

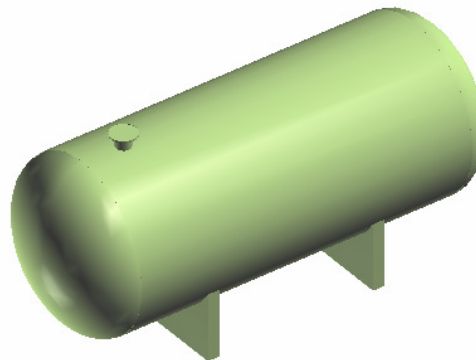
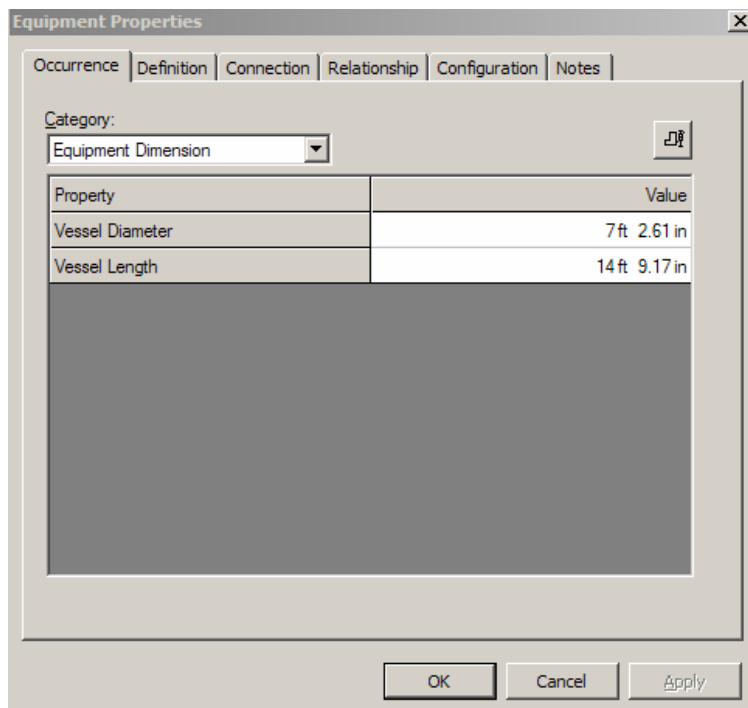
Process, Power and Marine Division

SP3D Equipment Task



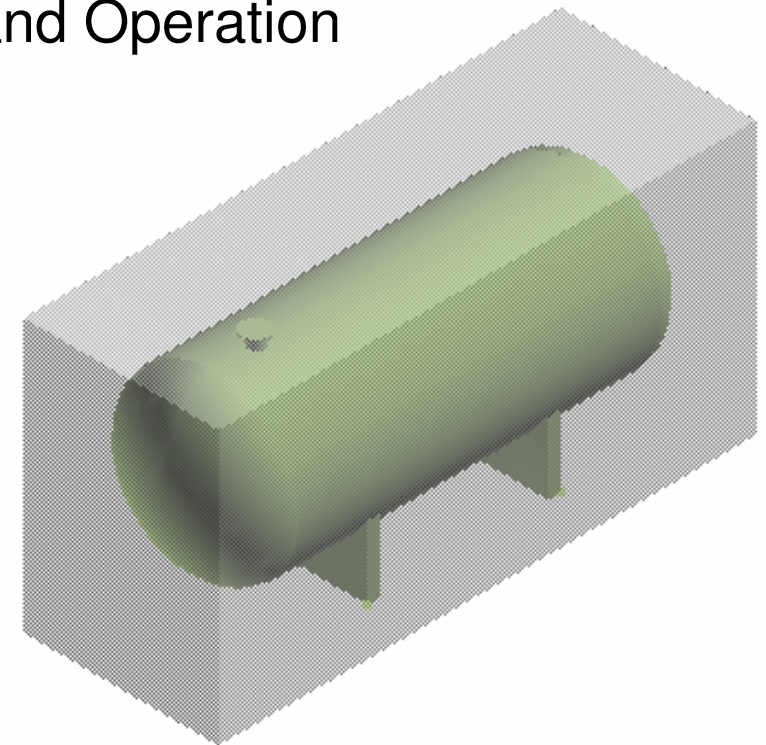
What is SmartPlant Equipment

- SmartPlant Equipment is an integrated equipment modeling environment that provides:
- Parametric Equipment placement
- Modeling of equipment using primitive shapes or equipment components
- Importing of equipment from external sources



What is SmartPlant Equipment

- Equipment is a custom assembly that contains members (nozzles, shapes, equipment components, etc..)
- Graphical representation of an Equipment can be created using:
 - Visual Basic (Geometry Type Functions)
 - 3rd party software – SAT format / DGN File
- Aspects: Physical, Insulation, Maintenance, and Operation
- Ports (connection points) available:
 - Piping port
 - Ducting port
 - Cabletray port
 - Conduit port
 - Cable port
 - Foundation Port

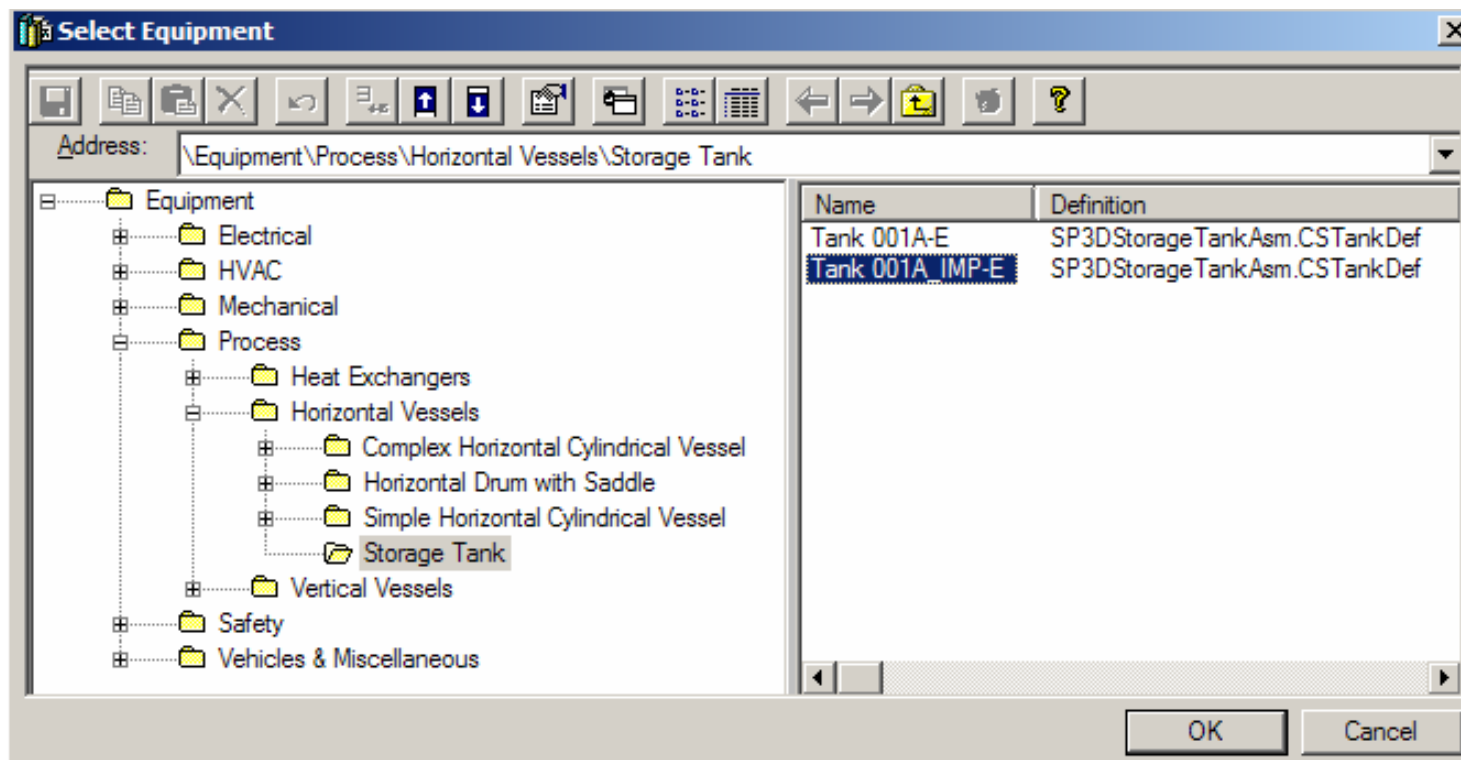


Equipment Task



Place Equipment Command

- The place equipment command activates the Select Equipment dialog box (Catalog Browser) that **provides access to equipment parametrics that have been defined in the Reference Data aka the Catalog Database**
- When using this command, the user must define a system hierarchy folder for the equipment to reside (e.g. area/unit location)

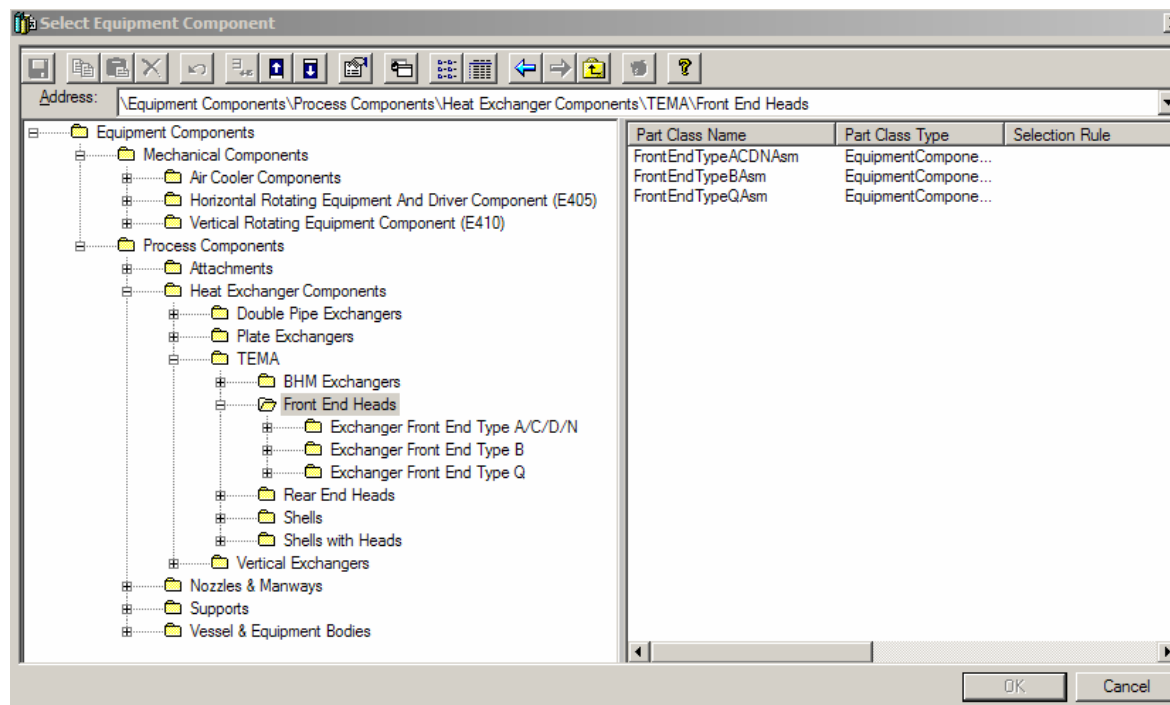


Equipment Task



Place Equipment Component Command

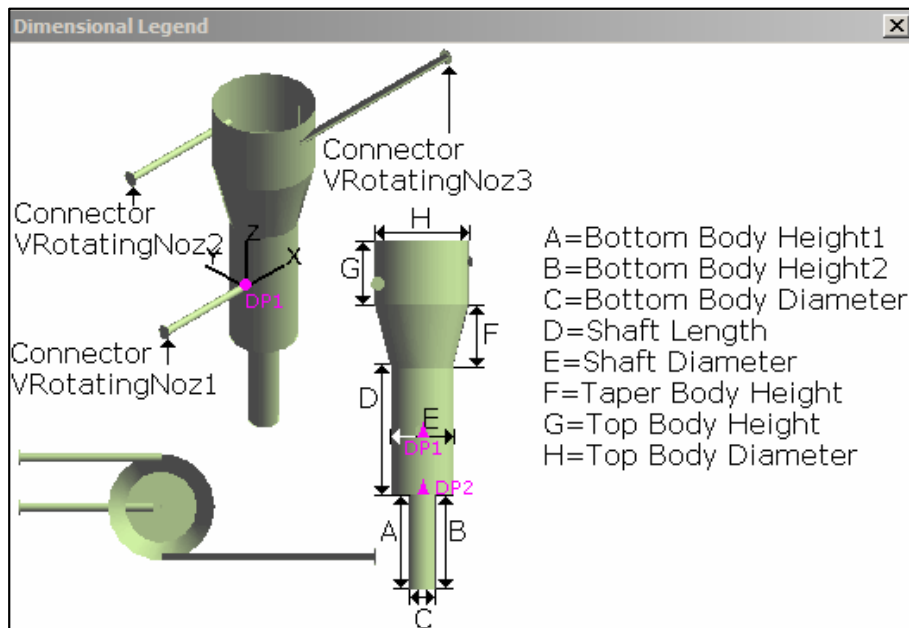
- The place equipment component command activates the Select Equipment Component dialog box (Catalog Browser) that provides access to the equipment component hierarchy
- To use this command, the user is prompted to select a parent eqp item previously created (using the command in the previous slide)



Equipment Task

Equipment Properties Page

- Occurrence Tab: Enables the user to enter driving dimensions for the parametric graphic



Equipment Properties

Occurrence | Definition | Connection | Relationship | Configuration | Notes

Category: Equipment Dimension

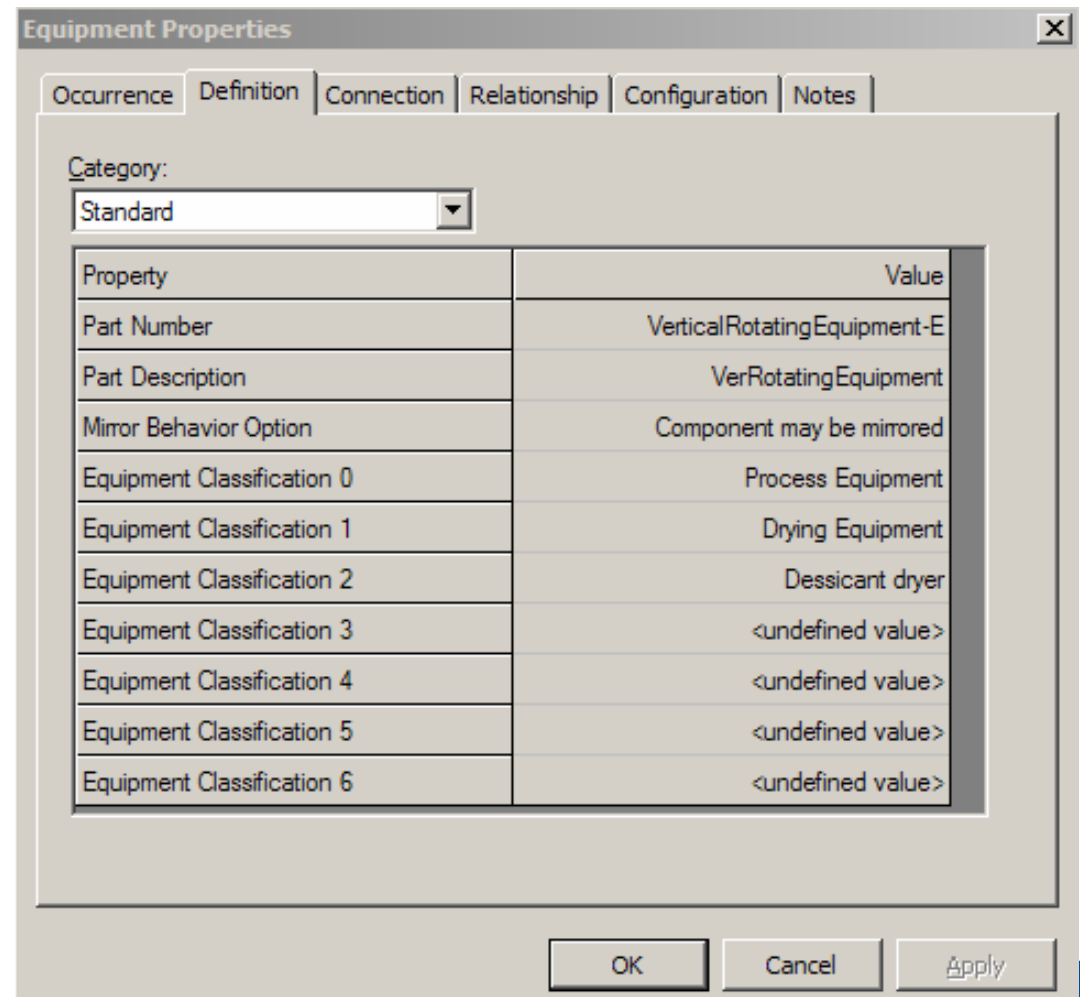
Property	Value
Bundle Pulling Length	3 ft 3.37 in
Shaft Diameter	1 ft 5.72 in
Shaft Length	4 ft 11.06 in
Coupling Length	
Bottom Body Diameter	3 ft 3.37 in
Bottom Body Height 1	3 ft 3.37 in
Bottom Body Height 2	3 ft 3.37 in
Taper Body Height	3 ft 3.37 in
Top Body Diameter	4 ft 11.06 in
Top Body Height	3 ft 3.37 in

OK Cancel Apply

Equipment Task

Equipment Properties Page

- Definition Tab: Enables the user to enter classification information. Some delivered parametrics have this info as read only like in the example. Others are editable.



Equipment Properties

Occurrence Definition Connection Relationship Configuration Notes

Category:
Standard

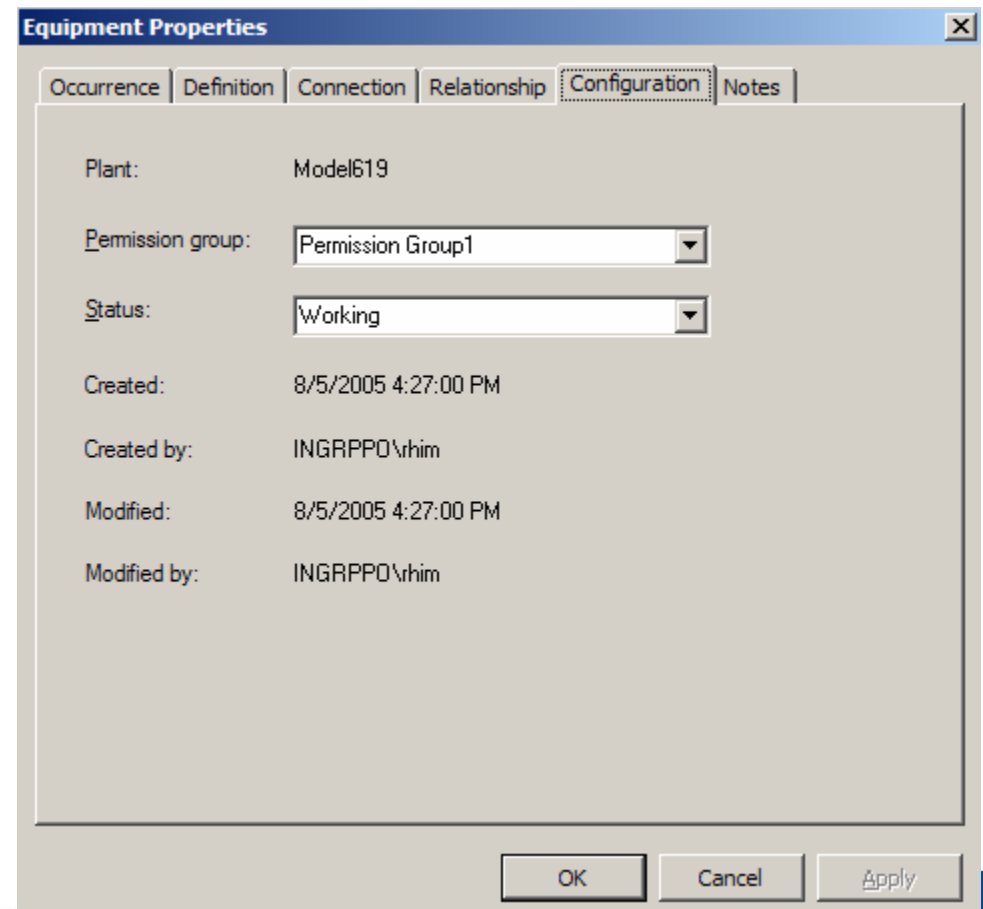
Property	Value
Part Number	VerticalRotatingEquipment-E
Part Description	VerRotatingEquipment
Mirror Behavior Option	Component may be mirrored
Equipment Classification 0	Process Equipment
Equipment Classification 1	Drying Equipment
Equipment Classification 2	Dessicant dryer
Equipment Classification 3	<undefined value>
Equipment Classification 4	<undefined value>
Equipment Classification 5	<undefined value>
Equipment Classification 6	<undefined value>

OK Cancel Apply

Equipment Task

Equipment Properties Page

- Configuration Tab: Users can change status to “Approved” here and prevent further modifications to their equipment. Date of creation and modification can be reviewed here, as well as the user name of the last person to modify the item



The image shows a screenshot of the 'Equipment Properties' dialog box, specifically the 'Configuration' tab. The dialog box has a title bar with a close button (X). Below the title bar are several tabs: 'Occurrence', 'Definition', 'Connection', 'Relationship', 'Configuration' (which is selected), and 'Notes'. The main area of the dialog box contains the following fields:

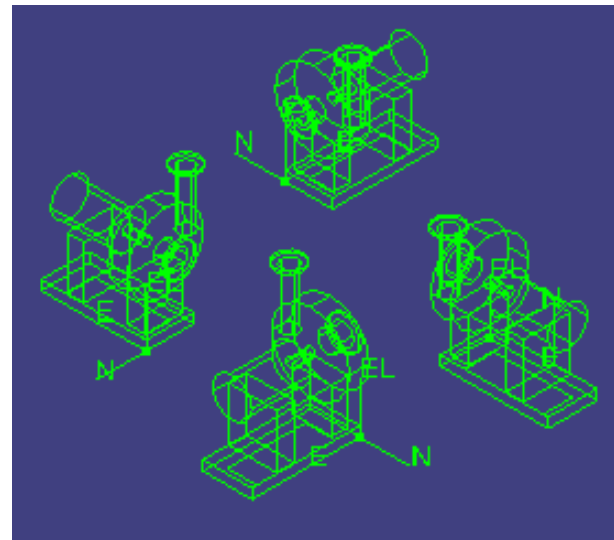
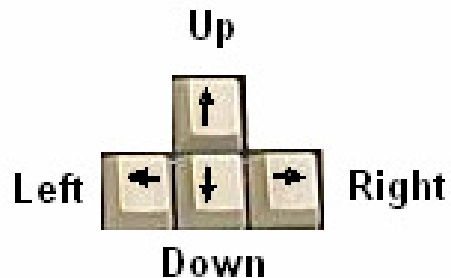
Plant:	Model619
Permission group:	Permission Group1
Status:	Working
Created:	8/5/2005 4:27:00 PM
Created by:	INGRPP0\rhim
Modified:	8/5/2005 4:27:00 PM
Modified by:	INGRPP0\rhim

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

Equipment Task

Place Equipment Command

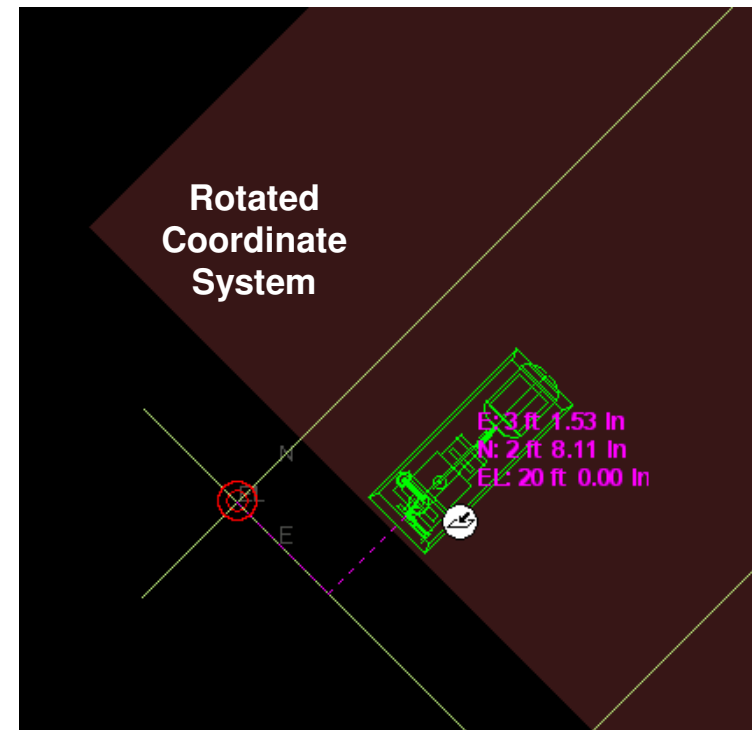
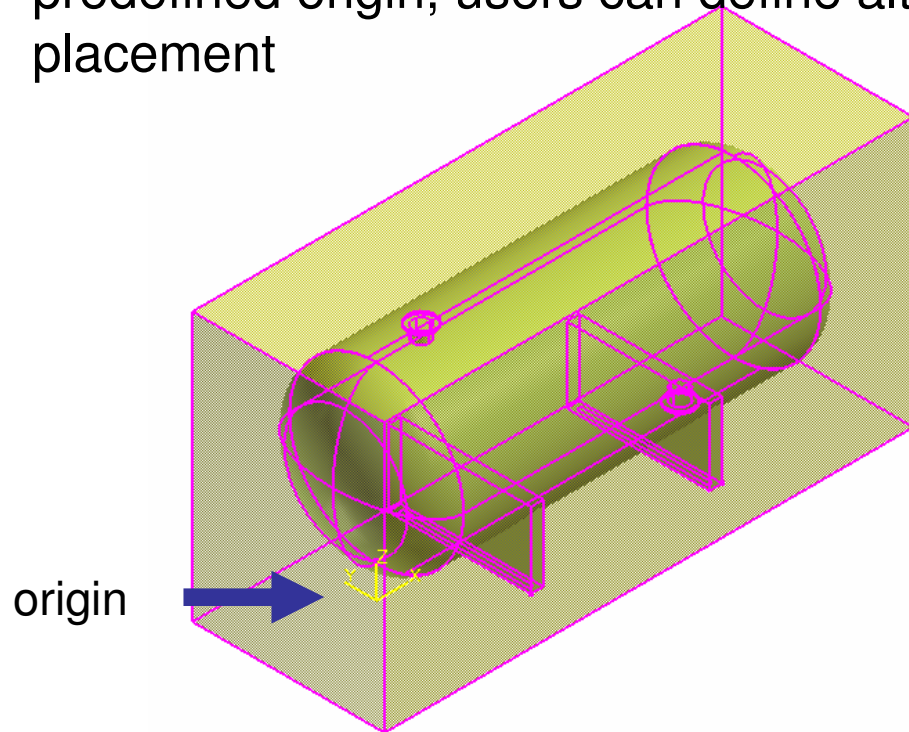
- The arrow keys on the keyboard are to be used to rotate, and set the axis of rotation for any equipment object that supports a local coordinate system. These keys should work on initial placement of an object, as well as subsequent editing of objects
- Up Arrow - change active axis in the recurring sequence of X, Y, Z



Equipment Task

Place Equipment Command

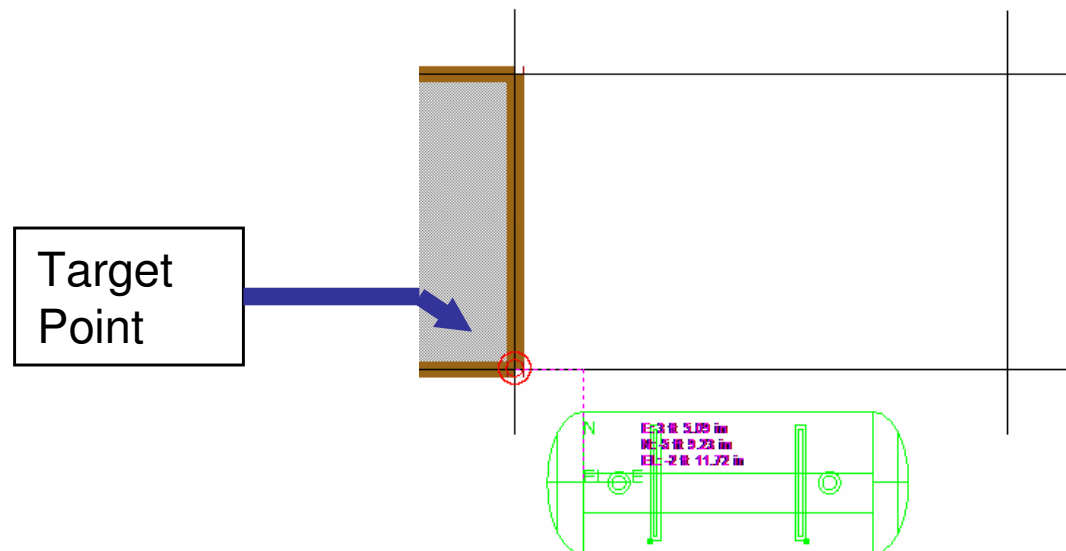
- Uses active coordinate system during placement
- Equipment is placed using Symbol Origin by default. All items have a predefined origin, users can define alternate points of origin after initial placement



Equipment Task

PinPoint Tool

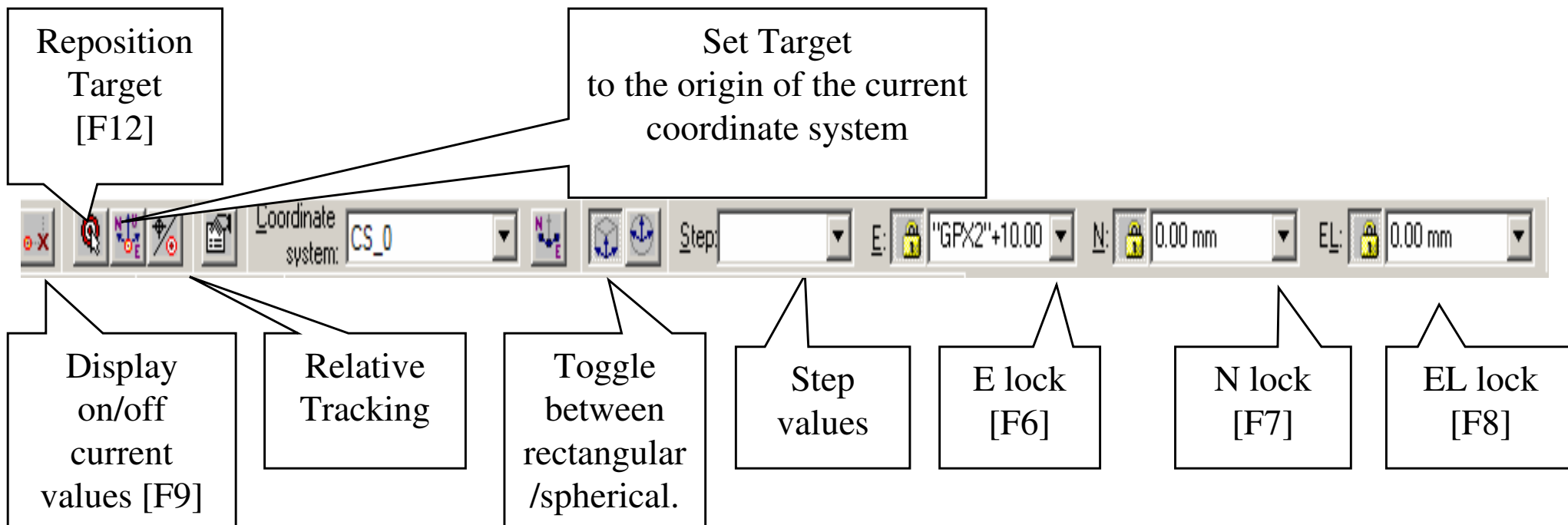
- Provides coordinate inputs to the active command
- x,y,z coordinates are relative to Target Point (see example below)
- Dynamically displays the coordinate/distance values
- Locks the coordinate/distance values



Equipment Task

PinPoint Tool

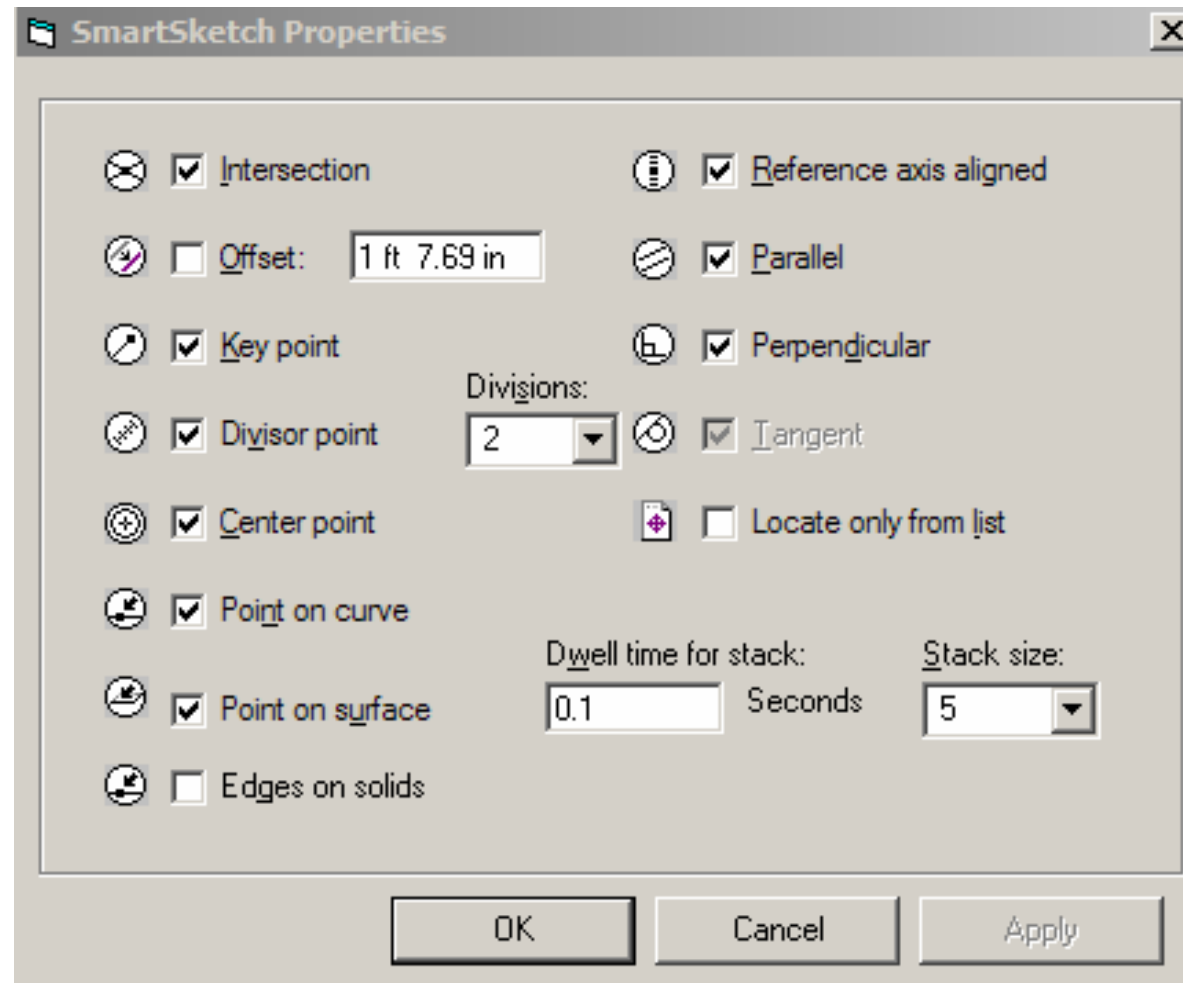
- Use the [F#] keys to lock the coordinates from the cursor's location
- Supports of mathematical operations and reference plane names. E.g. in Northing box user may enter “ + 2ft” at the end of the coordinate readout, this would be automatically calculated and the resulting value becomes the new active Northing coordinate.



Equipment Task


SmartSketch Options: Common locks used during graphics placement/modification

- Point on curve
 - 3D lines
 - 3D Arcs
- Point on surface
 - 3D Planes
 - 3D Projections
 - 3D Revolutions
 - 3D Cones
 - Ruled Surfaces & B-Splines



- Relationships/Constraints

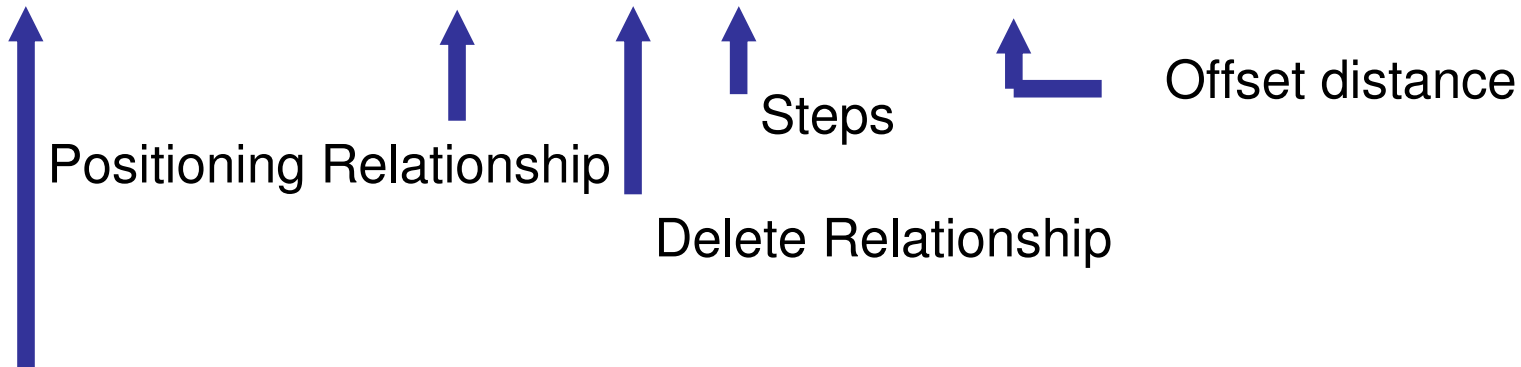
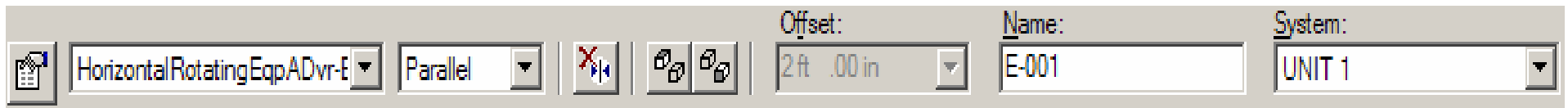
Positioning relationships available (constraints):

- Mate
 - Align
 - Connect
 - Minimum Distance (E-W, N-S, Vertical)
 - Parallel
 - Mate to Tangent Plane
- 



Equipment Task

Place Equipment SmartStep Ribbon Bar

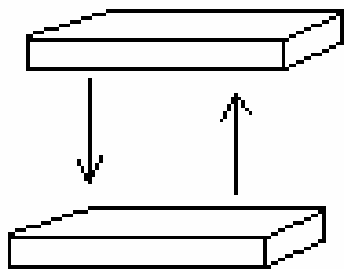


- Set the Positioning Relationship
- Shows the last relationship added in the relationship combo box

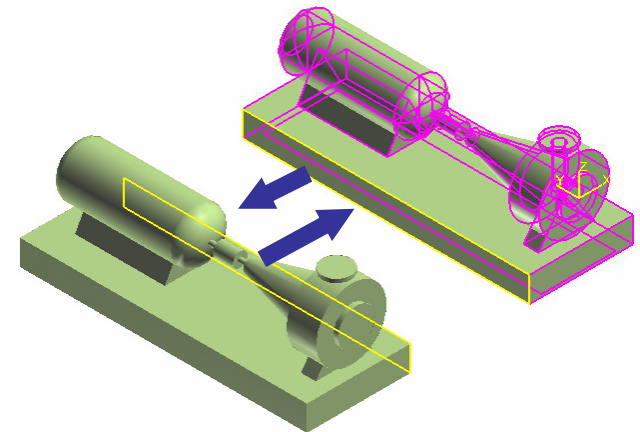
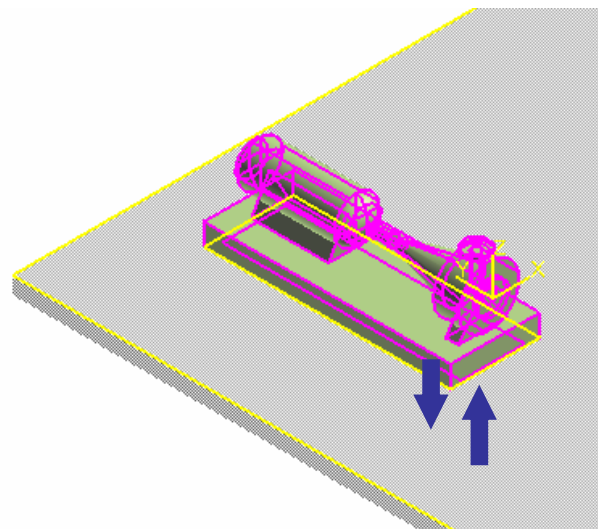
Equipment Task

Positioning Relationships

- Mate Relationship
 - Between planar surface and planar surface
 - Surface Normal vectors point to each other



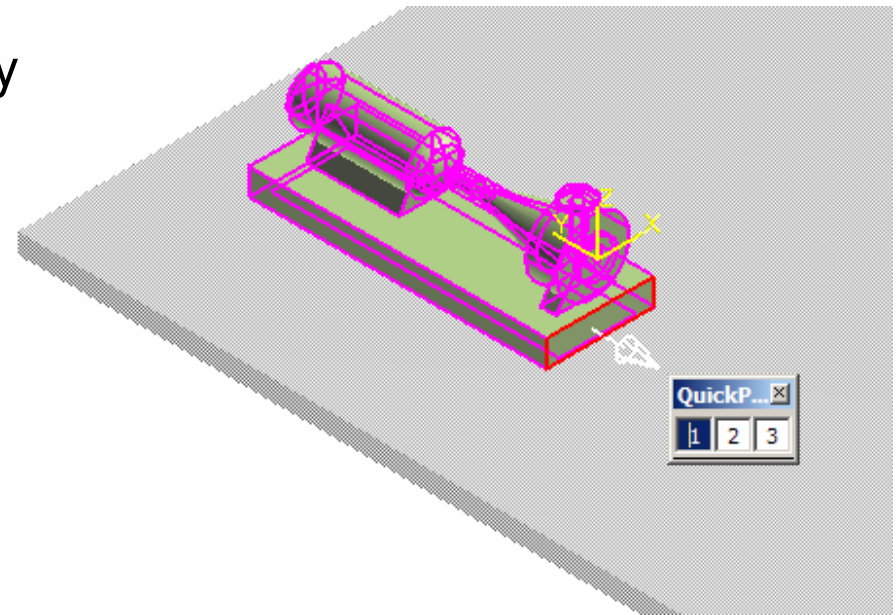
Mate



Equipment Task

Positioning Relationships

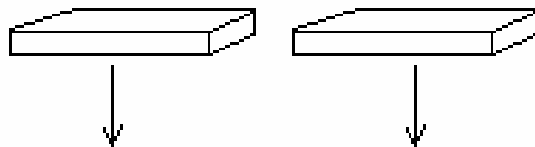
- When the equipment is placed into the active workspace the default surface is automatically constraint to a surface selected in the workspace
- If the equipment does not have a default surface defined, then the system uses an imaginary plane whose normal is along the local coordinate z-axis of the equipment symbol (origin)
- Use Quick Pick toolbar to help you select the surface
- When highlight surface for relationship, show surface direction vector



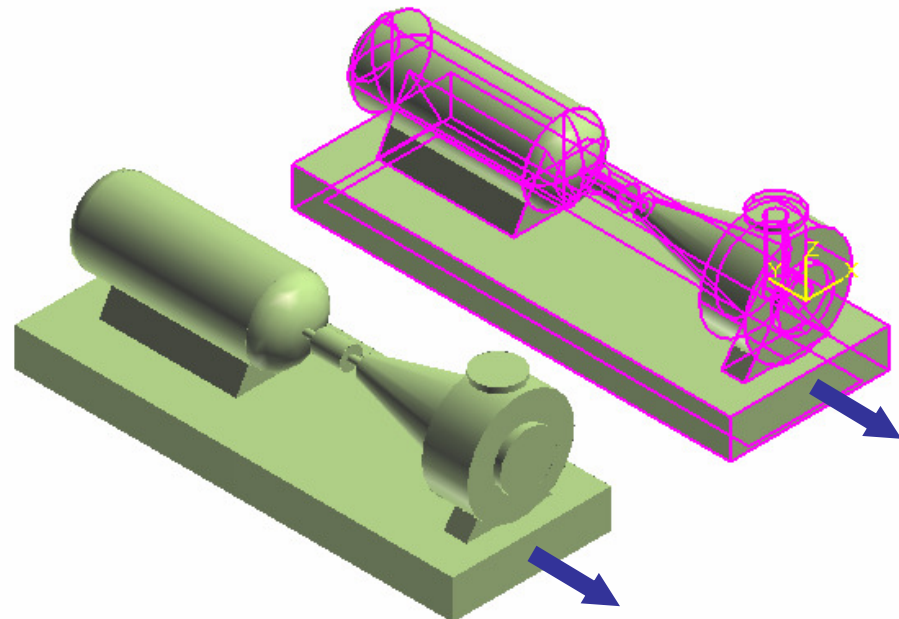
Equipment Task

Positioning Relationships

- Align Relationship
 - Between planar surface and planar surface
 - Surface normal vectors point in the same direction



Align

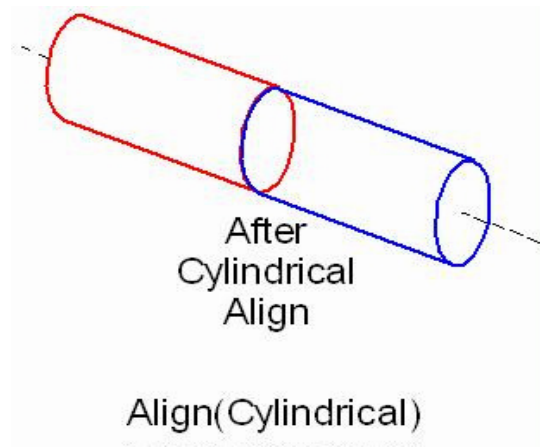
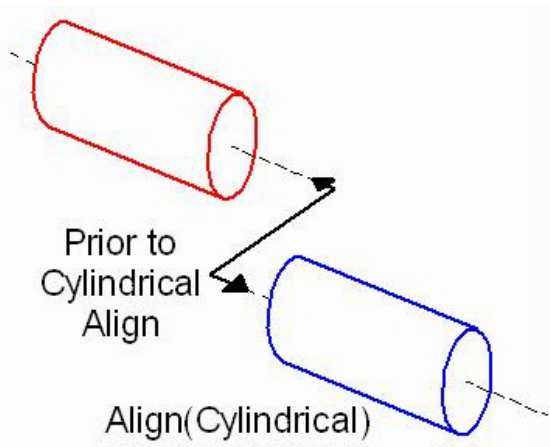
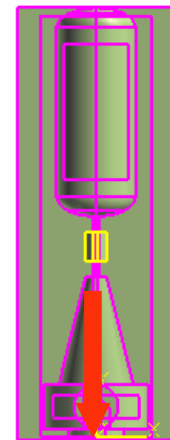
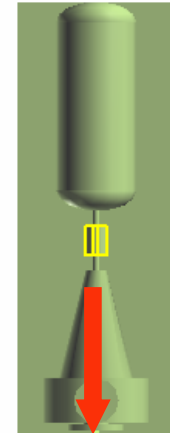


Equipment Task



Positioning Relationships

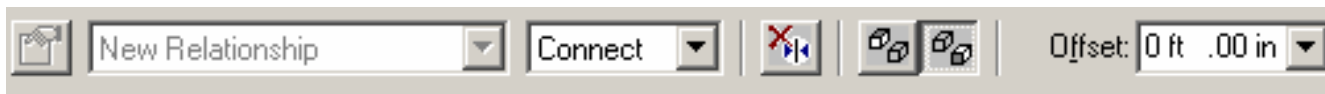
- Mate/Align Relationship
 - When you select cylindrical objects, the system uses the axes to create the relationship
 - Make the two axes collinear



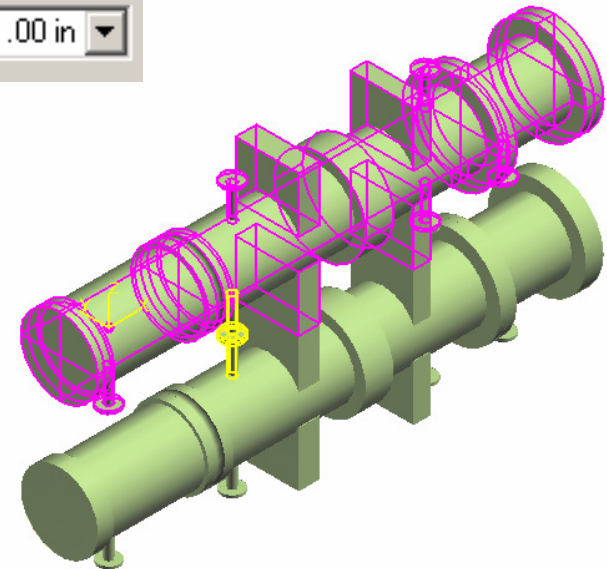
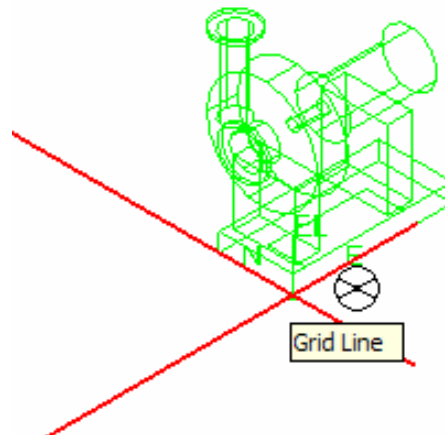
Equipment Task

Positioning Relationships

- Connect Relationship
 - Forces a port on an equipment to be coincident with a port on another equipment



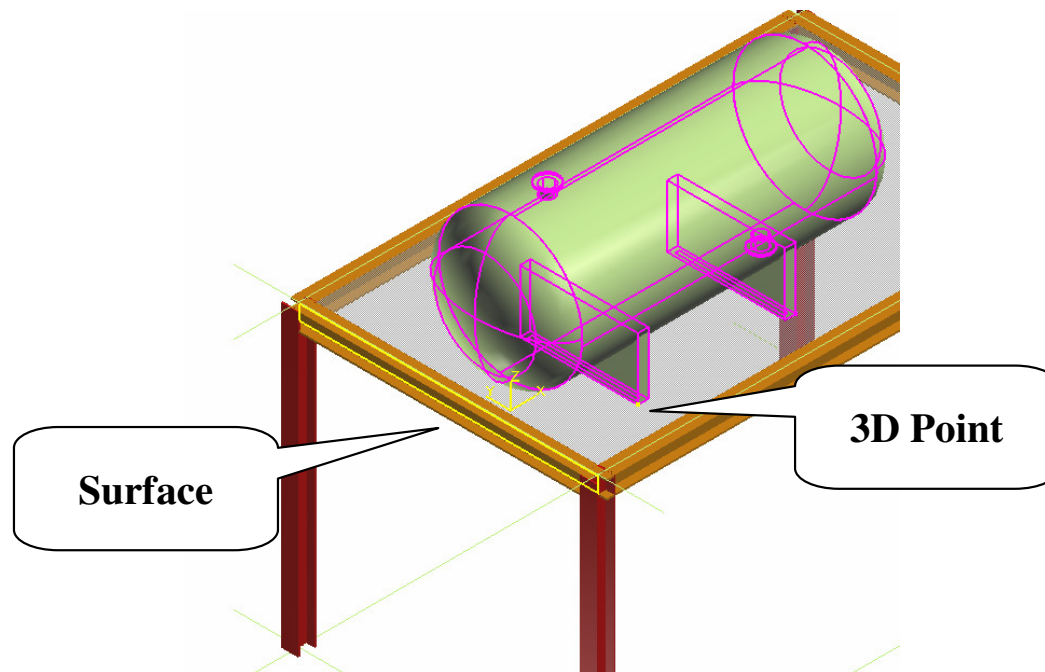
- Implicit move command



Equipment Task

Positioning Relationships

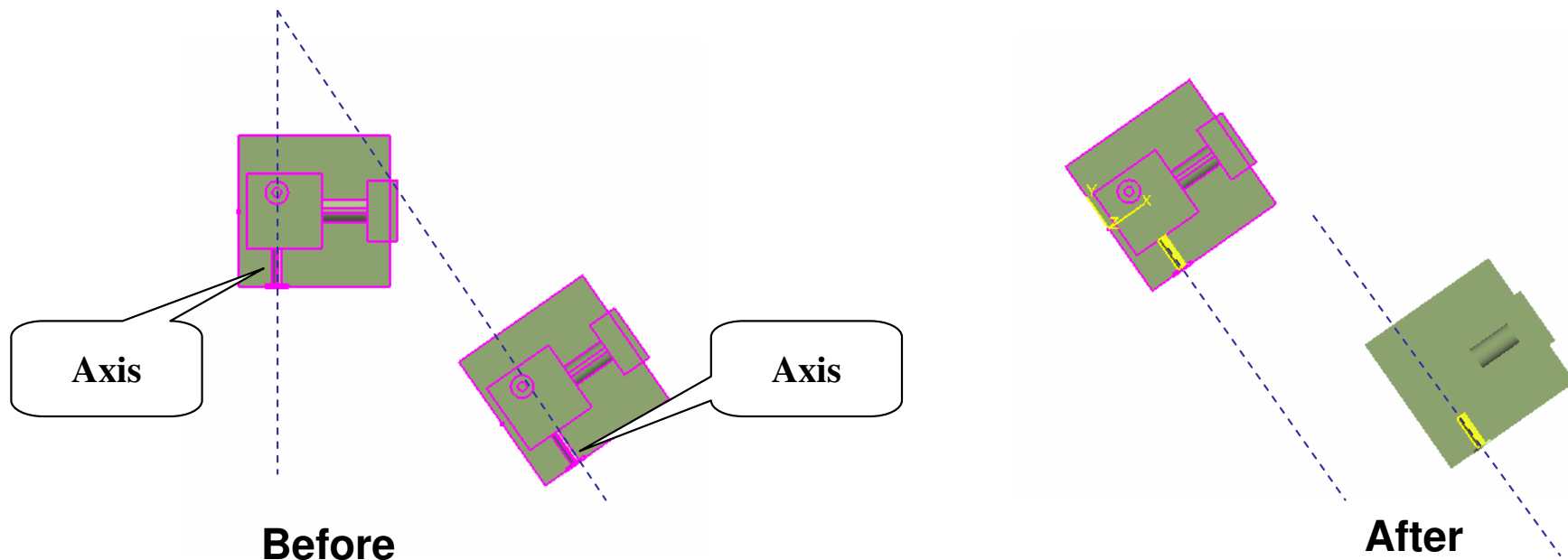
- Minimum Distance Relationships (E-W, N-S, Vertical)
 - Between 3D points and planar surface (example: 3D plane entities, slabs, etc)



Equipment Task

Positioning Relationships

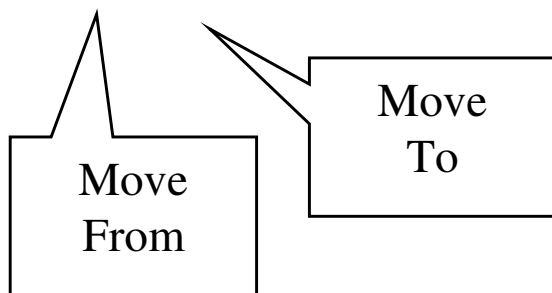
- Parallel Relationship
 - Only rotate the selected equipment to create the constraint



Equipment Task

Common Move command

- Linear SmartSketch points are enabled in the move command. This functionality allows easy movement along major axis/ or parallel to other objects



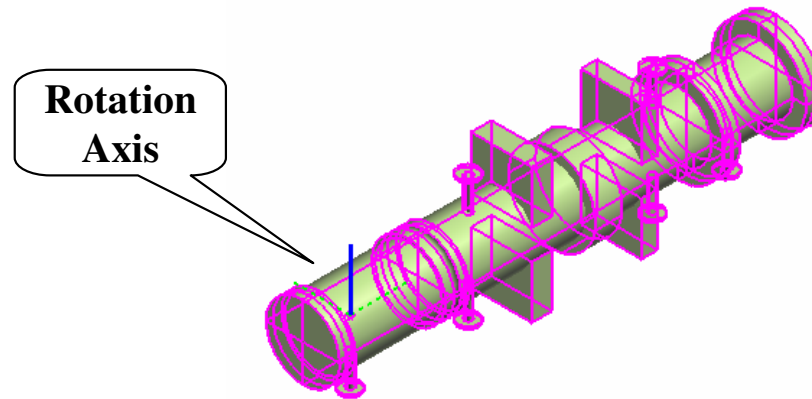
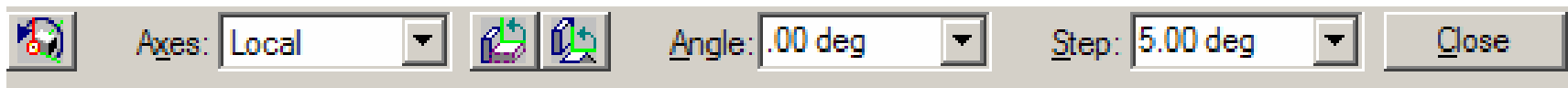
- The origin of the item is used by default as the *Move From* point
- Select Move From button first if the defaulted point of reference needs changing



Equipment Task

Rotate Equipment: 2 rotate commands

- Rotate Equipment Command: Rotation axis taken from eqp parts



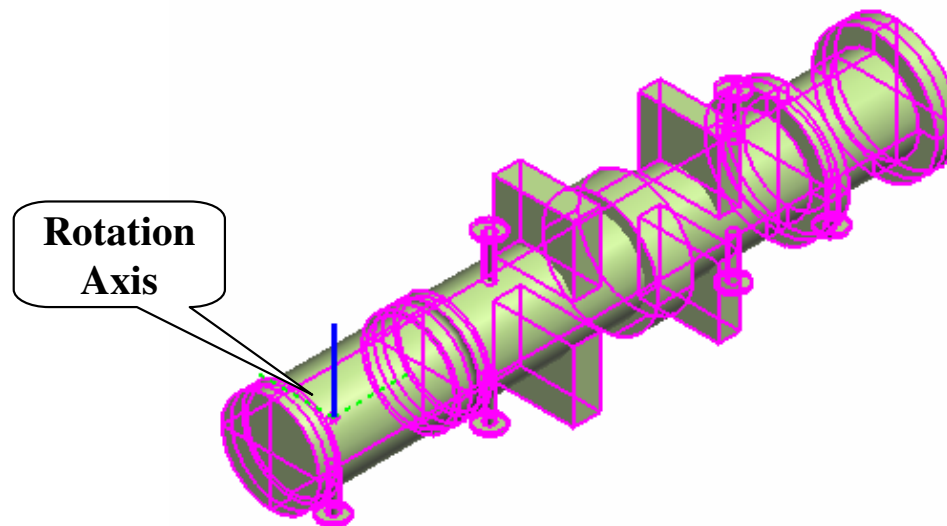
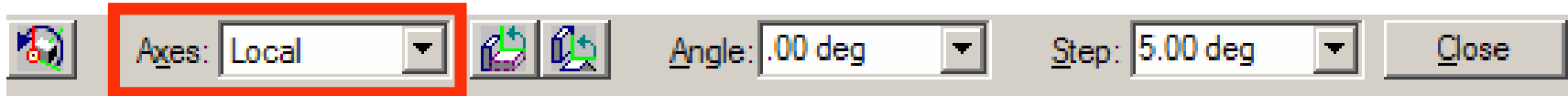
- Common Rotate Command: Rotation axis taken from coordinate system



Equipment Task

Rotate Equipment

- If the Equipment is constrained, only one choice is displayed (Perpendicular to the constraint plane)



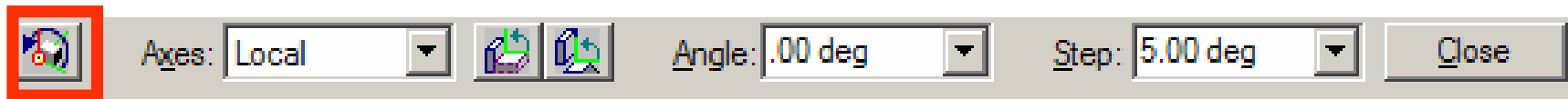
Equipment Task

Rotate Equipment

- Change the Rotation Point

The rotation point by default is the first foundation port of the equipment by default. If no foundation port exists, the origin of the equipment (local coordinate system origin) becomes the default point of rotation.

Use this option to select an alternate rotation point from other existing graphics

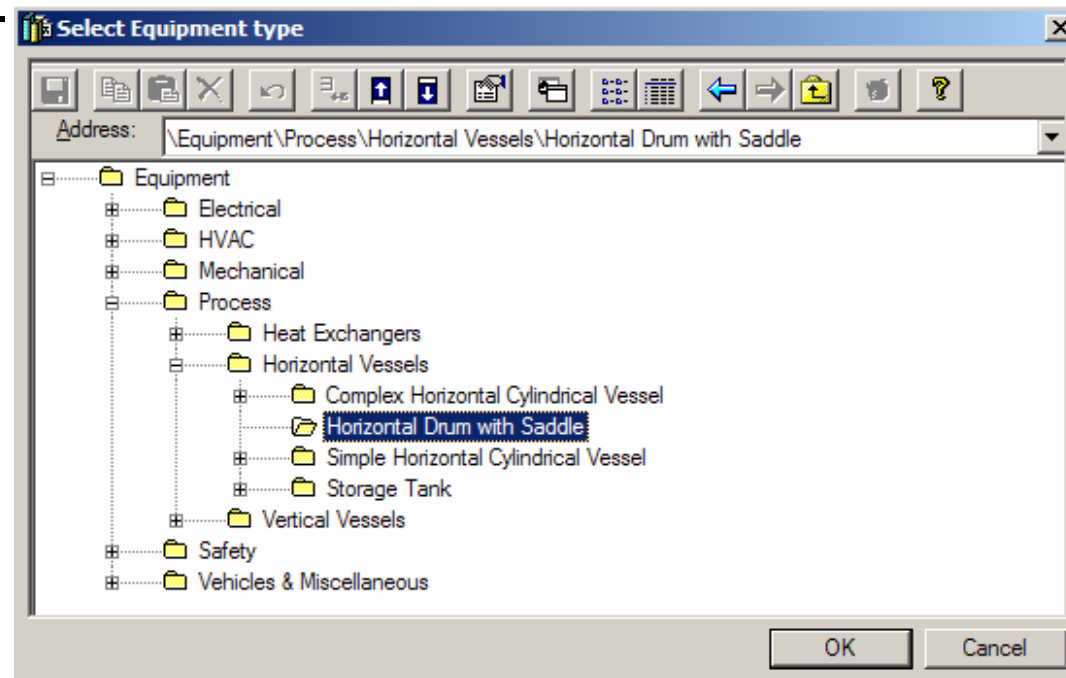


Equipment Task



Place Designed Equipment Command

- The place designed equipment command activates the Select Equipment Type dialog box (Catalog Browser) that provides access to the designed equipment hierarchy
- This command only defines the nature of an equipment item yet to be placed. The only graphic it produces is the placement location point. The rest of the graphics are placed as a secondary step using primitive shapes or imported shapes.

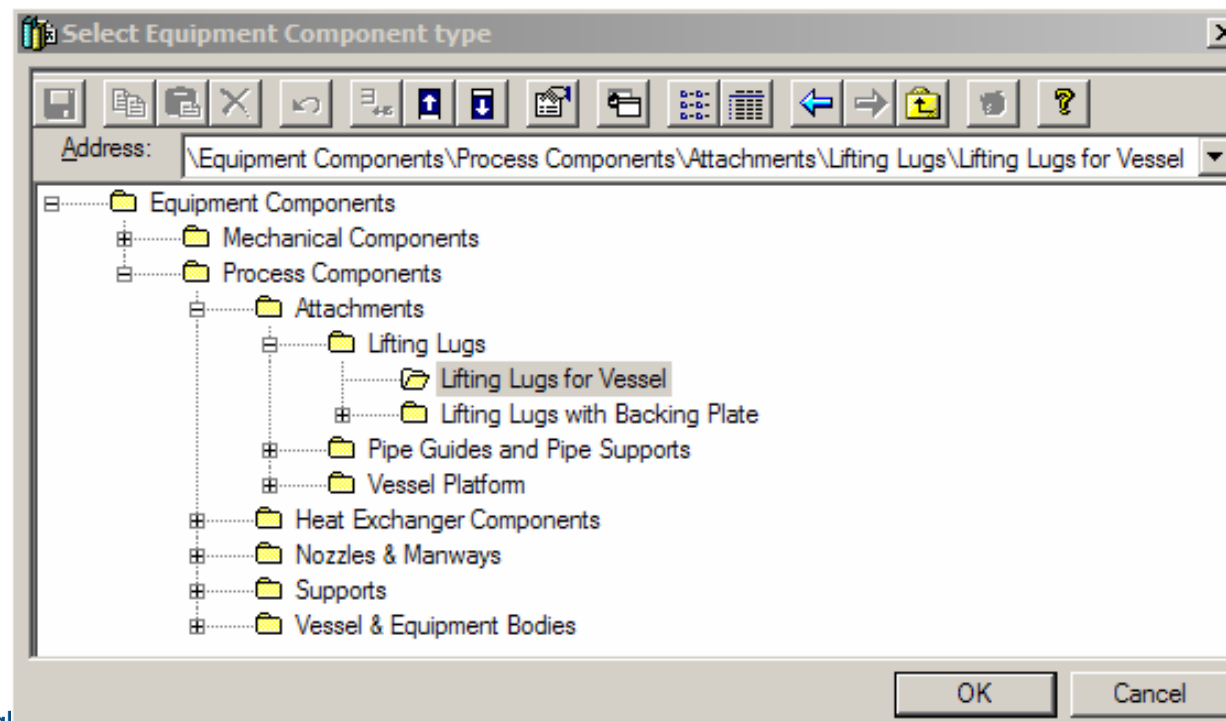


Equipment Task



Place Designed Equipment Component Command

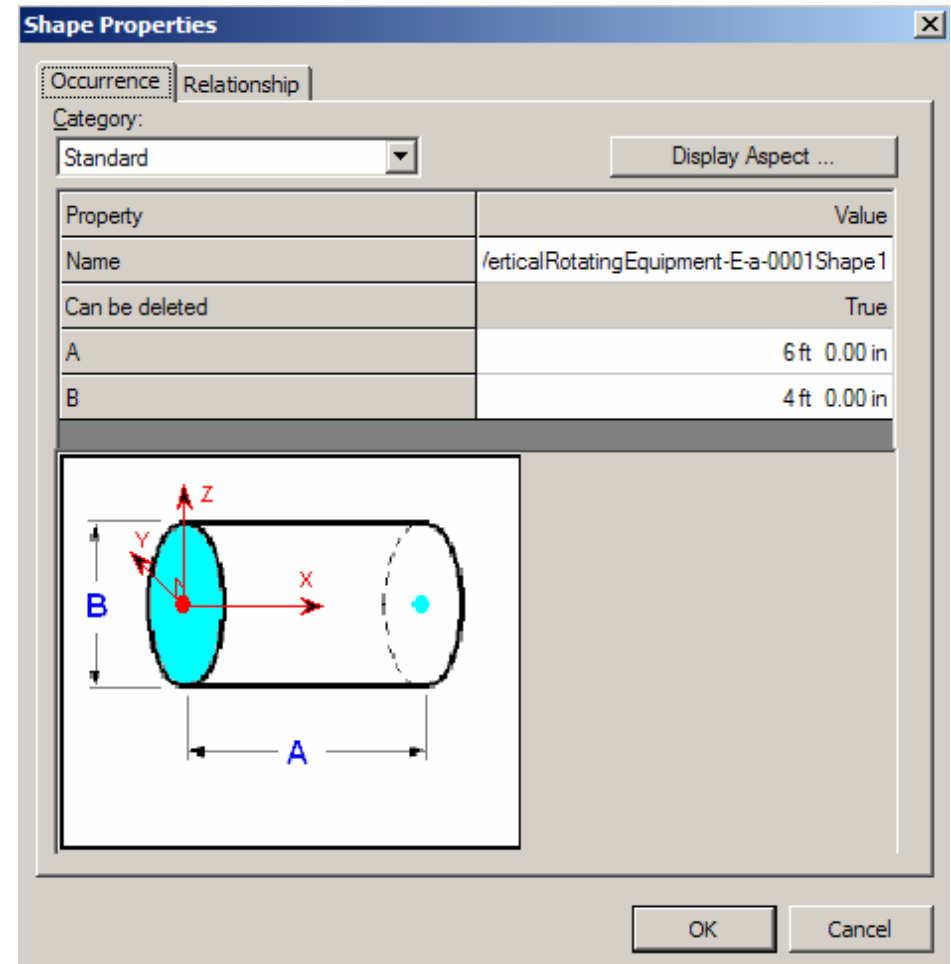
- The place designed equipment component command activates the Select Equipment Component Type dialog box (Catalog Browser) that provides access to the designed equipment component hierarchy
- This only describes the component to be placed, actual graphics are placed later and associated with this definition



Equipment Task

Shapes

- One-click placement
- Arrow keys for rotate during placement
- Must be associated to a parent graphic or a Designed Equipment



Equipment Task

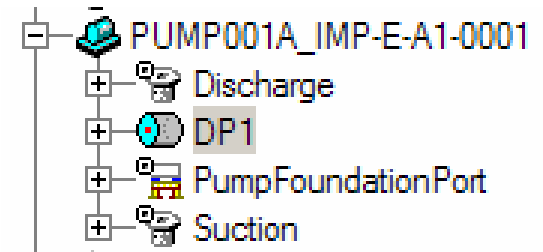
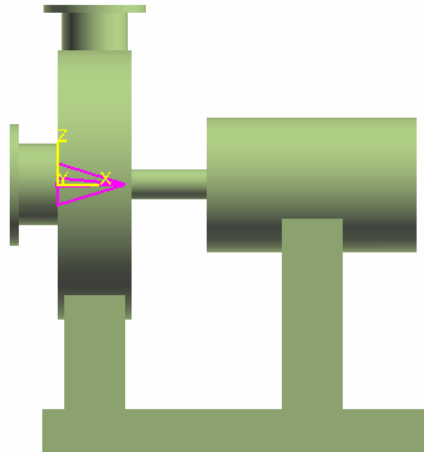
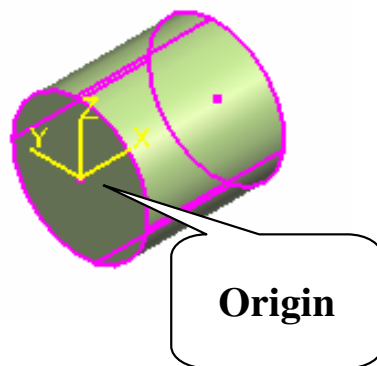


Shapes

- Place Shape using Symbol Origin by default
- Shape (Datum Shape)
- Catalog Equipments and Equipments Components come with datum shapes



Datum Shape



Equipment Task

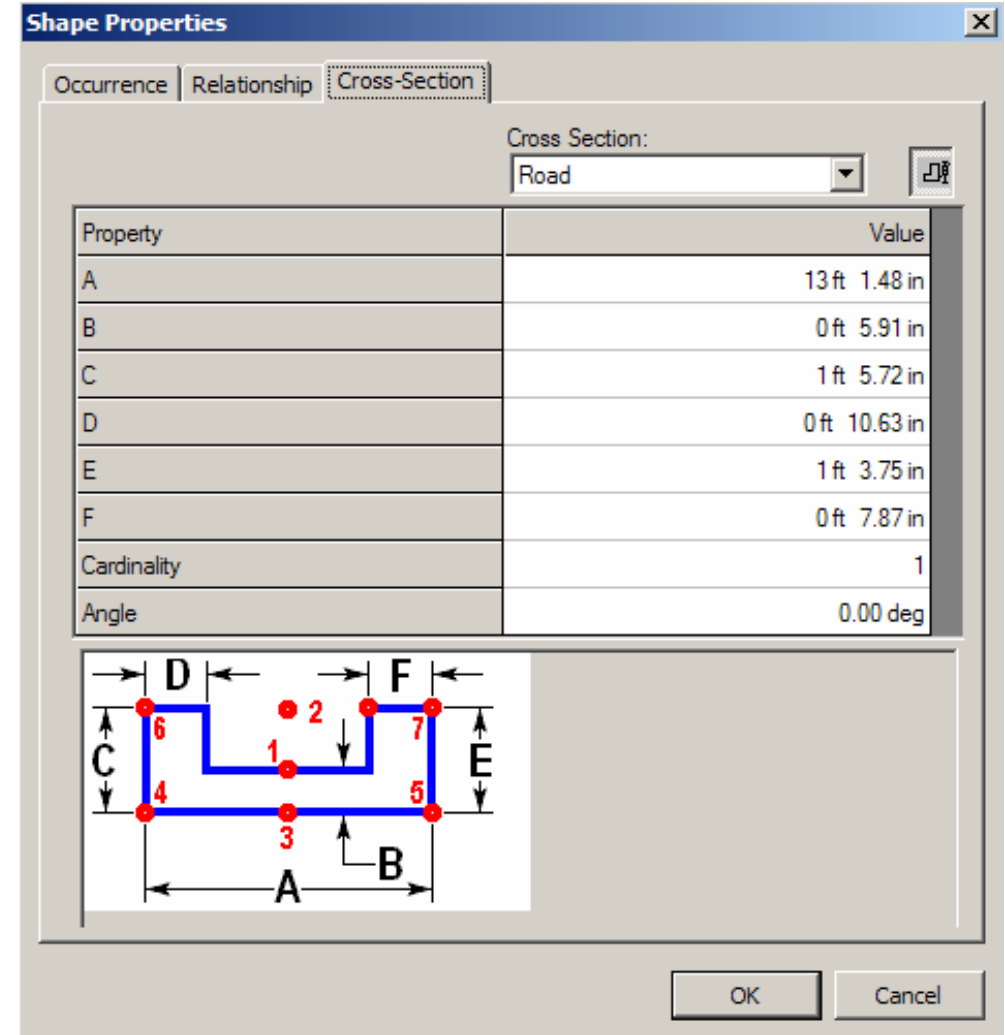


Shapes

- Availability of Prismatic (projected) Shapes



Prismatic Shape



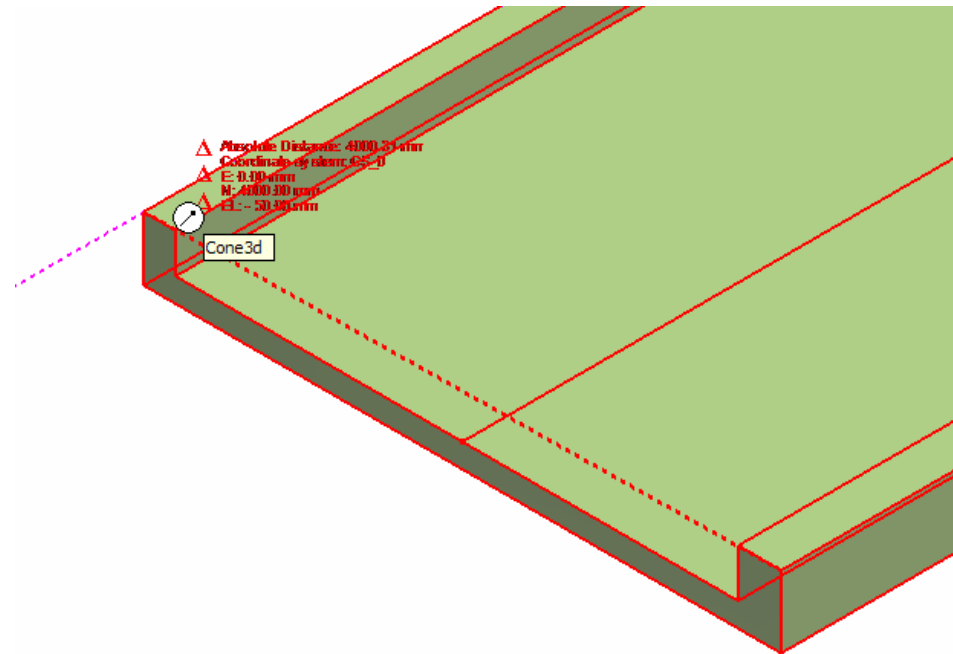
Equipment Task



Shapes



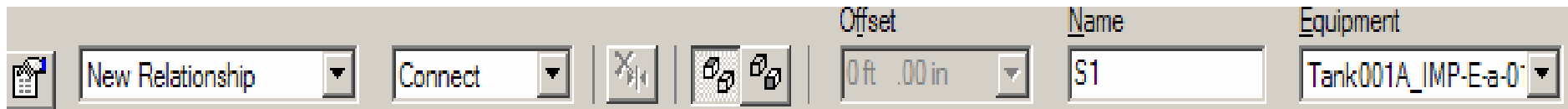
Prismatic Shape



Equipment Task

Place Shape SmartStep Ribbon Bar

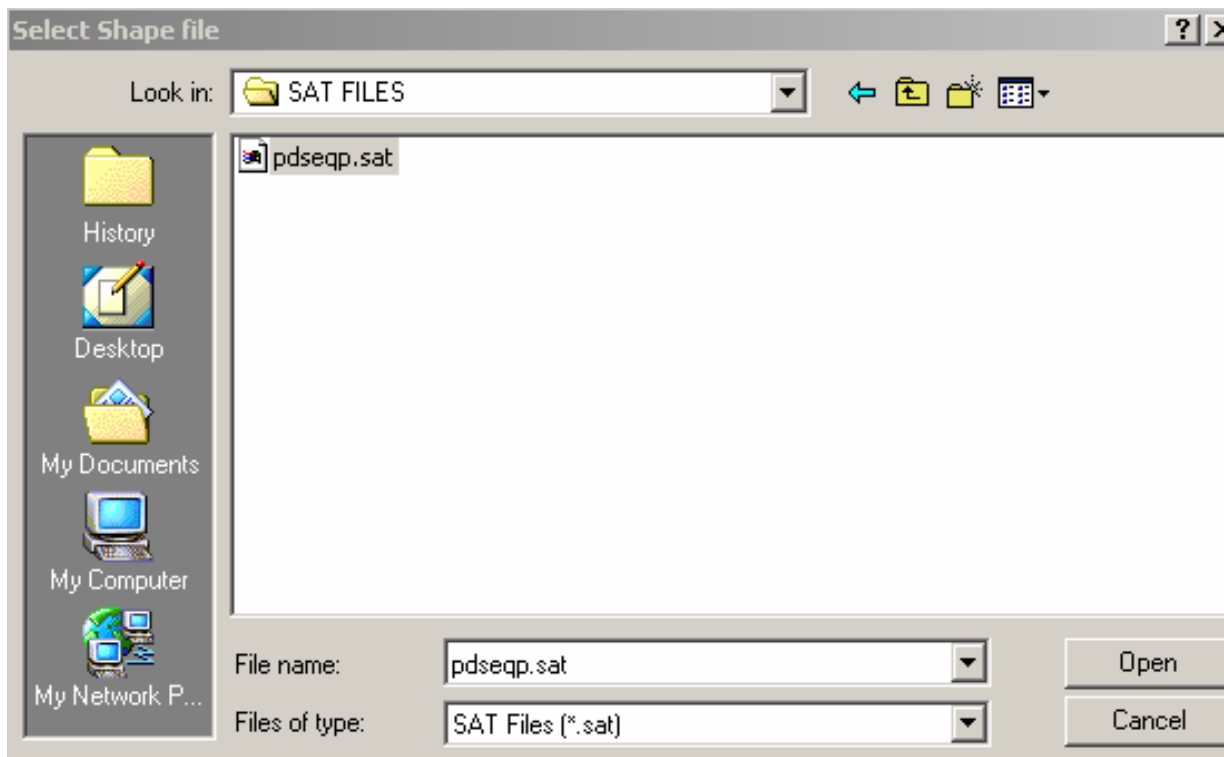
- Relationships/Constraints
 - Add constraints to further positioning the shape
- Positioning relationships (constraints):
 - Mate
 - Align
 - Connect



Equipment Task

Place Imported Shape from File Command

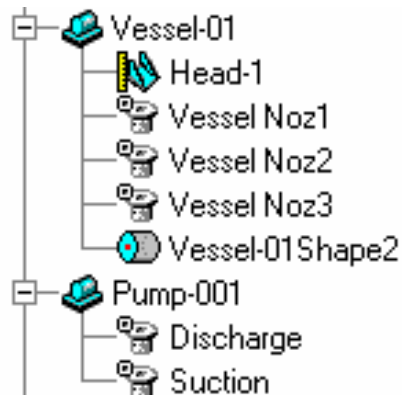
- This command imports the graphics from a **SAT** format file or **DGN** file as the geometry for a shape
- The geometry will be converted to G-type format in the model
- The shape's origin is defined by the coordinate system of the imported file



Equipment Task

Place Nozzle Command

- All nozzles become objects with their own identity. They are not nested outputs of the symbol. This allows users to turn off nozzles but leave the equipment display ON, for example
- Support occurrence properties for nozzles in catalog equipment
- Positioning relative to Equipment, Equipment Component and Shapes
- Ports are displayed in Workspace Explorer

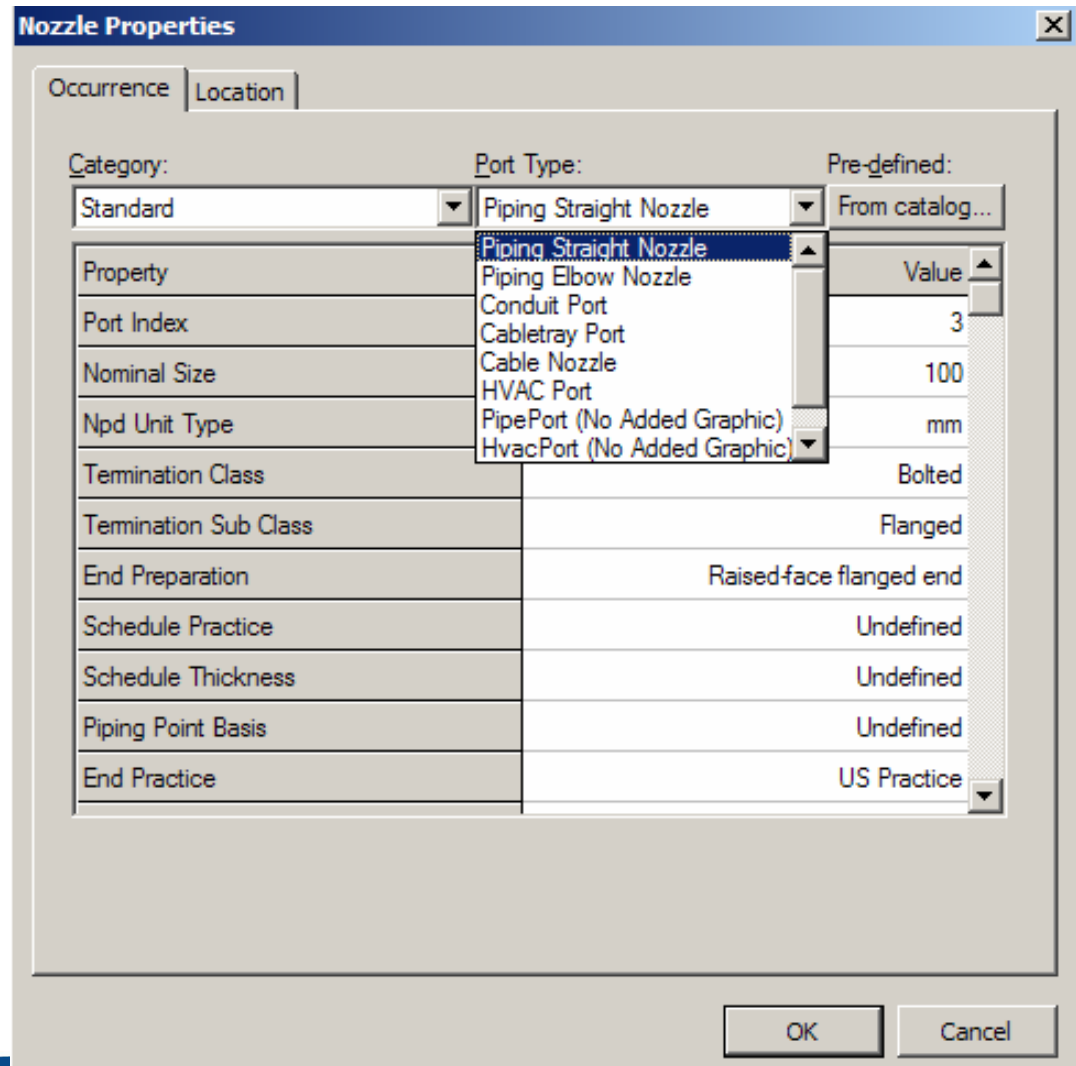


Equipment Task

Place Nozzle Command: Despite the name, it's not only used for piping nozzles. This command will place connection points for all disciplines

Port Connection Types:

- Piping Straight Nozzle
- Piping Elbow Nozzle
- Conduit port
- Cabletray port
- Cable port
- Hvac port
- Foundation port
- Pipe Port (No Graphic)
- Hvac Port (No Graphic)



The image shows the 'Nozzle Properties' dialog box with the 'Occurrence' tab selected. The 'Category' is set to 'Standard' and the 'Port Type' is set to 'Piping Straight Nozzle'. The 'Pre-defined' dropdown is set to 'From catalog...'. A list of properties is shown on the left, and a list of values is shown on the right. The 'Value' column has a scroll bar.

Property	Value
Port Index	3
Nominal Size	100
Npd Unit Type	mm
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

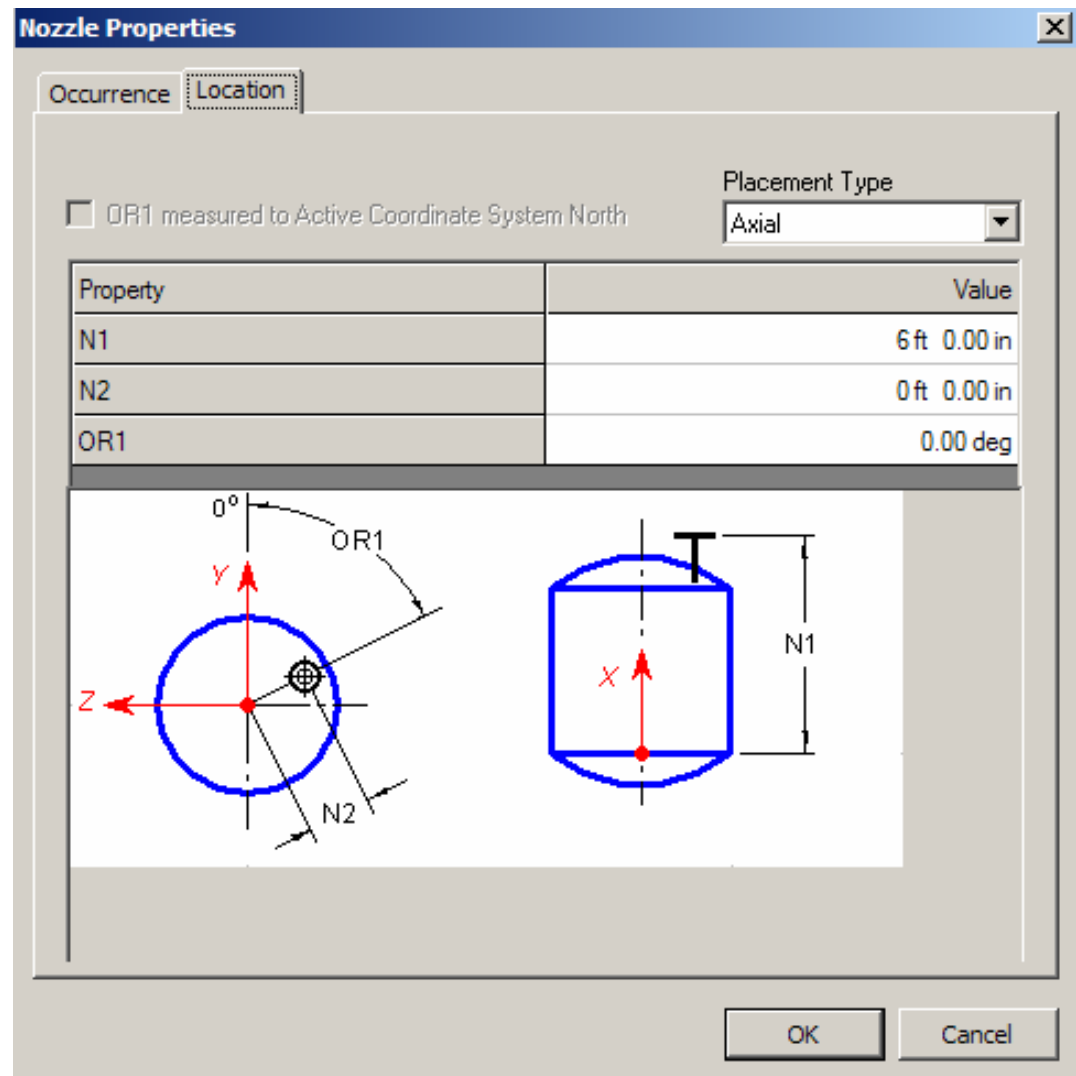
OK Cancel

Equipment Task

Place Nozzle Command

Placement Type:

- Radial
- Axial
- Tangential
- Skew
- Offset Skew
- Position by Plane and Axis
- Position by Point



Equipment Task

Replace Equipment Command

- Exchanges a selected equipment or equipment component in the model for a different item from the catalog
- System keeps the position and orientation properties the same, everything else is based on the new item's definition



Equipment Task

Equipment Entities manipulations available:

- Select Command
- Delete Command
- Undo Command
- Move Command
- Rotate Command
- Properties page review/revise
- Copy/Paste Command
- Mirror Copy command
- Paste and Restore command

Equipment Task

Summary - Modeling

- Catalog Equipments and Designed Equipments have the same structure and are treated the same by SP3D
- Catalog Equipments can have interactively added shapes, nozzles, Equipment components etc... just like Designed Equipments
- Designed Equipments have a symbol reduced to a single control point. Their parts are defined in the model as a secondary step using other placement commands
- Designed Equipments require a placement point at creation time
- Nozzles are filterable (but show/hide and style rules are not applicable)

Equipment Task

Summary - Modeling

- Equipment Components follow the same logic as Equipments
- Equipment Components cannot be placed standalone, they must have an Equipment as parent
- Equipment Components are Assemblies
- Equipment Components cannot have children Equipment Components
- Equipments cannot have children Equipments
- Constraint system works on homogeneous object types:
 - Equipment to Equipment
 - Shape to Shape (for siblings of an Equipment or Equipment component)
 - Equipment Component to Equipment Component (for siblings of an Equipment)