Figure 4: Place Designed Equipment Button

6. In the **Select Equipment Type** dialog box, select

\Equipment\Process\Horizontal Vessels\Horizontal Drum with Saddle.

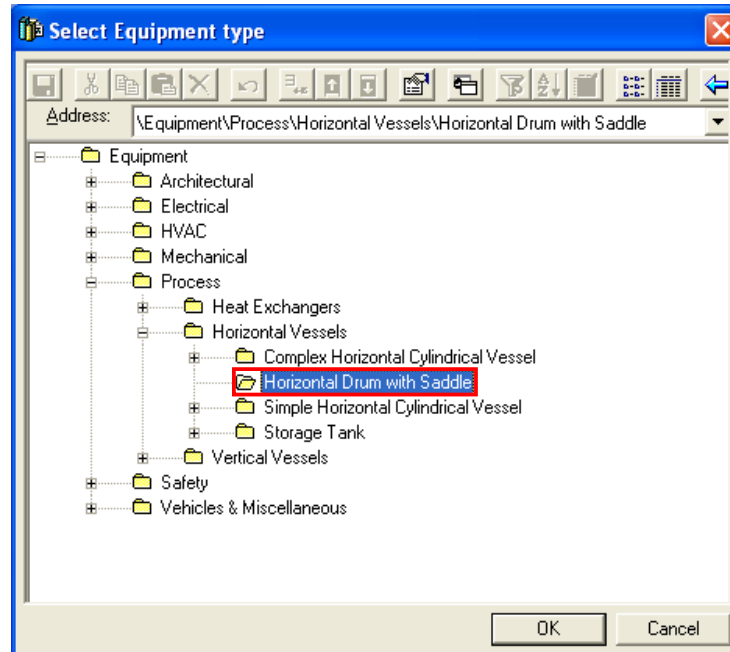


Figure 5: Selection of the Required Equipment

The **Designed Equipment Properties** page is displayed.

7. Key in **41V-101** in the **Name** field.

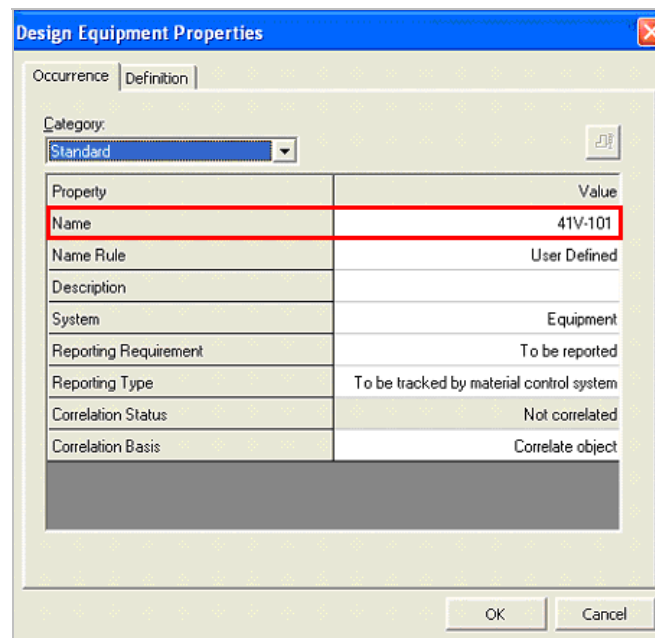


Figure 6: Name Field

8. Click the **System** field and select the **More...** option.

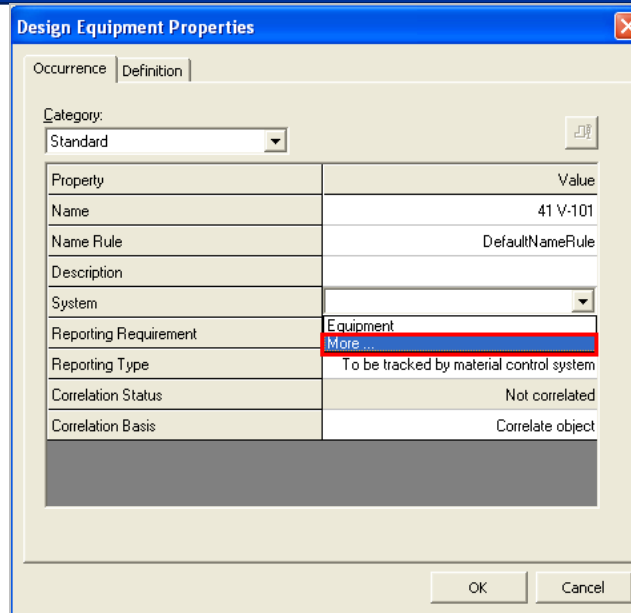


Figure 7: More Option

The **Select System** dialog box is displayed.

9. To place the equipment, select **A2 > U04 > Equipment** system, as shown in Figure 8.

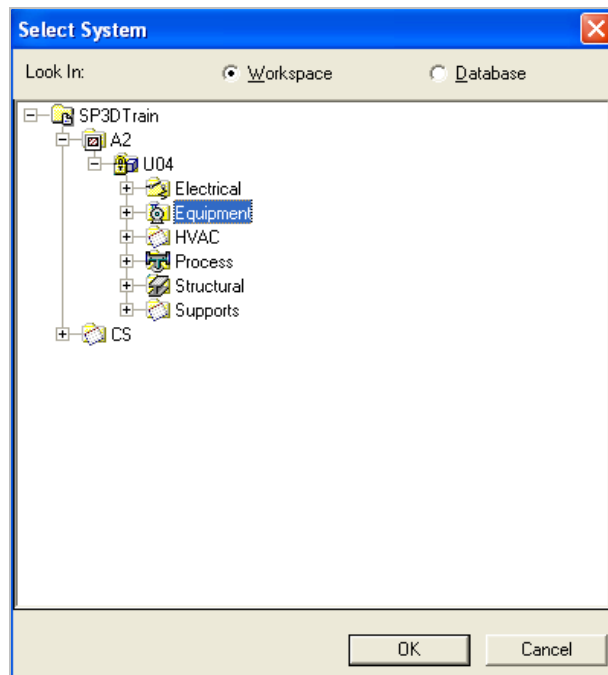


Figure 8: A2 > U04 > Equipment System Highlighted

10. Switch to the **Position and Orientation** category of options to specify the position of the equipment being placed.
11. Key in **5 ft** for **Easting**, **8 ft** for **Northing**, and **23 ft** for **Elevation**.

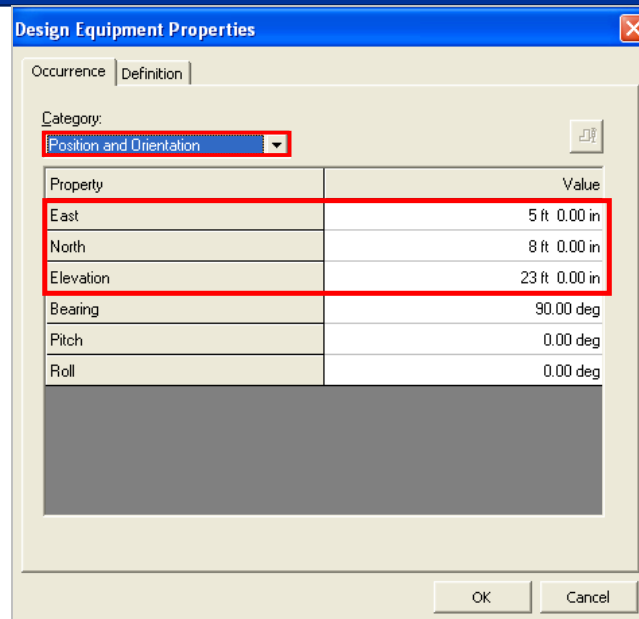


Figure 9: The E, N, El Values Set

12. Click OK on the **Designed Equipment Properties** page.
13. Click the **Place Equipment Component** button on the vertical toolbar.



Figure 10: Place Equipment Component Button

14. If prompted, select **41V-101** from **WSE**.
 - If the design equipment or an equipment component is not selected, you will be prompted to select the design equipment parent for the equipment component.
 - If the designed equipment is already selected when you click the **Place Equipment Component** button, then that equipment will automatically be used as the system parent without a prompt.

- If an equipment component is selected when you click the **Place Equipment Component** button, then the designed equipment of that equipment component will be used by default.
15. In the **Select Equipment Component** dialog box, expand the folder **Equipment Components\Process Components\ Vessel & Equipment Bodies\ Horizontal Vessels and Tanks\Simple Horizontal Cylindrical Equipment Component (E245)** folder until you see the part **E245-Horizontal Cylindrical Tank-EC**.

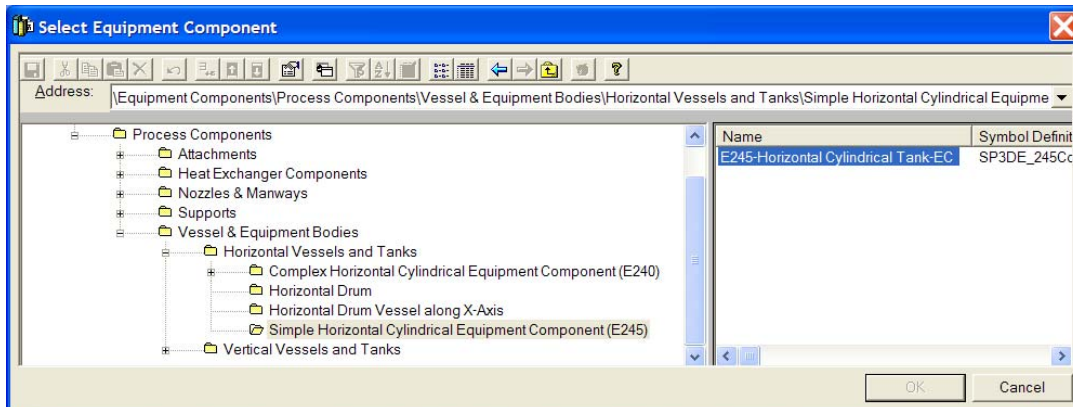


Figure 11: Selection of the Equipment in the Select Equipment Dialog Box

16. Select the part and click **OK**.
17. The **Equipment Components Properties** page appears defaulted to the **Standard** category of properties. In this page, key in **Tank** in the **Name** field, as shown in Figure 12.

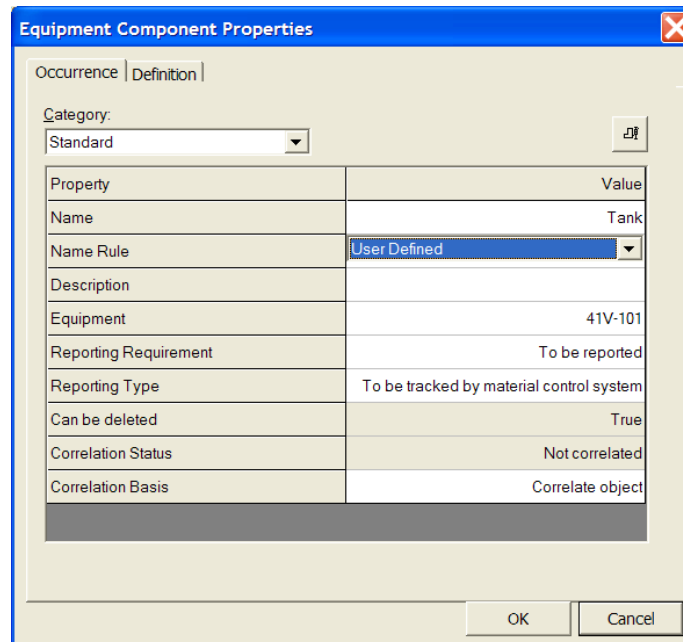
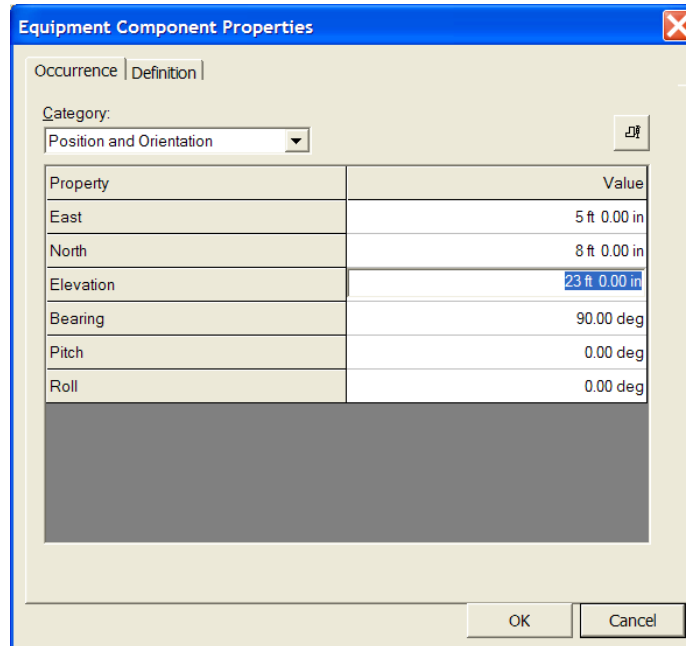


Figure 12: Equipment Named Tank

18. Switch to the **Position and Orientation** category of options and key in the values,

as shown in Figure 13.



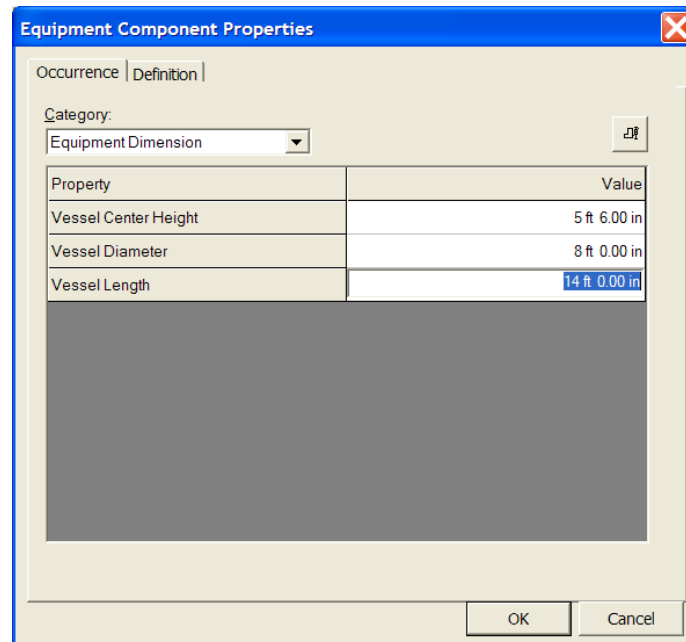
The dialog box 'Equipment Component Properties' has two tabs: 'Occurrence' and 'Definition'. The 'Definition' tab is active. Under the 'Category' dropdown, 'Position and Orientation' is selected. Below this is a table with two columns: 'Property' and 'Value'.

Property	Value
East	5 ft 0.00 in
North	8 ft 0.00 in
Elevation	23 ft 0.00 in
Bearing	90.00 deg
Pitch	0.00 deg
Roll	0.00 deg

At the bottom of the dialog are 'OK' and 'Cancel' buttons.

Figure 13: East, North, and Elevation Values for the Equipment

19. Switch to the **Equipment Dimension** category of options and key in the values shown in Figure 14.



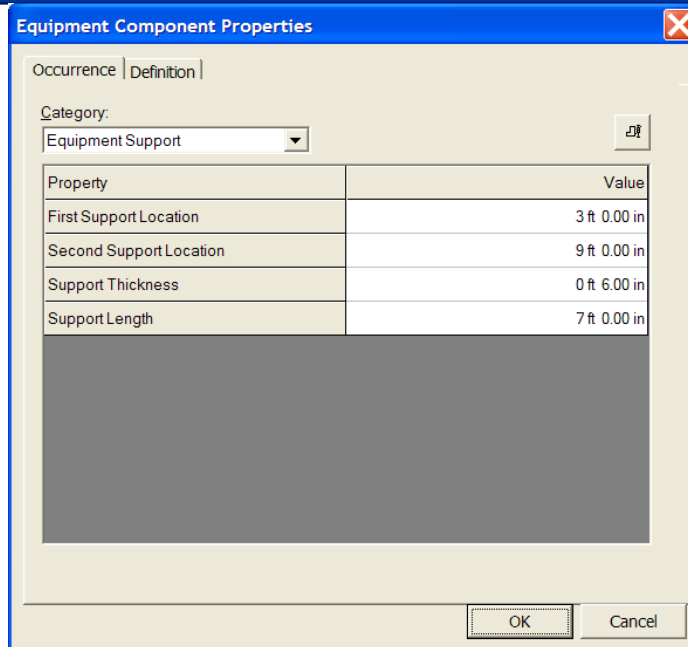
The dialog box 'Equipment Component Properties' has two tabs: 'Occurrence' and 'Definition'. The 'Definition' tab is active. Under the 'Category' dropdown, 'Equipment Dimension' is selected. Below this is a table with two columns: 'Property' and 'Value'.

Property	Value
Vessel Center Height	5 ft 6.00 in
Vessel Diameter	8 ft 0.00 in
Vessel Length	14 ft 0.00 in

At the bottom of the dialog are 'OK' and 'Cancel' buttons.

Figure 14: Equipment Dimensions

20. Switch to the **Equipment Support** category of properties and key in the values, as shown in Figure 15.



The dialog box is titled "Equipment Component Properties" and has two tabs: "Occurrence" and "Definition". The "Definition" tab is selected. It features a "Category:" label and a dropdown menu showing "Equipment Support". To the right of the dropdown is a small icon. Below this is a table with two columns: "Property" and "Value".

Property	Value
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

Below the table is a large gray rectangular area. At the bottom right of the dialog are "OK" and "Cancel" buttons.

Figure 15: Equipment Support Properties

21. Click **OK** to save settings.

The result is as shown in Figure 1. You can add nozzles and other geometry to the same Designed Equipment as necessary.

Steps for Placing Vessel Platforms, Ladders and Handrails:

Place two vessel platforms, a ladder and handrails from the SP3D catalog in Unit **U03**. After these objects have been placed on the model, the vertical vessel should look as shown in Figure 16.

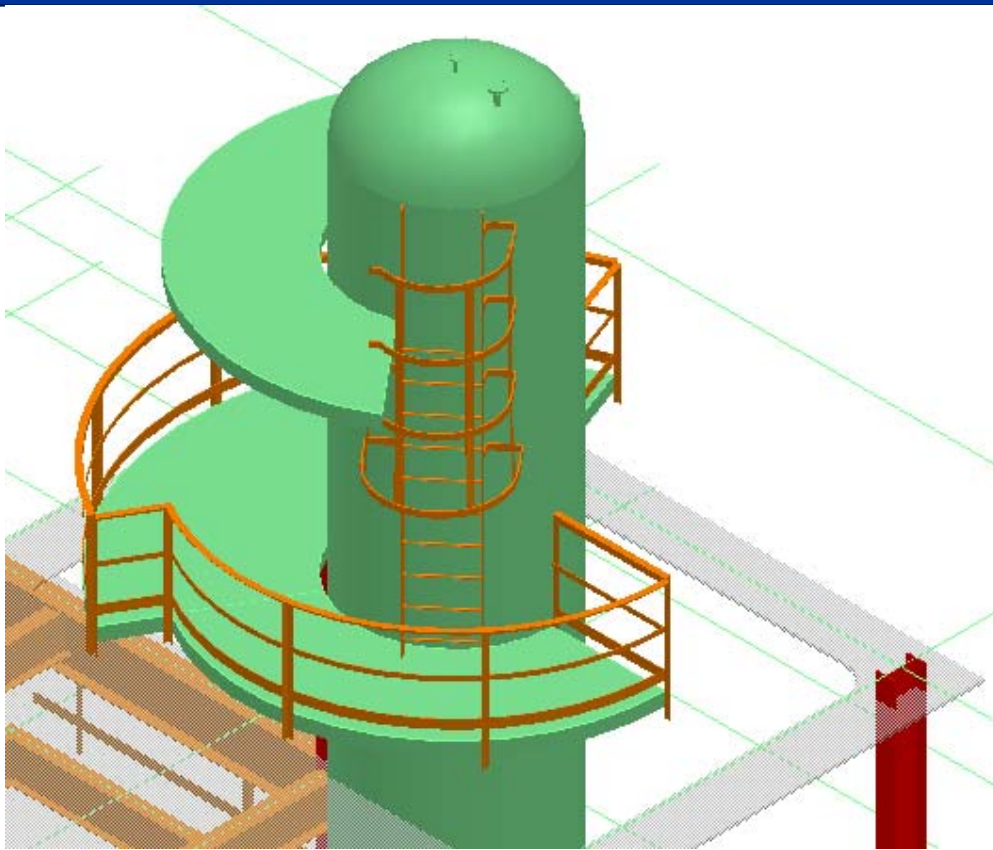


Figure 16: Vertical Vessel T-101

1. Define the workspace to display Unit **U03** and coordinate system **U03 CS**. In your training plant, select **U03** from **Plant Filters\Training Filters** in the **Select Filter** dialog box.
2. Click the **Common Views** button on the **Common** toolbar. The **Common Views** dialog box appears.
3. Change the view to **Isometric** view and magnify the area highlighted in Figure 17 by clicking the **Fit** and **Zoom Area** buttons on the **Common** toolbar. Choose an area that just includes the vertical vessel.

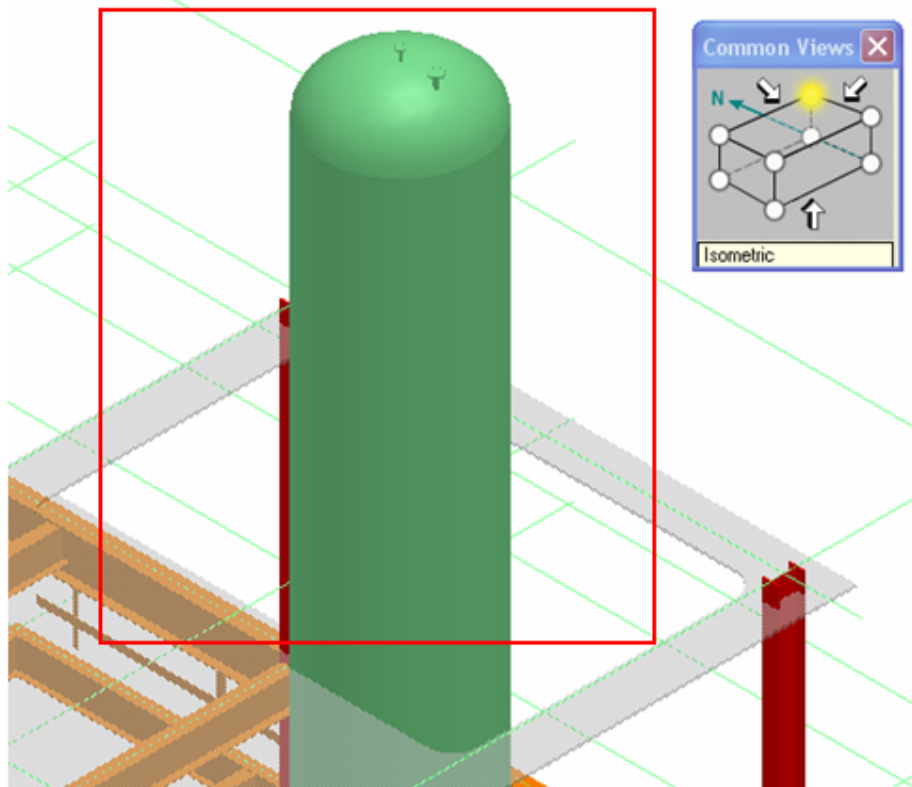


Figure 17: Looking Isometric View

3. Set the active coordinate system to **Global** on the **PinPoint** ribbon and activate the **Set Target to Origin** option.
4. Switch to the **Equipment and Furnishings** task and set the Active Permission Group to **Equipment**.
5. Click the **Place Equipment Component** button on the vertical toolbar.



Figure 18: Place Equipment Component Button

6. If the designed equipment or an equipment component of a designed equipment is already selected when you pick the **Place Equipment Component** command, then the designed equipment will be used by default. Otherwise, you will be prompted to select the designed equipment. If prompted, select **T-101** from **WSE** or in the active view.
7. In the **Select Equipment Component** dialog box, expand the folder **Equipment Components\Process Components\Attachments\Vessel Platform\ Vertical Vessel Platform** folder until you see the part **VerticalVesselPlatform-001-EC**.

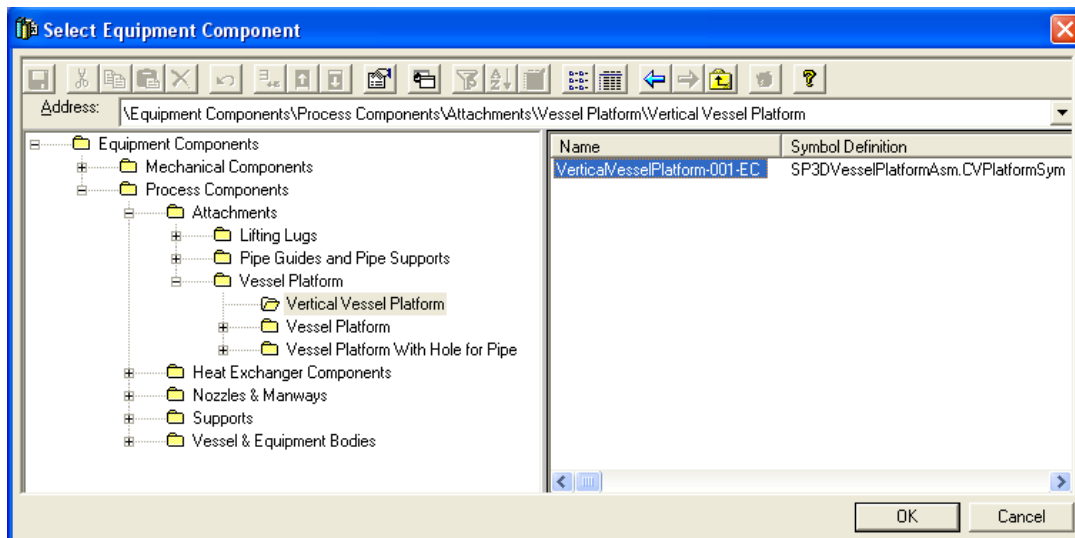
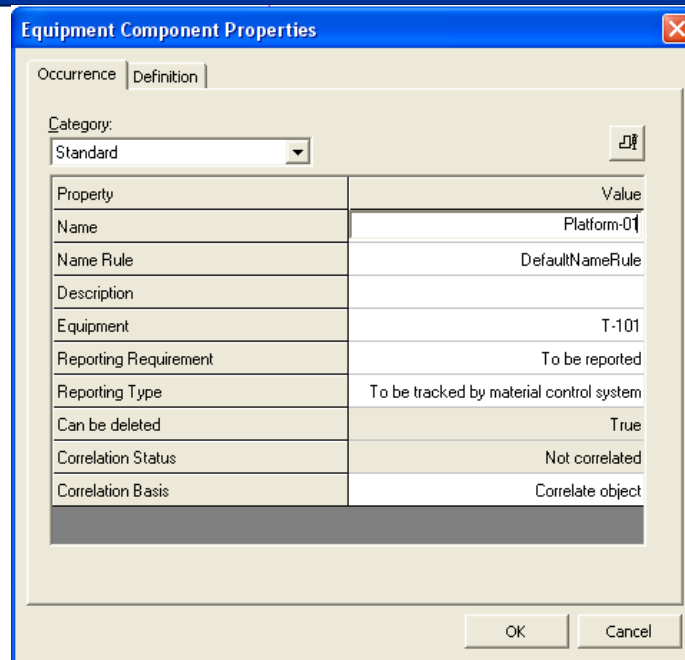


Figure 19: Selection of the Equipment Component in the Select Equipment Component Dialog Box

8. Select the part and click **OK**.
9. The **Equipment Component** property page appears defaulted to the **Standard** category of properties. In this page, key in **Platform-01** in the **Name** field, as shown in Figure 20.



Equipment Component Properties

Occurrence | Definition

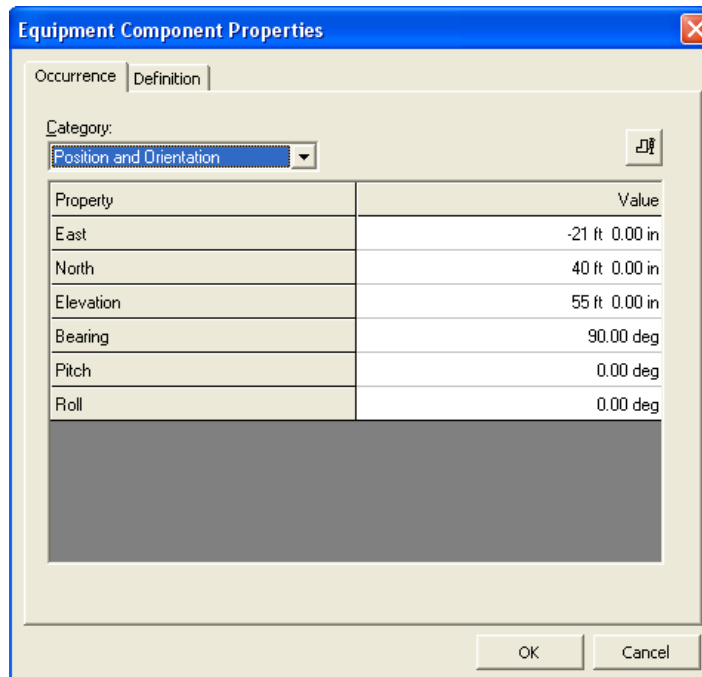
Category: Standard

Property	Value
Name	Platform-01
Name Rule	DefaultNameRule
Description	
Equipment	T-101
Reporting Requirement	To be reported
Reporting Type	To be tracked by material control system
Can be deleted	True
Correlation Status	Not correlated
Correlation Basis	Correlate object

OK Cancel

Figure 20: Name Field

- Switch to the **Position and Orientation** category of properties and key in the values shown in Figure 21.



Equipment Component Properties

Occurrence | Definition

Category: Position and Orientation

Property	Value
East	-21 ft 0.00 in
North	40 ft 0.00 in
Elevation	55 ft 0.00 in
Bearing	90.00 deg
Pitch	0.00 deg
Roll	0.00 deg

OK Cancel

Figure 21: East, North, and Elevation Values for the Vessel Platform-01

- Click the **Preview** button in the **Equipment Component Properties** page to see a picture of the equipment component geometry shown in Figure 22.

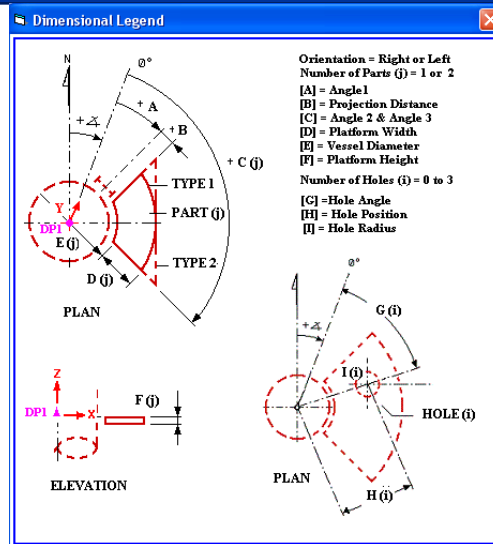


Figure 22: Preview Picture for the Vessel Platform

12. Close the preview picture dialog box. Switch to the **Equipment Dimension** category of properties and key in the following properties:

- **Projection Distance: 15 inch**
- **Angle 1: 50 deg**
- **Angle 2: 250 deg**
- **Platform Width 1: 4 ft**
- **Vessel Diameter: 7 ft**

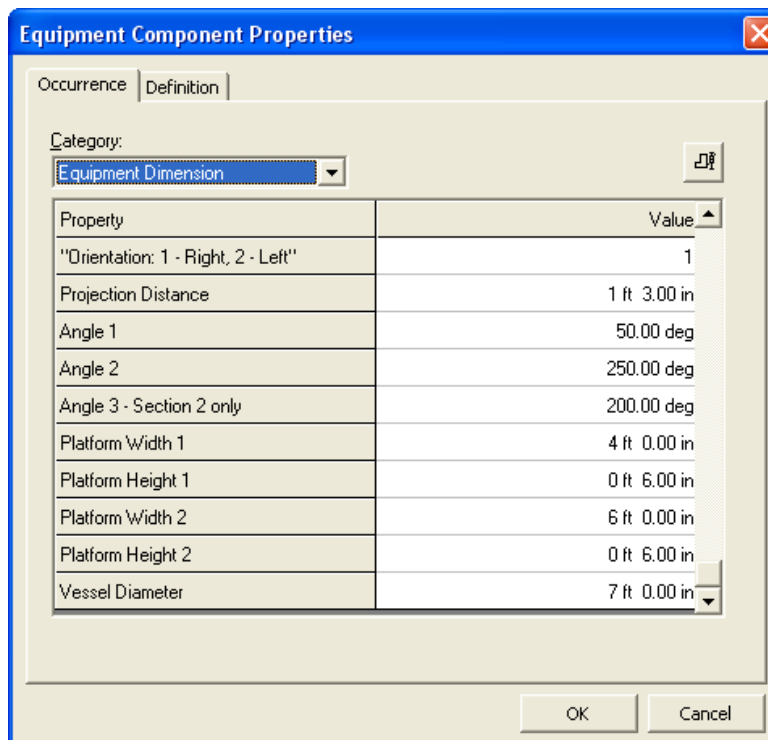


Figure 23: Equipment Component Dimensions

13. Click **OK** on the **Equipment Component Properties** page to place the equipment component (**Platform-01**). The view should resemble Figure 24.

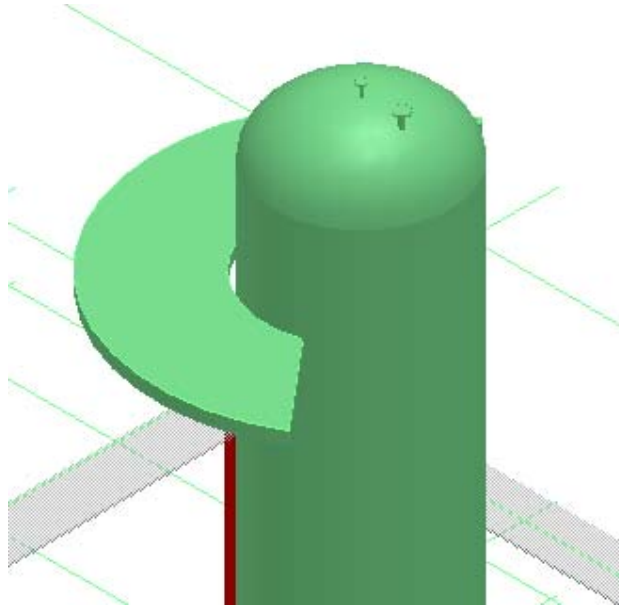
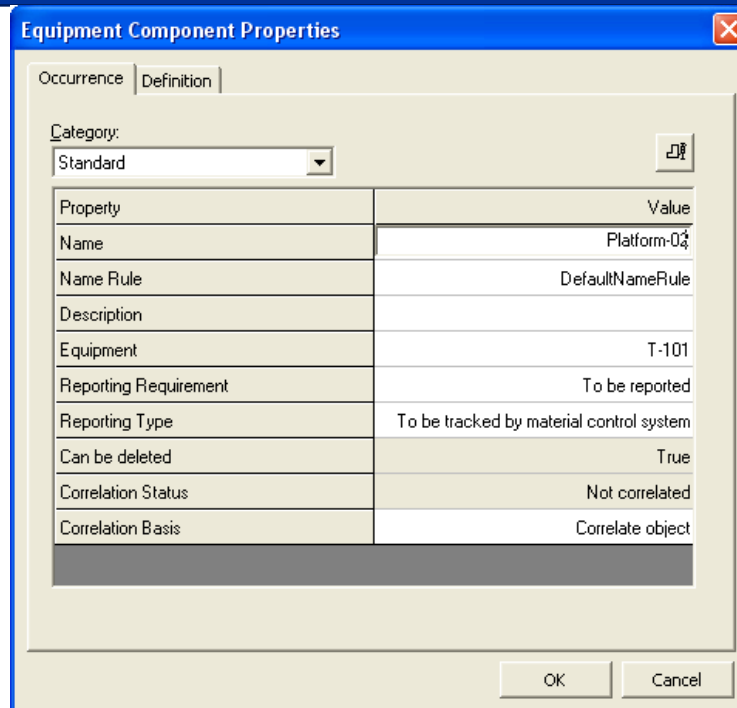


Figure 24: The Vessel Platform (Platform-01)

14. Click the **Place Equipment Component** button on the vertical toolbar.
15. If the designed equipment or an equipment component of a designed equipment is already selected when you pick the Place Equipment component command, then the designed equipment will be used by default. Otherwise, you will be prompted to select the designed equipment. If prompted, select **T-101** from **WSE** or in the active view.
16. In the Select **Equipment Component** dialog box, expand the folder **Equipment Components\Process Components\Attachments\Vessel Platform\Vertical Vessel Platform** folder until you see the part **VerticalVesselPlatform-001-EC**.
17. Select the part and click **OK**.
18. The **Equipment Component** property page appears defaulted to the **Standard** category of properties. In this page, key in **Platform-02** in the **Name** field, as shown in Figure 25.



Equipment Component Properties

Occurrence | Definition

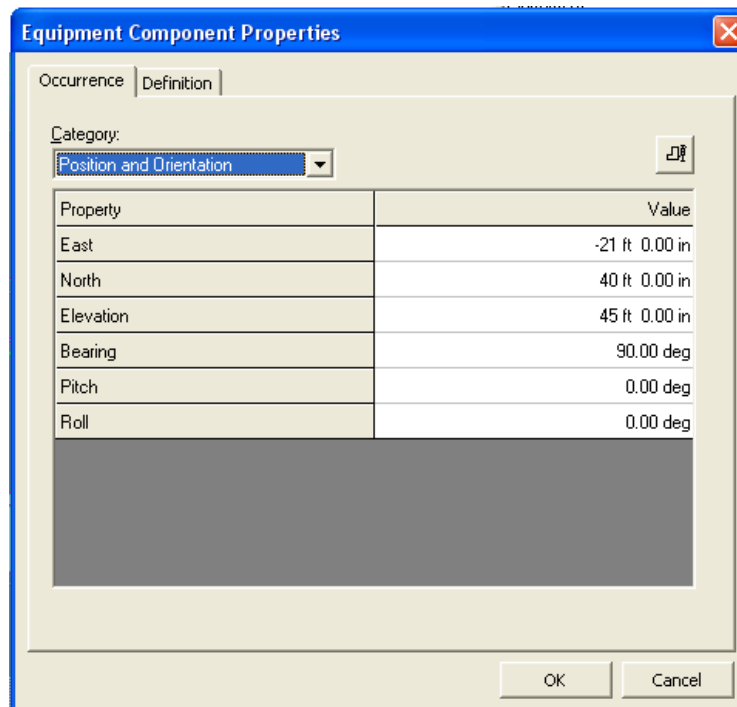
Category: Standard

Property	Value
Name	Platform-02
Name Rule	DefaultNameRule
Description	
Equipment	T-101
Reporting Requirement	To be reported
Reporting Type	To be tracked by material control system
Can be deleted	True
Correlation Status	Not correlated
Correlation Basis	Correlate object

OK Cancel

Figure 25: Name Field

19. Switch to the **Position and Orientation** category of properties and key in the values shown in Figure 26.



Equipment Component Properties

Occurrence | Definition

Category: Position and Orientation

Property	Value
East	-21 ft 0.00 in
North	40 ft 0.00 in
Elevation	45 ft 0.00 in
Bearing	90.00 deg
Pitch	0.00 deg
Roll	0.00 deg

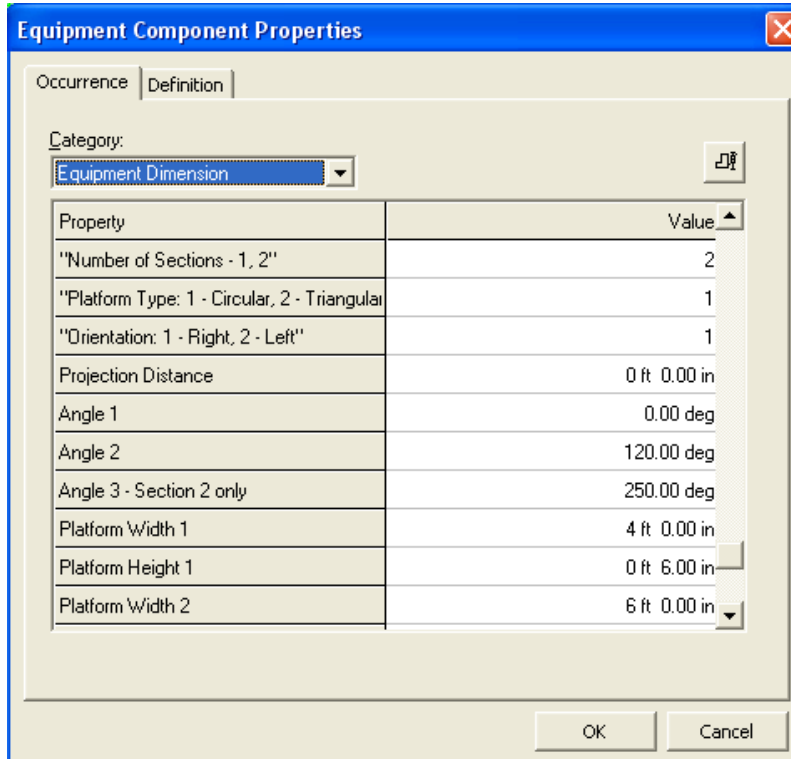
OK Cancel

Figure 26: East, North, and Elevation Values for the Vessel Platform-02

20. Switch to the **Equipment Dimension** category of properties and key in the

following properties:

- Number of Sections 1,2 in: 2
- Projection Distance: 0 ft
- Angle 1: 0 deg
- Angle 2: 120 deg
- Angle 3: 250 deg
- Platform Width 1: 4 ft
- Vessel Diameter: 7 ft



The dialog box titled "Equipment Component Properties" has two tabs: "Occurrence" and "Definition". The "Definition" tab is active. It features a "Category:" dropdown menu set to "Equipment Dimension". Below this is a table with two columns: "Property" and "Value". The table contains the following data:

Property	Value
"Number of Sections - 1, 2"	2
"Platform Type: 1 - Circular, 2 - Triangular"	1
"Orientation: 1 - Right, 2 - Left"	1
Projection Distance	0 ft 0.00 in
Angle 1	0.00 deg
Angle 2	120.00 deg
Angle 3 - Section 2 only	250.00 deg
Platform Width 1	4 ft 0.00 in
Platform Height 1	0 ft 6.00 in
Platform Width 2	6 ft 0.00 in

At the bottom of the dialog are "OK" and "Cancel" buttons.

Figure 27: Equipment Component Dimensions

21. Click **OK** on the **Equipment Component Properties** page to place the equipment component (**Platform-02**). The view should resemble Figure 28.

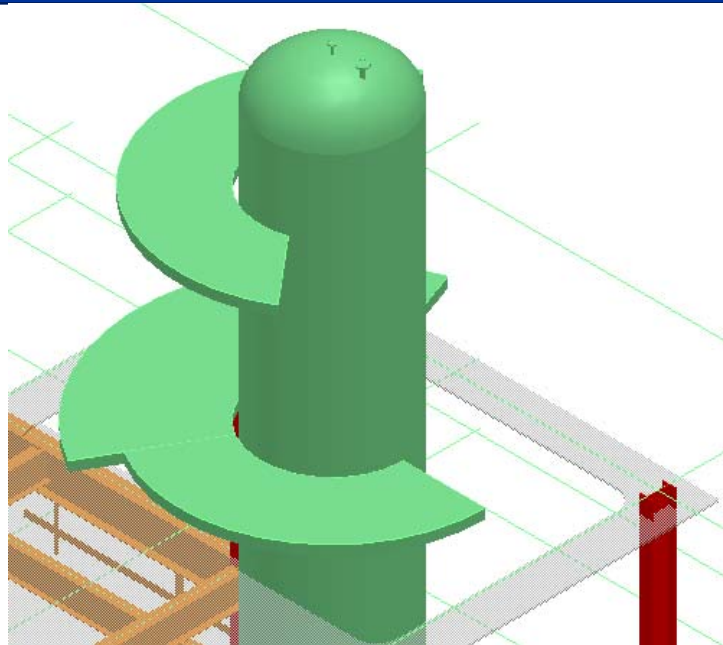


Figure 28: The Vessel Platform (Platform-02)

22. Switch to the **Structure** task.
23. Activate **PinPoint** ribbon by using the **Tools > PinPoint** command.
24. Place a temporary coordinate system on the equipment nozzle **C** using the **Define Coordinate System by 3 Points** option on the **PinPoint** ribbon shown in Figure 29.

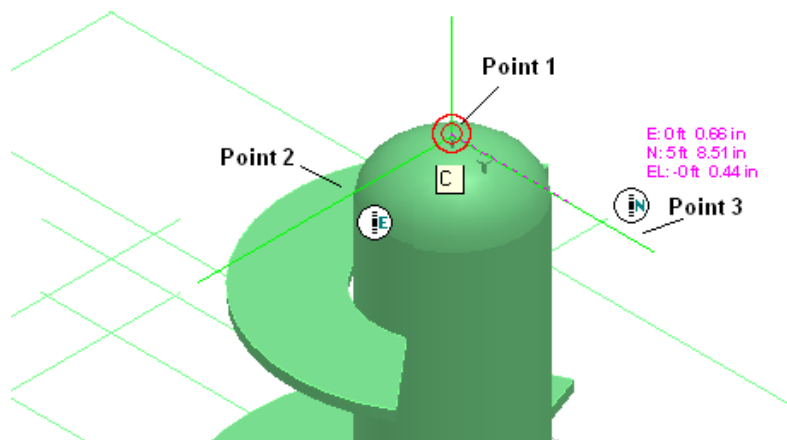


Figure 29: Define Coordinate System by Three Points

Note:

- **Define Coordinate System by 3 Points** option defines a temporary coordinate system by three points. 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.

25. Click the **Place Ladder** button on the vertical toolbar.



Figure 30: Place Ladder Button

26. **Select ladder** dialog box appears. To select the type of ladder in the **Select ladder** dialog box, expand the folder **Ladders\Ladder TypeA** until you see the part number **LadderLeftSideStep**. Select the part number and click **OK**. The selected part number becomes the default selection for the next time you place a ladder. You can change the default option by using the **Type** option on the **Place Ladder** ribbon. Your company can create standard sizes in your Catalog so you just have to select the desired standard and do not have to enter the data.

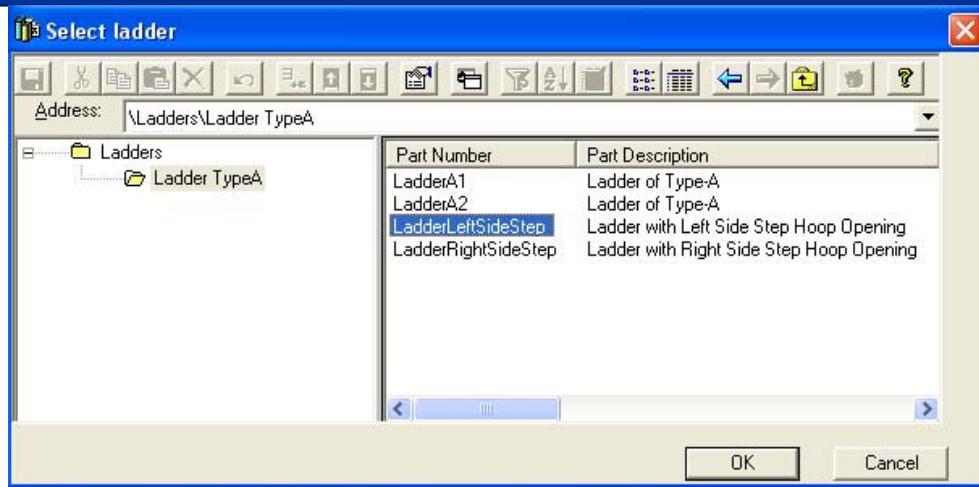


Figure 31: Select Ladder Dialog Box

27. You can specify the following setting on the **Place Ladder** ribbon:

- System: A2 > U03 > Equipment > T-101

28. Click the **Cylindrical Coordinates** option on **PinPoint** ribbon.

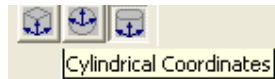


Figure 32: PinPoint ribbon

28. Select the projection surface of the vertical vessel to define the top edge of the ladder, as shown in Figure 33.

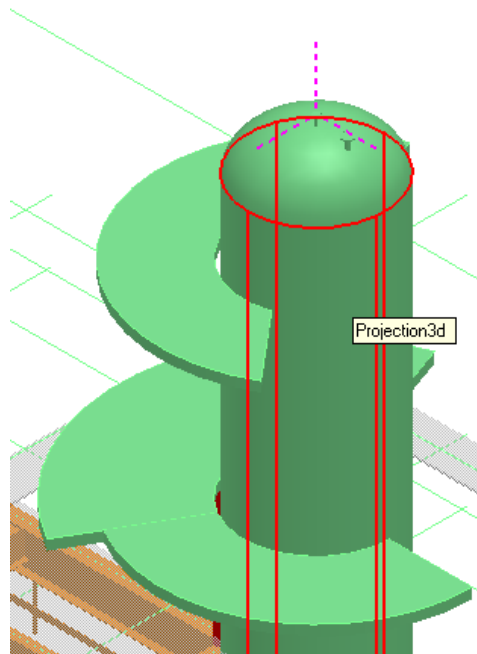


Figure 33: Defining the top edge of the ladder

29. Select top 3D plane of the second platform (**Platform-02**) to define the bottom plane of the ladder.

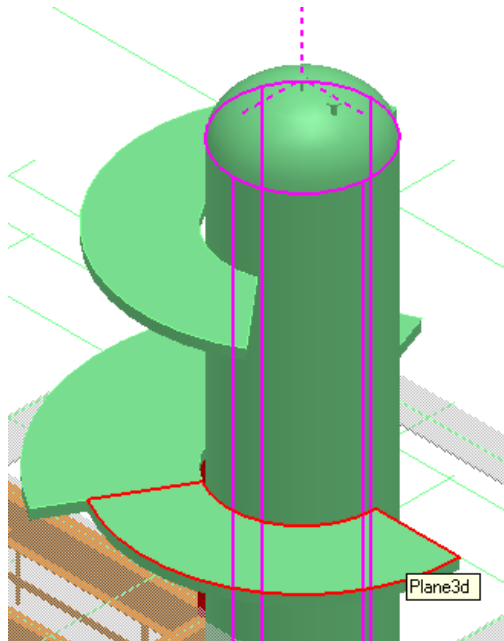


Figure 34: Defining the bottom plane of the ladder

30. Select edge of the platform step off area (**Platform-01**) as the reference edge of the ladder.

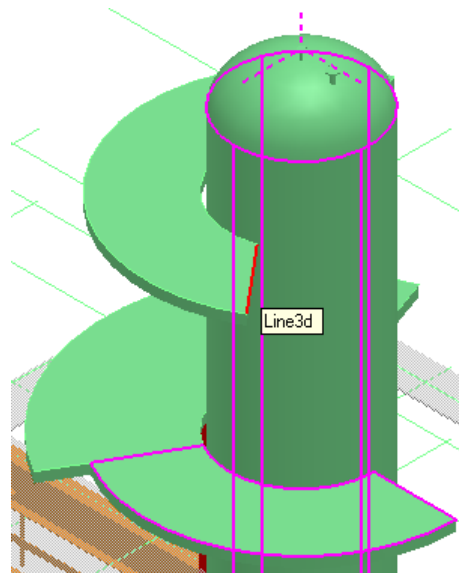


Figure 35: Defining the reference edge of the ladder

Note:

- When you select the reference edge of the ladder, you can see an outline of the ladder. 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.

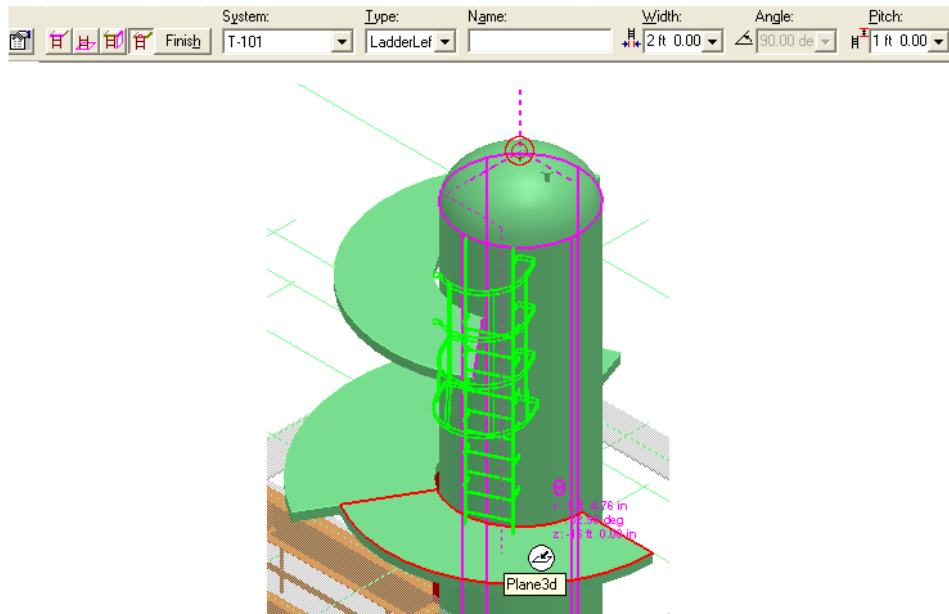


Figure 36: Outline of the ladder and ladder ribbon

31. To position the ladder perpendicular to the platform step off area, specify the following settings on the **PinPoint** ribbon:

- **Radius: 7 ft**
- **Theta: 38.67 deg**

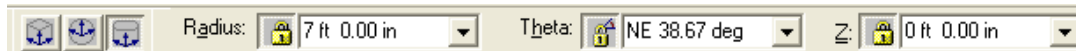


Figure 37: PinPoint ribbon

32. Click the **Finish** option on the **Place Ladder** ribbon.
33. Select **Properties** option on the **Place Ladder** ribbon to open its property page.
34. In this page, set **With Wall Support** field to **False** and key in **6.5 in** in the **Wall Offset** field. Click **OK** on the **Ladder Properties** page. The view should resemble Figure 38.

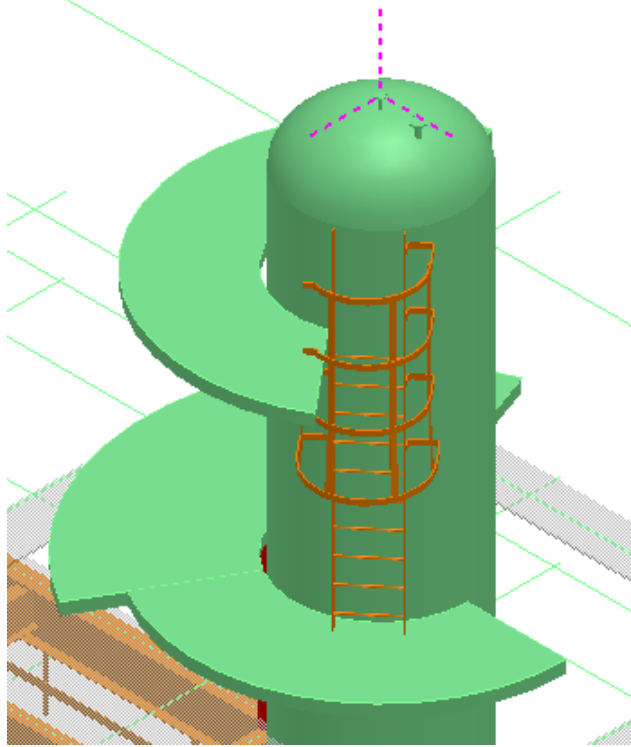


Figure 38: Placed ladder

35. Click the **Cylindrical Coordinates** option and set the active coordinate system to **Global** on the **PinPoint** ribbon. Activate the **Set Target to Origin** option and close the **PinPoint** ribbon.
36. Next, you are going to place handrails around the second vessel platform. Click the **Place Handrail** button on the vertical toolbar.



Figure 39: Place Handrail Button

37. **Select Handrail** dialog box appears. To select the type of handrail in the **Select Handrail** dialog box, expand the folder **Handrails\Handrails TypeA Side Mounted** until you see the part number **SideMountedHandrail**. Select the part number and click **OK**. Similarly to ladders, the selected part number becomes the default selection for the next time you place a handrails. You can change the default option by using the **Type** option on the **Place Handrail** ribbon.

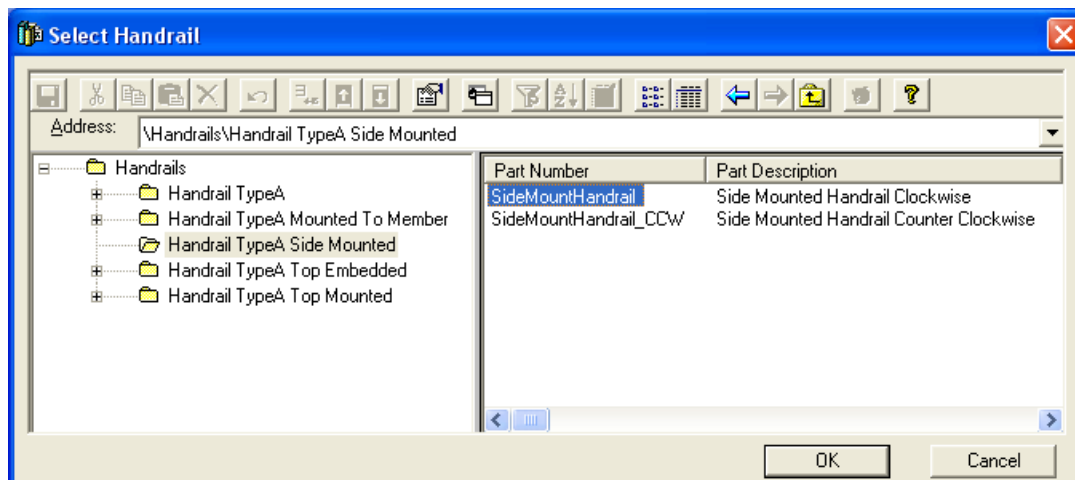


Figure 40: Select Handrail Dialog Box

38. The **Sketch 3-D Path** ribbon appears. The **Sketched 3-D Path** ribbon can be used

to define the location of a handrail.

39. Sketch the path of the handrail as shown in Figure 41.

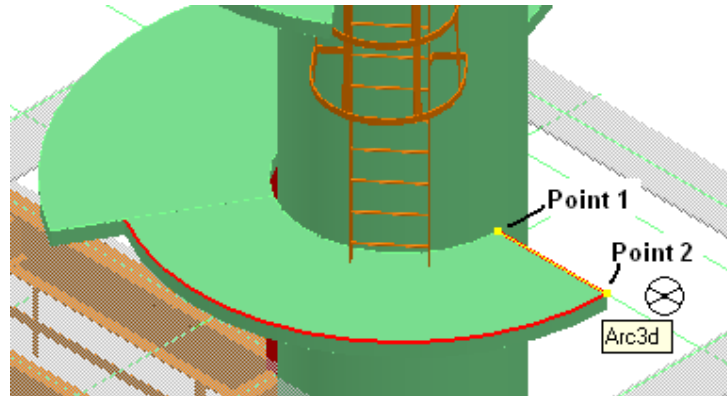


Figure 41: Handrail Path

40. Click the **Finish** button on the ribbon.
41. The **Place Handrail** ribbon appears. On the ribbon, set the handrail placement properties as follows:
- **System:** A2 > U03 > Equipment > T-101
 - **Begin Treatment:** None
 - **End Treatment:** None
42. Click the **Finish** button on the ribbon to place the handrail.
43. Select **Properties** option on the **Place Handrail** ribbon to open its property page.
44. In this page, set **Post Section Cardinal Point** field to **1-Bottom Left**. Click **OK** on the **Handrail Properties** page. The view should resemble Figure 42.

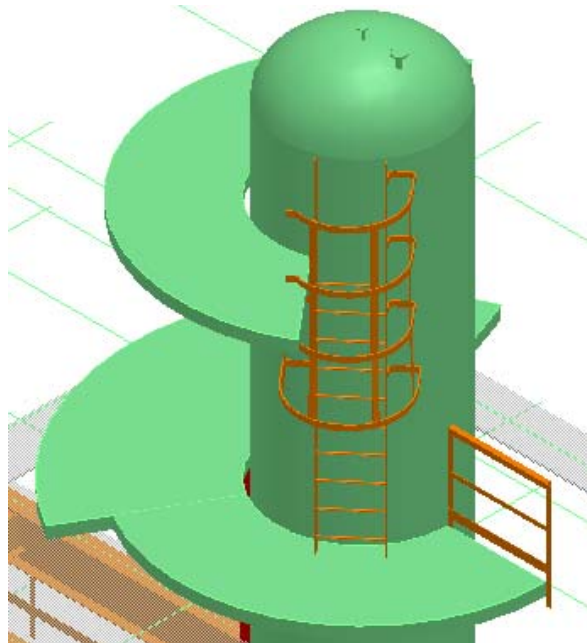


Figure 42: Placed Handrail

45. Click the **Place Handrail** button on the vertical toolbar.
46. The **Sketch 3-D Path** ribbon appears. Use the **Path Type** as **Arc by End Points** to sketch the next path of the handrail.
47. Sketch the path of the handrail as shown in Figure 43

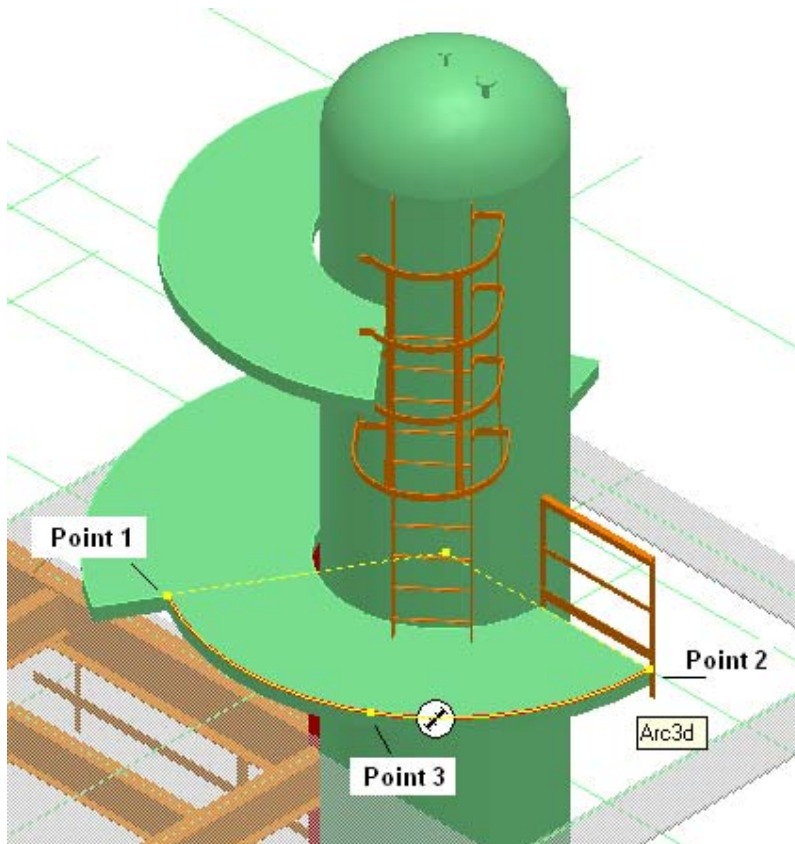


Figure 43: Handrail Path

48. Click the **Finish** button on the ribbon.
49. The **Place Handrail** ribbon appears. On the ribbon, set the handrail placement properties as follows:
 - **System:** A2 > U03 > Equipment > T-101
 - **Type:** SideMountedHandrail_CCW
 - **Begin Treatment:** None
 - **End Treatment:** None
50. Click the **Finish** option on the ribbon to place the handrail.
51. Select **Properties** option on the **Place Handrail** ribbon to open its property page.
52. In this page, set **Post Section Cardinal Point** field to **1-Bottom Left**. Click **OK** on the **Handrail Properties** page. The view should resemble Figure 44.

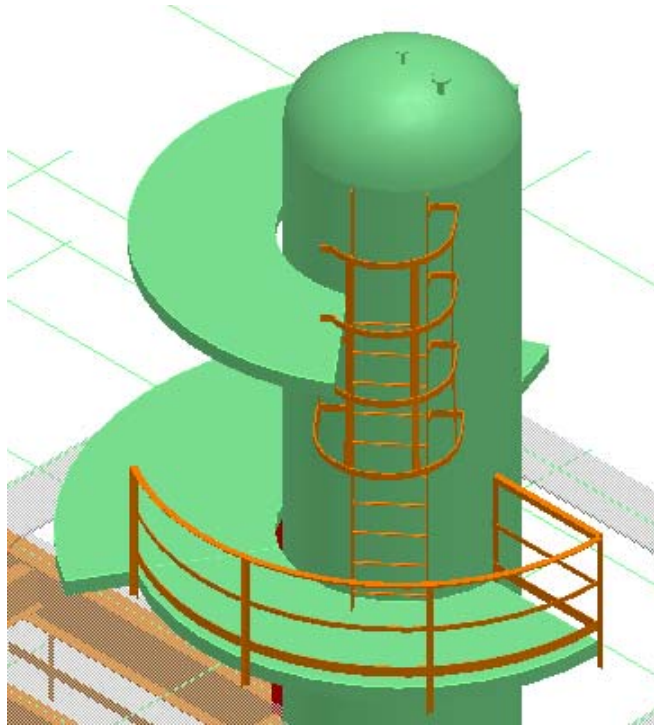


Figure 44: Placed Handrail

53. Repeat the above steps to place the other handrails on the second platform. The view should resemble Figure 45.

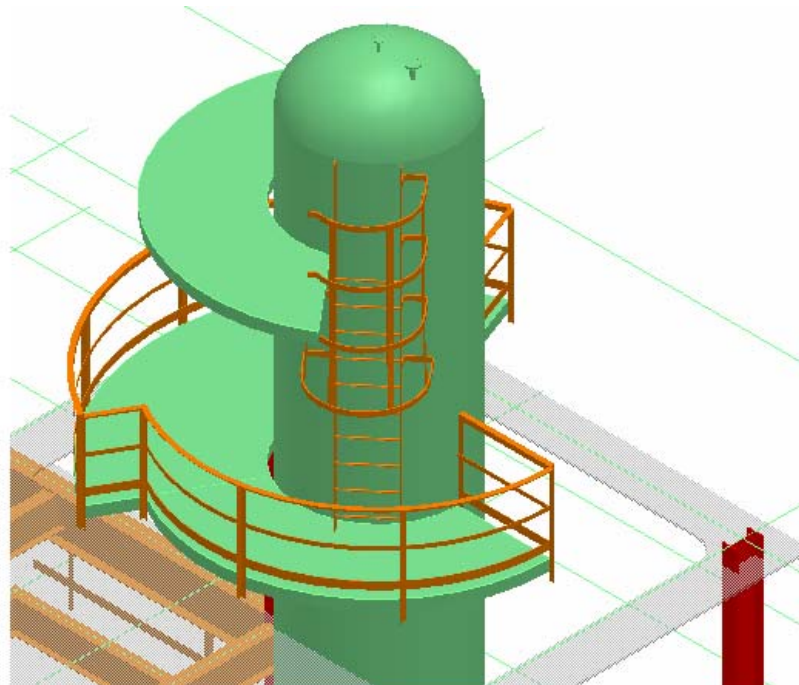


Figure 45: Output of Placing Platforms, Ladder and Handrails from the Catalog



SP3D Equipment Tutorial: Placing Designed Equipment and Components

For more information related to placing designed equipment and equipment components, refer to the *Placing Designed Equipment* topic in the user guide *EquipmentUsersGuide.pdf*.

For more information related to placing stairs and ladders, refer to the *Providing for Traffic: An Overview* topic in the user guide *StructureUsersGuide.pdf*.

Session 5: Modeling Designed Equipment with Shapes

Objective:

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

- Model designed equipment geometry by using the **Place Shape** command.

Prerequisite Sessions:

- SP3D Overview
- SP3D Common Sessions
- Equipment Overview
- Placing Designed Equipment and Equipment Components

Overview:

You can add shapes to existing designed equipment or an equipment component by using the **Place Shape** command. A shape object is a parametric volume such as a cylinder, a cone, or a rectangle defined in the Catalog. On placement from the Catalog, you enter the parameter values to size the geometry. The default Catalog is delivered with a set of shapes commonly used to represent equipment geometry. Your Catalog administrator can add custom shapes to the Catalog.

You can use the **Place Shape** command 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.

Steps for Placing a Shape:

Place a **Kettle Heat Exchanger E-102** from the SP3D 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 as stands to mount this Heat Exchanger and add caps on both sides by using the **Place Shape** command. The shape placed in the model should be similar to the object displayed in Figure 1.

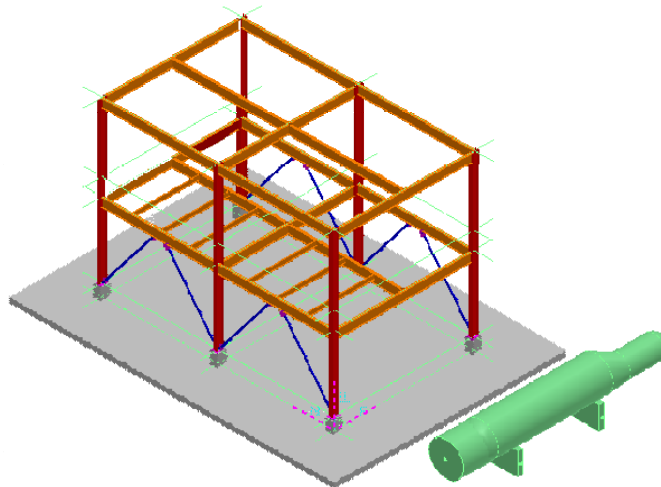


Figure 1: The Kettle Heat Exchanger E-102

1. Define your workspace to display Unit **U01** and coordinate system **U01 CS** and switch to the **Equipment and Furnishings** task.
2. Activate the **PinPoint** by using the **Tools > PinPoint** command. The **PinPoint** ribbon appears.

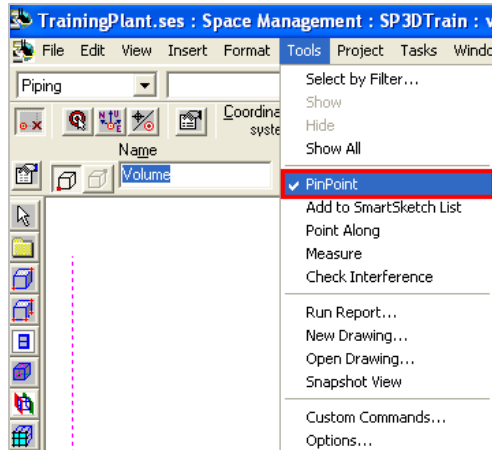


Figure 2: The Pinpoint option Selected

3. Change the active coordinate system to **U01 CS** in the **coordinate system** drop-down list of the **PinPoint** ribbon, as shown in Figure 3.

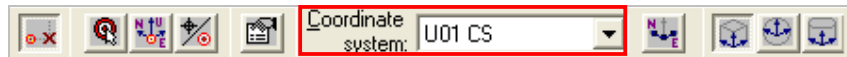


Figure 3: The Active Coordinate System Selected

4. Select the **Set Target to Origin** option on the **PinPoint** ribbon to move the target to the origin of the current **coordinate system**, as shown in Figure 4.

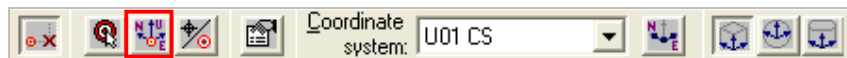


Figure 4: Set Target to Origin Option

5. Click the **Place Designed Equipment** command on the vertical toolbar, as shown in Figure 5.



Figure 5: Place Designed Equipment Button

6. From the catalog browser select **\Equipment\Process\Heat Exchangers\Kettle Heat**

Exchanger and click **OK**, as shown in Figure 6.

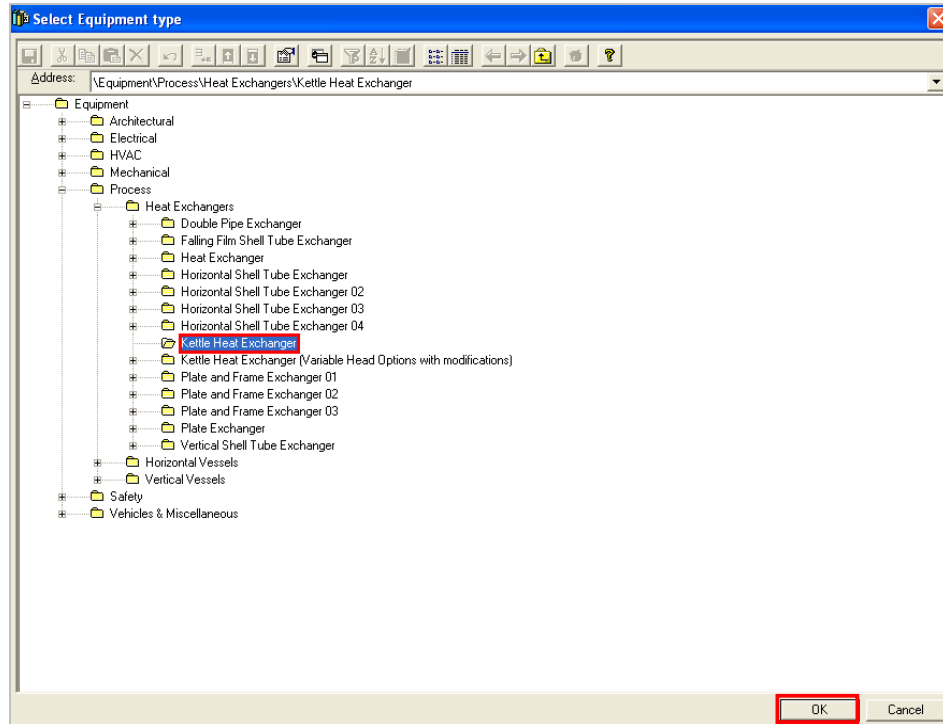


Figure 6: The Kettle Heat Exchanger Selected

The **Select Equipment type** dialog box is displayed.

6. Key in **E-102** for the **Name** as shown in the Figure 7.

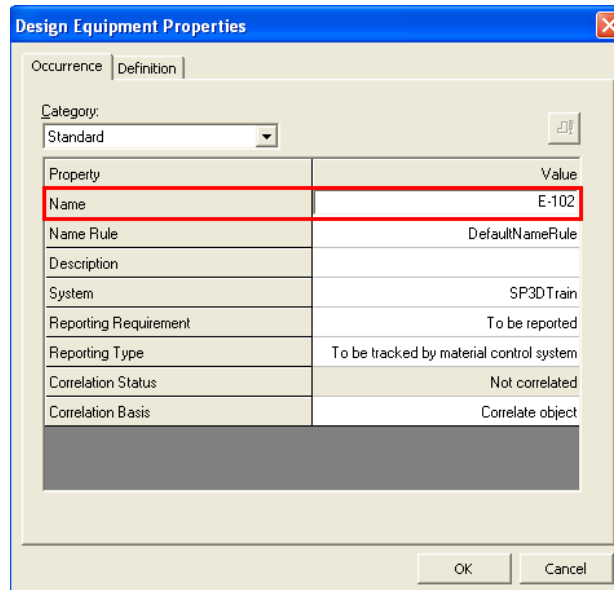


Figure 7: The Equipment Named as E-102

7. In the **Design Equipment Properties** dialog box, click the **System** field and select the **More...** option. The **Select System** dialog box appears. Select the **A2 > U01 > Equipment**

system as shown in Figure 8 and click **OK**.

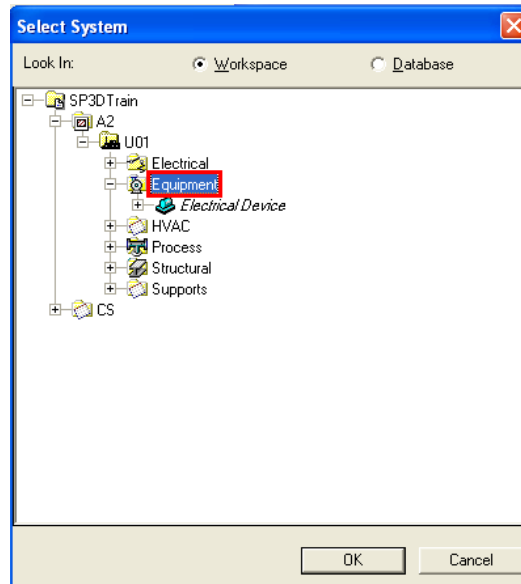


Figure 8: The Equipment System Selected

8. Switch to the **Position and Orientation** category. Key in the following specifications in the **Position and Orientation** category in the **Design Equipment Properties** dialog box:

Easting: 5ft
Northing: -20 ft
Elevation: 6 ft

This sets the origin of the designed equipment at the indicated location.

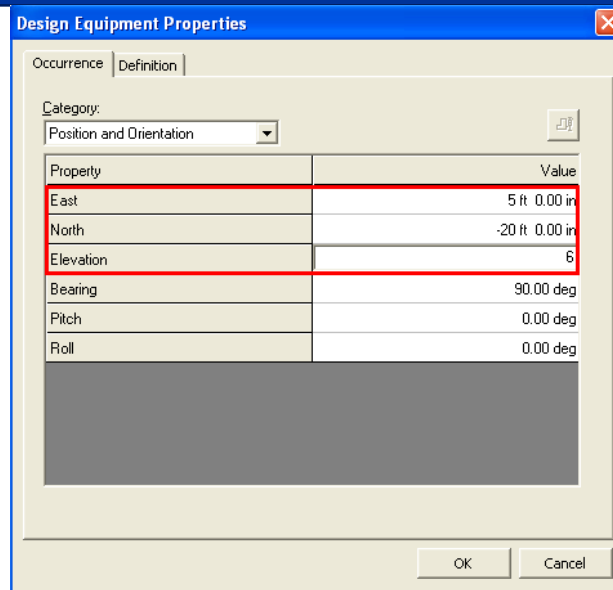


Figure 9: The E, N and El Values Selected

- Switch to the **Definition** Tab and set the classifications, as shown in Figure 10.

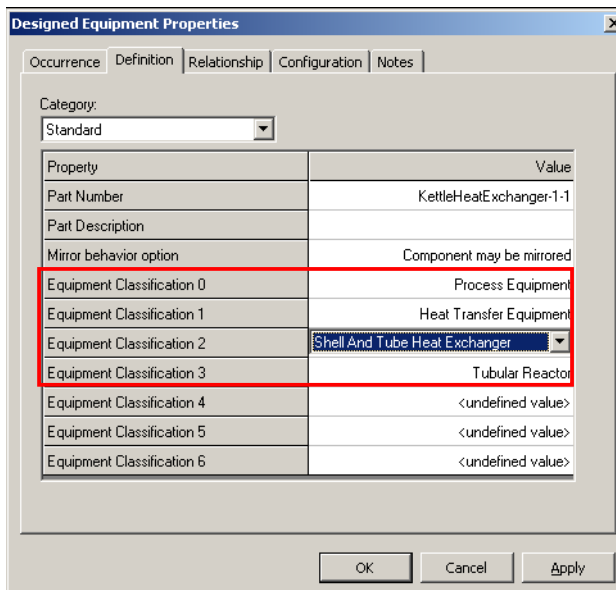


Figure 10: The Definition Classifications Selected

- Click **OK**.
- Click and hold the **Place Shape** on the vertical toolbar to display the shape selection palette and then, click **RtCircularCylinder** to select a cylinder, as shown in Figure 11.

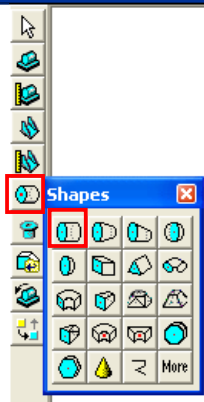


Figure 11: Place Shape Command on the Vertical Toolbar

Note:

- A click on the Place Shape button on the vertical toolbar will initiate placement of the indicated shape.
 - When you click **Place Shape** button and hold, the **Shapes** palette is displayed. This palette will remain displayed for later direct selection of shapes until you close it. Click on the shape you want to place. You can browse the Catalog for more shapes by picking the **More...** option on the **Shapes** palette.
12. If prompted, select **Equipment E-102** in the **Workspace Explorer**. This displays the **Shape Properties** dialog box. Key in the following specifications:

A: 20ft

B: 6 ft

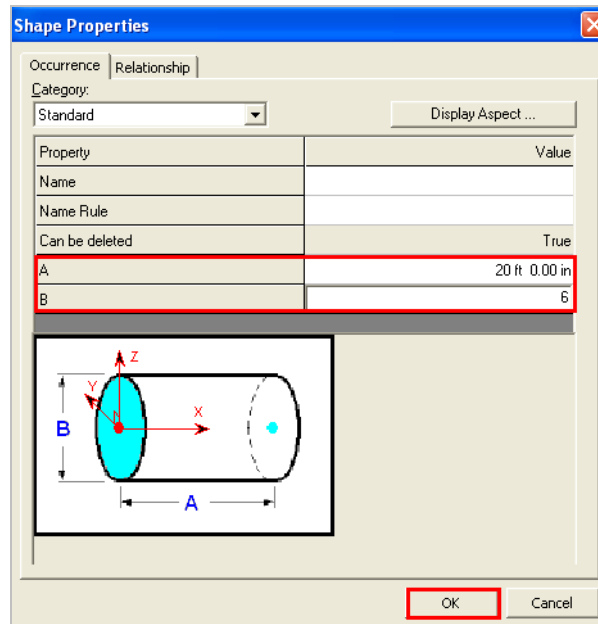


Figure 12: The Shape and Properties Values

Note:

- Shapes have a local **coordinate system** as indicated in Figure 14. 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 keyed in step 12 are measured relative to the Active coordinate system.
13. Key in **5 ft** for **E**, **-20 ft** for **N**, **6 ft** for **El** on the **PinPoint** ribbon to specify the position of the cylinder to be placed, as shown in Figure 13.

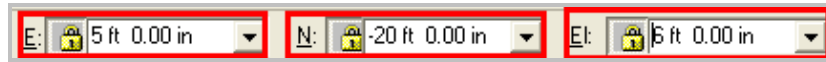


Figure 13: Specifying the Coordinates of the Cylinder

14. Click in the graphic view to place the cylinder, as shown in Figure 14.

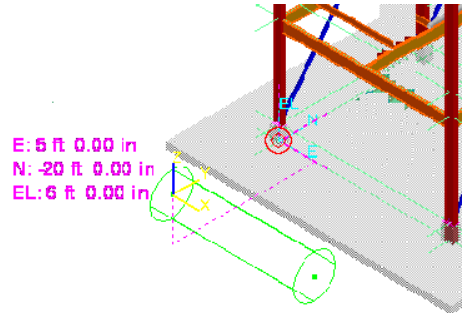
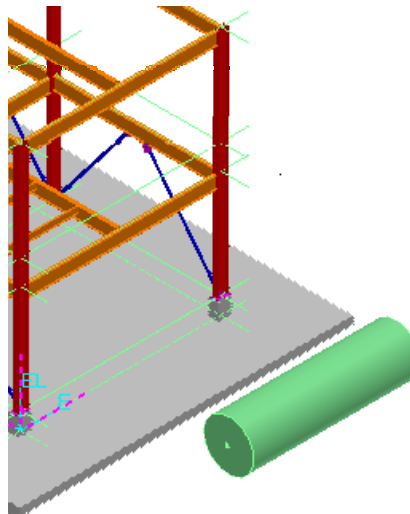


Figure 14: The Cylinder in the Specified Position

The cylinder will be placed as shown in Figure 15.



15: The Placed Cylinder

15. Click the **Place Shape** button on the vertical toolbar and select the **EccentricCone 001** shape, as shown in Figure 16.

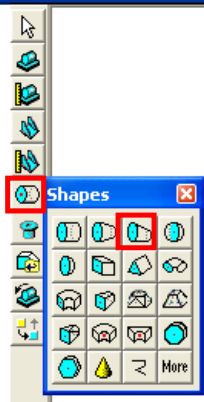


Figure 16: Place Shape Button and Eccentric Cone Shape

15. This displays the **Shape Properties** dialog box. Key in the following specifications in the **Properties** dialog box and click **OK**:

A: 3 ft
B: 6 ft
C: 4 ft

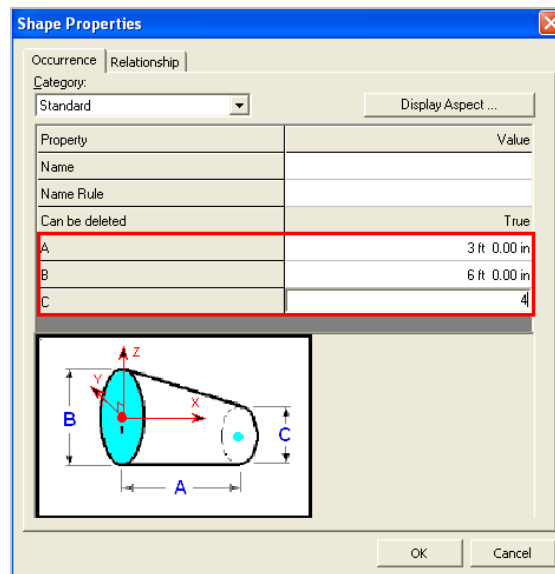


Figure 17: The Properties of the Cone Selected

16. On the **Place Shape** ribbon, set the relationship to **Connect** in the **Positioning Relationship** drop-down list, as shown in Figure 18.

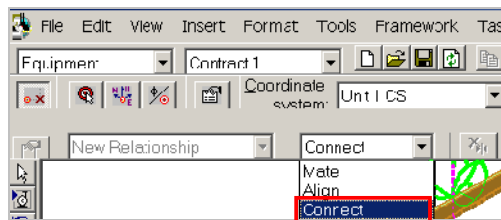


Figure 18: The Connect Option Selected for Positioning Relationship

17. Select a point at the east end of the cylinder and click on the end point to place the cone.

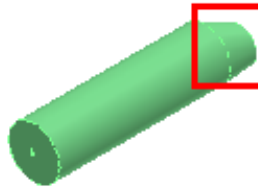


Figure 19: The Cylinder Along with the Cone

Note:

- If the cone is not flat at the bottom, you can rotate it to make the bottom of the cone flat. You can use the **UP Arrow** key to change the rotation axis and the **Left** and **Right Arrow** keys to rotate the cone.
- 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 position when you edit the length of the cylinder, you can place with a mate relationship.

18. Click the **Place Shape** button on the vertical toolbar and select a **Cylinder**. Click to identify **Equipment E-102** in the **WSE**. Key in the following specifications in the **Shape Properties** dialog box:

A: 6 ft

B: 4 ft

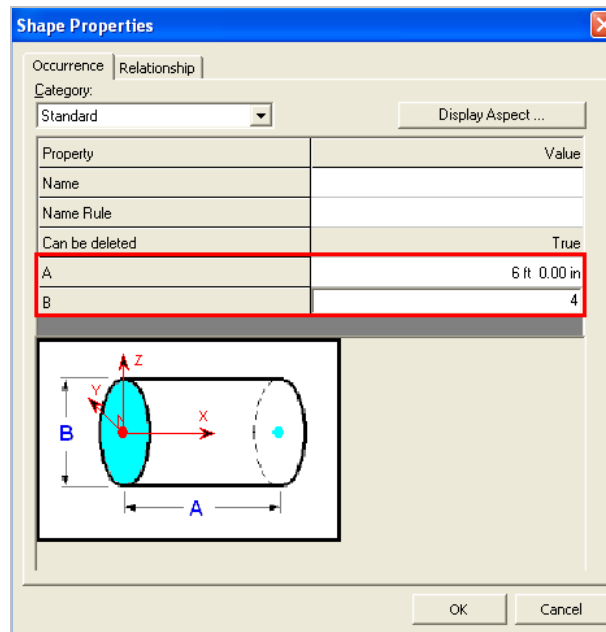


Figure 20: The Shape Properties Dialog Box with Values of A and B

19. Using **Connect** relationship as mentioned in step 16, place it at the free end of the **Eccentric Cone**, as shown in Figure 21.

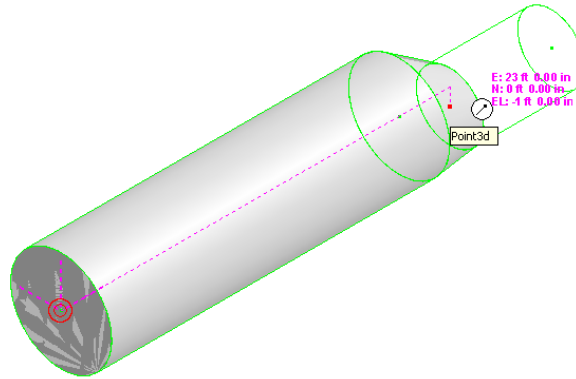


Figure 21: The Placed Equipment

Note:

- If the point is difficult to locate because the surface of the cylinder is being found by SmartSketch, toggle the surface locate off using **F3** function key. Pressing **F3** function key again will toggle the surface locate back on.

20. Click the **Reposition Target** option on the **PinPoint** ribbon to change target to the end of the cylinder. Now, to place the first rectangle beneath the equipment object **E-102**, key in the coordinates as **4 ft** for **E**, **0 ft** for **N**, and **-2 ft** for **EL**. Figure 23 depicts the repositioned target and the rectangle to be placed.

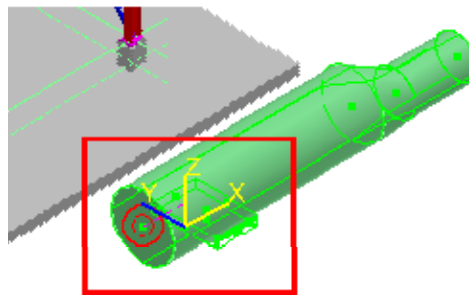


Figure 23: The Coordinates of the Rectangle as per Repositioned Target

21. Click the **Place Shape** button on the vertical toolbar and select the **Rectangular Solid** shape. Enter the specifications in the **Shape Properties** dialog box:

A: 4 ft

B: 6 ft

C: 10 in

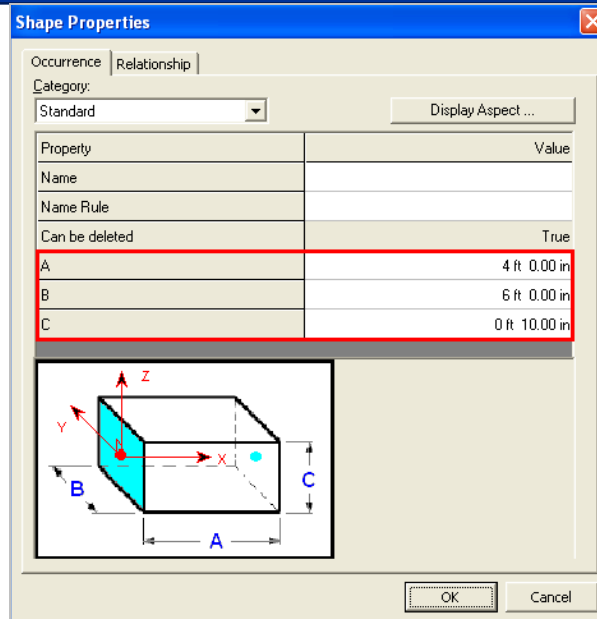


Figure 22: The Specifications for the Dimensions Mentioned

22. Press the **Right Arrow** key to rotate the rectangle and place it, as shown in Figure 24.

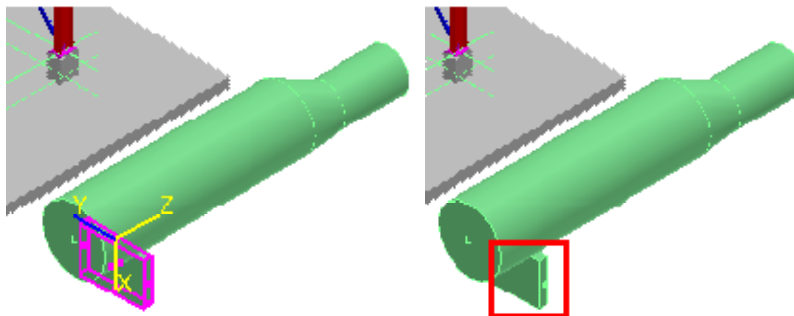


Figure 24: The First Rectangle Placed

23. Repeat steps 21-22 with the same dimensions and the coordinates as **18 ft for E**, **0 ft for N**, and **-2 ft for E1** to place the second rectangle beneath the equipment object **E-102**. Figure 25 shows the equipment object mounted on the two rectangles.

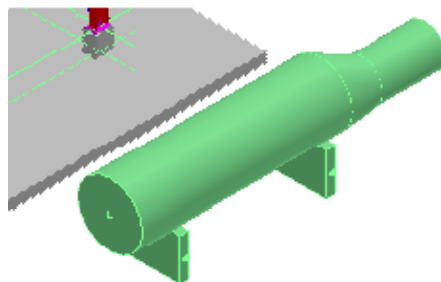


Figure 25: The Equipment Object Mounted on Two Rectangles

24. Rename all the shapes under the **Designed Equipment E-102**, as shown in Figure 26.

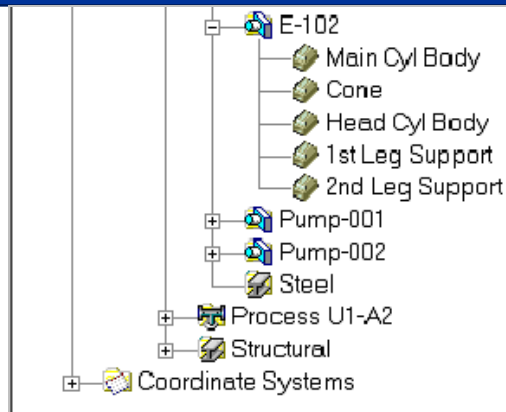


Figure 26: The Shapes Renamed

25. To place the first cap of the equipment object, click the **Place Shape** button on the vertical toolbar and select the **Semi Elliptical Head** shape. In the **Shape Properties** dialog box enter the specifications for dimensions as **6 ft** for **A** and **3 ft** for **B**. Figure 27 shows the required dimensions keyed in the **Shape Properties** dialog box.

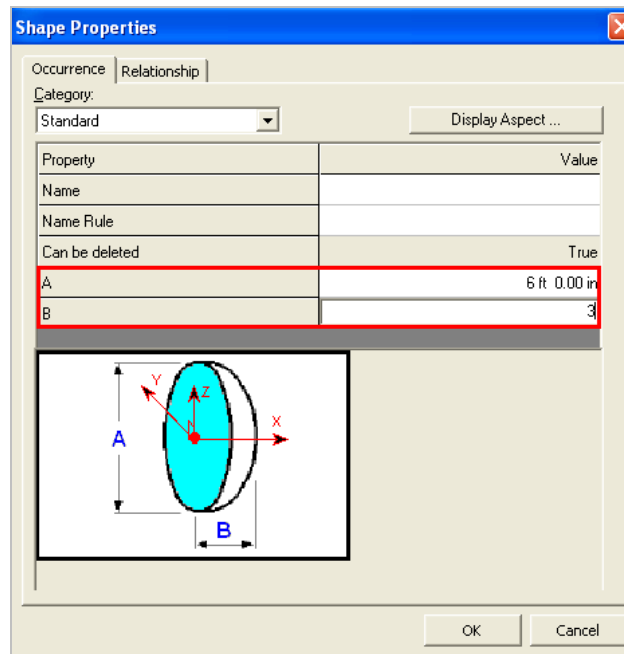


Figure 27: The Shape Property Values of First Cap

26. Using **Connect** relationship as mentioned in step 16, place it at the west end of the equipment object as highlighted in Figure 28.

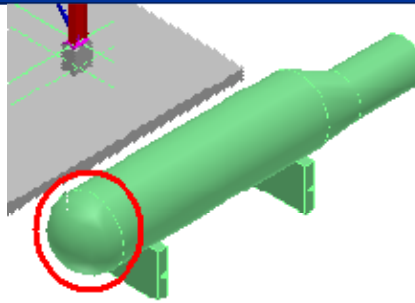


Figure 28: The First Cap Highlighted

27. Repeat steps 25-26 with dimensions as **4 ft** for **A** and **2 ft** for **B** to place the second cap of the equipment object, as shown in Figure 29.

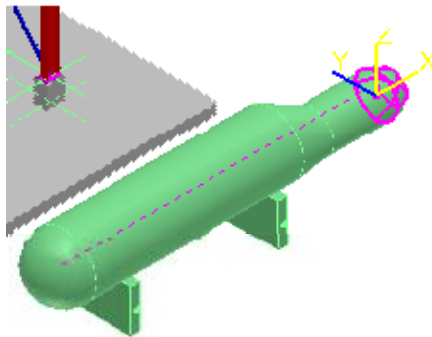


Figure 29: The Second Cap Placed

Now, the equipment object should resemble the object as shown in Figure 30.



Figure 30: The Equipment Object after Placing the Caps

28. Turn the **Maintenance Aspect** on in the **Format View** dialog box and click **OK**, as shown in Figure 31.

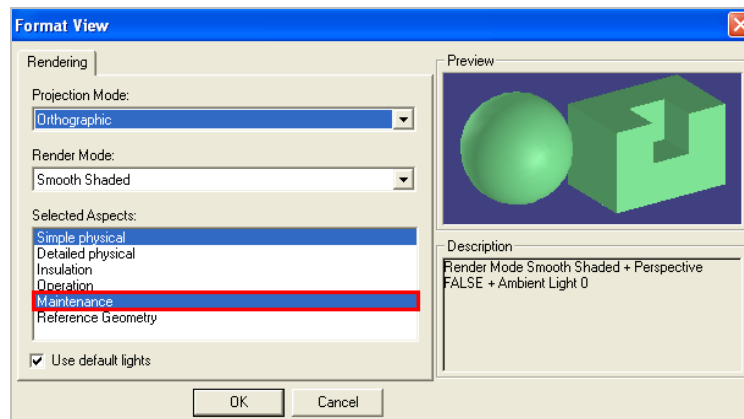


Figure 31: The Maintenance Aspect Selected

29. To place the **Maintenance Envelope** on the bigger end of the equipment, click the **Place Shape** button and select the **Cylinder** option.
30. Select the **Display Aspect...** button. Unselect the **Simple physical** and select the **Maintenance Aspect**.
31. Click **OK** in the **Display Aspects** dialog box.

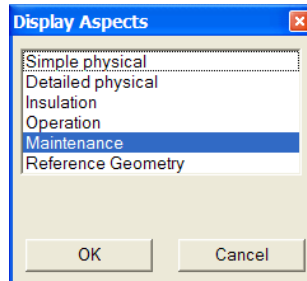


Figure 32: Display Aspect Dialog Box

32. Key in **6 ft** for **A** and **6 ft** for **B** in the **Shape Properties** dialog box, as shown in Figure 33.

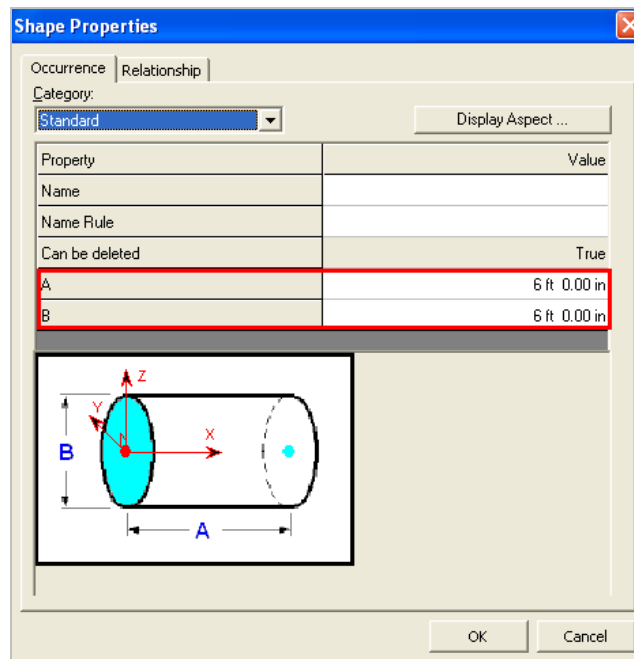


Figure 33: The Dimensions of the Maintenance Envelope Highlighted

20. Use the arrow keys to rotate the shape and place it at the west end of the equipment object.
21. Turn the **Maintenance Aspect** off in the **Format View** dialog box.

The equipment with the **Maintenance Envelope** will now resemble Figure 34 if you

select the “Equipment Maintenance – Delivered” Surface Style Rule (see common tutorials). If you don’t set the style rule, the volume will be shown in the default solid green color.

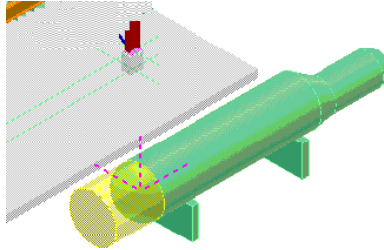


Figure 34: The Equipment with the Maintenance Envelope

For more information related to placing shapes, refer to the *Place Shape Command* topic, in session *Placing Shapes* of the user guide *EquipmentUsersGuide.pdf*.

Session 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.

Prerequisite Sessions:

- SP3D Overview
- SP3D Common Sessions
- Placing Designed Equipment and Equipment Components
- Modeling Designed Equipment

Overview:

The  **Place Imported Shape from File** command creates a shape that contains the geometry from SAT or DGN format files. SAT file geometry can be created from solids modeling softwares such as Solid Edge, Solid Works, etc. The imported Shape can be placed in designed equipment or equipment component.

The local coordinate system of the shape is the SAT file coordinate system. Once imported, the geometry from the SAT or DGN file is stored in the SP3D model database. The file on the disk is not referenced by SP3D.

Steps for Placing Equipment Using Imported Shapes from a File:

Place 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. The end result of this procedure should be similar to the highlighted object displayed in Figure 1.

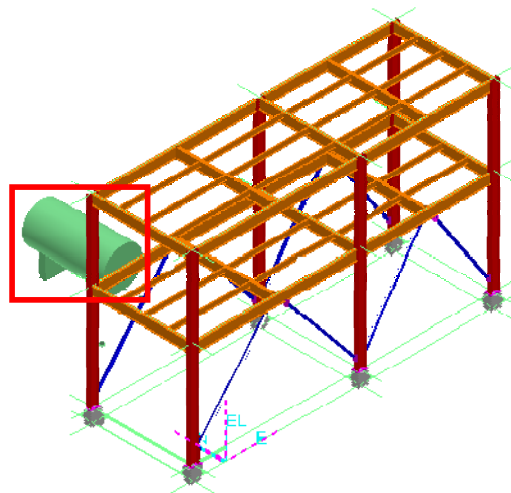


Figure 1: Final Output: After Placing the Equipment Using Imported Shapes From a File

27. Define your workspace to display Unit **U02** and coordinate system **U02 CS**.
28. Activate the **PinPoint** ribbon from **Tools>PinPoint**.
29. Change the active coordinate system to **U02 CS** from **PinPoint** ribbon.



Figure 2: PinPoint Ribbon

30. Move the target position to place the equipment at the origin of the current coordinate system. For this, click the **Set Target to Origin** option on the **PinPoint** ribbon.

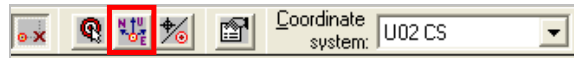


Figure 3: Set Target to Origin Option on the PinPoint Ribbon

31. Click the **Place Designed Equipment** button on the vertical toolbar.



Figure 4: Place Designed Equipment Button

32. A **Select Equipment type** dialog box appears. Expand **Equipment\Process\Horizontal Vessels** and select **Horizontal Drum with Saddle** from the Catalog and click **OK** as shown in Figure 5.

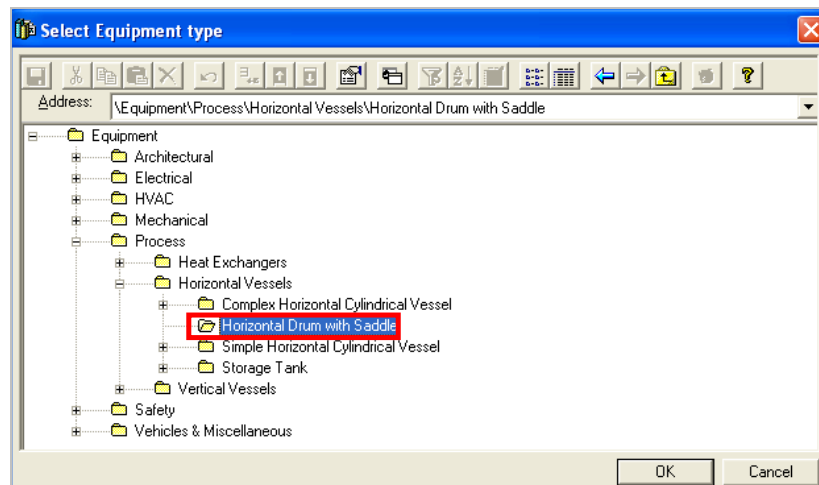
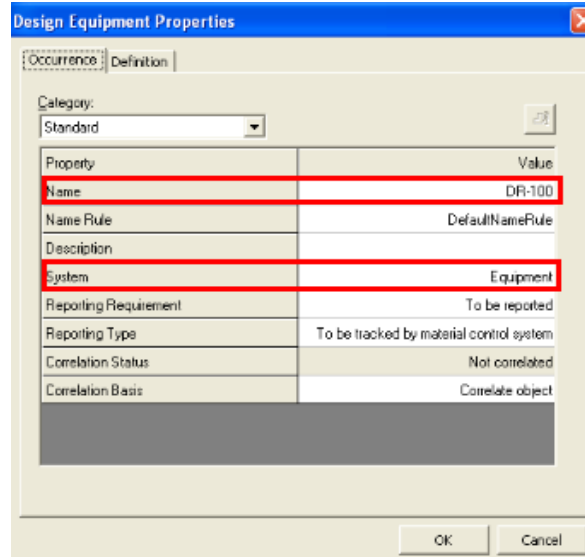


Figure 5: Select Equipment Type Dialog Box

33. Key in the following specifications on the **Standard Category** in the **Design Equipment Properties** dialog box as shown in Figure 6.

System: A2 > U02 > Equipment
Name: DR-100



The dialog box is titled "Design Equipment Properties" and has two tabs: "Occurrence" and "Definition". The "Definition" tab is active. Below the tabs, there is a "Category:" label and a dropdown menu set to "Standard". Below this is a table with two columns: "Property" and "Value". The table contains the following rows:

Property	Value
Name	DR-100
Name Rule	DefaultNameRule
Description	
System	Equipment
Reporting Requirement	To be reported
Reporting Type	To be tracked by material control system
Correlation Status	Not correlated
Correlation Basis	Correlate object

At the bottom of the dialog box are "OK" and "Cancel" buttons.

Figure 6 : Standard Category in the Design Equipment Properties Dialog Box

34. Key in the following specifications on the **Position and Orientation Category** in the **Design Equipment Properties** dialog box (Refer to Figure 7):

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

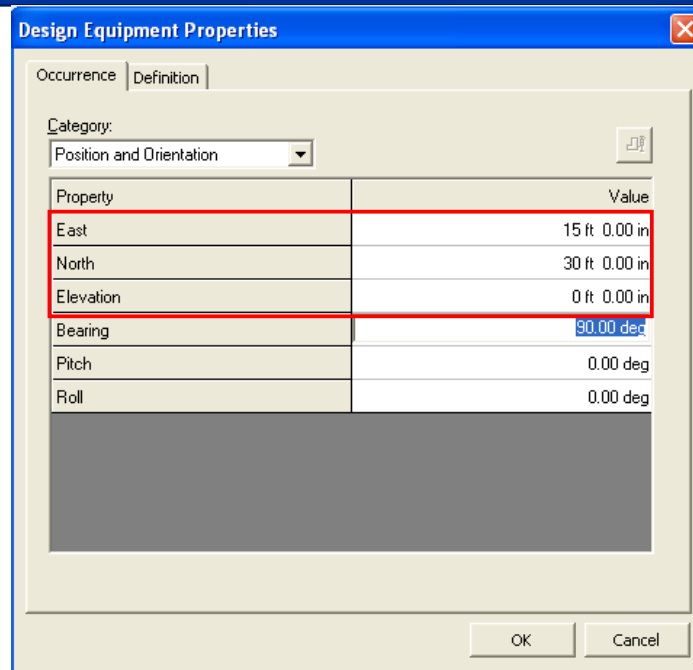


Figure 7: Position and Orientation Category in the Design Equipment Properties Dialog Box

35. Click **OK** in the **Design Equipment Properties** dialog box to place the designed equipment with the indicated local coordinate system origin.

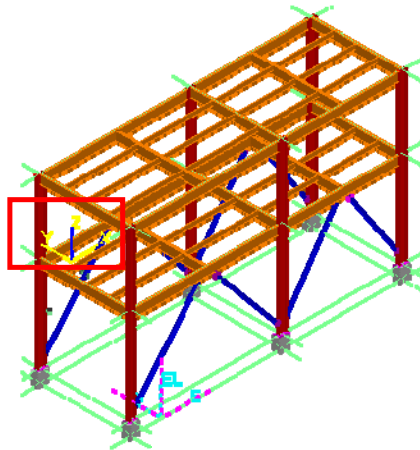


Figure 8: Graphic View: Equipment to be Placed

36. Click the **Place Imported Shape from File** button on the vertical toolbar.



Figure 9: Place Imported Shape from File Button

Note:

- If an equipment object or equipment component is not selected, select it in a graphic view or in the **Workspace Explorer**.

37. In the **Select Shape File** dialog box, browse to locate the **Tank_Shape.sat** file using the UNC path connection [\\machine\TrainingSymbols\TrainingFiles](#) and click **Open**.

Notes:

- Ask the instructor the appropriate UNC path of the Training Symbol share.
 - The **Select Shape File** dialog box specifies the .SAT file that contains the shape to be imported. This dialog box appears automatically when you click the **Place Imported Shape from File** button. You can browse through the folders containing the available .SAT or .DGN files to locate the appropriate file.
38. After selecting the shape file, the **Display Aspects** dialog box appears. Select the **Simple physical** option and click **OK**.

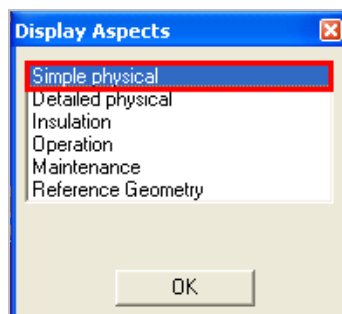


Figure 10: Display Aspects Dialog Box

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** option to further define the specifications for the object.
- You can click the **Format > View** command and change the **Render Selected Aspects** option in the **Format View** dialog box to display the aspect in the active graphic view.

39. Key in the following coordinates on the **PinPoint** ribbon to specify the position of the tank.

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

40. Click in the graphic view to accept the placement of the tank as shown in Figure 11.

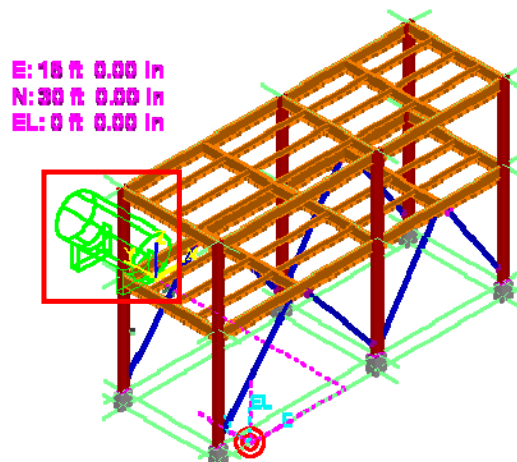


Figure 11: Output: Placement of the Tank

For more information related to placing equipment using imported shapes, refer to the *Place Imported Shape from File Command* topic in the user guide *EquipmentUsersGuide.pdf*.

Session 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 by using the **Place Nozzle** command.


Prerequisite Sessions:

- SP3D Overview
- SP3D Common Sessions
- Placing Designed Equipment and Equipment Components
- Modeling Designed Equipment with Shapes

Overview:

Ports define the connection point and descriptive information needed to connect routing application objects such as piping, ducting, cableway, conduit, and cable and structural foundations to the equipment. For example, the piping port, commonly referred to as a nozzle, defines the information to connect piping. This includes the piping standard, pipe diameter, and end preparation. The information is sufficient to automatically select the appropriate connection parts from the Catalog based on the rules defined by the piping specification being used.

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

Every type of port can be added to designed equipment or an equipment component by using the nominal  **Place Nozzle** command on the **Equipment and Furnishings** task vertical toolbar. The ports or nozzles can be positioned relative to the equipment origin by several different methods including absolute position and the orientation. The placement options are listed and described in the placement dialog box.

Steps for Placing a Piping Nozzle:

Place a nozzle, **N1**, on heat exchanger named **E-102**, in Unit **U01** at the specified location relative to coordinate system **U01 CS**:

N1 = 4 ft
N2 = 4 ft
OR1 = 270 degree

After the nozzle is placed, the view of the equipment should resemble the highlighted area in Figure 1.

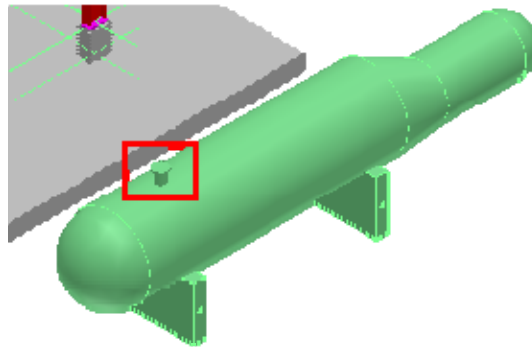


Figure 1: Final Output - After Placing the Nozzle

Note:

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

1. Activate the **PinPoint** ribbon by using the **Tools > PinPoint** command.

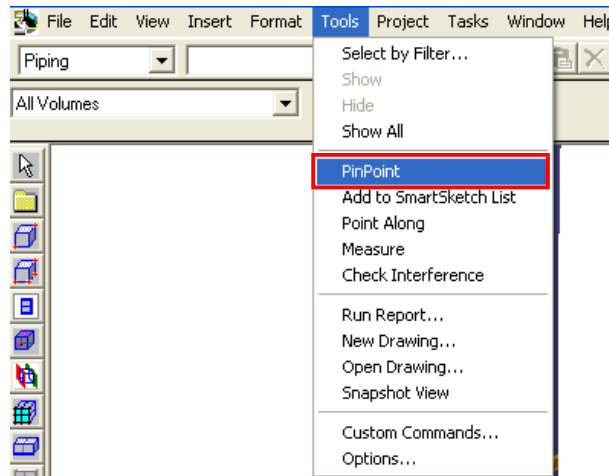


Figure 2: Tools > PinPoint Command

2. Change the active coordinate system to **U01 CS** in the **Coordinate system** drop-down list on the **PinPoint** ribbon as shown in Figure 3.

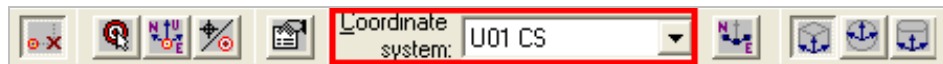


Figure 3: Coordinate System Option on the PinPoint Ribbon

3. Click the **Set Target to Origin** option on the **PinPoint** ribbon to move the target to the active coordinate system origin.

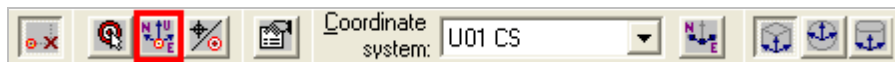


Figure 4: Set Target to Origin Button on the PinPoint Ribbon

4. Click the **Place Nozzle** button on the vertical toolbar.



Figure 5: Place Nozzle Button

5. Select the parent shape **Main Cyl Body** graphically or under **Equipment > E-102** in the **Workspace Explorer**, as shown in Figure 6.

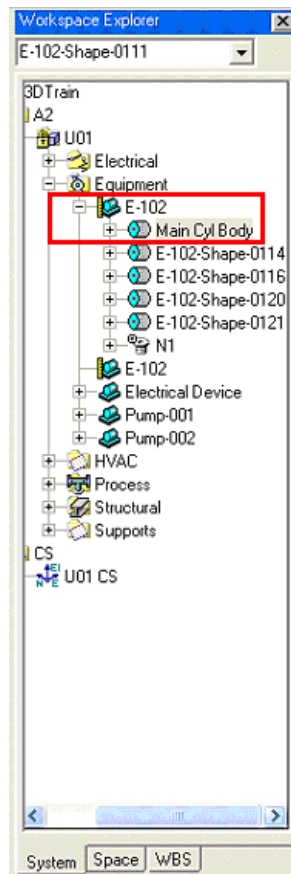


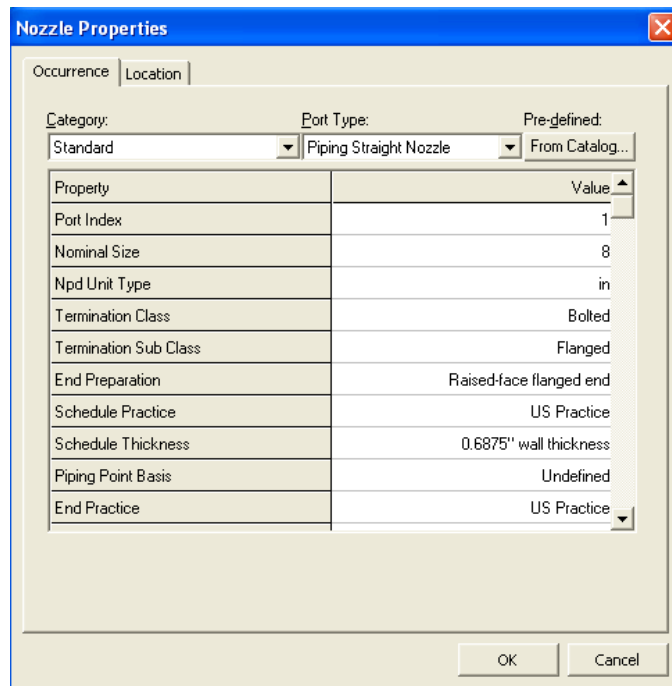
Figure 6: Selecting the Main Cyl Body Part of the Equipment

Note:

- Nozzles are placed relative to the local coordinate system of the Shape you select. If the shape is moved, the nozzles also move with the shape.

- The **Nozzle Properties** dialog box appears. Select **Piping Straight Nozzle** in the **Port Type** drop-down list and define the following properties:

Port Index: 1
Nominal Size: 8
Npd Unit Type: in
Termination Class: Bolted
Termination Sub Class: Flanged
End Preparation: RFFE
End Practice: US Practice
End Standard: Default
Rating Practice: US Practice
Pressure Rating: CL150
Flow Direction: Flow leaves this port
Nozzle Length: 1 ft
Name: N1



Property	Value
Port Index	1
Nominal Size	8
Npd Unit Type	in
Termination Class	Bolted
Termination Sub Class	Flanged
End Preparation	Raised-face flanged end
Schedule Practice	US Practice
Schedule Thickness	0.6875" wall thickness
Piping Point Basis	Undefined
End Practice	US Practice

Figure 7: Nozzle Properties Dialog Box

Note:

- 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.

- Switch to the **Location** tab in the **Nozzle Properties** dialog box and select **Radial** in the **Placement Type** drop-down list. Set the properties as **4 ft for N1, 4 ft for N2, and 270**

degree for OR1 as shown in Figure 8 and click OK.

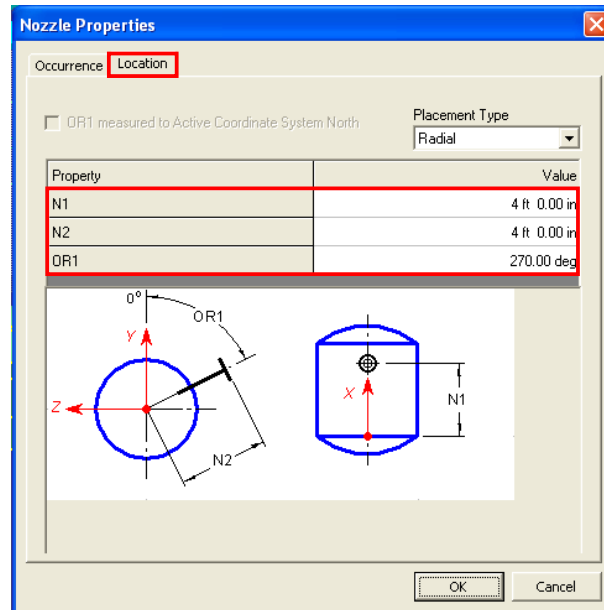


Figure 8: The Properties on the Location Tab

The nozzle will be placed as shown in Figure 9.

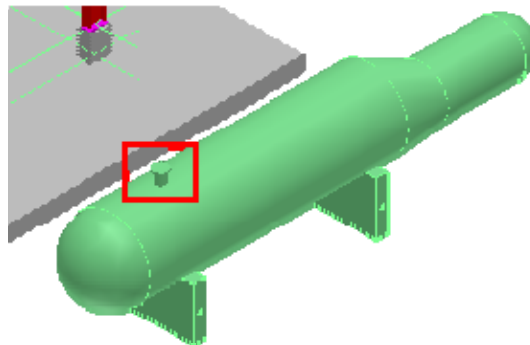


Figure 9: The Equipment with the First Nozzle Placed

8. To place the second nozzle repeat steps 4-6 but set the following properties in the **Nozzle Properties** dialog box:

Port Index:	2
NominalSize:	8
Npd Unit Type:	in
Termination Class:	Bolted
Termination Sub Class:	Flanged
End Preparation:	RFFE
End Practice:	US Practice
End Standard:	Default
Rating Practice:	US Practice
Pressure Rating:	CL150
Flow Direction:	Flow leaves this port
Nozzle Length:	1 ft
Name:	N2

9. Switch to the **Location** tab and select **Radial** in the **Placement Type** drop-down list, define the properties as **18 ft** for **N1**, **4 ft** for **N2**, and **270 degree** for **OR1**. Click **OK**. This places the second nozzle as shown in Figure 10.

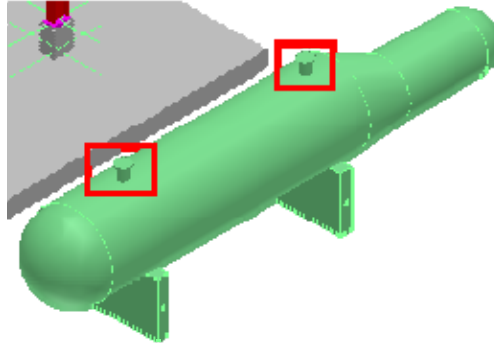


Figure 10: Output - Equipment After Placing Both Nozzles

Steps for Placing a Nozzle Port by Point:

Place a nozzle, **N1** of length **1 ft** on the existing tank **DR-100** under unit **U02**. 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 as may come from an equipment data sheet. The result is shown in Figure 11.

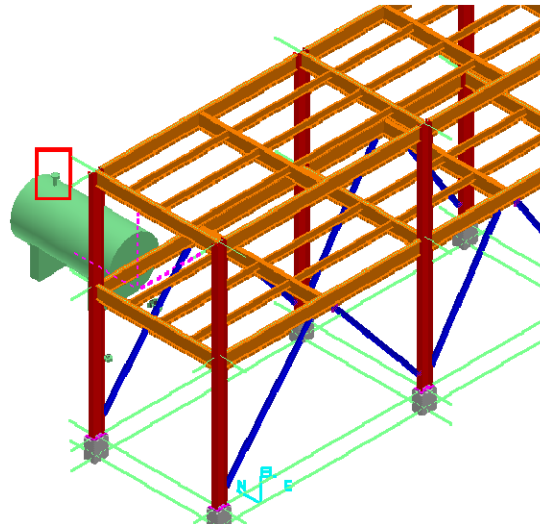


Figure 11: Final Output: After Placing Nozzle on a SAT File

Note:

- Define your workspace to display unit **U02** and coordinate system **U02 CS**.

41. Activate the **PinPoint** ribbon if it is not already active.
42. Change the active coordinate system to the local coordinate system of the equipment **DR-100**.

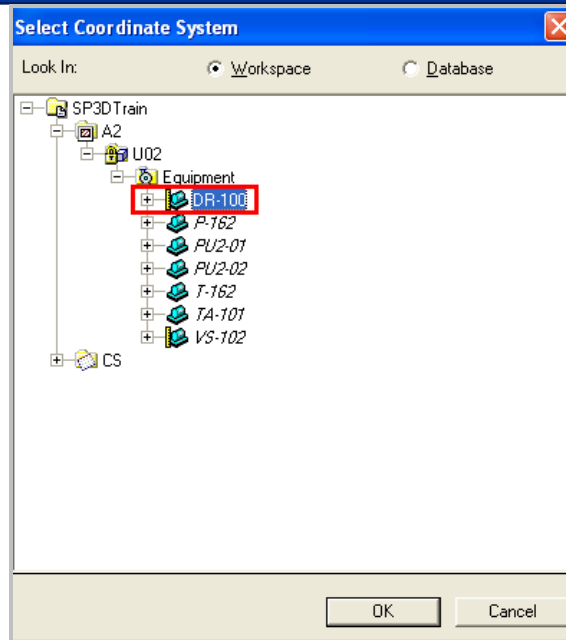


Figure 12: Select Coordinate System Dialog Box

43. To move the target position to the origin of the current coordinate system, click the **Set Target to Origin** option on the **PinPoint** ribbon.
44. Click the **Place Nozzle** button on the vertical toolbar.
45. Select the **Drum Body** as the shape to use to orient the nozzle placement.

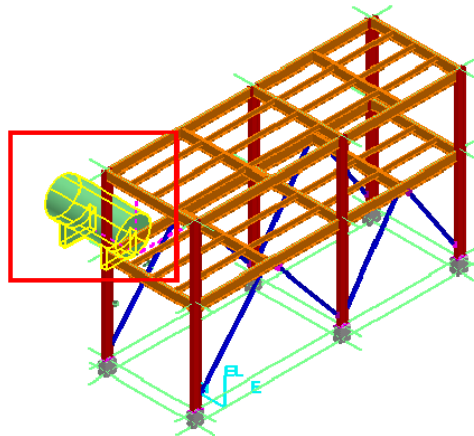


Figure 13: Drum Body Selected

46. Define the following specifications in the **Nozzle Properties** dialog box:

Port Type: Piping Straight Nozzle
Length: 1 ft
Name: N1

All other nozzle properties: Same as the previous exercise.

47. On the **Location** tab, select the **Position by Point** option in the **Placement Type** drop-down list and click **OK**.

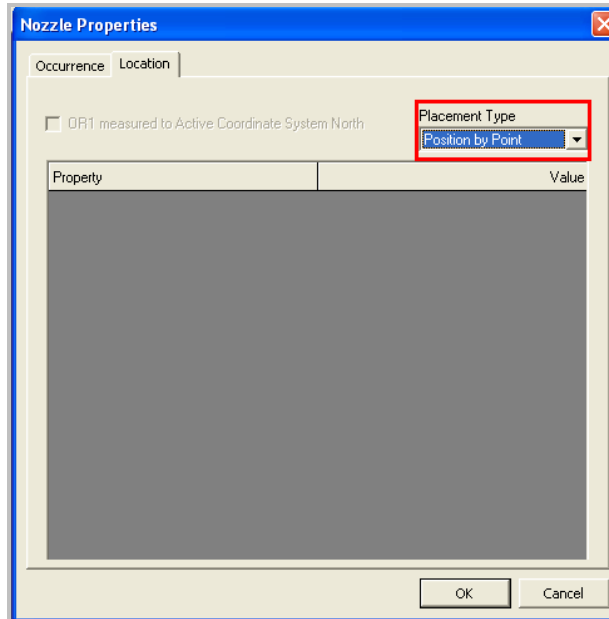


Figure 14: Location Tab: Nozzle Properties Dialog Box

48. Key in the following coordinates of the nozzle port connection point on the **PinPoint** ribbon:

East: -2.5 ft
North: 8 ft
Elevation: 9 ft

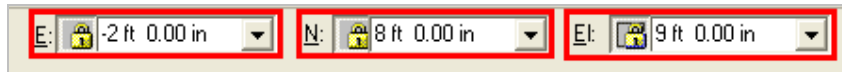


Figure 18: The Required Coordinates Selected on the Pinpoint Ribbon

49. Rotate the nozzle using the arrow keys so that the **Flange** faces vertical, as shown in Figure 15 and click to place the nozzle.

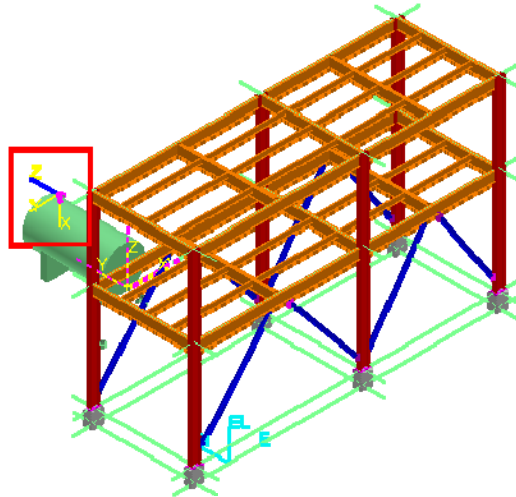


Figure 15: Flange Face on the Equipment

Place another nozzle E, on the tower T-101, in Unit U03 at the specified location relative to coordinate system U03 CS:

East: 13 ft 6 in
North: 31 ft 6 in
Elevation: 61 ft

After the nozzle is placed, the view of the equipment should resemble the highlighted area in Figure 16.

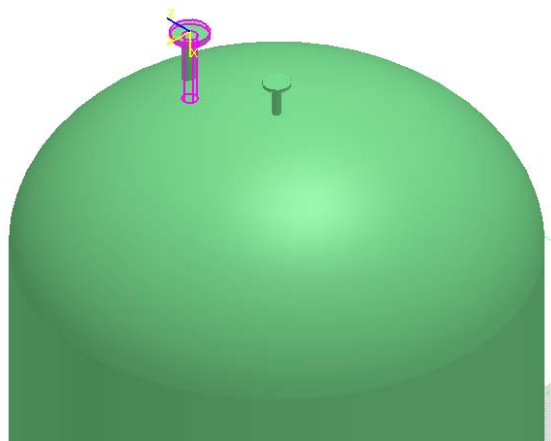


Figure 16: Output - After Placing Pipe Nozzle on T-101t

1. Define the workspace to display Unit U03 and coordinate system U03 CS.
2. Activate the **PinPoint** ribbon by using the **Tools > PinPoint** command.
3. Change the active coordinate system to U03 CS in the **Coordinate system** drop-down list on the **PinPoint** ribbon.
4. Click the **Set Target to Origin** option on the **PinPoint** ribbon to move the target to the

active coordinate system origin.

5. Click the **Place Nozzle** button on the vertical toolbar.
6. Select the **DP1** as the shape to use to orient the nozzle placement.
7. Define the following specifications in the **Nozzle Properties** dialog box:

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

18. On the **Location** tab, select the **Position by Point** option in the **Placement Type** drop-down list and click **OK**.
19. Key in the following coordinates on the **PinPoint** ribbon:

East: 13 ft 6 in
North: 31 ft 6 in
Elevation: 61 ft
20. Rotate the nozzle using the arrow keys so that **Flange** faces vertical and click to place the nozzle.

Steps for Placing a Nozzle Port Without Geometry

When an equipment model is imported using the **Place Imported Shape from File** command, the geometry may include all the physical detail needed including the nozzle shapes. While the geometry of the nozzle is visible after you import the SAT file, you must still add the nozzle port information to allow connections to the nozzle.

You place this type of nozzle port 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. The result of this exercise is shown in Figure 17.

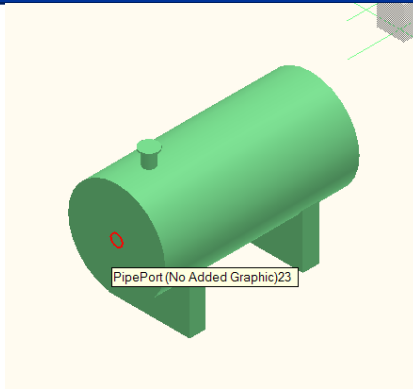


Figure 17: Nozzle placed Without Graphics

Note:

- 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.
- No interference is reported between the shapes and nozzles you add to a designed equipment.

1. Define the workspace to display Unit **U02** and coordinate system **U02 CS**.
2. Click the **Place Nozzle** button on the vertical toolbar.
3. Select the **Drum Body** of equipment **DR-100** used in the example above.
4. Define the following specifications in the **Occurrence** tab of the **Nozzle Properties** dialog box:

Port Type: PipePort (No Added Graphic)

Port Index: 2

NominalSize: 8

Npd Unit Type: in

Termination Class: Bolted

Termination Sub Class: Flanged

End Preparation: RFFE

End Practice: US Practice

End Standard: Default

Rating Practice: US Practice

Pressure Rating: CL150

Flow Direction: Flow leaves this port

Nozzle Length: 1 ft

Name: N10

5. Select the **Location** tab of the **Nozzle Properties** dialog box. The placement type is defaulted to **Position by Plane and Axis**. No graphic is displayed. The **N1** property is the offset of the nozzle port from the plane. Leave **N1= 0**. Click **OK**.
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.

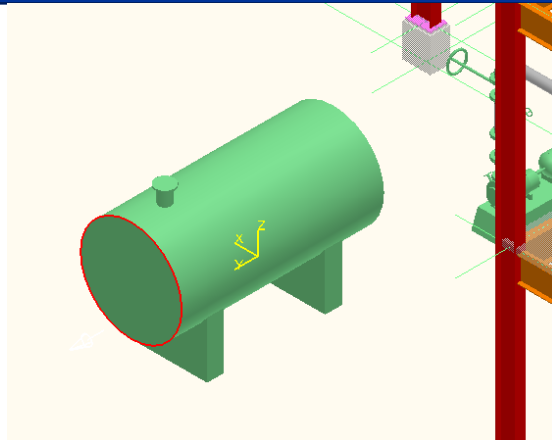


Figure 18: Select Plane for Nozzle Port Position

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

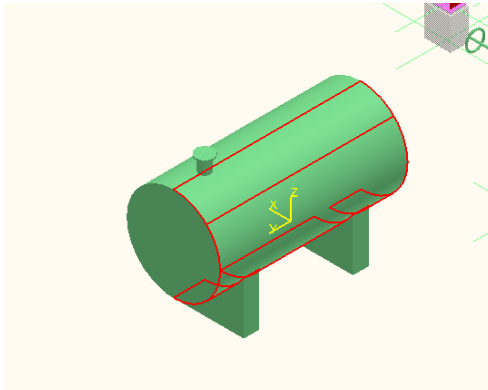


Figure 19: Select Axis for Nozzle Port Position

The nozzle is placed as shown in Figure 17.

Steps for Placing a Foundation Port:

For placing the foundation port, use the **Place Nozzle** command and key-in the following specification in the **Nozzle Properties** dialog box:

Type: Rectangular Foundation Port
Footprint Offset: 0.00 ft
Number of bolt holes in X: 2
Number of Bolt Holes in Y: 2
Distance between Holes (X): 5 ft
Distance between Holes (Y): 1 ft
Hole Diameter: 0.75 in

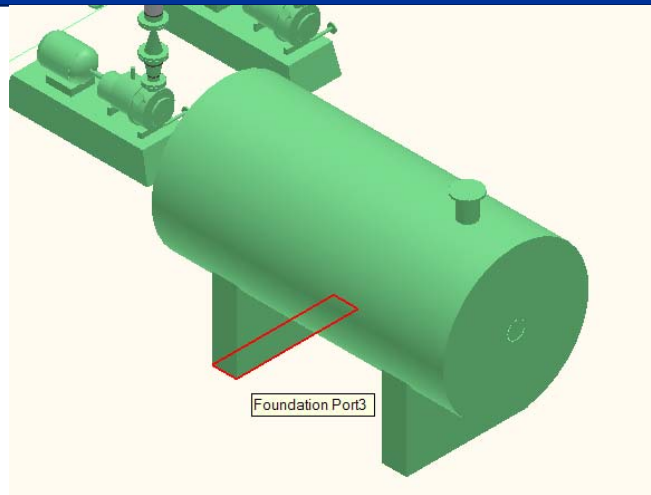
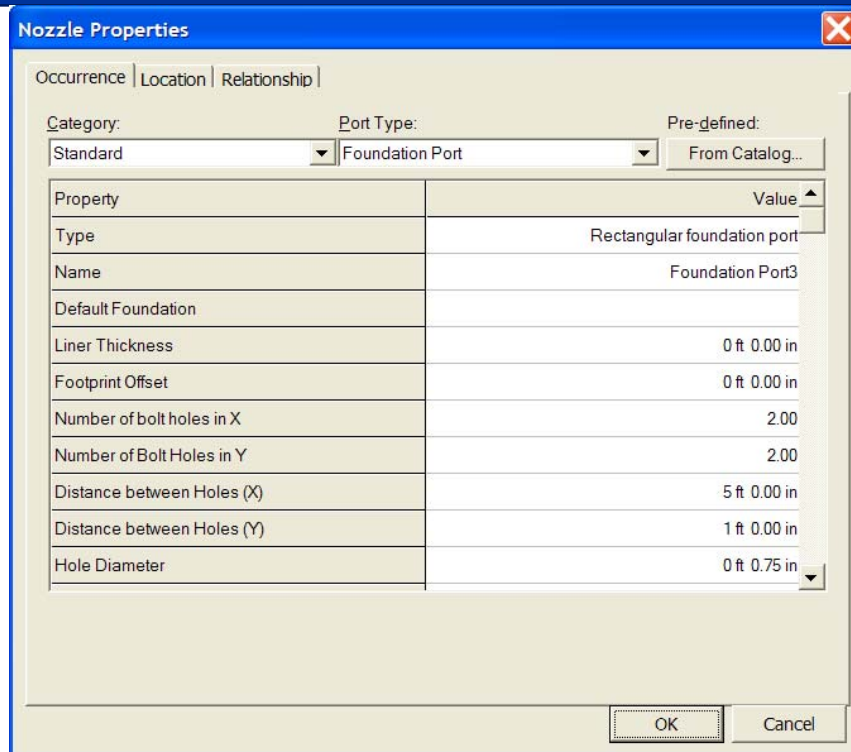


Figure 20: Final Output: After Placing the Foundation Port

Notes:

- The foundation port is used by the **Place Foundation** command in the Structure task to help size and position foundations.
 - 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.
1. Click the **Place Nozzle** button on the vertical toolbar.
 2. Select the equipment **DR-100** as the shape to which you need to add a foundation port.
- Note:**
- You can either select the parent object in the graphic view or the **Workplace Explorer**.
3. The **Nozzle Properties** dialog box appears. On the **Occurrence** tab, select **Foundation Port** as the type of nozzle in the **Port Type** drop-down list. The properties will update to reflect the **Foundation Port** properties.
 4. Key-in the specifications in the **Nozzle Properties** dialog box as shown in Figure 21:



The dialog box is titled "Nozzle Properties" and has three tabs: Occurrence, Location, and Relationship. The Occurrence tab is active. It contains the following fields and a table:

Category: Standard | Port Type: Foundation Port | Pre-defined: From Catalog...

Property	Value
Type	Rectangular foundation port
Name	Foundation Port3
Default Foundation	
Liner Thickness	0 ft 0.00 in
Footprint Offset	0 ft 0.00 in
Number of bolt holes in X	2.00
Number of Bolt Holes in Y	2.00
Distance between Holes (X)	5 ft 0.00 in
Distance between Holes (Y)	1 ft 0.00 in
Hole Diameter	0 ft 0.75 in

Buttons: OK, Cancel

Figure 21: Occurrence Tab in the Nozzle Properties Dialog Box

Notes:

The available bolt hole patterns are:

- Circular
- Rectangular
- Single Hole
- No Holes (only the footprint is created and displayed)

Circular Pattern

When the circular pattern is selected, an equally spaced hole pattern is generated (based on the number of holes and the bolt circle diameter). Hole 1 will always be at the 12 o'clock position relative to the origin at the center. Local coordinate system origin is at center with y-axis pointing to hole 1. The circular pattern allows only equal spacing of holes.

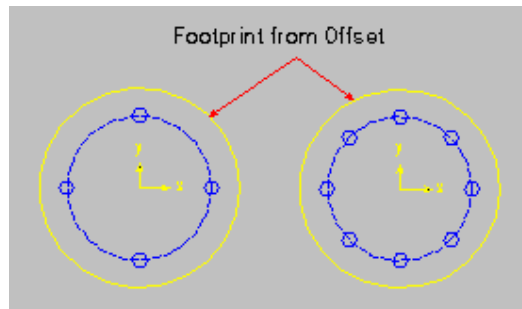


Figure 22: Circular Pattern

The additional properties are:

- Bolt Circle Diameter
- Number of bolt holes
- Footprint Offset

Rectangular

Local coordinate system origin at hole 1 (lower left) with y-axis pointing to hole 2.

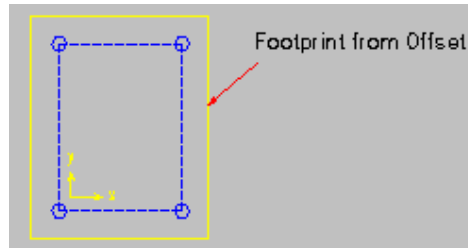


Figure 23: Rectangular Pattern

The additional properties are:

- Number of bolt holes in X
- Number of Bolt Holes in Y
- Distance between Holes (X)
- Distance between Holes (Y)
- Footprint Offset

Single Hole

Local coordinate system origin at center of the bolt hole. No footprint boundary is generated in this case.

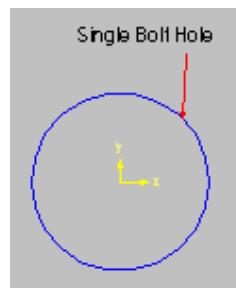


Figure 24: Single Hole

No Hole

Local coordinate system origin is the bottom-left corner of the footprint. Only the footprint boundary is generated in this case. This option does not currently work properly.

5. Click the **Location** tab, and select **Tangential** in the **Placement Type** drop-down list and key-in **OR1 and OR2** as **90.00 deg**. Leave all offsets at zero.

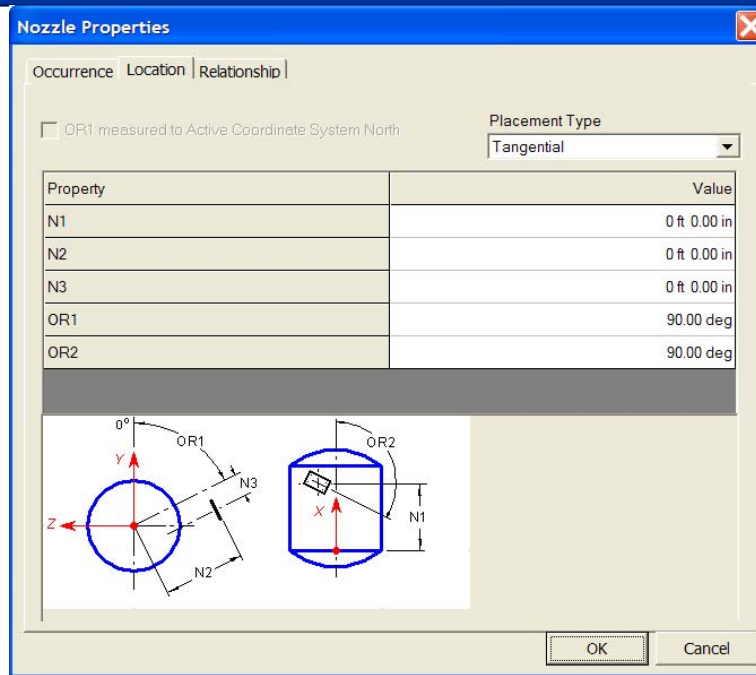


Figure 25: Location Tab in the Nozzle Properties Dialog Box

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

Notes:

- If the local coordinate system of the shape is not in the right place to easily use this example positioning method, it may be easier to just **position by point** and then use the common move/rotate to get it into your desired position.
- If placing by point, you can press the **Left** or **Right Arrow** key to rotate the foundation port by 90-degree increments at any time during the placement operation. Press the **Up/Down Arrow** key to scroll through the three possible axes of rotation.
- To edit the properties of the new foundation port after it is placed, right-click the foundation port and select the **Properties** command.

For more information related to placing equipment using imported shapes, refer to the *Place Imported Shape from File Command* topic in the user guide *EquipmentUsersGuide.pdf*. Refer to *Place Nozzle Command* topic for more information related to placing nozzles.

Session 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.

Prerequisite Sessions:

- SP3D Overview
- SP3D Common Sessions
- Placing Designed Equipment and Equipment Components
- Placing Nozzles and Ports

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 SP3D. Data is published to and retrieved from this central repository to electronically share information between the software applications. The data is exchanged at the individual object level. SmartPlant Foundation defines a data schema for the design objects (or things) 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 will be shared to the SmartPlant Foundation schema.

Authorized users retrieve the desired design data from SmartPlant Foundation into the SP3D database. For example, P&ID drawings with associated SmartPlant Foundation design objects. Once the SmartPlant Foundation data is stored for reference in a portion of the model database called the Design Basis, all users of SP3D can access the information. When an SP3D 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 (the SmartPlant Foundation definition of the thing).

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

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

Steps for Placing Equipment Objects and Nozzles from P&ID

Place equipment **T-162** in Unit **U02** of **Area 2**. The equipment **T-162** contains three vessel nozzles **Vessel Noz1**, **Vessel Noz2**, and **Vessel Noz3**. Update these nozzles by placing three nozzles from P&ID, **B2**, **P2**, and **A5**. Also, place a new nozzle **T3** from P&ID and add it to the shape **DP2** in the equipment **T-162**.

Place another equipment **P-162** in Unit **U02**. Update nozzles **N1** and **N2** existing in the equipment **T-162** from P&ID.

The specifications to place these objects are as below:

Equipment T-162:

- **System:** U02 > Equipment
- **Vessel Height:** 35 ft 0.00 in
- **Vessel Diameter:** 6 ft 0.00 in
- **Vessel Start Height:** 9 ft 0.00 in
- **Skirt Top Diameter:** 6 ft 0.00 in
- **Skirt Bottom Diameter:** 11 ft 0.00 in
- **Skirt Height:** 9 ft 0.00 in
- **Platform Width:** 2 ft 6 in
- **Platform Height:** 3.00 in
- **Platform Angle:** 180 deg
- **East:** 10 ft 0.00 in
- **North:** -35 ft 0.00 in
- **Elevation:** 2 ft 0.00 in

Nozzle B2:

- **Nozzle Length:** 1 ft 6 in

Nozzle P2:

- **Nozzle Length:** 1 ft 6 in
- **N1:** 33 ft 0.00 in

Nozzle A5:

- **Nozzle Length:** 1 ft 6 in
- **N1:** 32 ft 0.00 in

Nozzle T3:

- **Nozzle Length:** 1 ft 0.00 in
- **N1:** 15 ft 0.00 in
- **B2:** 3 ft 6.00 in
- **OR1:** 270.00 deg

Equipment P-162:

- **System:** U02 > Equipment
- **East:** 25 ft 0.00 in
- **North:** -50 ft 0.00 in
- **Elevation:** 3 ft 0.00 in

The view of the equipment **T-162** and the nozzles **B2**, **P2**, **T3**, and **A5** should resemble Figure 1.

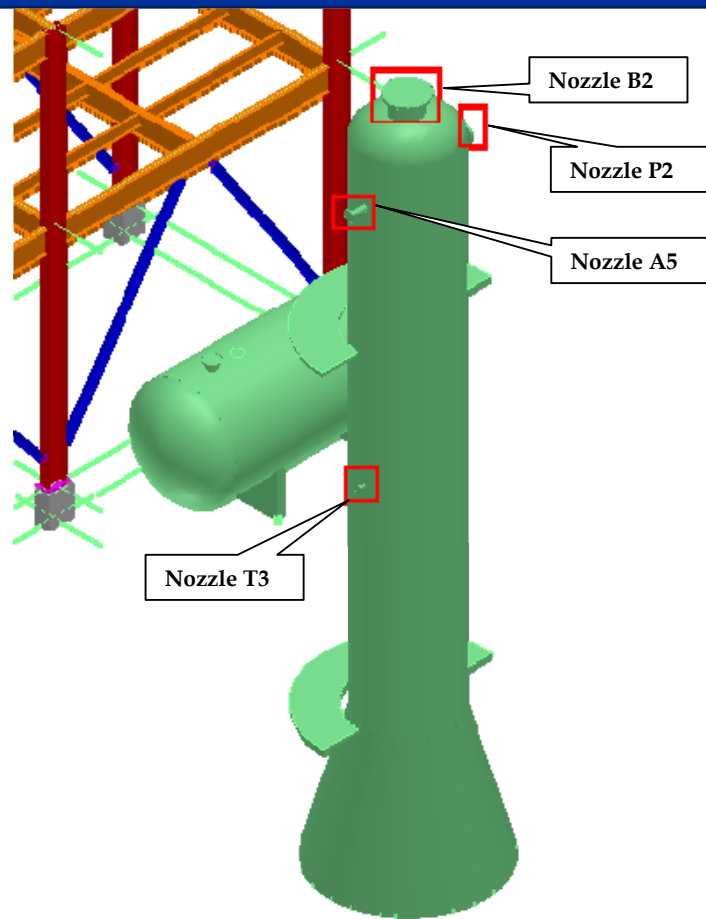


Figure 1: Equipment T-162 and Nozzles B2, P2, A5, and T3

The view of the equipment **P-162** and the nozzles **N1** and **N2** should resemble Figure 2.

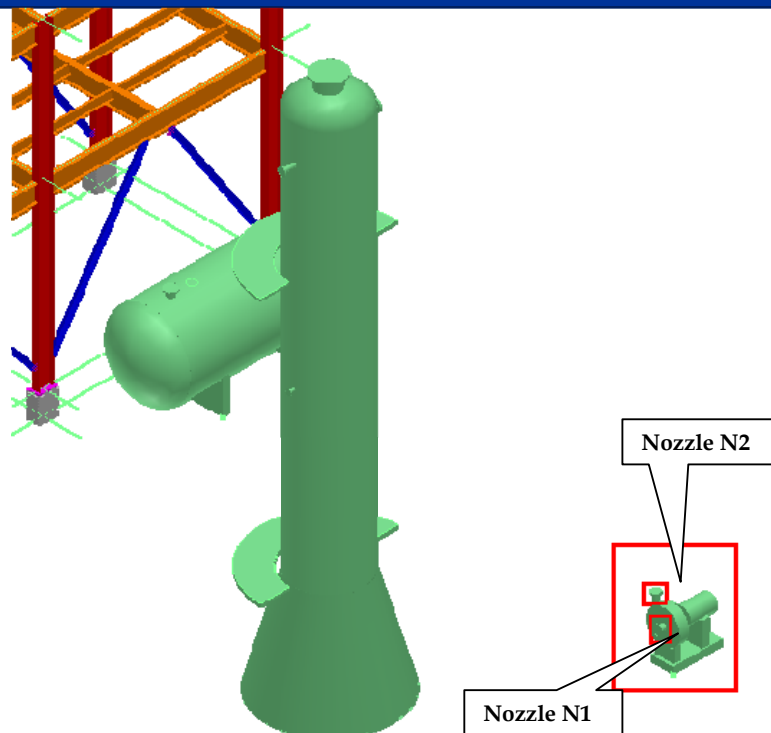


Figure 2: Equipment P-162 and Nozzles N1 and N2

Steps for Placing Equipment T-162:

50. Define your workspace to display Unit **U02** and coordinate system **U02 CS**.
51. Switch to the **Equipment and Furnishings** task and select **Equipment** as the Active Permission Group.
52. Activate the **PinPoint** ribbon using the **PinPoint** button on the **Common** toolbar.
53. On the **PinPoint** ribbon, change the active coordinate system to **U02 CS**.
54. To move the target to the origin of the current coordinate system, select the **Set Target to Origin** option on the **PinPoint** ribbon.
55. Click the **SmartPlant > View P&ID...** command.

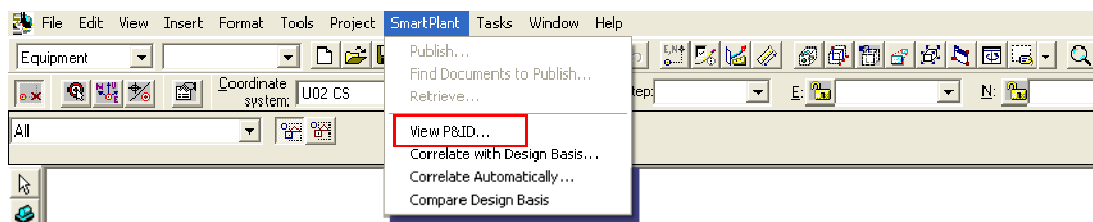


Figure 3: SmartPlant > View P&ID... Command

56. The **View P&ID** dialog box appears. Select **INT01** in the **P&ID** list and click **Open**.

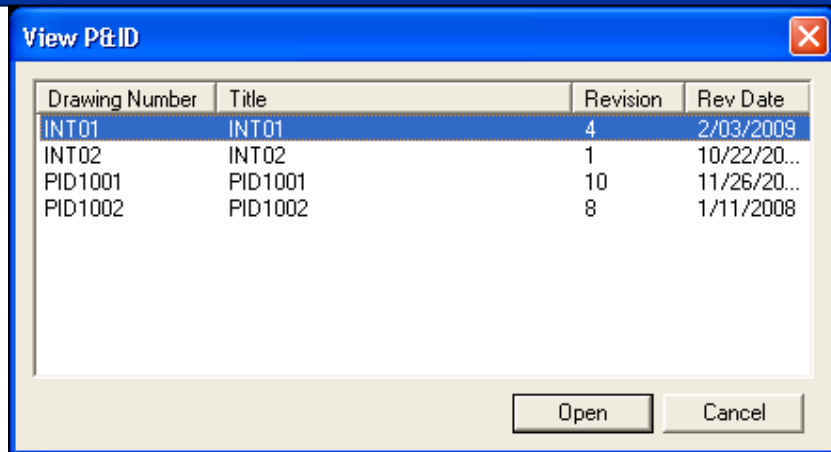


Figure 4: View P&ID Dialog Box

Note:

- **P&ID File Viewer** dialog box appears in a new window. Graphical objects in the **P&ID File Viewer** dialog box are represented in different colors to display the correlation status between SP3D model design objects and design basis information from the P&ID. For example, an object in P&ID that is not correlated with an object in the SP3D model is shown in blue color. The mismatch between the properties of the correlated objects in the P&ID and the SP3D model is highlighted in red color. When the properties of the objects are matched, the objects become green in color. You can change the color settings by clicking the **Set Correlation Status Colors** command on the **Options** menu in the **P&ID File Viewer** dialog box.

For more details refer to the *Viewing P&IDs: An Overview* topic in *SmartPlant 3D Integration Reference Guide*.

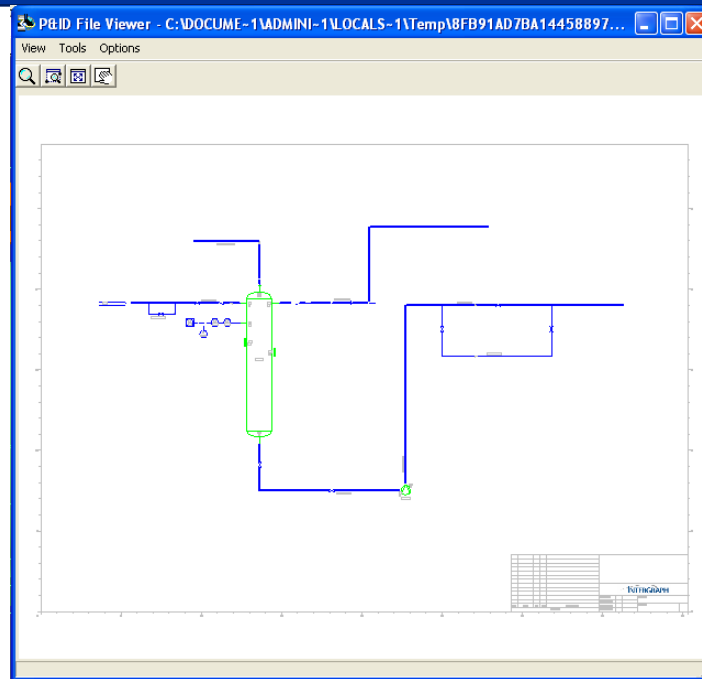


Figure 5: P&ID File Viewer Dialog Box

57. Select the equipment object T-162 in the P&ID File Viewer dialog box.

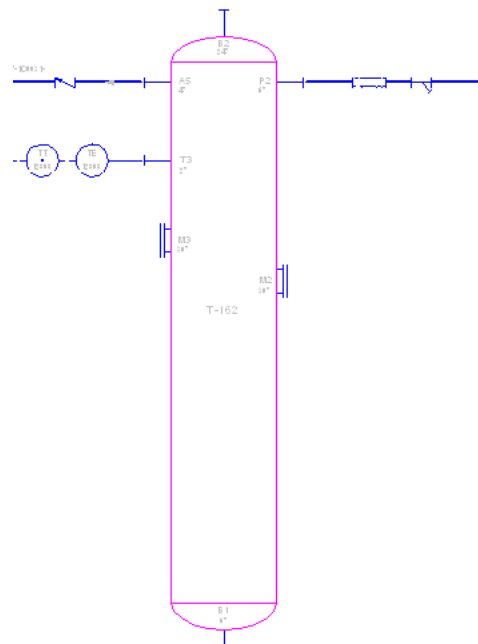


Figure 6: Equipment T-162 Selected in the P&ID File Viewer Dialog Box

Notes:

- The selected object in the **P&ID File Viewer** dialog box is pink in color.
- If a design basis equipment is selected on the P&ID viewer when you start the

Place Equipment command, the equipment you create will be correlated to the selected design basis object.

- If a design basis equipment is not selected and the P&ID viewer is displayed when you start the **Place Equipment** command, you will be prompted to select the equipment to correlate on the P&ID viewer.

58. Click the **Place Equipment** button on the vertical toolbar.

59. The **Select Equipment** dialog box is displayed. Expand the folder **Equipment\Process\Vertical Vessels\Simple Vertical Vessel With Platforms** until you see the part **CESWessel2Plat3-E**. Select this part and click **OK**.

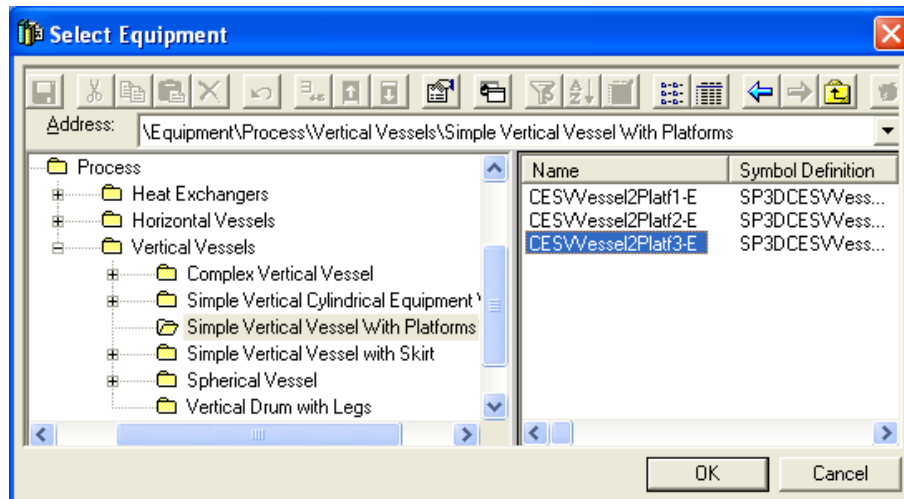


Figure 7: Select Equipment Dialog Box

60. The **Compare with Design Basis** dialog box is automatically displayed. Click **Update** and then click **Close** to update the properties of the equipment **T-162** to match the correlated design basis object.

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. The **Compare with Design Basis** command 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.

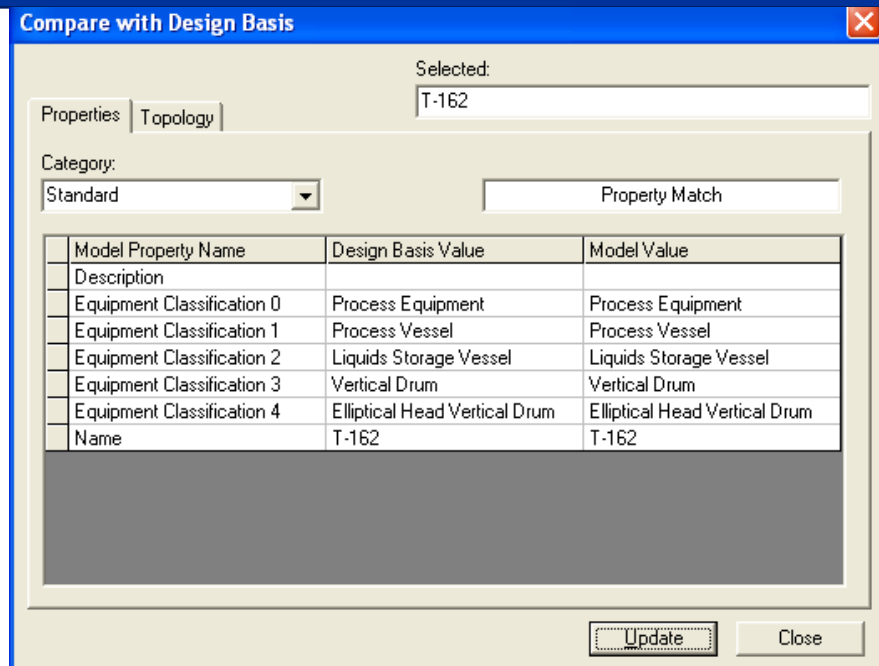


Figure 8: Compare With Design Basis Dialog Box

61. After you click **Close** in the **Compare with Design Basis** dialog box, the **Equipment Properties** dialog box appears. Change the system to **A2 > U02 > Equipment** and then select the option **Equipment Dimension** from the **Category** drop-down list. Set the equipment dimensions as follows:

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

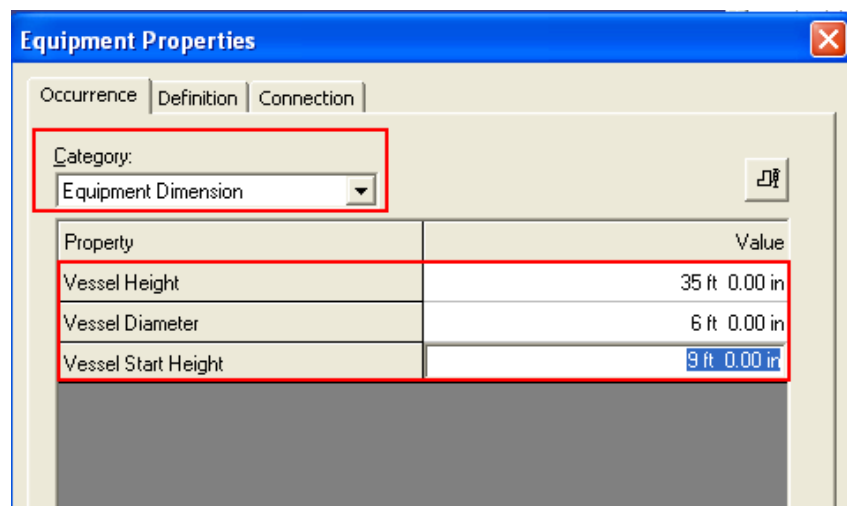
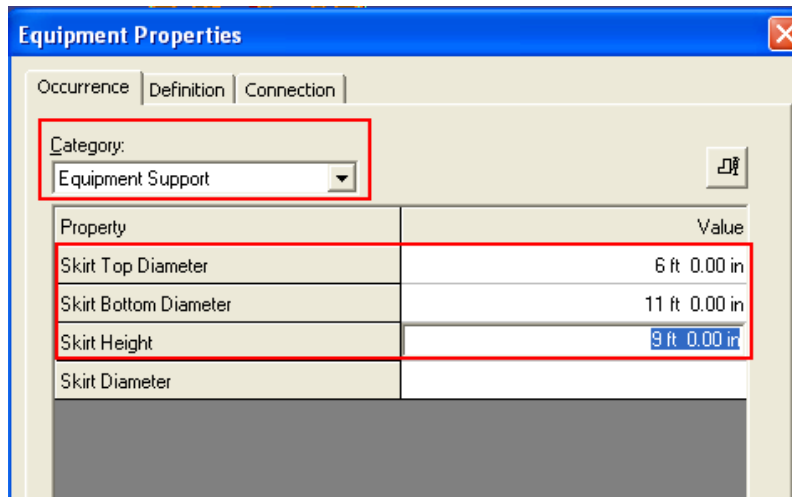


Figure 9: Equipment Dimension Category on the Equipment Properties Dialog Box

62. Now select the **Equipment Support** option in the **Category** drop-down list and set the following dimensions:

Skirt Top Diameter: 6 ft 0.00 in

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



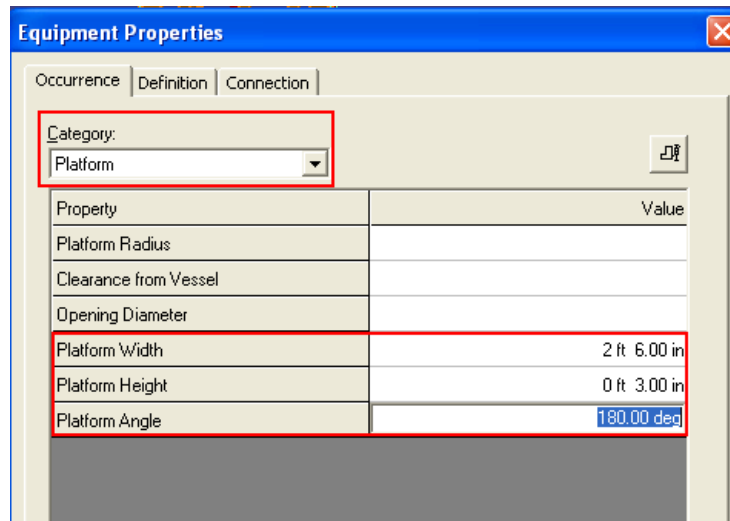
The dialog box is titled "Equipment Properties" and has three tabs: Occurrence, Definition, and Connection. The Definition tab is selected. A red box highlights the "Category:" dropdown menu, which is set to "Equipment Support". Below this is a table with two columns: "Property" and "Value".

Property	Value
Skirt Top Diameter	6 ft 0.00 in
Skirt Bottom Diameter	11 ft 0.00 in
Skirt Height	9 ft 0.00 in
Skirt Diameter	

Figure 10: Equipment Support Category on the Equipment Properties Dialog Box

63. Select the **Platform** option in the **Category** drop-down list and specify the following settings:

Platform Width: 2 ft 6 in
Platform Height: 0 ft 3.00 in
Platform Angle: 180 deg



The dialog box is titled "Equipment Properties" and has three tabs: Occurrence, Definition, and Connection. The Definition tab is selected. A red box highlights the "Category:" dropdown menu, which is set to "Platform". Below this is a table with two columns: "Property" and "Value".

Property	Value
Platform Radius	
Clearance from Vessel	
Opening Diameter	
Platform Width	2 ft 6.00 in
Platform Height	0 ft 3.00 in
Platform Angle	180.00 deg

Figure 11: Platform Category on the Equipment Properties Dialog Box

64. Then, select the **Position and Orientation** option in the **Category** drop-down list and specify following values for the coordinates:

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

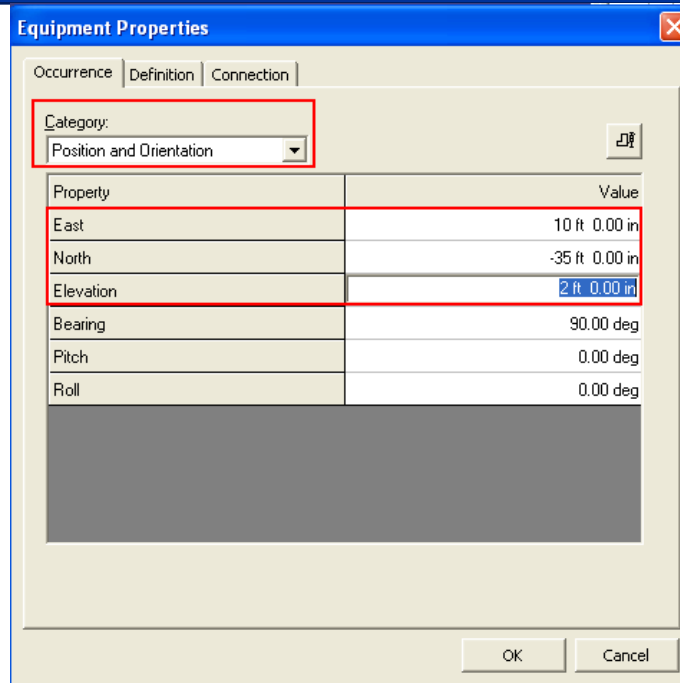


Figure 12: Position and Orientation Category on the Equipment Properties Dialog Box

65. Click **OK** in the **Equipment Properties** dialog box. The equipment **T-162** will be placed in the model.

The equipment **T-162** contains three vessel nozzles: **Vessel Noz1**, **Vessel Noz2**, and **Vessel Noz3**. Now, you will update these nozzles by correlating them with the three P&ID (Design Basis) nozzles: **B2**, **P2**, and **A5** and then modify some of the geometric properties of the model nozzles.

Steps for Correlating Nozzle B2 and Editing the Nozzle Geometry:

1. Set the filter to **Pipe Nozzle** in the **Locate Filter** drop-down list.
2. Select the nozzle **Vessel Noz1** at the top of the equipment **T-162** in the model.

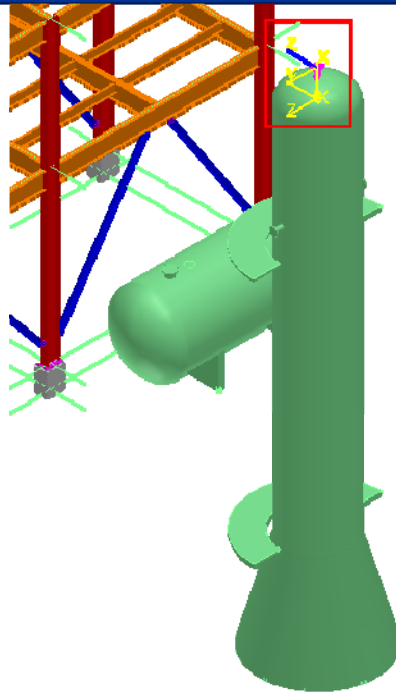


Figure 13: Nozzle Vessel Noz1 Selected

3. On the **SmartPlant** menu, click **Correlate with Design Basis...** command, as shown in Figure 14.

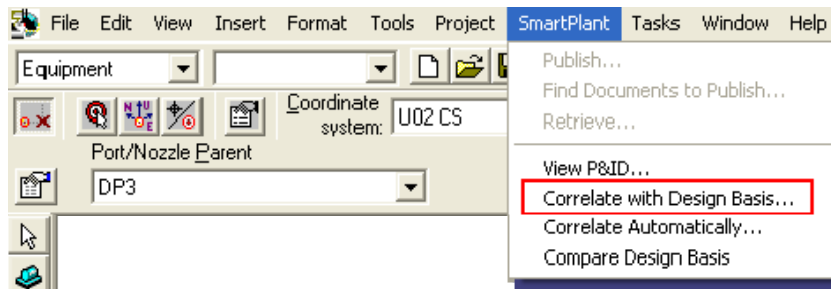


Figure 14: SmartPlant > Correlate with Design Basis... Command

4. Select the nozzle, **B2**, at the top in the **P&ID File Viewer** dialog box.

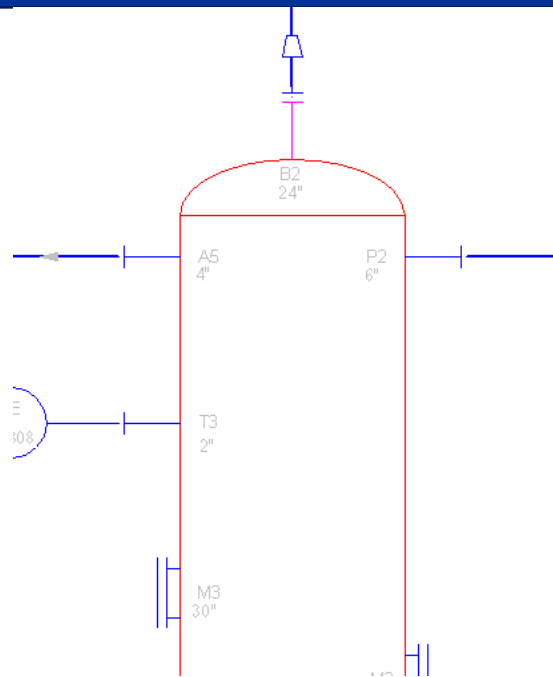


Figure 15: Selected Nozzle B2 in P&ID

- The **Compare with Design Basis** dialog box is displayed. Click **Update** in the dialog box. This will change the properties of the nozzle **Vessel Noz1** to match with the properties of the nozzle **B2** in P&ID. Click **Close**.

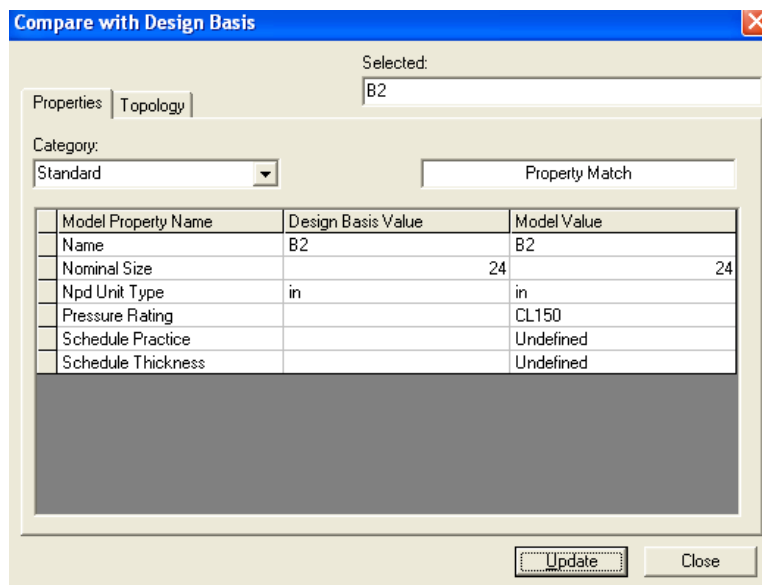


Figure 16: Compare With Design Basis Dialog Box

- The nozzle remains selected. Click the **Properties** option on the **Place Nozzle** ribbon to open the **Pipe Nozzle Properties** dialog box.

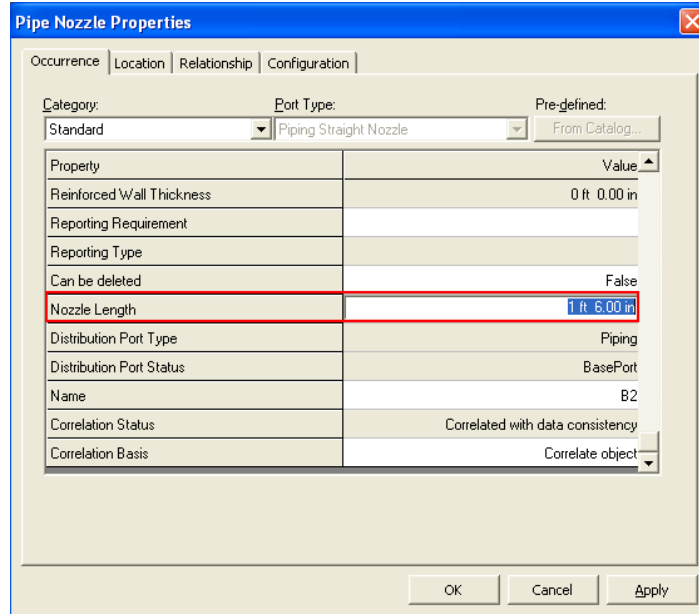


Figure 17: Properties Option on the Place Nozzle Ribbon

Tip:

- Alternately, right-click the selected nozzle and click the **Properties** option to open the **Pipe Nozzle Properties** dialog box.

7. In the **Pipe Nozzle Properties** dialog box, change the **Nozzle Length** to **1 ft 6 in.**



The dialog box titled "Pipe Nozzle Properties" has four tabs: Occurrence, Location, Relationship, and Configuration. The Configuration tab is active. It contains a table with properties and their values. The "Nozzle Length" property is highlighted with a red box and has its value "1 ft 6.00 in" selected.

Property	Value
Reinforced Wall Thickness	0 ft 0.00 in
Reporting Requirement	
Reporting Type	
Can be deleted	False
Nozzle Length	1 ft 6.00 in
Distribution Port Type	Piping
Distribution Port Status	BasePort
Name	B2
Correlation Status	Correlated with data consistency
Correlation Basis	Correlate object

At the bottom of the dialog box are three buttons: OK, Cancel, and Apply.

Figure 18: Pipe Nozzle Properties Dialog Box

8. Click **Apply** and then click **OK**.

The nozzle **B2** should resemble the highlighted section in Figure 19.

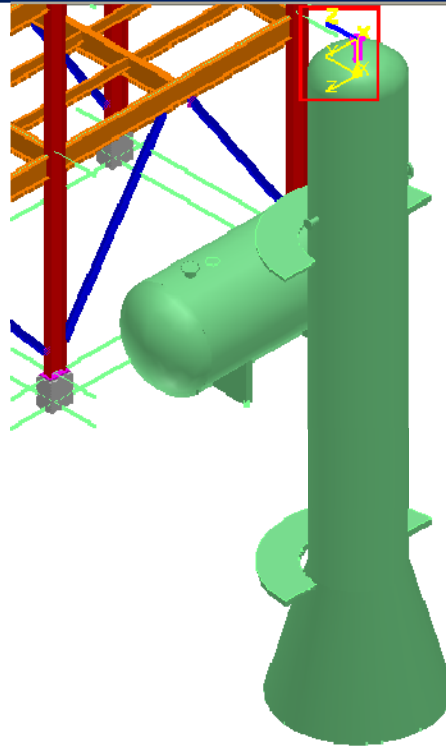


Figure 19: Nozzle B2 Placed

Steps for Correlating Nozzle P2:

You will correlate this nozzle in the same way as nozzle **B2**.

1. Select the nozzle **Vessel Noz2** on the equipment **T-162** in the model, as shown in Figure 20.

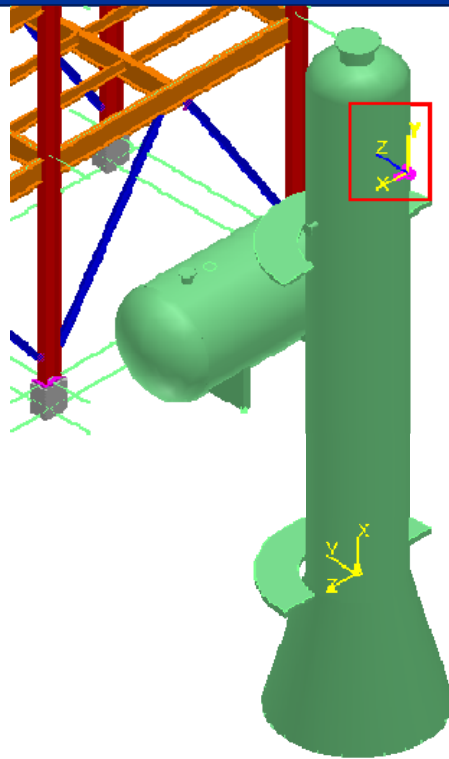


Figure 20: Nozzle Vessel Noz2 Selected

2. On the **SmartPlant** menu, click **Correlate with Design Basis...** command.
3. Select the nozzle, **P2**, in the **P&ID File Viewer** dialog box.

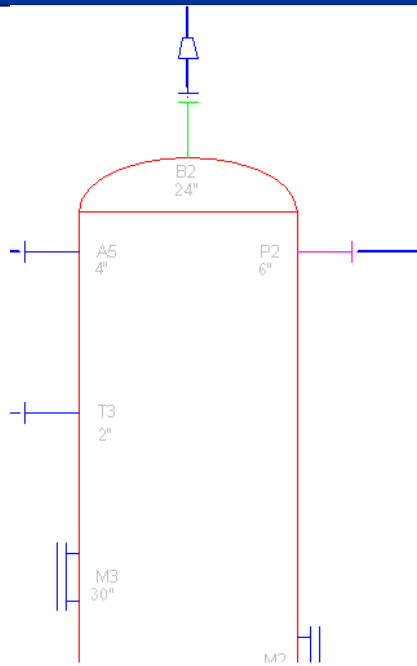


Figure 21: Nozzle P2 Selected in the P&ID File Viewer Dialog Box

4. The **Compare with Design Basis** dialog box is displayed. Click **Update** in the dialog box. This will change the properties of the nozzle **Vessel Noz2** to match with the properties of the design basis nozzle **P2** in P&ID. Click **Close**.
5. In the **Pipe Nozzle Properties** dialog box for **P2**, change the **Nozzle Length** to **1 ft 6 in.** In the **Location** tab, change **N1** to **33 ft 0.00 in.**

The nozzle **P2** should resemble the highlighted section in Figure 22.

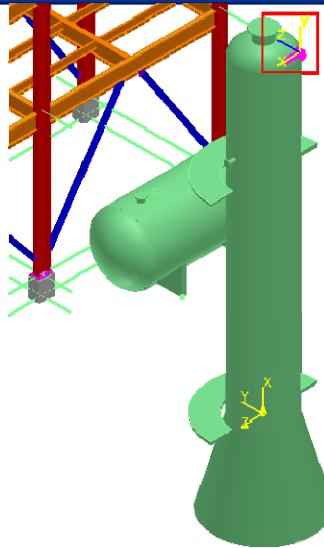


Figure 22: Nozzle P2 Placed

Steps for Correlating Nozzle A5:

You will correlate this nozzle in the same way as you correlated nozzles **B2** and **P2**.

1. Select the nozzle **Vessel Noz3** on the equipment **T-162** in the model.

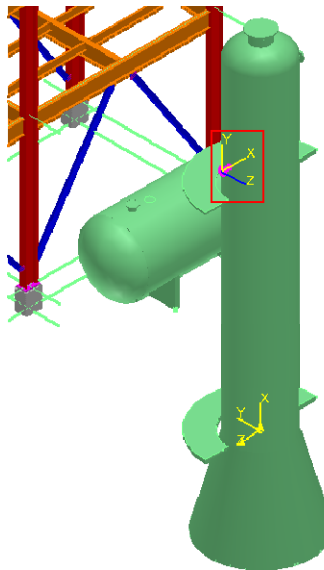


Figure 23: Nozzle Vessel Noz3 Selected

2. On the **SmartPlant** menu, click **Correlate with Design Basis...** command.
3. Select the nozzle, **A5**, in the **P&ID File Viewer** dialog box.

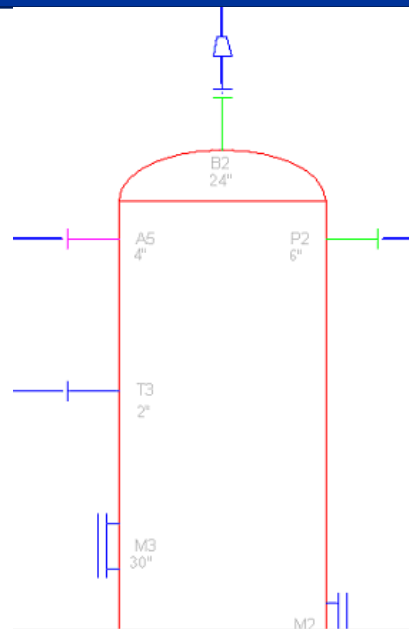


Figure 24: Nozzle A5 Selected in the P&ID File Viewer Dialog Box

4. The **Compare with Design Basis** dialog box is displayed. Click **Update** in the dialog box. This will change the properties of the nozzle **Vessel Noz3** to match with the properties of the design basis nozzle **A5** in P&ID. Click **Close**.
5. In the **Pipe Nozzle Properties** dialog box for **A5**, change the **Nozzle Length** to **1 ft 6 in.** On the **Location** tab, change **N1** to **32 ft 0.00 in.**

The nozzle **A5** should resemble the highlighted section in Figure 25.

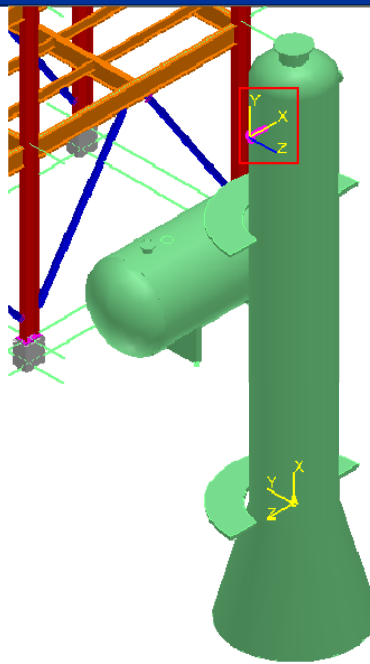


Figure 25: Nozzle A5 Placed

Now, you will place a new nozzle **T3** from P&ID and add it to the shape **DP2** in the equipment **T-162**.

Steps for Placing Nozzle T3:

In this case, the nozzle does not already exist in the equipment. You will place a nozzle that is correlated to **T3** on the P&ID.

1. Select nozzle **T3** in the **P&ID File Viewer** dialog box.

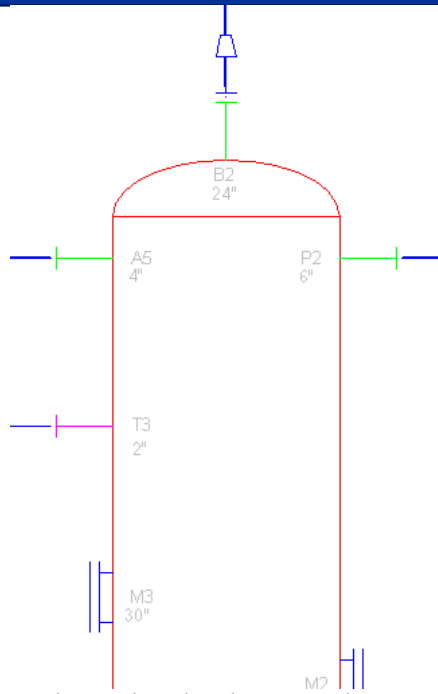


Figure 26: Nozzle T3 Selected in the P&ID File Viewer Dialog Box

2. Click the **Place Nozzle** button on the vertical toolbar.
3. To add the nozzle **T3** to the shape **DP2**, select **DP2** from the **Workspace Explorer**.
4. The **Nozzle Properties** dialog box is displayed. Set the **Nozzle Length** as **1 ft 0.00 in**. Select the **Location** tab and make the following changes:
 - **Placement Type: Radial**
 - **N1: 15 ft 0.00 in**
 - **N2: 3 ft 6.00 in**
 - **OR1: 270.00 deg**

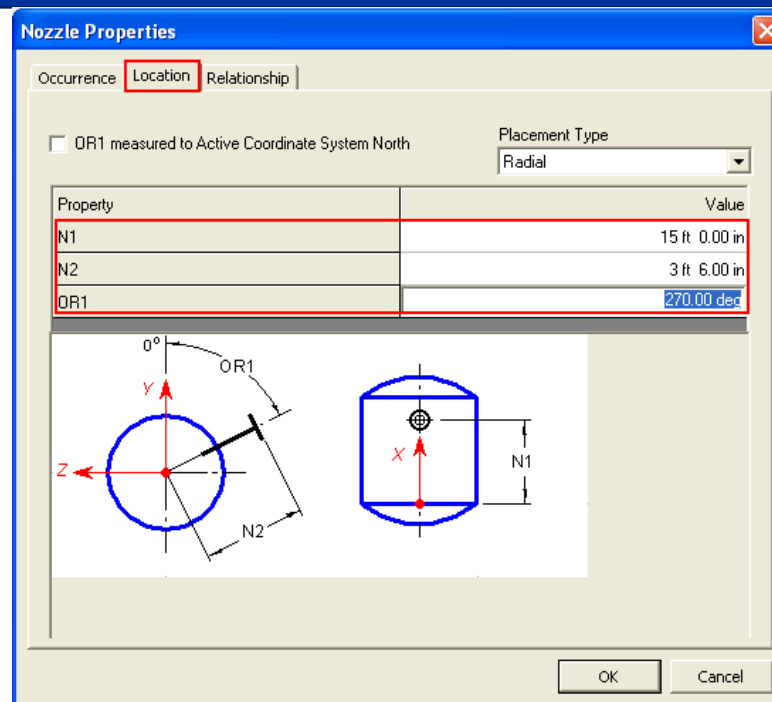


Figure 27: Nozzle Properties Dialog Box

- Click **OK** in the **Nozzle Properties** dialog box. The nozzle **T3** should resemble the highlighted section in Figure 28.

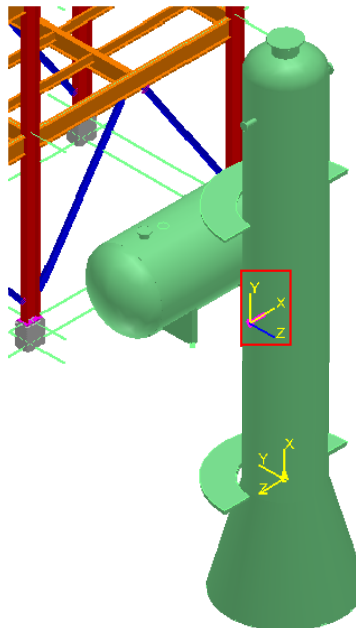


Figure 28: Nozzle T3 Placed

Now, you will place another equipment **P-162** in the Unit **U02**.

Steps for Placing the Equipment P-162:

1. On the **File** menu, click the **Define Workspace...** command.
2. The **Define Workspace...** dialog box appears. In the **Filter** drop-down list, select the **More...** option.
3. The **Select Filter** dialog box appears. To define the workspace for the complete Training Plant, in the **Select Filter** dialog box, select the **ALL** option under the **Plant Filters** folder.

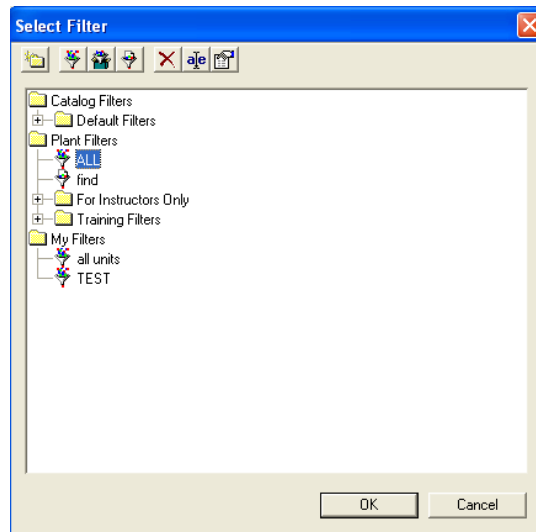


Figure 29: Select Filter Dialog Box

4. You can view the Training Plant. Set **Equipment** filter in the **Locate Filter** drop-down list.
5. Expand Unit **A2 > U04 > Equipment** in the **Workspace Explorer** and select the equipment **41P-101A**.

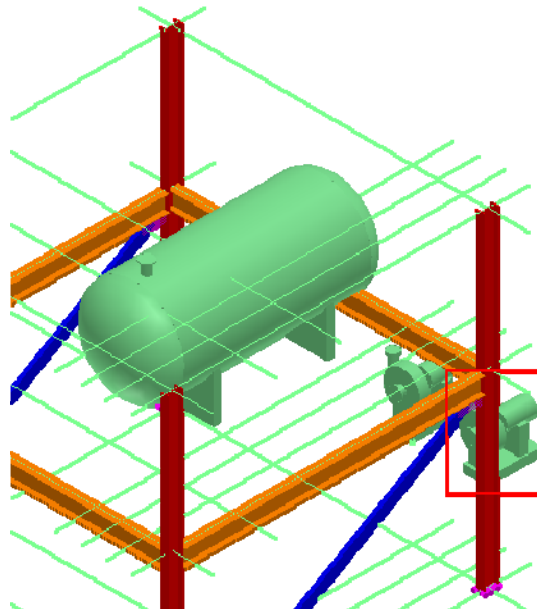


Figure 30: Equipment 41P-101A in Unit U04

6. Click the **Copy** command from the **Edit** menu or click the button on the **Common** toolbar.
7. Select the origin of the equipment as the From reference point.
8. Click the **Paste** button on the **Common** toolbar. You can also click this command on the **Edit** menu on the menu bar.
9. The **Paste** dialog box is displayed. Select system **U02 > Equipment** as the new system parent of the equipment.
10. Clear the **Paste in place** check box. Click **OK** in the dialog box.
11. 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**
12. Click in the graphic view to enter the fixed position point for the paste.
13. The equipment is now copied to Unit **U02**. Select the copied equipment and click **SmartPlant > Correlate with Design Basis...** command.
14. In the **P&ID File Viewer** dialog box, select pump **P-162**. As you select this pump, the **Compare with Design Basis** dialog box is displayed.

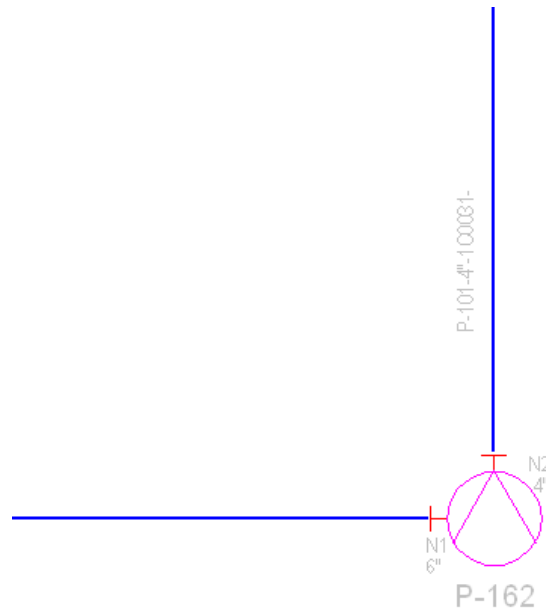


Figure 31: Pump P-162 Selected in P&ID File Viewer Dialog Box

15. Click **Update** in the **Compare with Design Basis** dialog box. The properties of the copied equipment will be updated as per the properties of the pump **P-162** in the **P&ID File Viewer** dialog box. The new equipment placed will now be named as **P-162** in the **Workspace Explorer**. Click **Close**.
16. Set **Pipe Nozzle** filter in the **Locate Filter** drop-down list.

17. Select the Suction Nozzle **N1** under pump in **P&ID File Viewer** dialog box.

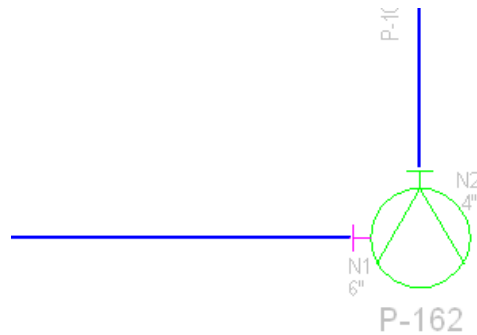


Figure 32: Nozzle N1 Selected in the P&ID File Viewer Dialog Box

18. Select the **SmartPlant > Compare Design basis** command. The **Compare with Design Basis** dialog box appears.
19. Click **Update** in the **Compare with Design Basis** dialog box to update the properties of Suction Nozzle **N1**. Click **Close**.
20. Similarly, select the Discharge Nozzle **N2** in the **P&ID File Viewer** dialog box and update the properties of Discharge Nozzle **N2** in the model.

For more information related to placing equipment and nozzles from P&ID, refer to the *Correlate Existing Equipment for Use in an Integrated Environment* topic in the user guide *EquipmentUsersGuide.pdf*.

Session 9: Manipulating Equipment

Objectives:

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

Prerequisite Sessions:

- SP3D Overview
- SP3D Common Sessions
- Placing Designed Equipment and Equipment Components
- Placing Nozzles

Overview:

SP3D provides generic commands such as copy/paste, move, and rotate for manipulation of design objects. These commands allow simultaneous manipulation of design objects from multiple disciplines. Specialized functions for manipulating the design objects are provided on the **Edit** ribbon when one or more objects are selected in the task where they were created.

All manipulation commands require the design objects to be selected as first step.

Modifying Equipment/Nozzle Properties:

Modify the properties of the nozzle **STNoz1** and **41P-101A** within the existing equipment **40V-101** in Unit **U04** by using the following specifications:

Nozzle **STNoz1**

Nominal Size: 6 in
Name: A

Nozzle **41P-101A**

Nominal Size: 8 in
Name: N1

Steps for Modifying the Properties of Equipment/Nozzles:

1. Define your workspace to show Unit **U04** and coordinate system **U04 CS**.
2. In your **Workspace Explorer**, expand equipment **40V-101**.
3. Under the **Equipment** node **40V-101**, select nozzle **STNoz1**.

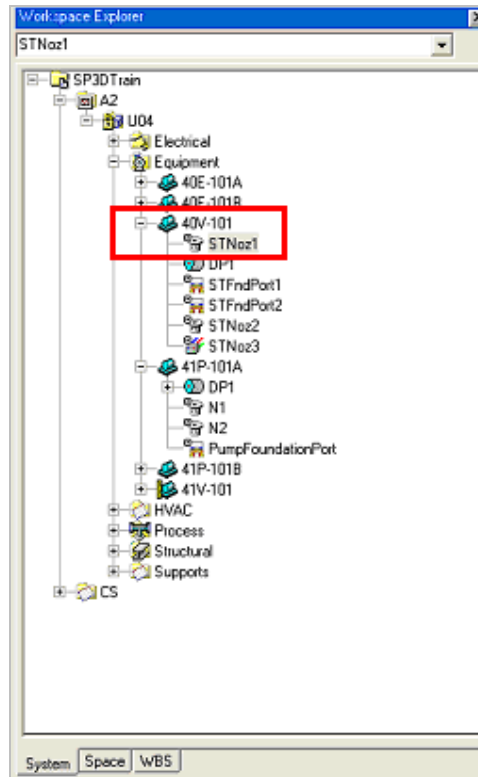
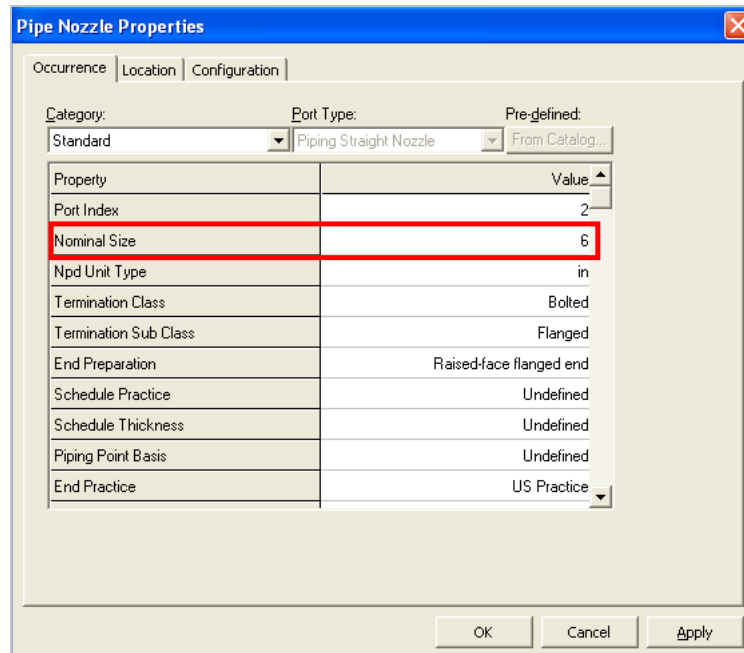


Figure 1: Nozzle STNoz1 Selected in the Workspace Explorer

4. Open the property page for nozzle **STNoz1**.
5. Change the following specifications and click **Apply** (this leaves the property page displayed so you can more quickly edit the next nozzle).

Nominal Size: 6 in

Name: A



Pipe Nozzle Properties

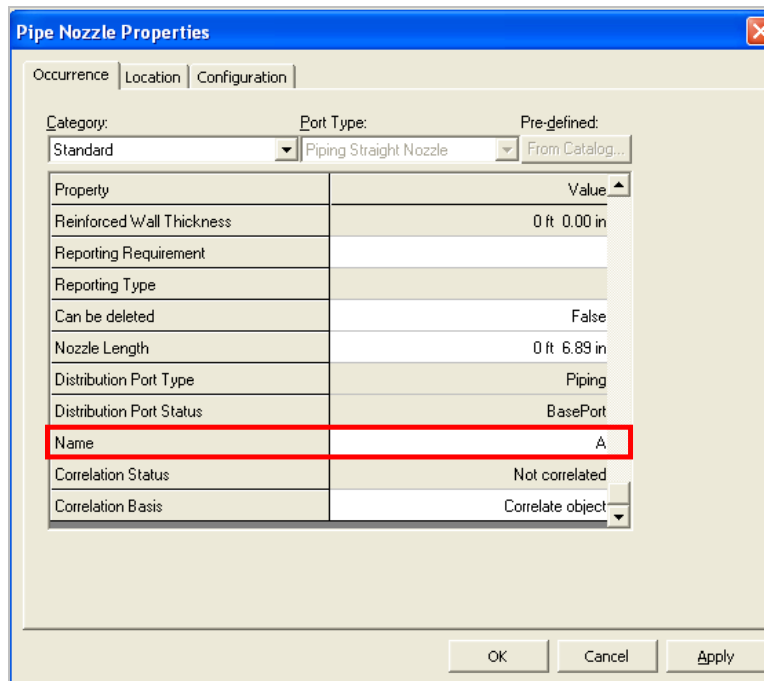
Occurrence | Location | Configuration

Category: Standard Port Type: Piping Straight Nozzle Pre-defined: From Catalog...

Property	Value
Port Index	2
Nominal Size	6
Npd Unit Type	in
Termination Class	Bolted
Termination Sub Class	Flanged
End Preparation	Raised-face flanged end
Schedule Practice	Undefined
Schedule Thickness	Undefined
Piping Point Basis	Undefined
End Practice	US Practice

OK Cancel Apply

Figure 2: Nominal Size Field on the Pipe Nozzle Properties Dialog Box



Pipe Nozzle Properties

Occurrence | Location | Configuration

Category: Standard Port Type: Piping Straight Nozzle Pre-defined: From Catalog...

Property	Value
Reinforced Wall Thickness	0 ft 0.00 in
Reporting Requirement	
Reporting Type	
Can be deleted	False
Nozzle Length	0 ft 6.89 in
Distribution Port Type	Piping
Distribution Port Status	BasePort
Name	A
Correlation Status	Not correlated
Correlation Basis	Correlate object

OK Cancel Apply

Figure 3: Name Field on the Pipe Nozzle Properties Dialog Box

- Now select the Suction Nozzle under equipment **41P-101A**.

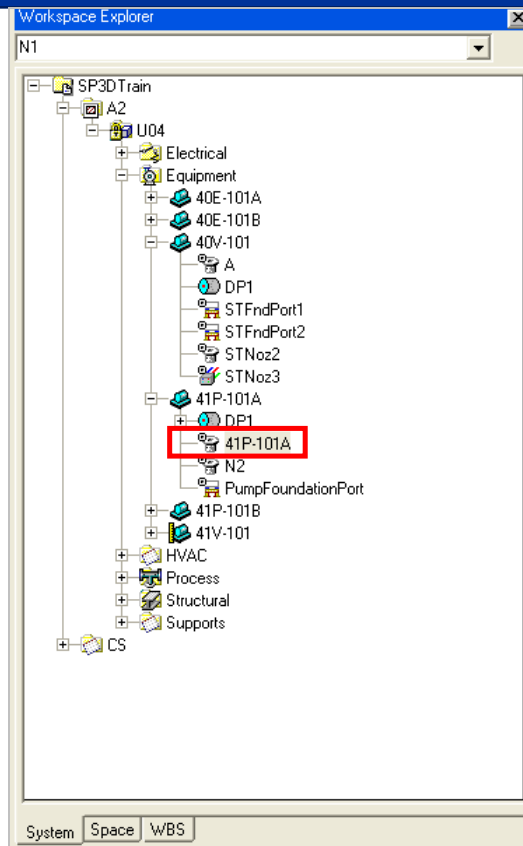
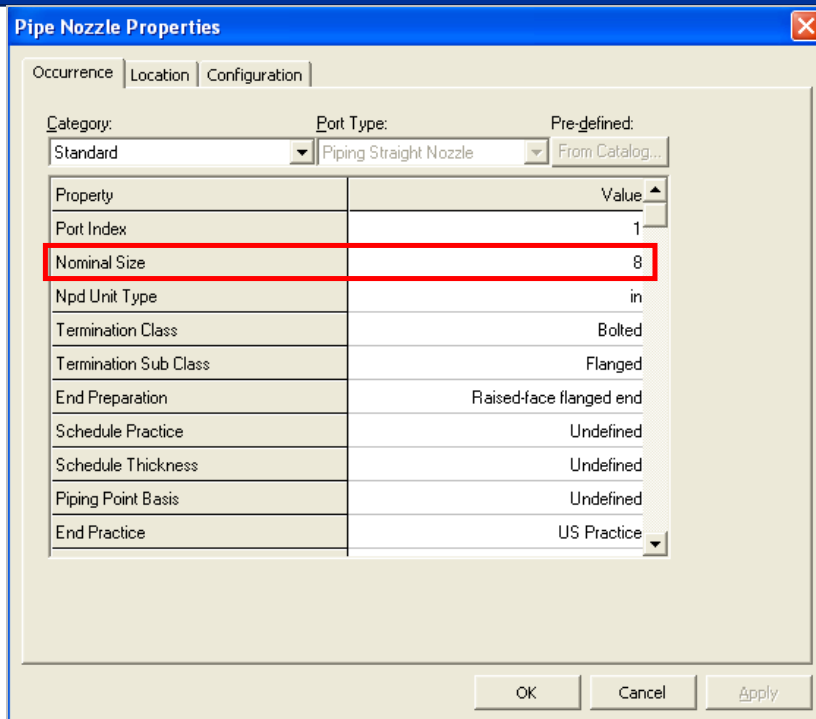


Figure 4: Suction Nozzle Under 41P-101A Selected

7. Open the property page for the Suction Nozzle **41P-101A**.
8. Change the following specifications and click **OK**.

Nominal Size: 8 in
Name: N1



Pipe Nozzle Properties

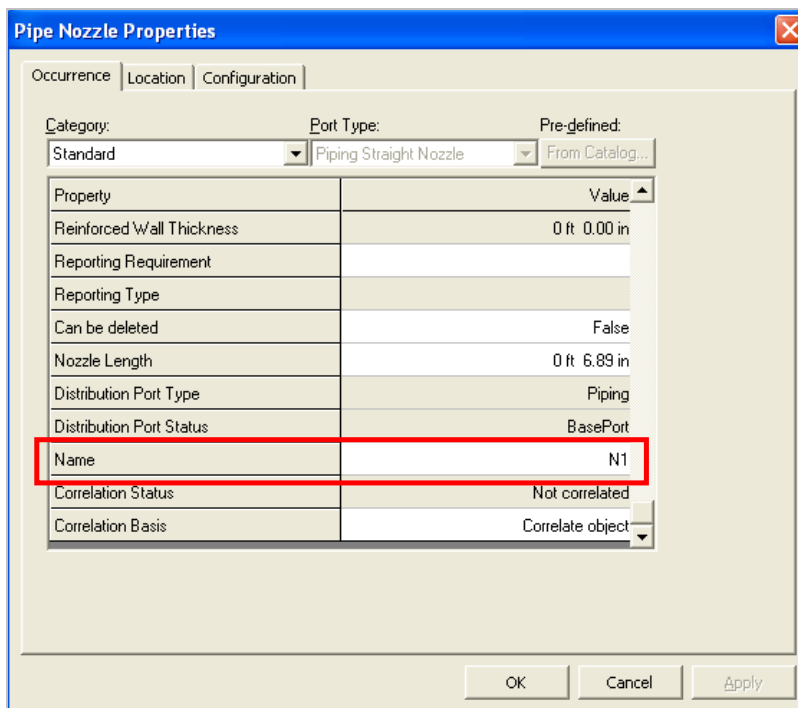
Occurrence | Location | Configuration

Category: Standard Port Type: Piping Straight Nozzle Pre-defined: From Catalog...

Property	Value
Port Index	1
Nominal Size	8
Npd Unit Type	in
Termination Class	Bolted
Termination Sub Class	Flanged
End Preparation	Raised-face flanged end
Schedule Practice	Undefined
Schedule Thickness	Undefined
Piping Point Basis	Undefined
End Practice	US Practice

OK Cancel Apply

Figure 5: Nominal Size Field on the Pipe Nozzle Properties Dialog Box



Pipe Nozzle Properties

Occurrence | Location | Configuration

Category: Standard Port Type: Piping Straight Nozzle Pre-defined: From Catalog...

Property	Value
Reinforced Wall Thickness	0 ft 0.00 in
Reporting Requirement	
Reporting Type	
Can be deleted	False
Nozzle Length	0 ft 6.89 in
Distribution Port Type	Piping
Distribution Port Status	BasePort
Name	N1
Correlation Status	Not correlated
Correlation Basis	Correlate object

OK Cancel Apply

Figure 6: Name Field on the Pipe Nozzle Properties Dialog Box

Steps for Moving the Equipment/Nozzles:

Move the existing equipment **40V-101**. The original position of the object is as follows:

East: 98 ft
North: 99 ft 8 in
Elevation: 8 ft 3 in

The new position of the object should be as follows:

East: 85 ft 1.85 in
North: 117 ft 0.84 in
Elevation: 2 ft 4.76 in

The repositioned equipment should look like the position of the pump in Figure 7.



Figure 7: Final Output - Repositioned Equipment in the Model

1. Define your workspace to include Unit **U04** and coordinate system **U04 CS**.
2. Set the active coordinate system to **Global**, as shown in Figure 8.



Figure 8: Coordinate System - Global

3. Click the **Set Target to Origin** option on the **PinPoint** ribbon to move the target position for placing the equipment to the origin of the active coordinate system.

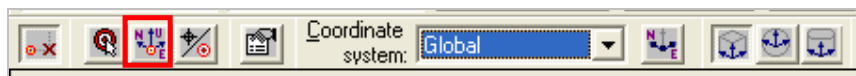


Figure 9: Set Target to Origin Option

4. Select equipment **40V-101** in the **Workspace Explorer**.

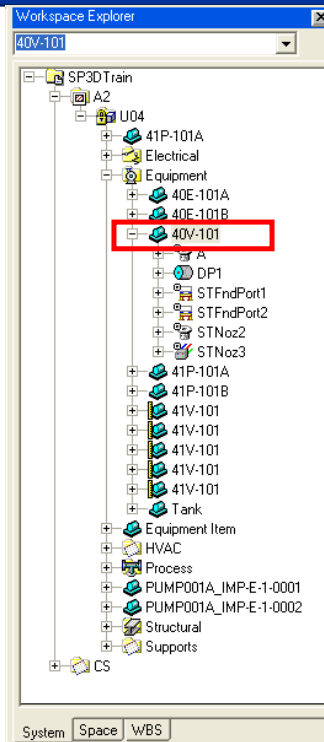


Figure 10: Equipment 40V-101 Selected in the Workspace Explorer

The view of the model should resemble Figure 11.

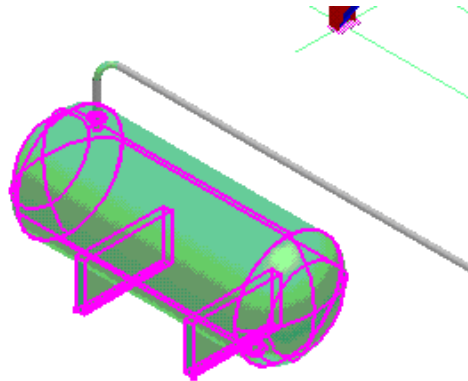


Figure 11: Selected Equipment 40V-101 in the Graphic View

5. Click the **Move** button on the **Common** toolbar.



Figure 12: Move Button on the Common Toolbar

The **Move** command automatically defaults the From point to the origin of the equipment. You can pick a different From point by clicking on the **From** button on the

Move ribbon. In this case, the specifications call for you to move the origin to a specific point relative to the Global coordinate system so the default From point is what you want.

6. Enter the new origin location on the **PinPoint** ribbon:

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.

The position of the moved equipment should resemble Figure 7.

8. Click the **Undo** button on the **Common** toolbar to undo the move operation.

Note:

- Perform the undo operation so that equipment **40V-101** is at the correct location for the Piping practice labs.

Steps for Copying/Pasting the Equipment/Nozzles:

Copy and paste the existing pump **41P-101A**. The original position of the object is as follows:

East: 98 ft
North: 99 ft 8 in
Elevation: 8 ft 3 in

The new position and name of the object should be as follows:

East: 30 ft
North: 11 ft
Elevation: 2 ft
Name: 41P-101B

The repositioned pump should resemble the highlighted section in Figure 13.

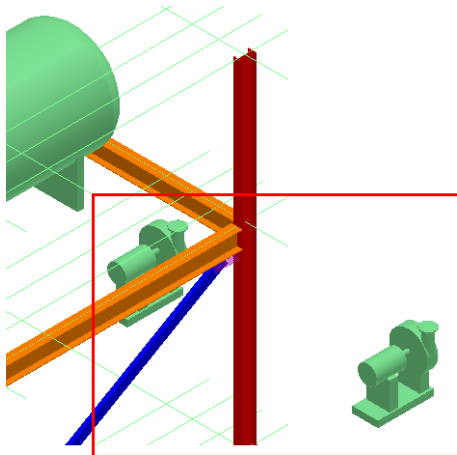


Figure 13: Final Output – Copying and Pasting the Existing Pump

1. Set the active coordinate system to **U04 CS**.

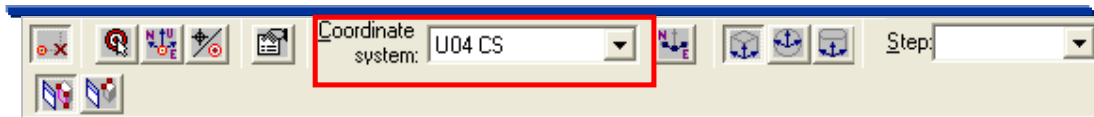


Figure 14: Coordinate System

2. Click the **Set Target to Origin** option to move the target position for placing the equipment to the origin of the active coordinate system.

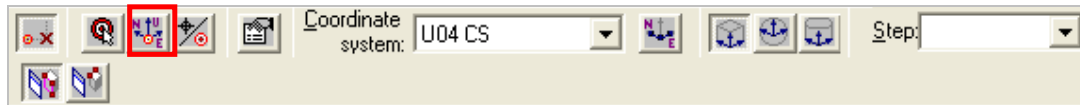


Figure 15: Set Target to Origin Option

3. Select the pump **41P-101A** graphically or by keying in the name in the **Workspace Explorer** name search field.
4. Click the **Copy** button on the **Common** toolbar.
5. When prompted for a reference point, select the control point at the bottom left corner of the pump.
6. Click the **Paste** button on the **Common** toolbar.

Note:

- The **Copy** and **Paste** commands are also available on the **Edit** menu.

7. The **U04 > Equipment** folder is already selected as the new system folder in the **Workspace Explorer**.
8. Clear the **Paste in place** check box in the **Paste** dialog box and click **OK**.

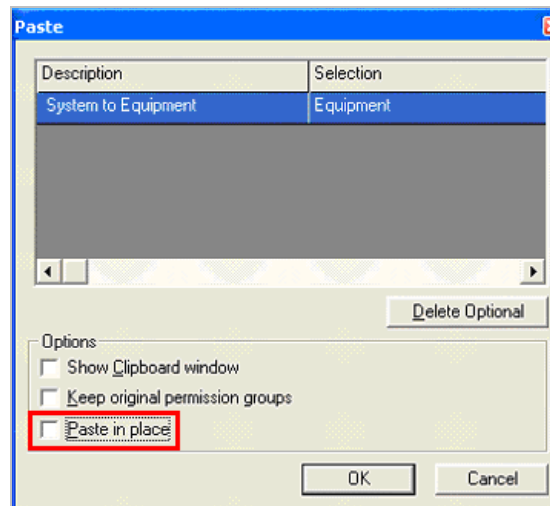


Figure 16: Paste In Place Check Box in the Paste Dialog Box

9. Key in the following specifications on the **PinPoint** ribbon and click in the graphic view to enter the To point for the paste operation:

East: 30 ft
North: 11 ft
Elevation: 2 ft

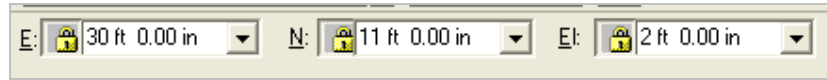


Figure 17: Coordinates on the PinPoint Ribbon

10. Change the name to **41P-101B** by editing the name field on the **Equipment Edit** ribbon.

For more information related to manipulating equipment(s) refer to *Copy/Paste, Delete and Edit* topics in the user guide *EquipmentUsersGuide.pdf*.