Process, Power and Marine Division

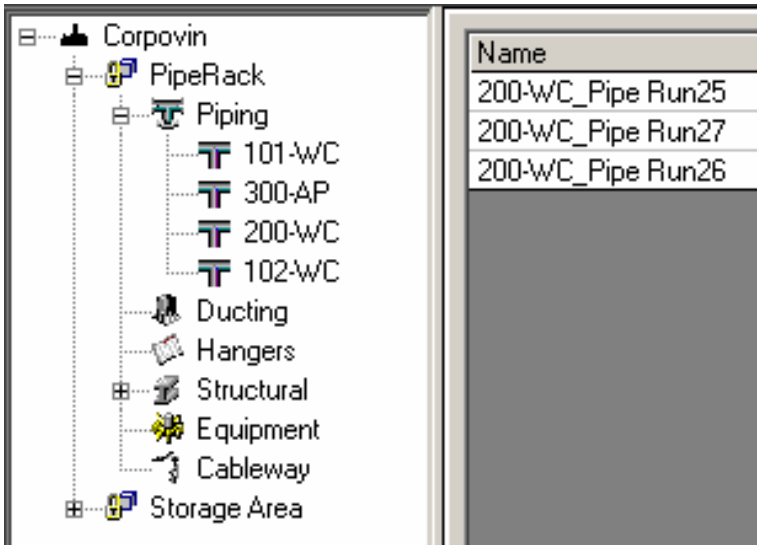
SP3D Piping Task

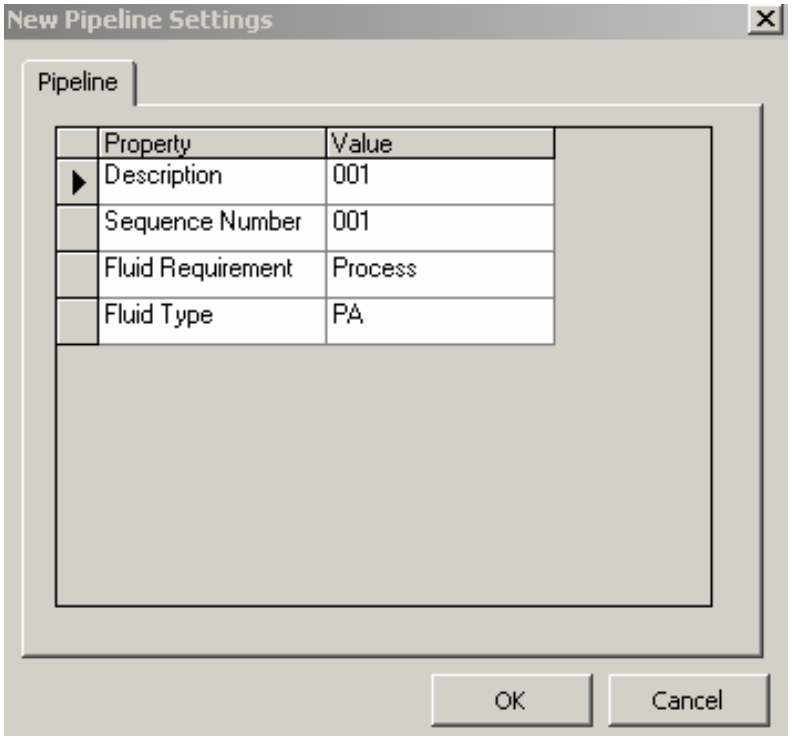


INTERGRAPH

Pipeline

Is a high-level grouping of Pipe Runs that is created in System and Spec Task environment.

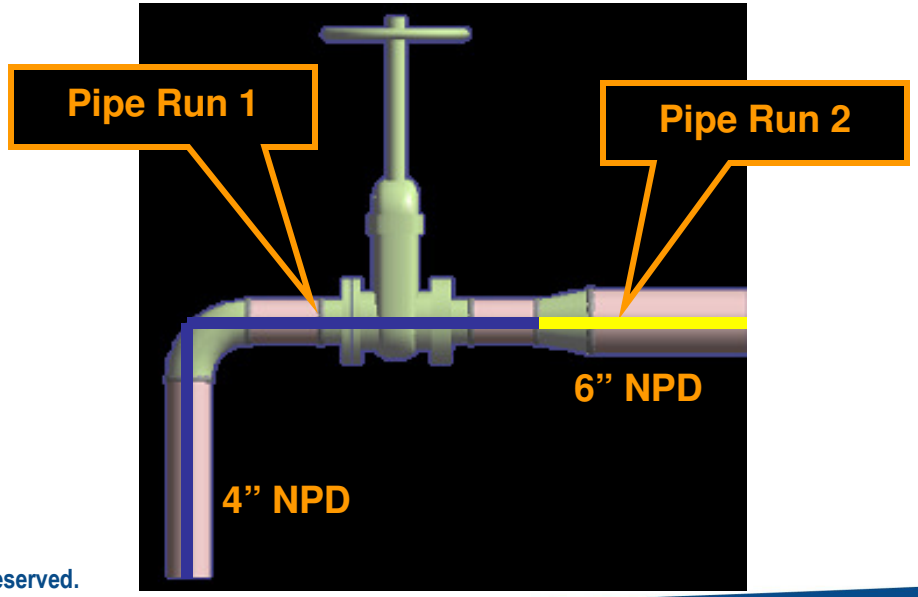




Pipe Run

A pipe run identifies one or more path features that share a common pipe specification, flow direction, size, temperature, pressure, etc…

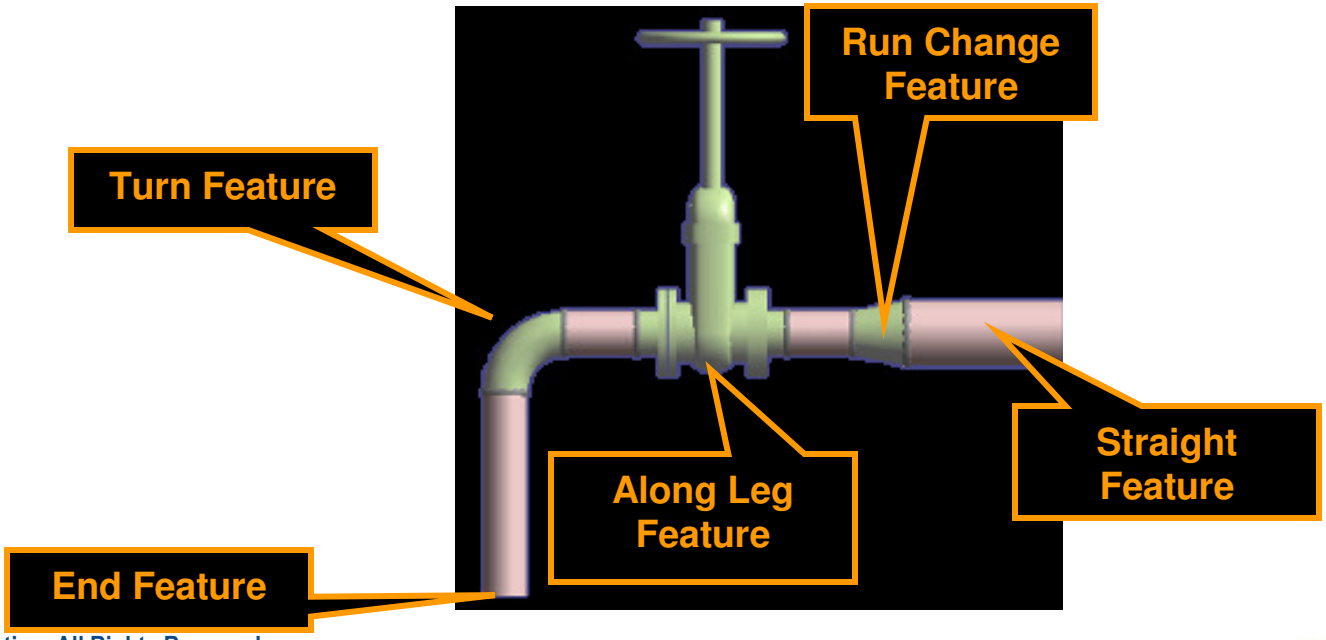
One or more pipe runs make up a pipeline.



Features

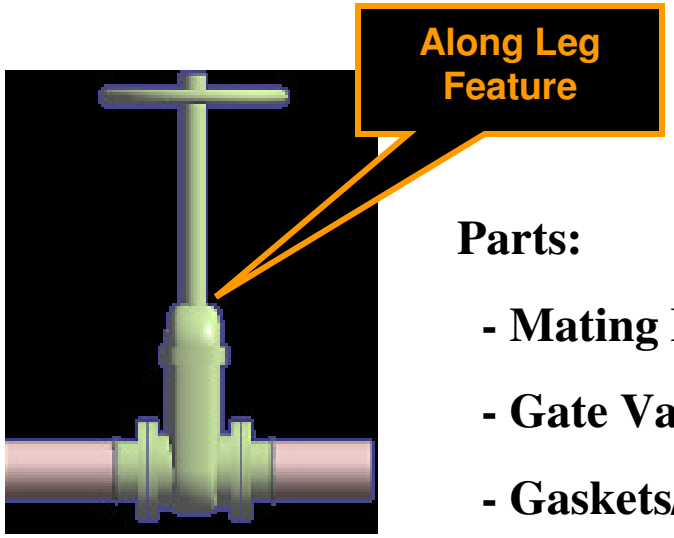
Define the geometry path of the pipe run and your design intent that occur along the path.

When you route a pipe run, you place features.



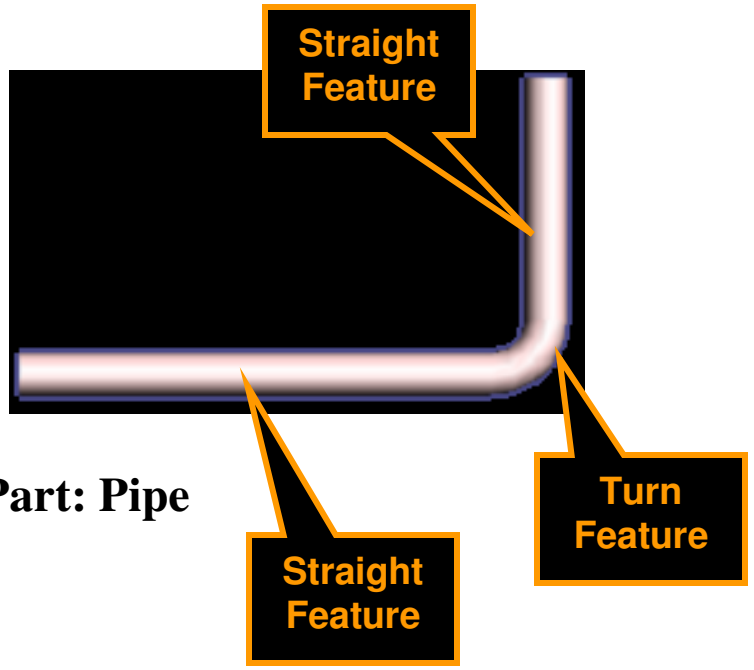
Parts

Are the physical components generated by the feature.



Parts:

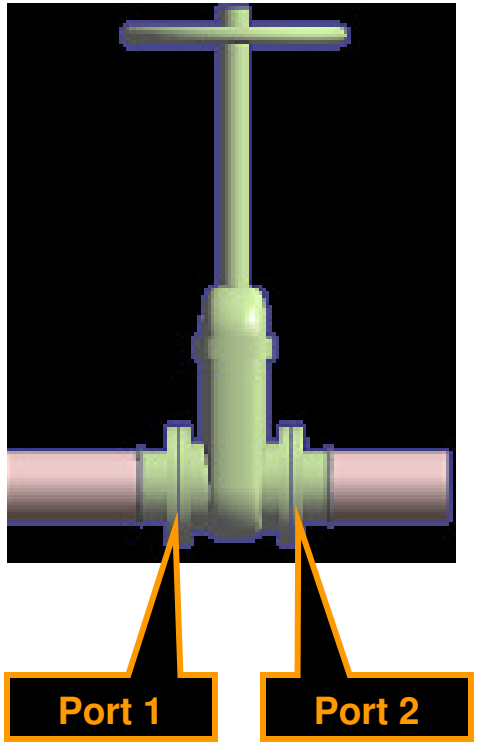
- **Mating Flanges**
- **Gate Valve**
- **Gaskets/Bolts/Nuts**



Part: Pipe

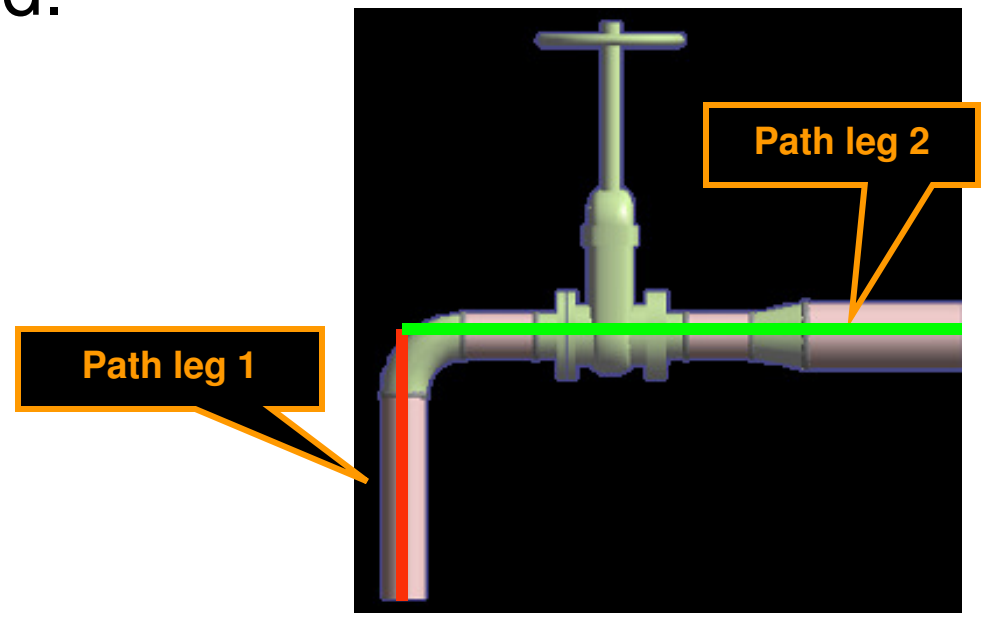
Port

Is the actual connection point for the part.



Path leg

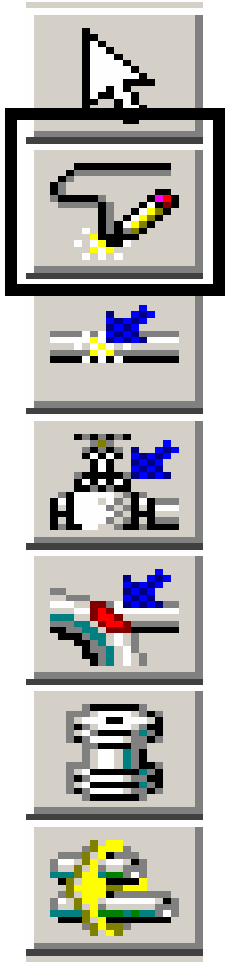
Is a section of a pipe run maintaining one general direction between turns, branches and end.



Piping Hierarchy

- Piping System { System and Spec Task
  - Pipeline System
    - Pipe Run
      - Features
        - Parts/Components
        - Ports
        - Connections

Route Pipe Command



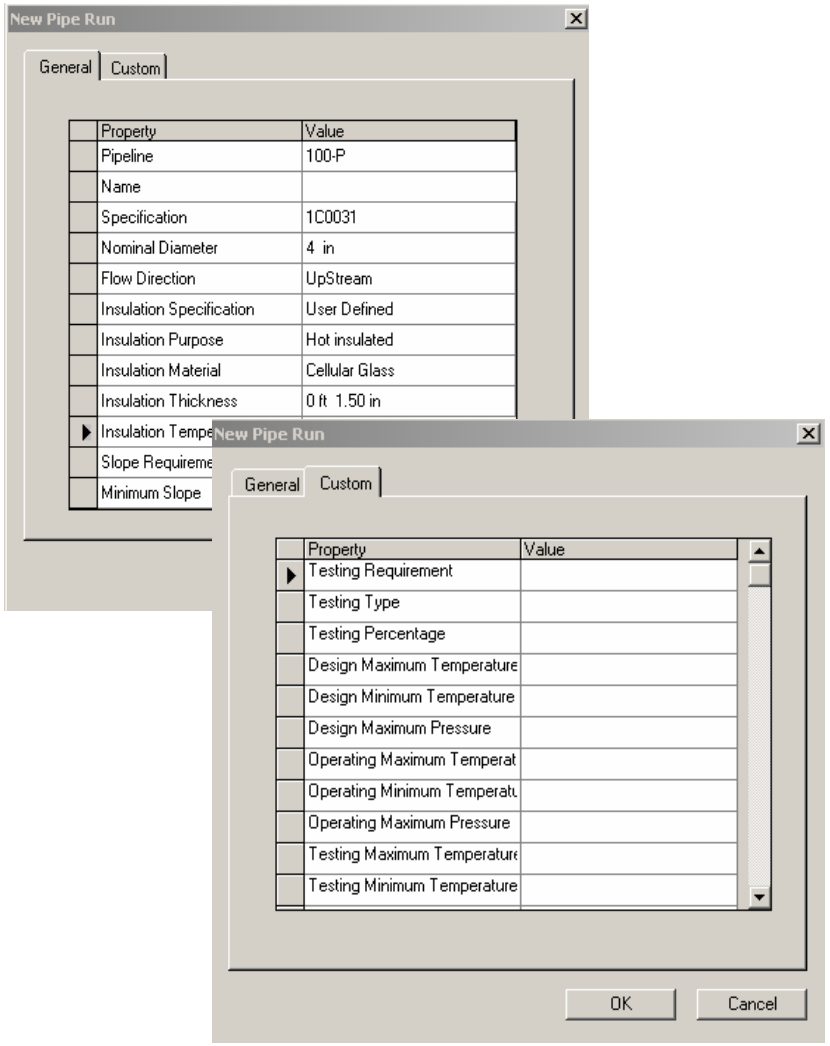
Start routing a Pipe Run from

- a nozzle/component port
- a point in space
- an existing pipe run

Pipe Run Dialog Box

Pipe Run properties

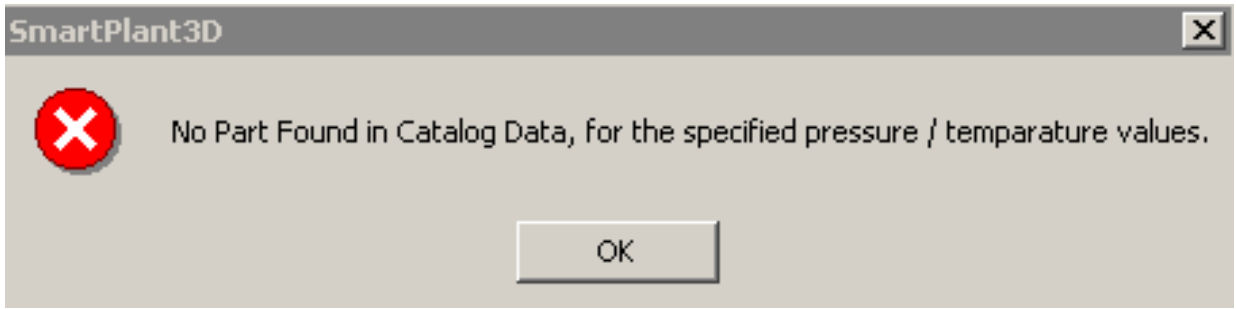
- Minimum properties required to route piping:
  - Piping Specification
  - Nominal Size
- Depending on plant catalog configuration, user may be required to enter temperature and pressure



Route Pipe Command

Wall thickness calculations require Temperature and Pressure values

Piping	0.75	1.5	in				1	PADAAAWAAE	S-XS
Piping	2	12	in				1	PAAAAAWAAA	S-STD
Piping	14	24	in				1	PAAAAAWAAA	ANSI B31.3
Piping	26	36	in				1	PAAJVAWABT	ANSI B31.3



Calc standard in spec instead of schedule or thickness value will trigger wall thickness calculations

Route Pipe Command

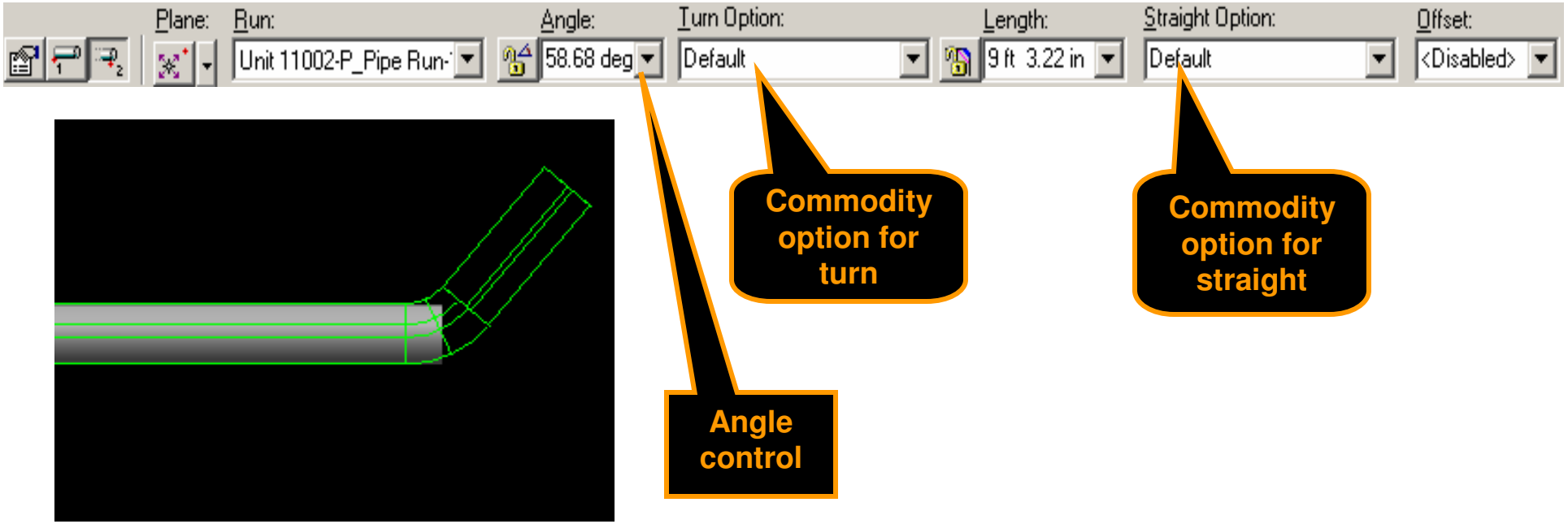
Branch reinforcement calculations require Temperature and Pressure values

Piping task will pick the strongest short code

SpecName	HeaderSize_Lo	HeaderSize_High	BranchSize_Lo	BranchSize_High	AngleLow	AngleHigh	HdrSizeNPDUnitType	BrSizeNPDUnitType	ShortCode	SecondaryShortCode	TertiaryShortCode
	26	26	10	10	89.5deg	90.5deg	in	in	Reinforcing Pad	Weldolet	
	26	26	12	12	89.5deg	90.5deg	in	in	Reinforcing Pad	Weldolet	
	26	26	14	14	89.5deg	90.5deg	in	in	Reinforcing Pad	Weldolet	
	26	26	16	16	89.5deg	90.5deg	in	in	Reinforcing Pad	Weldolet	
	26	26	18	18	89.5deg	90.5deg	in	in	Reinforcing Pad	Weldolet	
	26	26	20	20	89.5deg	90.5deg	in	in	Reinforcing Pad	Weldolet	
	26	26	24	24	89.5deg	90.5deg	in	in	Reinforcing Pad	Weldolet	

Route Pipe Command

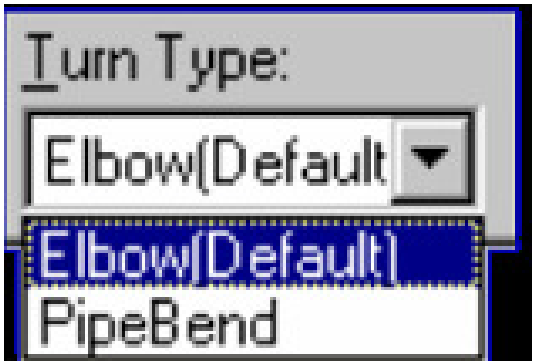
Designation of commodity options while routing



Turn Type Option

Displays the type of turn (Default, Elbow, Pipe Bend, or Miter).

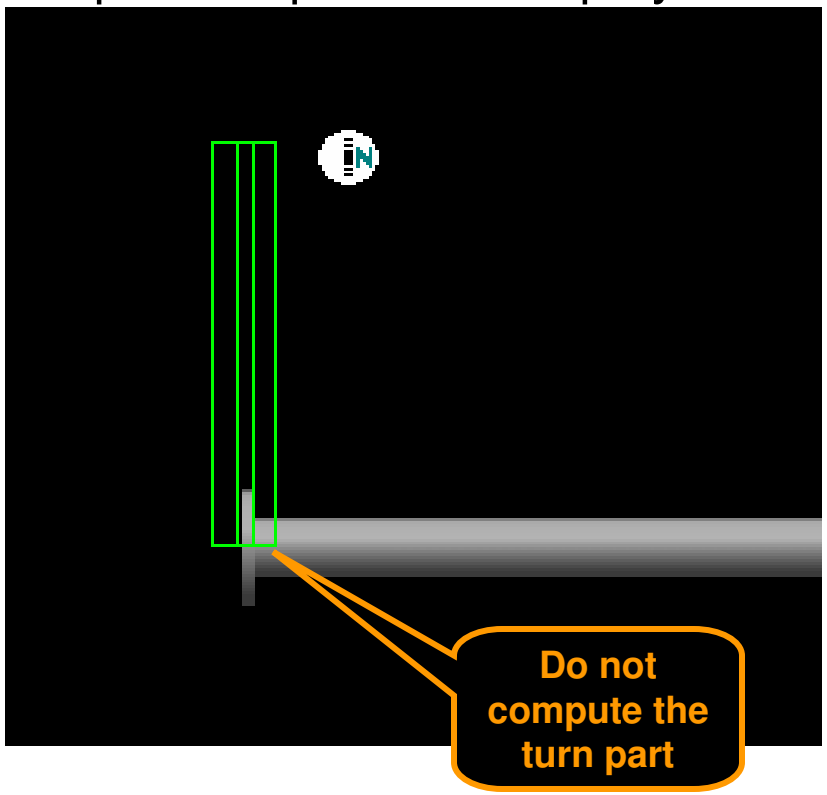
Default turn type: the system selects the type of turn as defined in the Ref Data (Default Change of Direction)

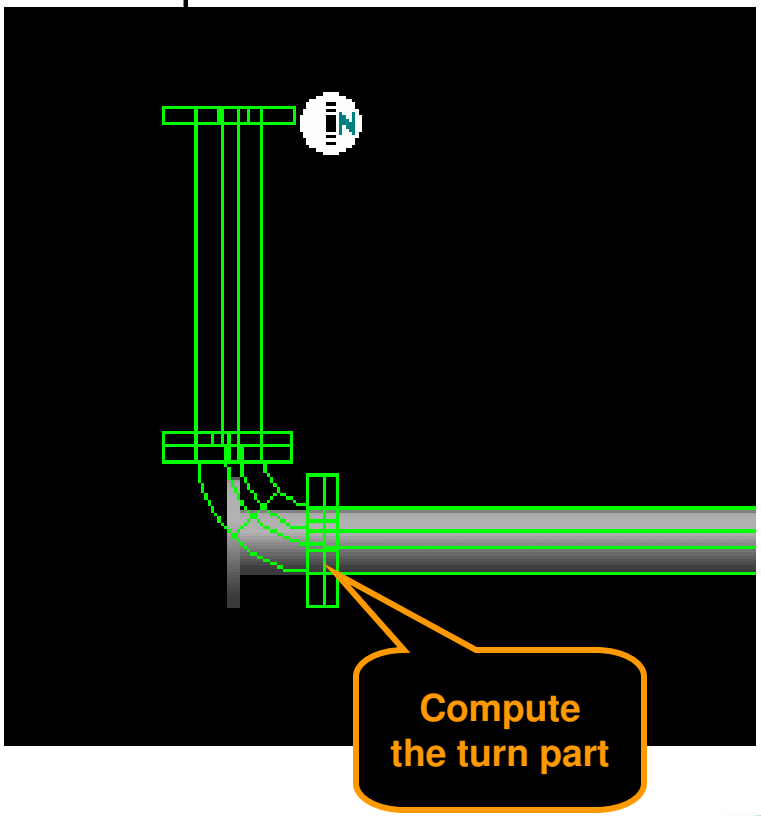


SP3D Piping can check pipe bends as they are modeled to ensure that they have adequate lengths for fabrication on an allocated bending machine.

Route Pipe Command

- By default route command will only compute the turn part on commit (when pipe turns from wireframe to solid)
- Use Shift + F keys to toggle the compute modes. This allows a pre-compute and display of the turn feature prior to commit

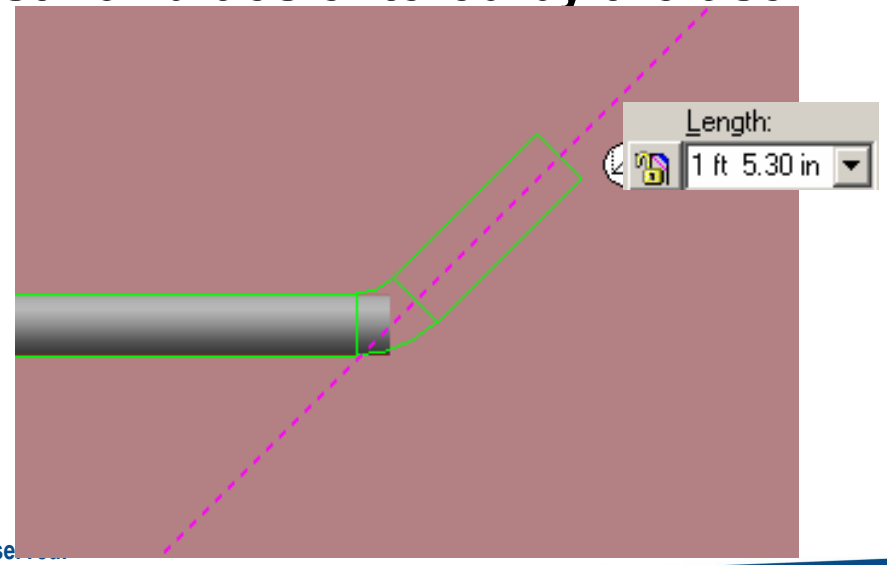




Length Control Tool

Enter or select a length for the current route path.

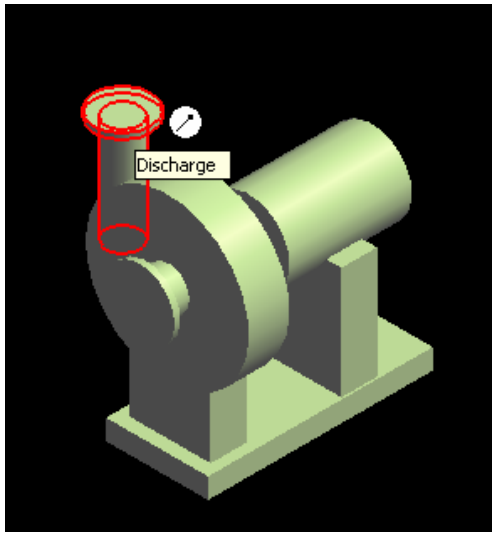
- Length Lock: Lock or unlock the length field.
- By Default: dynamically displays the current length of the pipe run from a turn point or a starting point.
- contains the last 10 values entered by the user.

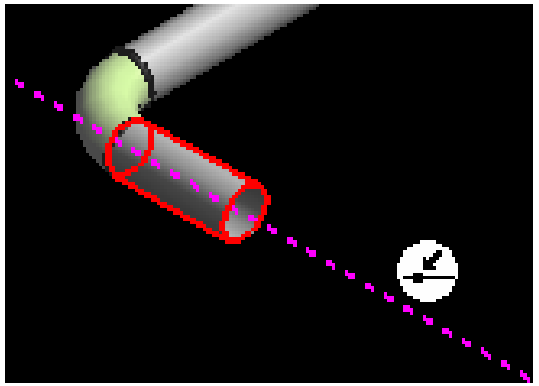


SmartSketch

Provides the user interface, relies on lock mechanisms common to CAD environments

- Parallel
- Perpendicular
- Angle
- Reference axis aligned
- Point on plane
- Offset
- Intersection
- Divisor
- Point on element
- Key point
- Add to stack



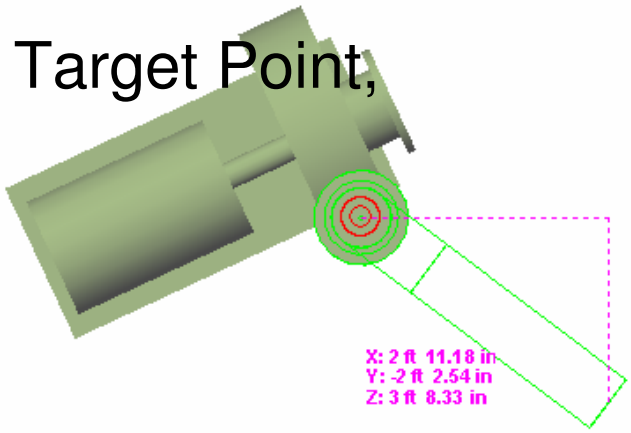


Route Pipe Run with PinPoint

PinPoint provides coordinate inputs to the route command. Inputs are entered by:

- Coordinate key-in by user
- Delta increment key-in by user (in relative tracking mode)
- Selection of existing graphics to read their coordinates

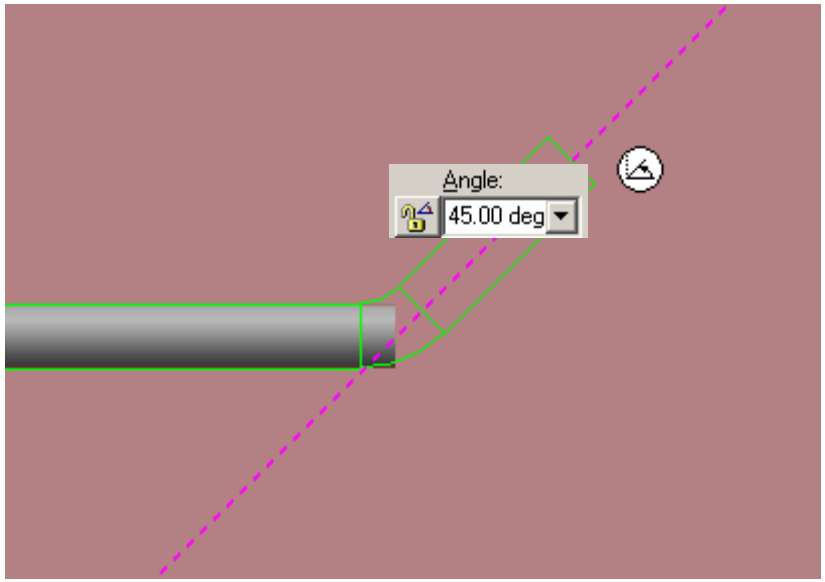
x,y,z coordinates are relative to the Target Point, shown as red marker at active origin



Angle Control Tool

Enter or select an angle for the current route path.

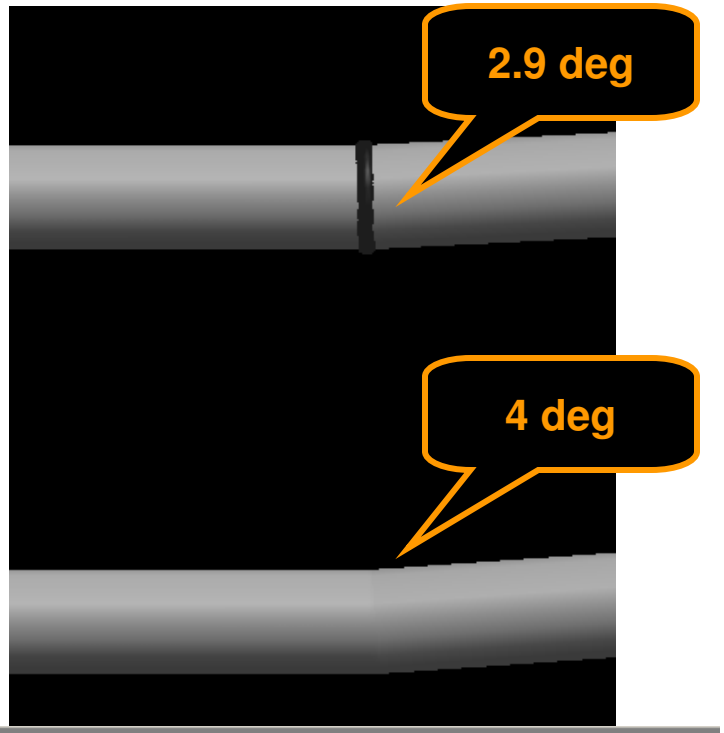
- Angle Lock: Lock or unlock the Angle field.
- By Default: Dynamic readout of the current bend angle as defined by the cursor.
- The angle field can only be 0 or 90 deg if the working plane is set to NO Plane.

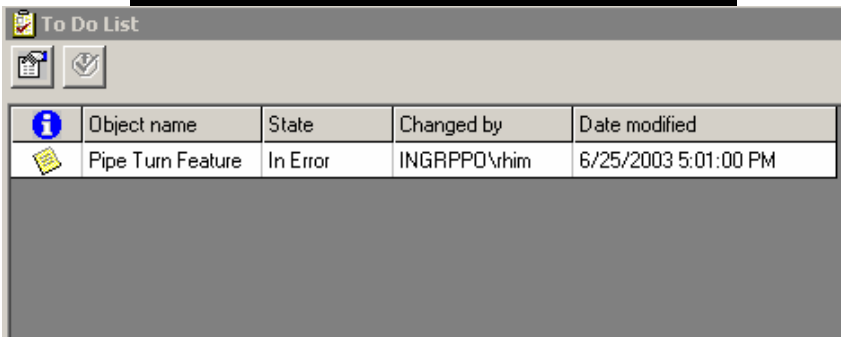


Route Pipe Command

- Port flexibility to allow connection of non-aligned objects. E.g. per spec below, 3deg or less is allowed, greater deflections result in error

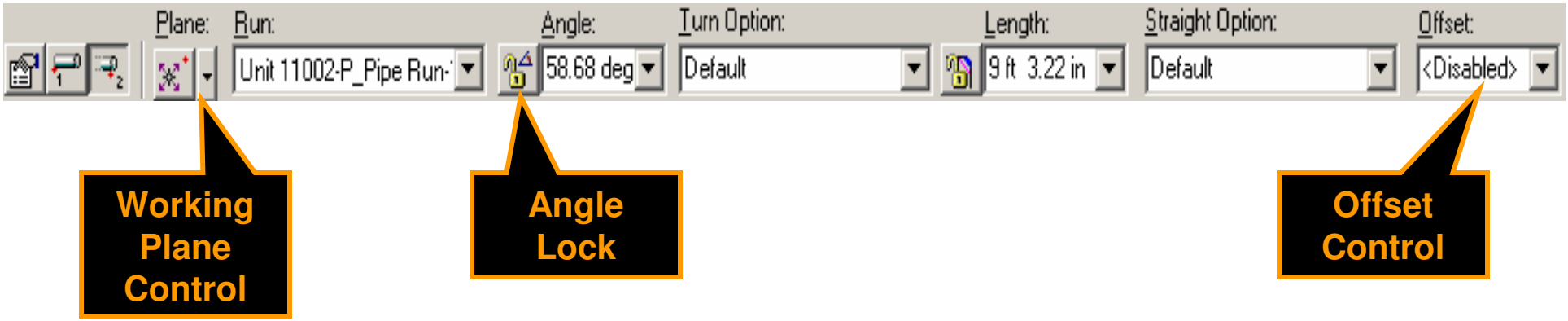
SpecName	NominalPipingDiameterFrom	NominalPipingDiameterTo	NominalPipingDiameterUnits	EndPreparation	MethodOfTrimming	AcceptableAlignmentTolerance
	2	8	in	301	5	3deg
	10	14	in	301	5	2.5deg
	16	24	in	301	5	2deg
	26	30	in	301	5	1.5deg
	32	36	in	301	5	1deg





Pipe Run Smart Step Ribbon Bar

- **Angle lock** in Route command should remain locked until manually unlocked
- **Working plane** should be set to plan plane when sloped run is created
- **Compute offset** of piping from duct and cableway routes



Working Plane Control Tool

Constrains the route path to a specific plane.

Ctrl + Keyboard

1 - Plane Plane

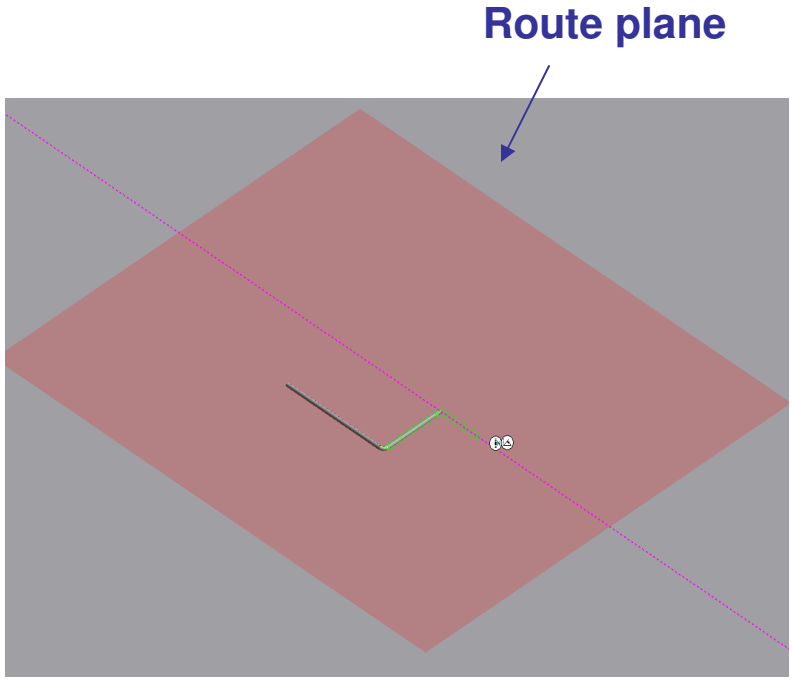
2 - Elevation Plane

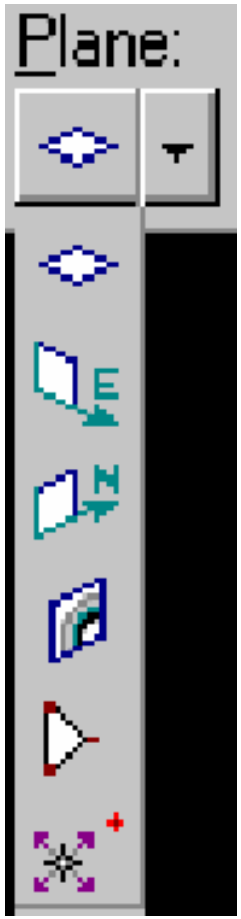
3 - Section Plane

4 - Plane by Turn/Branch

5 - Plane by Three Points

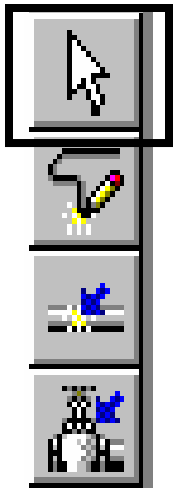
6 - No Plane

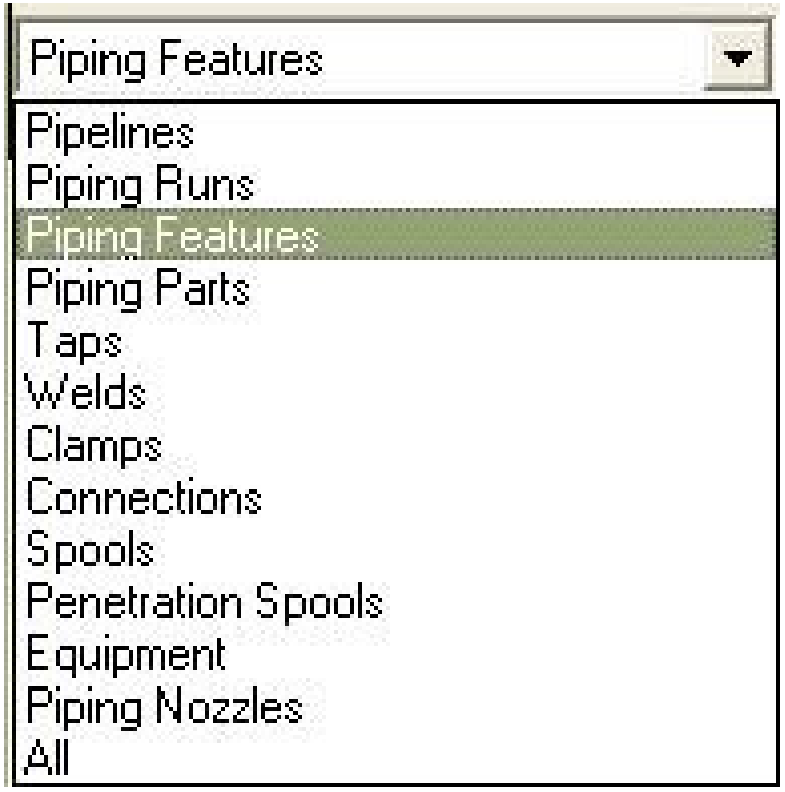




Pipe Select Command

Provides specific filters:





TIP- Workspace Explorer search: Set the filter to “All” and key in the string in the field to find an object.

Delete a Pipeline

 Deleting a pipeline deletes all pipe runs, features, and parts associated with that pipeline. Do not use this option if you intend to keep the pipeline name to associate to future pipe runs.

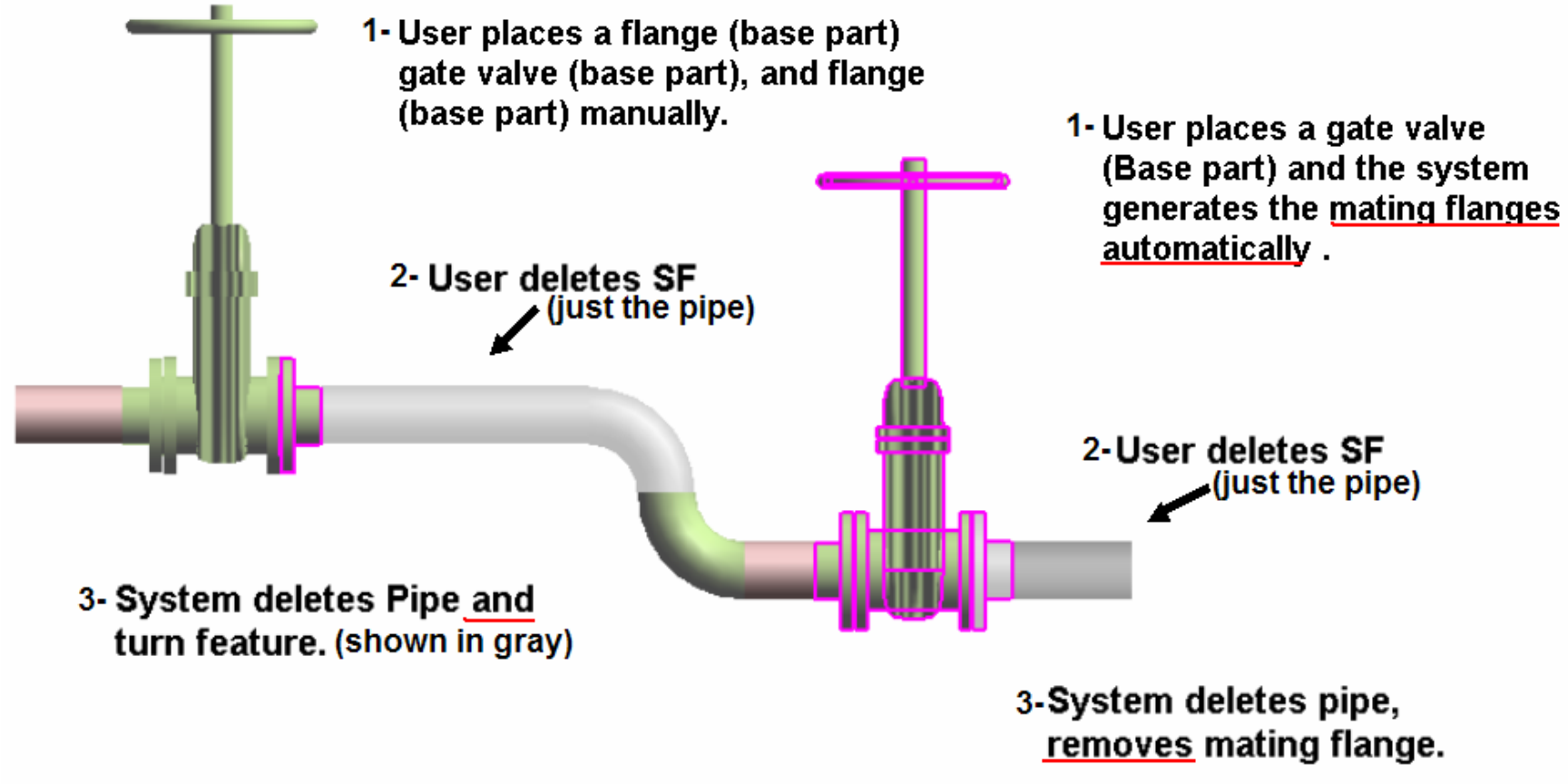
Delete a Pipe Run

Deleting the run deletes all features (and thereby all parts) belonging to the run.

The software attempts to maintain the design integrity of the model by adjusting all previously connected features. Use this option to delete complete pipeline graphics without deleting the pipeline definition (which contains non-graphic info like fluid code)

Delete Straight Features

Example:



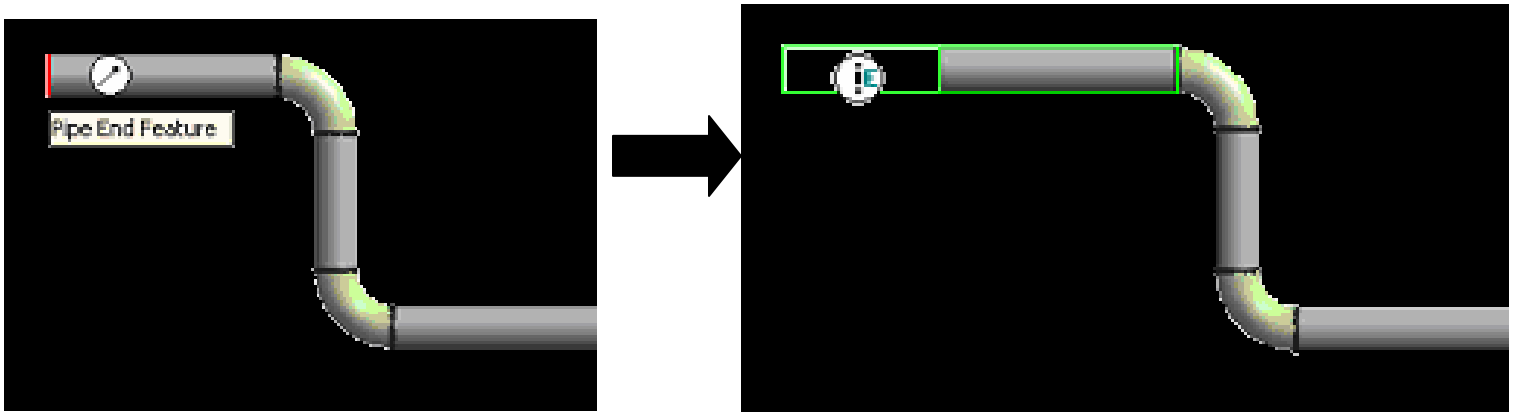
LAB – 1

LAB – 2

LAB – 3

Run To or From End Features or Nozzle

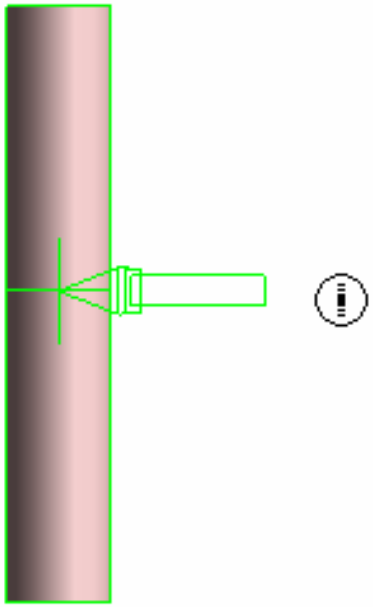
When you select an end feature during the creation of a pipe run, the Route Pipe command joins the run with the end feature and inherits the properties of the run that the end feature belongs to.



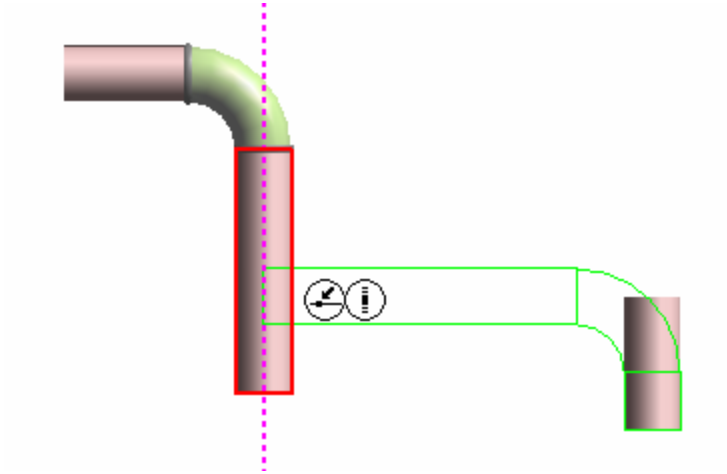
Routing To or From a Straight Feature

Use the Route Pipe command

- Branch on Pipe Run

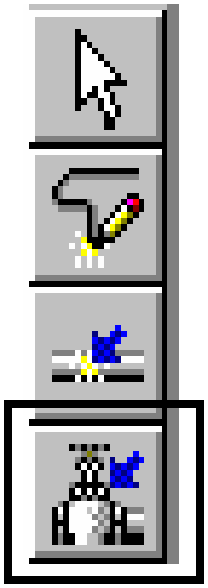


- Intersect to Branch

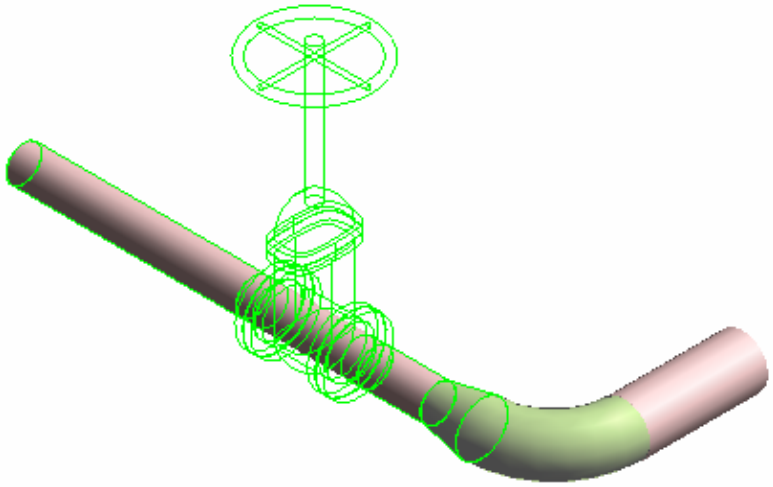


Insert Component

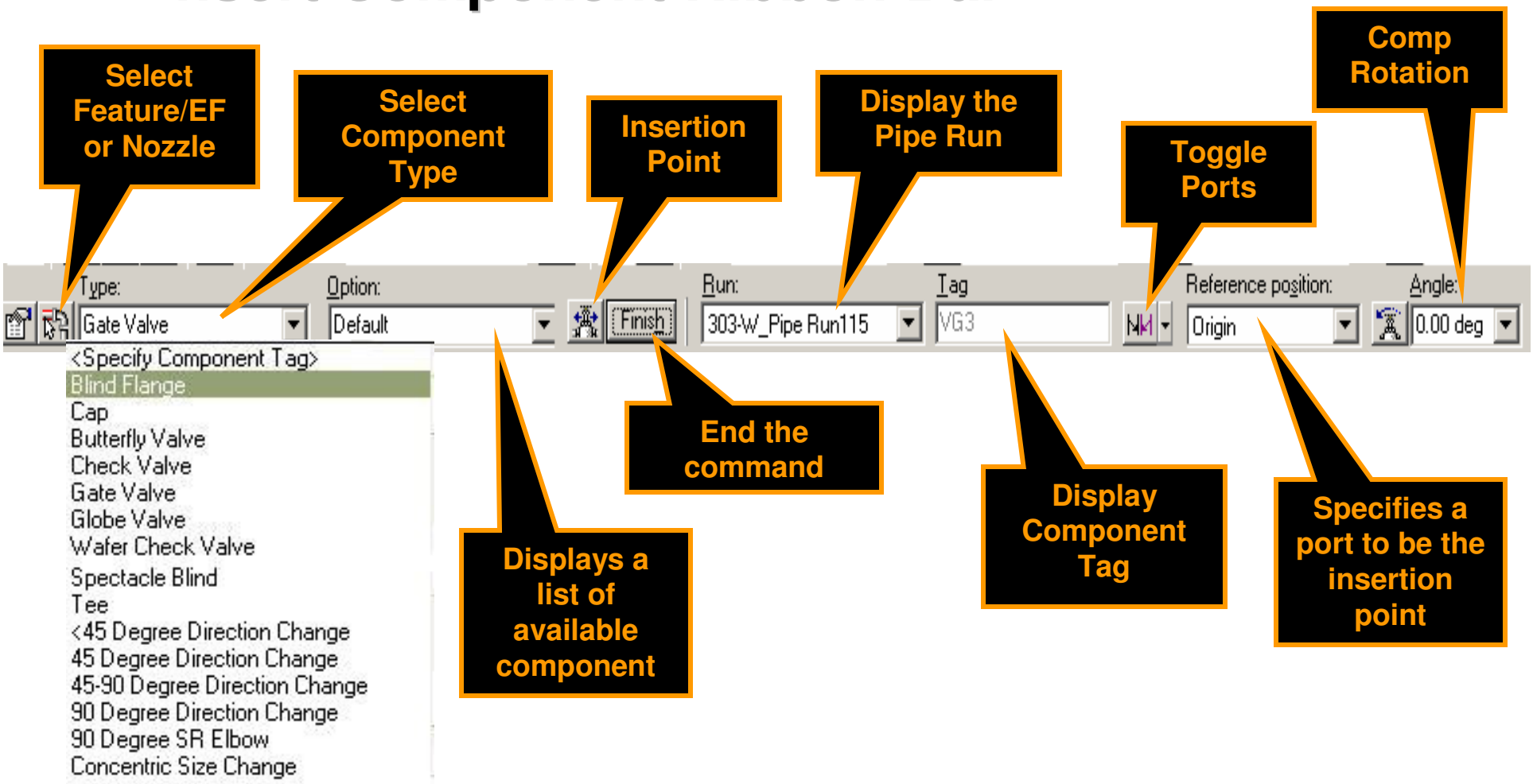
Insert command inserts a component interactively.



In-line components (Valves, Tees, Reducers); Change of direction (Elbows, Miters, Bends); End Components (caps and plugs); Strainers (Y-strainers, Basket Strainers) etc…



Insert Component Ribbon Bar



Insert Component

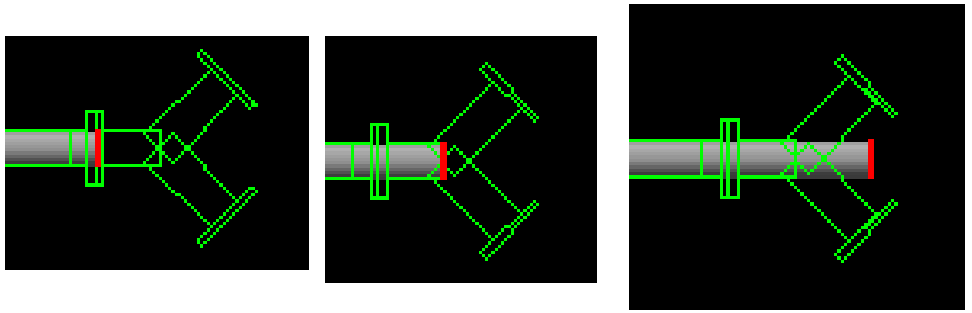
- Reference Position option:
  The system should slide the component along the path so that the select position (example: Origin) is located at the insertion point.

Flip option: port 1

Reference position: port 1

Reference position: origin

Reference position: port 2 or port 3



Insert Component

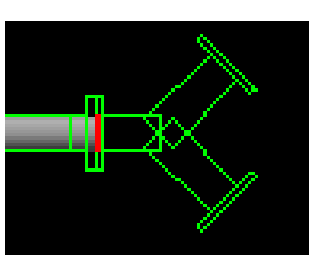
- Flip option:
  Toggles through the ports available for the component being inserted. As each port is toggled, the component is oriented so that the selected port is aligned along the axis of the leg on which it is being inserted.

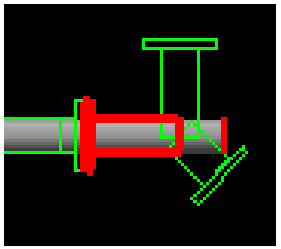
Reference position: port 1

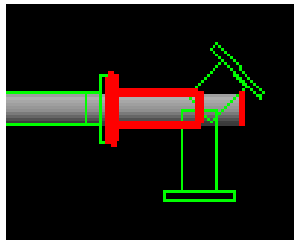
Flip option: port 1

Flip option: port 2

Flip option: port 3

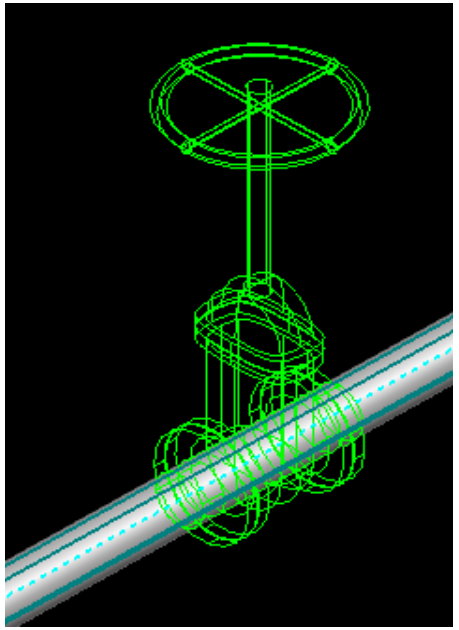


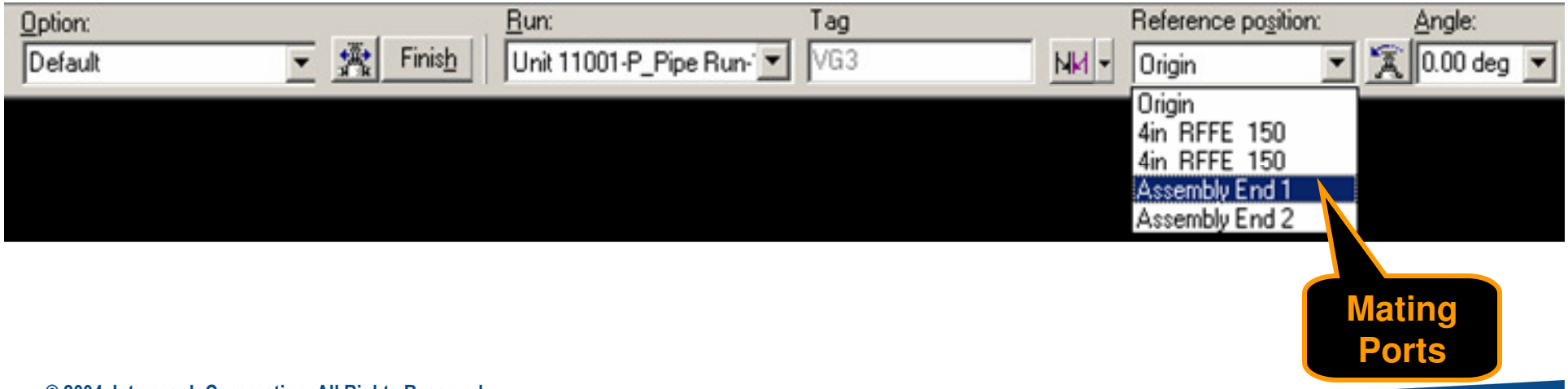




Insert Component

Mating part ports / end terminus available in the Ref Position list.

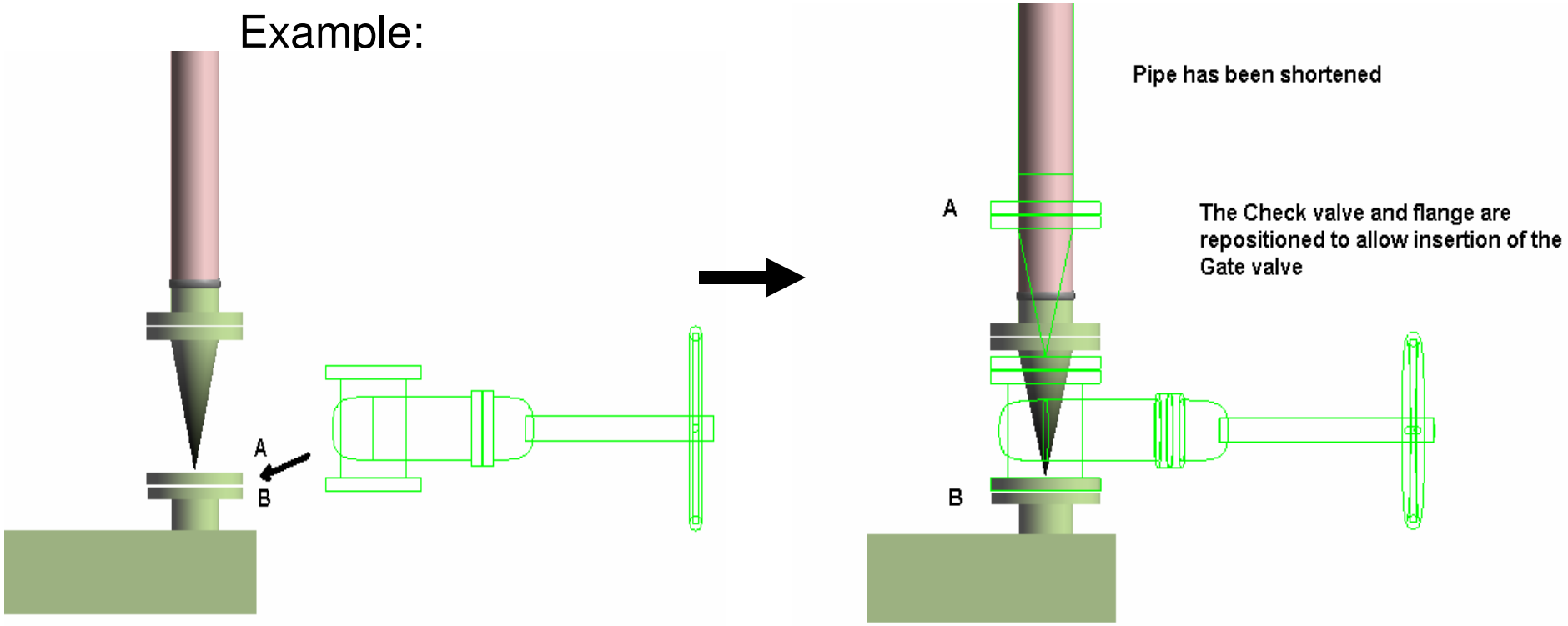




Insert Component

- Insertion of a new component at an equipment nozzle

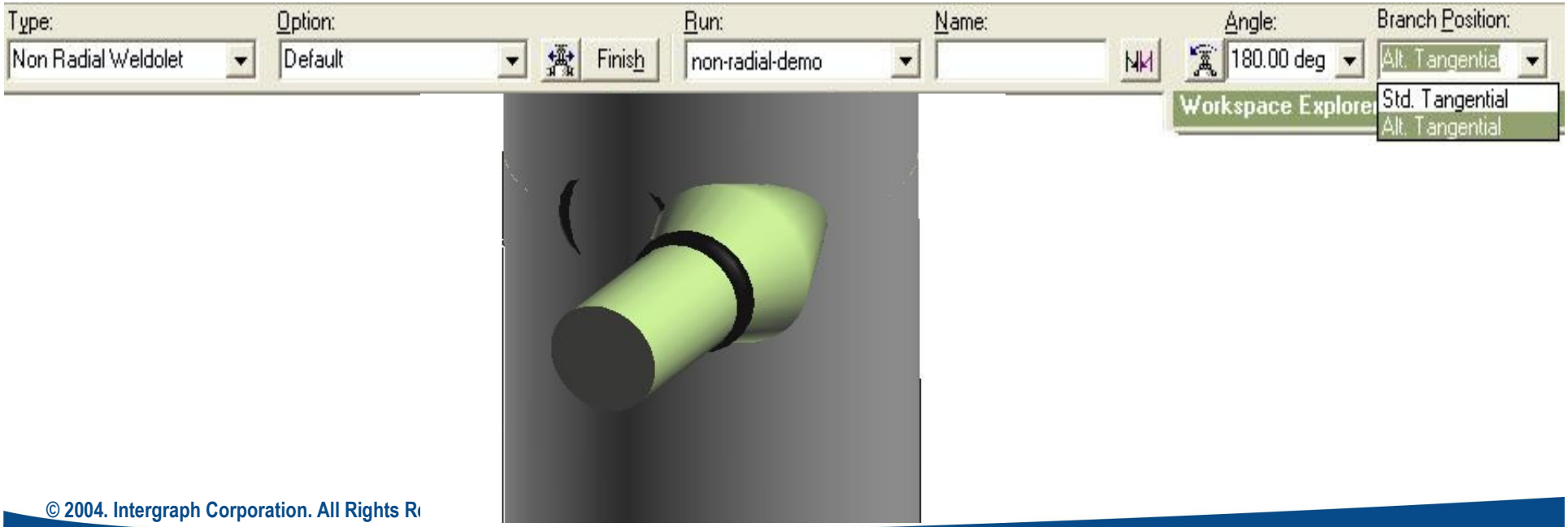
Example:



Since a suitable straight feature exists on the leg, the check valve and its connecting flange are repositioned and the gate valve is inserted.

Insert Non-Radial Branching

Supported using either the **Insert Component** command or the **Route Pipe** command. Possible to create tangential branches with reinforcing welds, reinforcement pads, or non-radial weldolets.



LAB – 4

LAB – 5

LAB – 6

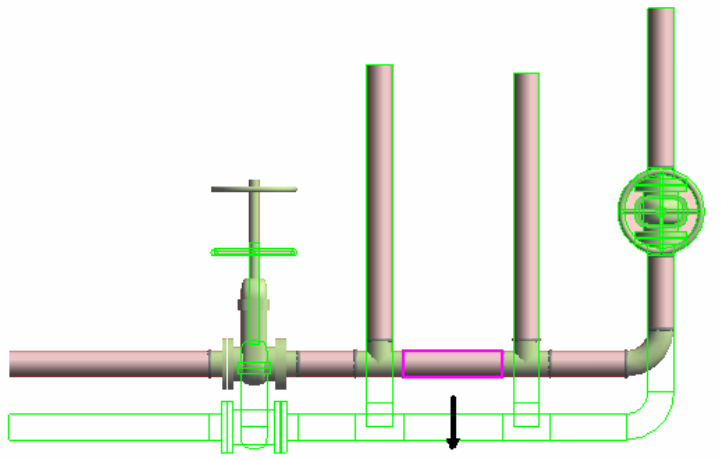
LAB – 7

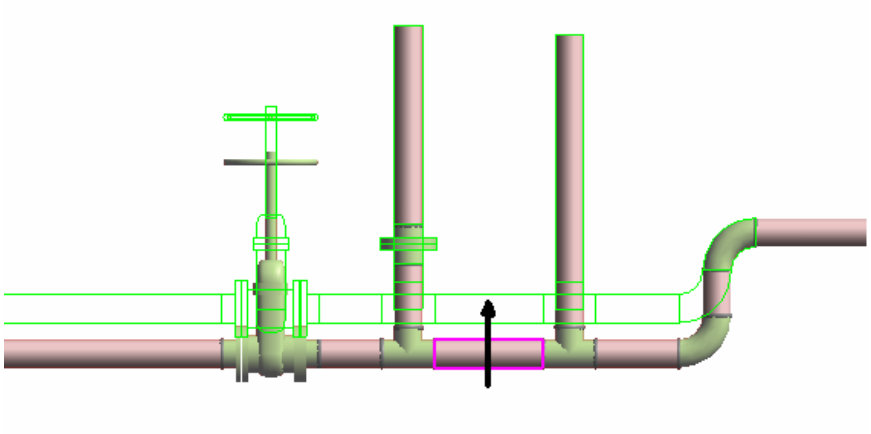
LAB – 8

LAB – 8A

Edit Straight Features (SF)

- Moving a SF moves the entire leg to which the feature is connected.
- The move direction is always perpendicular to the axis of the SF.
- A branch feature (BF) connected to the moved leg maintains its original angle.
- Movement stops when parts on the associated leg overlap, or when they overlap with adjacent parts on connected legs.

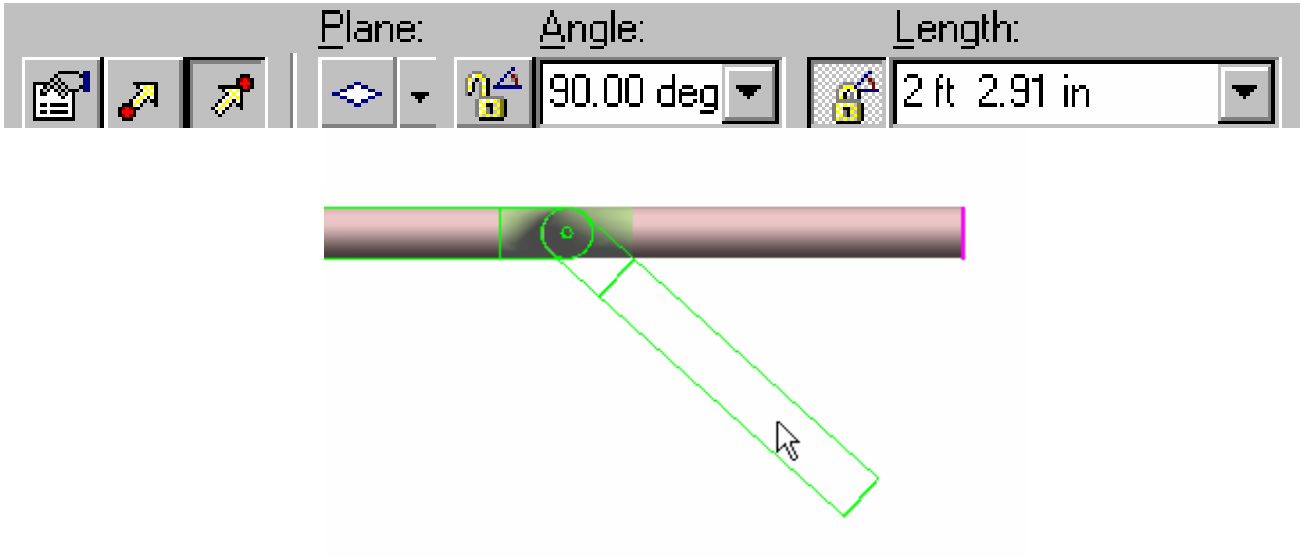




Edit End Features

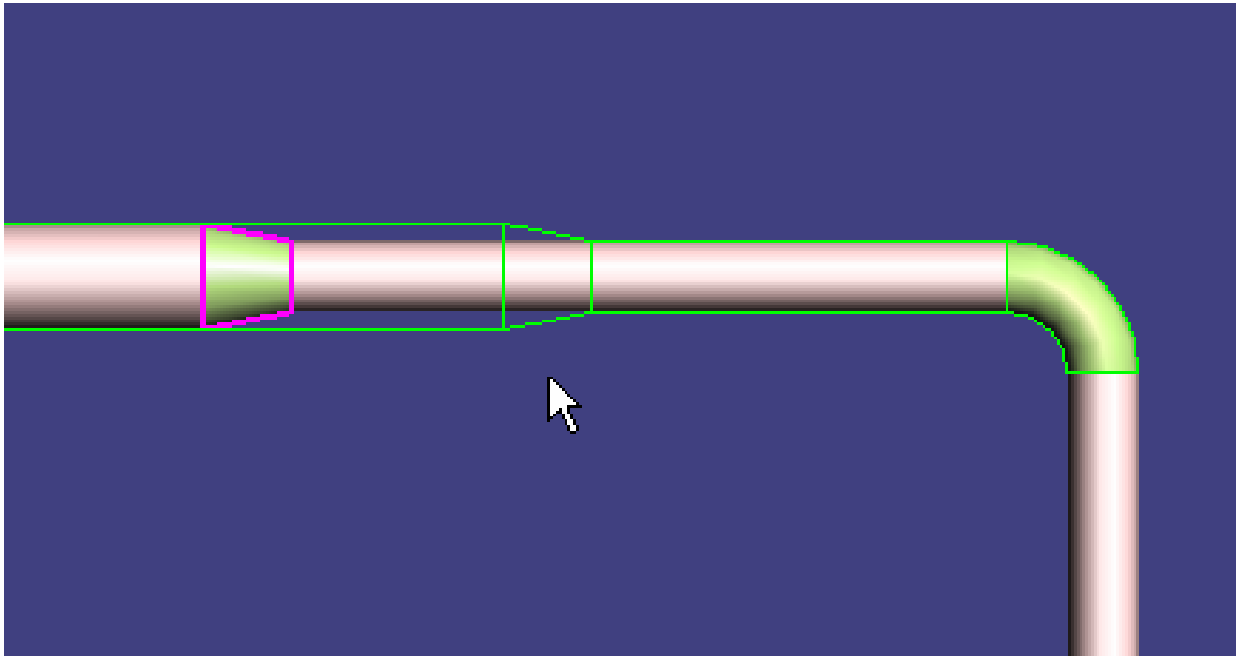
Moving the end feature by key in the length

- End feature location can be revised causing pipe to stretch/shorten or have direction changed



Edit Run Change Features

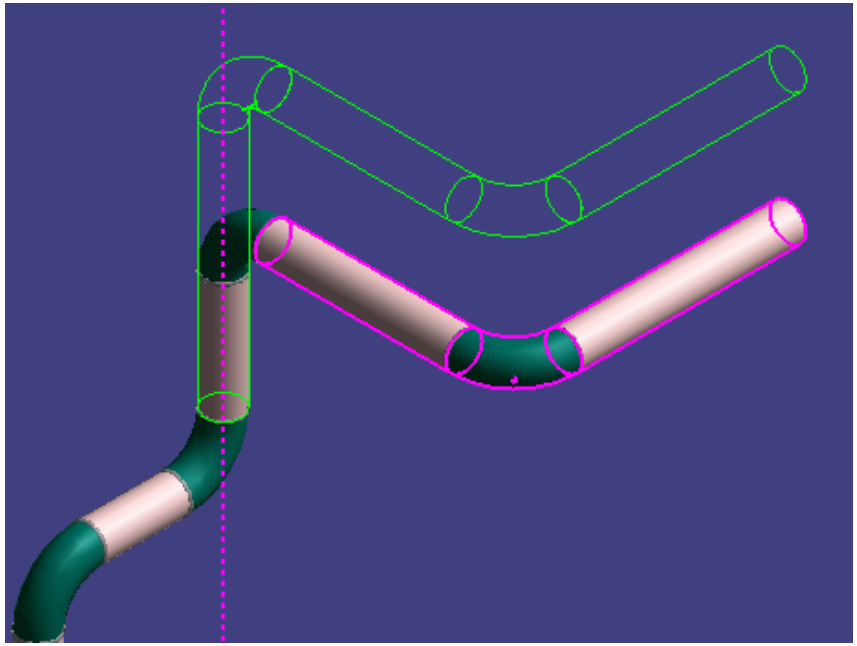
You can move the RCF along the associated straight feature. As you move the feature, the RCF appears in dynamic mode.



Editing Features

Shift – Select Command

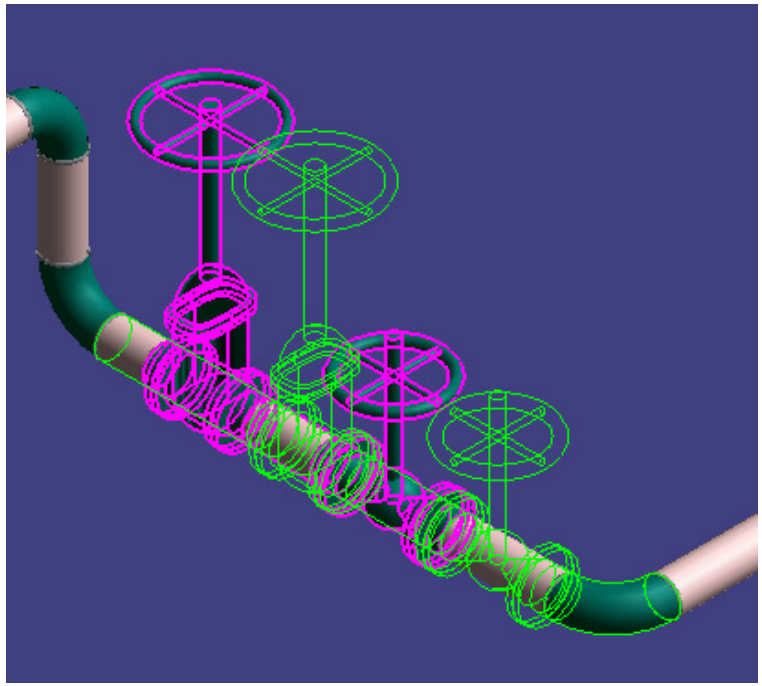
- To multi-select connected features, select first feature, then shift-select the feature at other end of group. All features in between will be selected for manipulation, e.g. move



Editing Features

Shift – Select Command

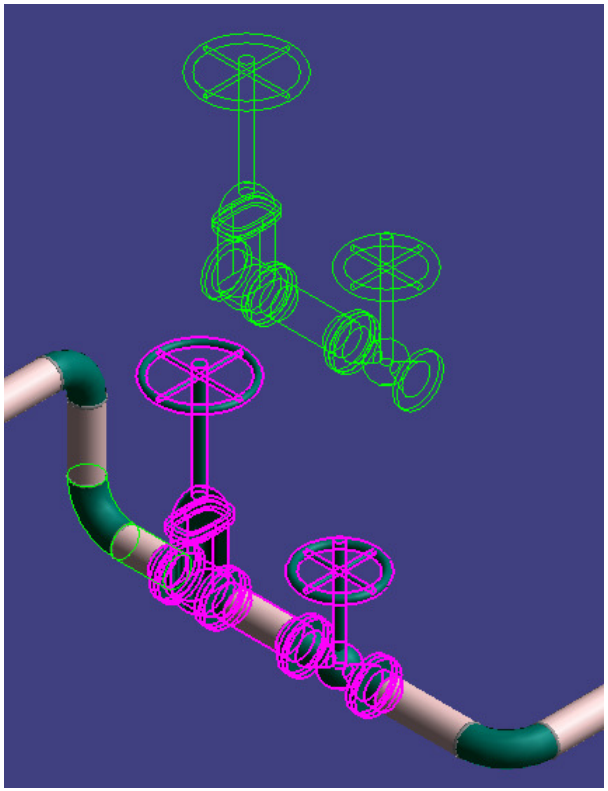
Move along the leg the selected items

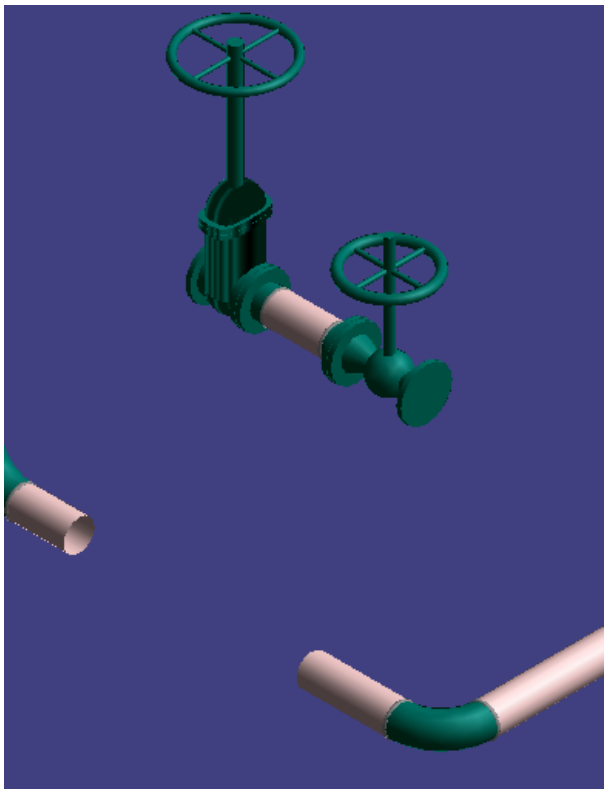


Editing Features

Shift – Select Command

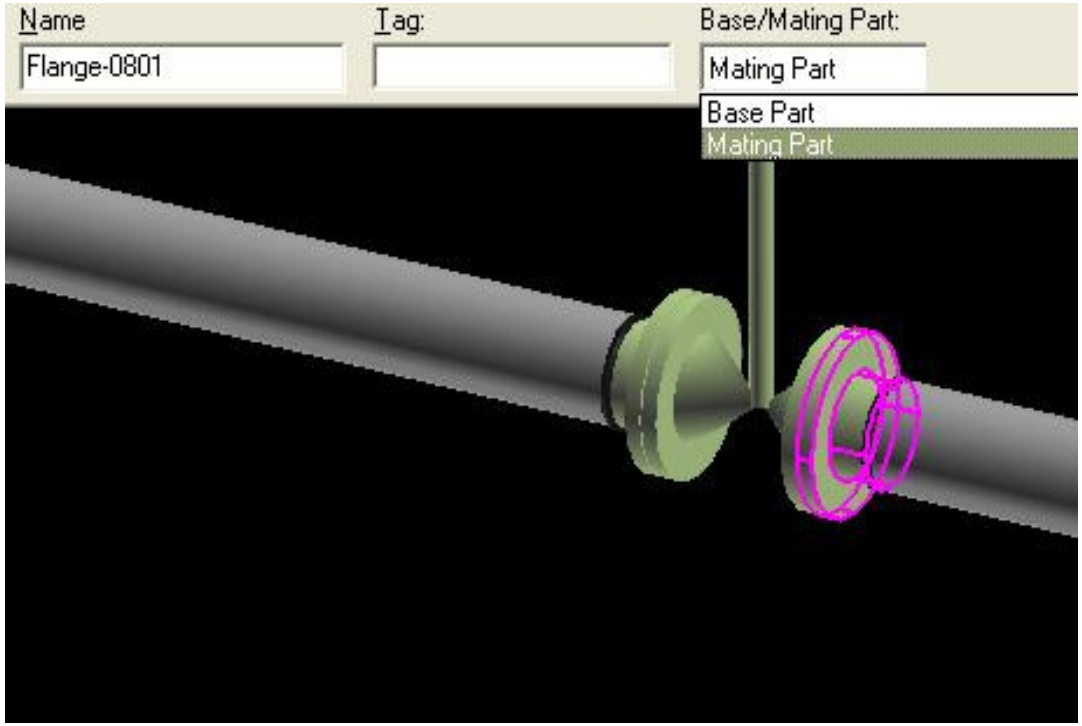
Turn off the moving along the leg





Modification

Mating parts can be changed to base parts using either the ribbon or the property page.

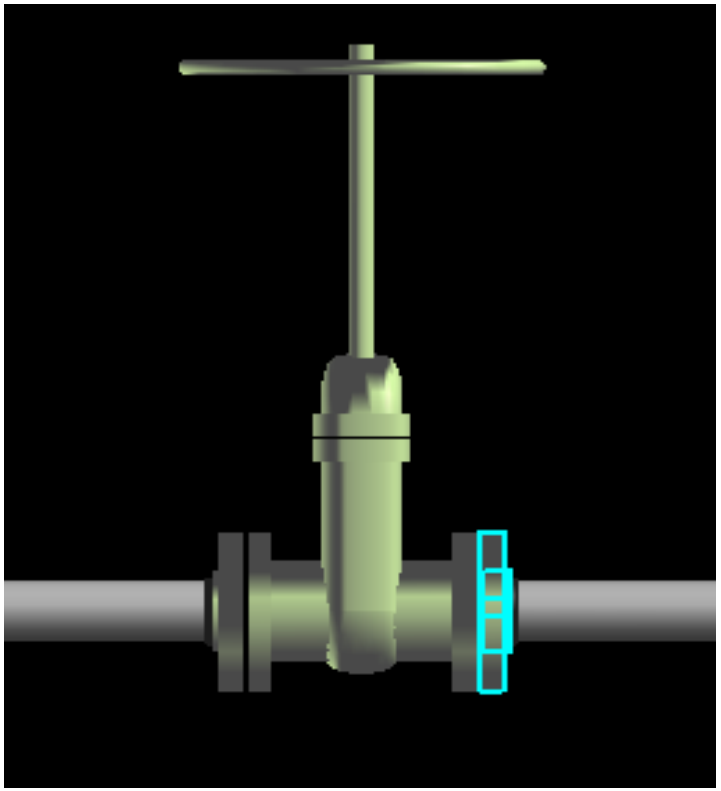


Mating Parts: Depend of a parent component for placement, i.e. if parent valve is deleted, mating flange is also removed.

Base Parts: Independent from mating component, i.e. if connecting valve is deleted, flange remains.

Modification

SP3D will allow the user to specify a commodity option for the base part being inserted or modified. During modification, the user is able to change the option code for mating parts.



Modification

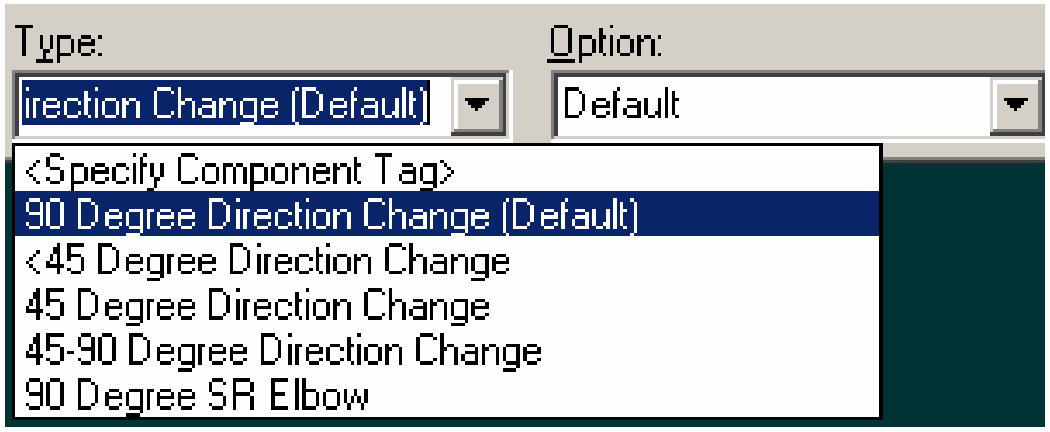
- Elegant solution to branch/turn angle modification if component is not valid

- For Trimmable Elbows (eg 2-45 deg) if the angle is changed to any value in this range , the component is retained. Other than this range the solver replaces the component with the suitable part (i.e. default).

- For NonTrimmable any change in angle will replace the part with the best suitable one.

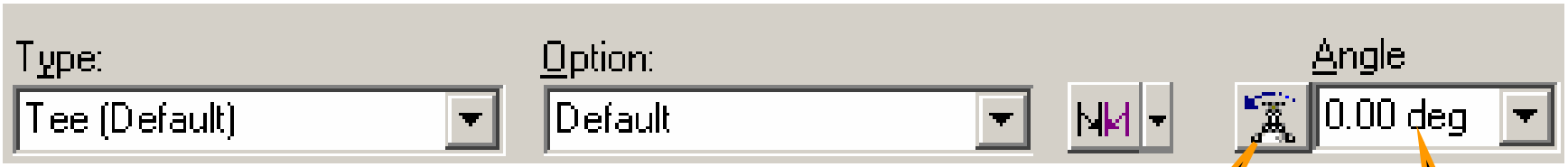
Modification

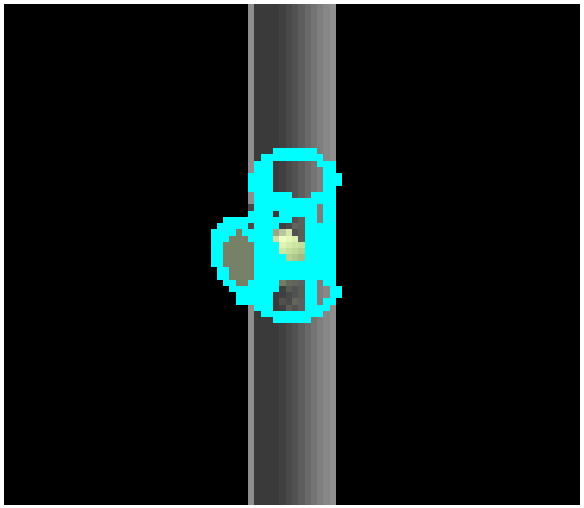
- Operator may replace item with another of same type
- Presentation of only one short code for a particular item.
- If a component has been generated automatically by the solver, the user sees two entries in the Type list for that object: one with a "Default" suffix signifying that this part is rule generated and one without the suffix.



Modification

Ability to rotate components after insertion





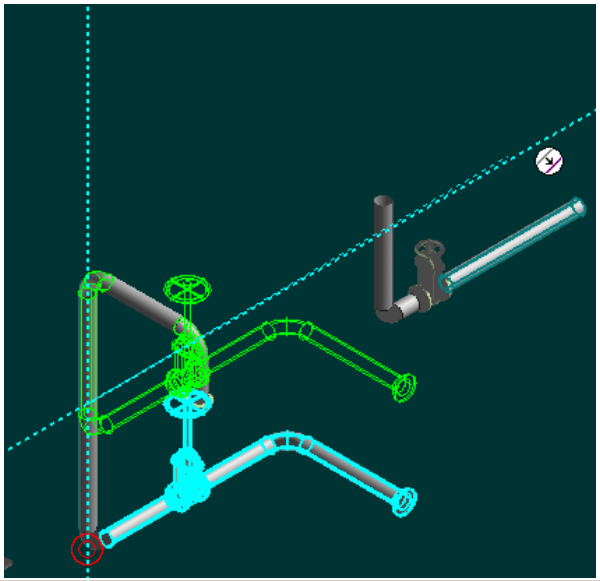
Dynamic Rotate

Key-In

Modification

Offset field on multiple edit ribbon bar

- Offset option allows placement at a +/- delta distance from a reference graphic

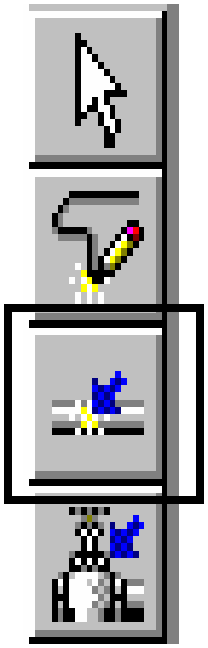


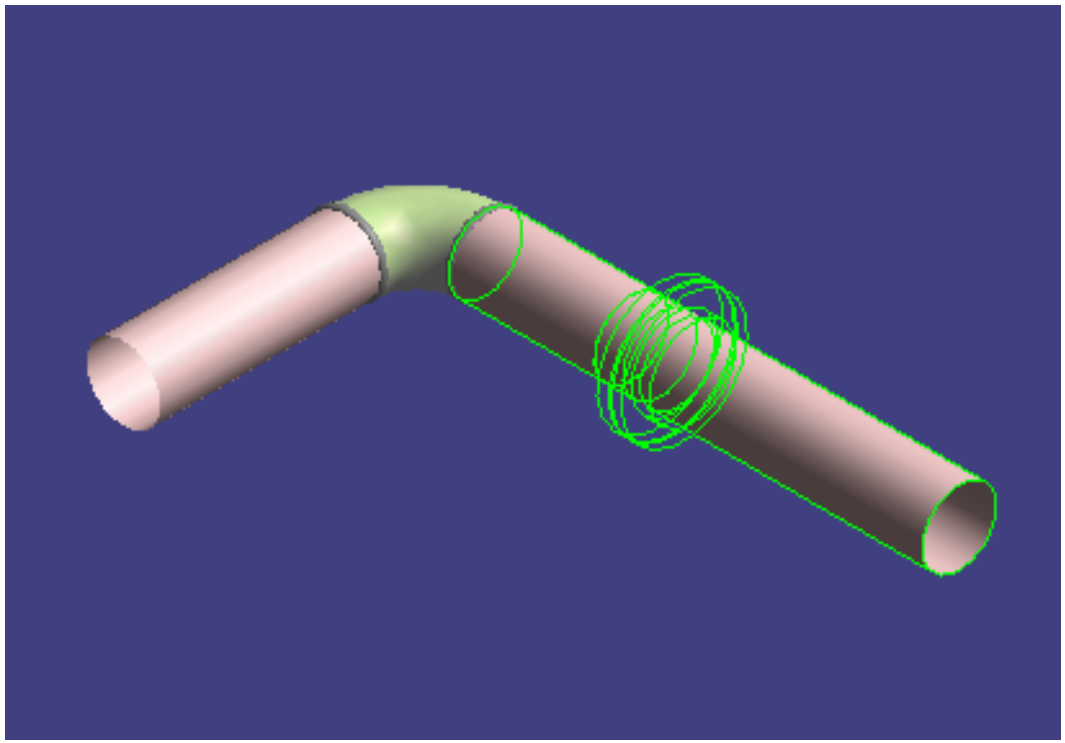
Modification

- Copy/Paste commands are available
  - To/From Clipboard
  - To/From Catalog
- Mirror Copy command is available
- Creation of a connection when multiple objects are moved and placed on another object

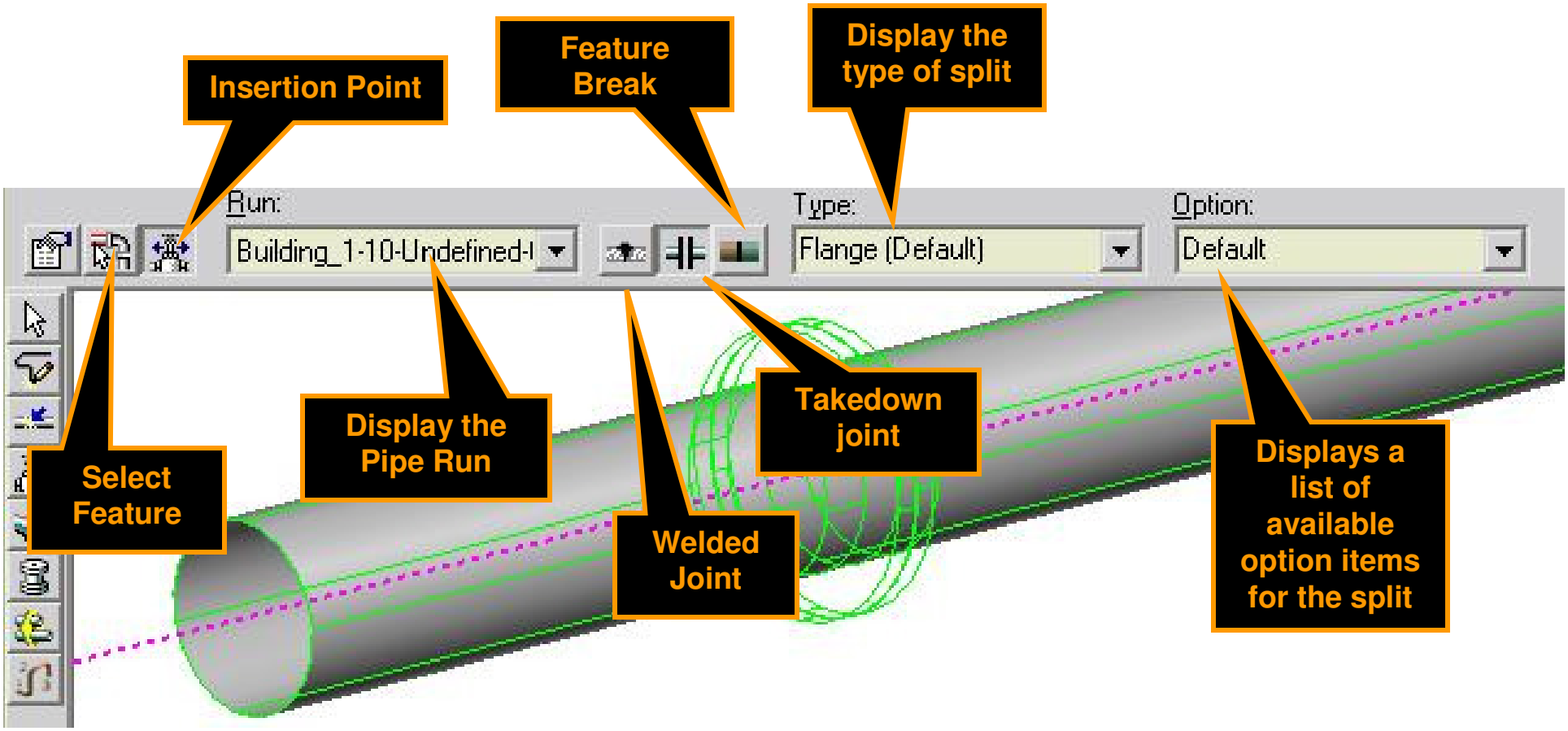
Insert Split Command

The Insert Split command cuts a straight pipe and connects the parts by a weld joint or a takedown joint like flanges or unions.



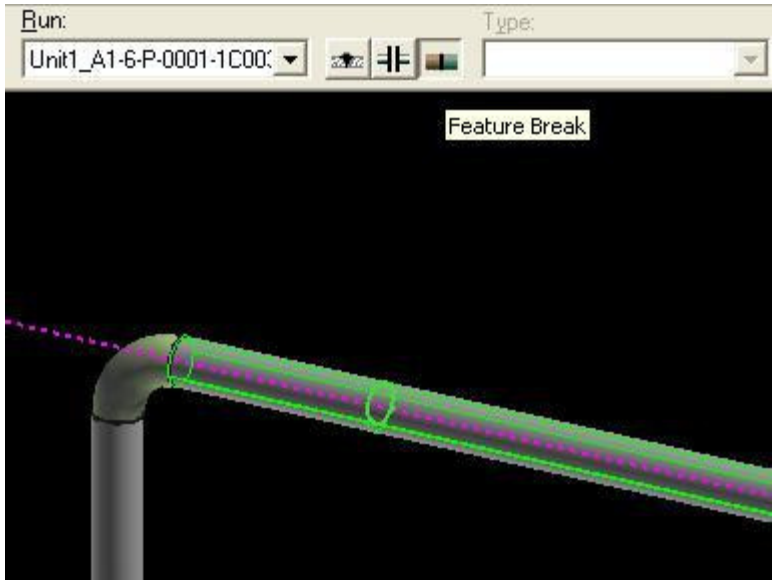


Insert Split Ribbon Bar



Attribute Break

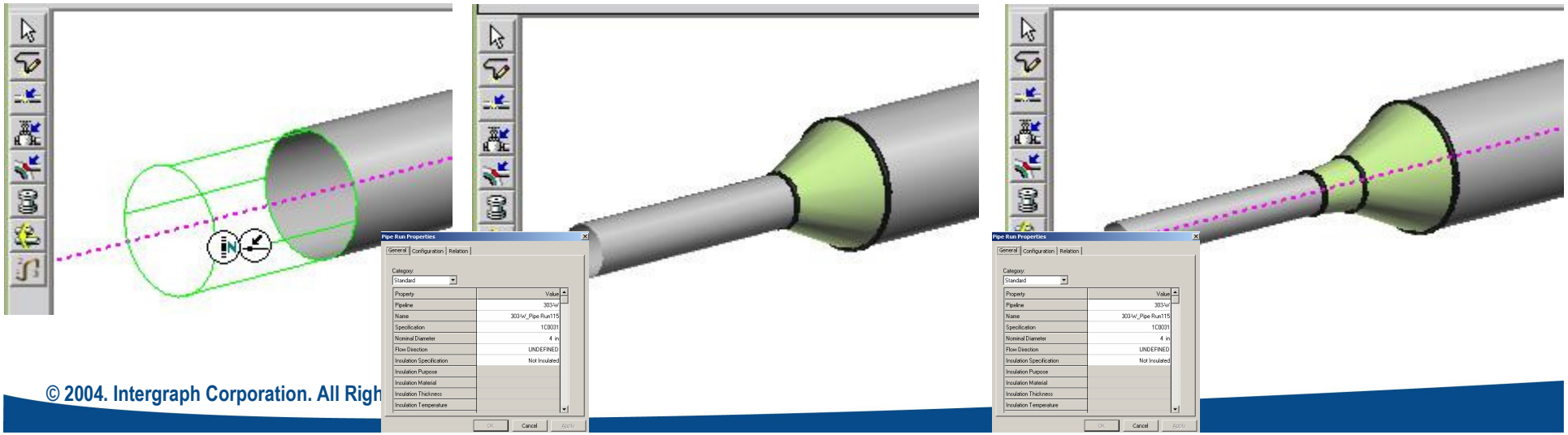
The **Insert Split** command can also be used to create a feature break. This makes it possible to stop heat-tracing, insulation, or a surface coating at an arbitrary location along a pipe instead of at a weld or other physical break in the line.



Attribute Break

Edit Pipe Run properties during modeling to create an attribute break.

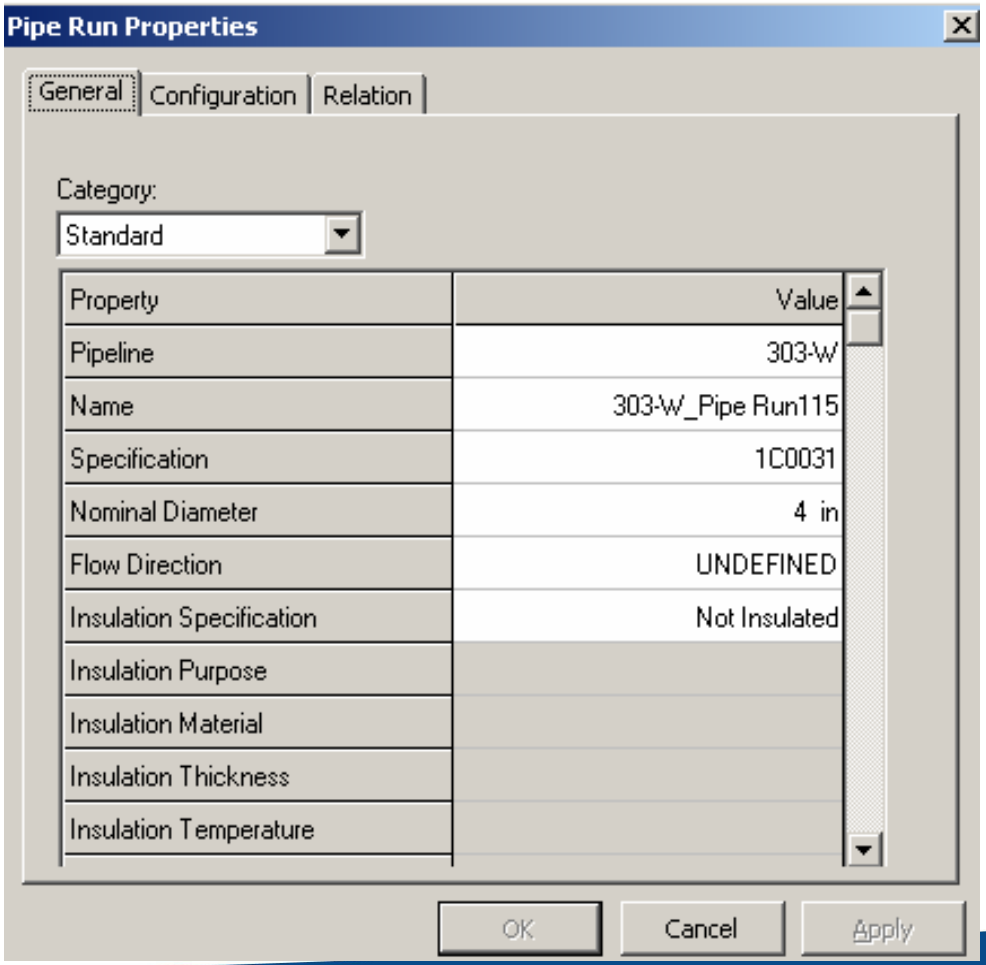
- When the run properties are changed, the corresponding feature properties are automatically changed as well.
- When NPD is changed, reducers are selected from the spec to satisfy the NS change.



Edit Properties Command

Edit Pipe Run properties.

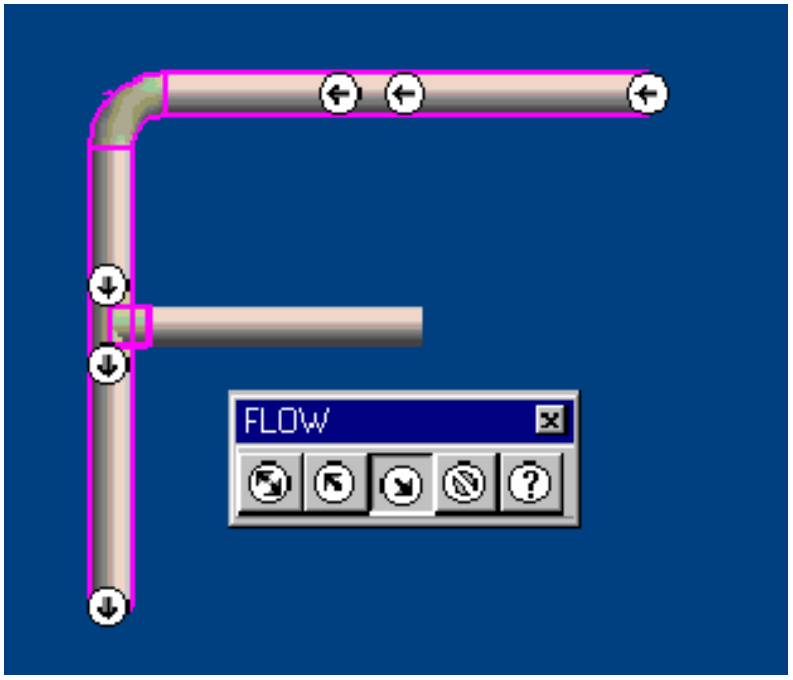
- Features inherit the common properties of the run by default.



Edit Properties Command

Flow Direction

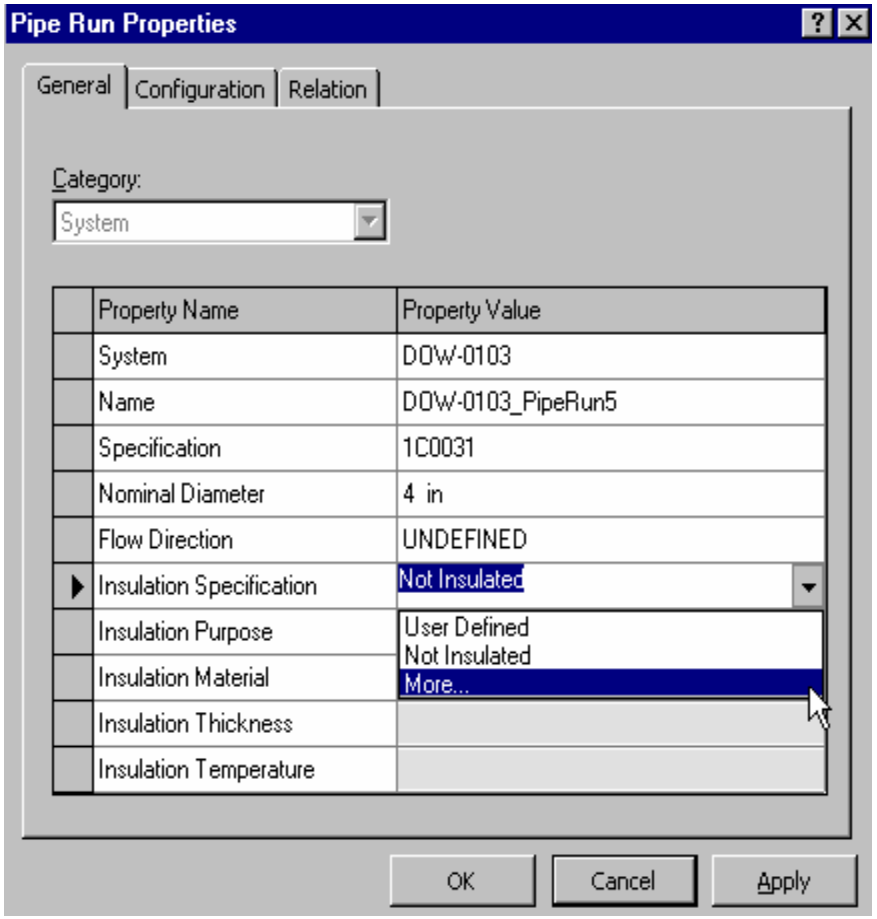
- Downstream is the direction from the start to the end of the run (port1-port2)



Bi-directional, Upstream, Downstream, No flow, Undefined

Edit Properties Command

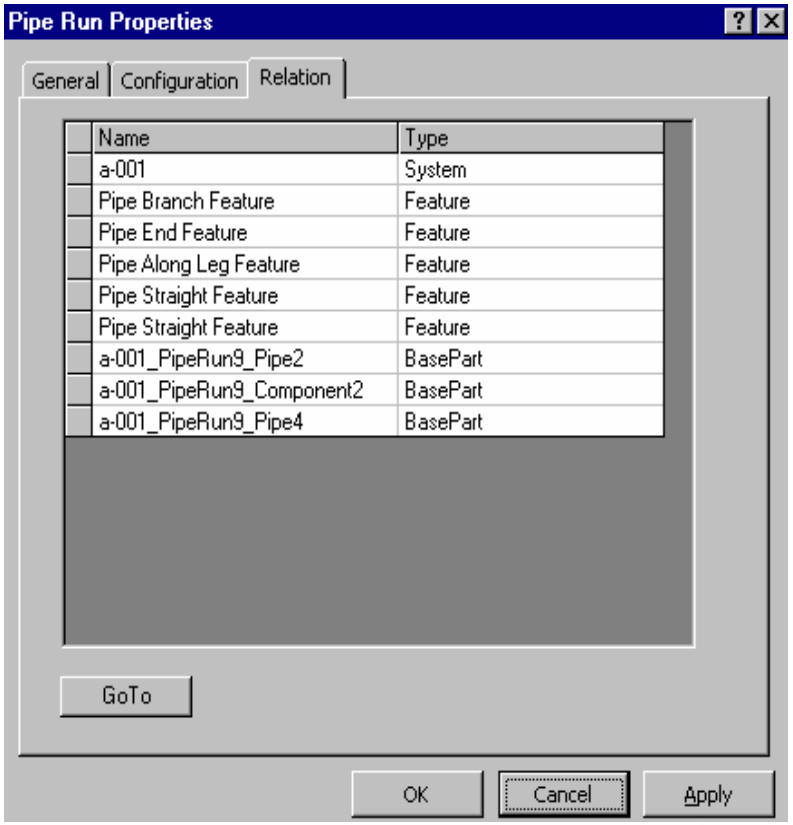
Insulation



Edit Properties Command

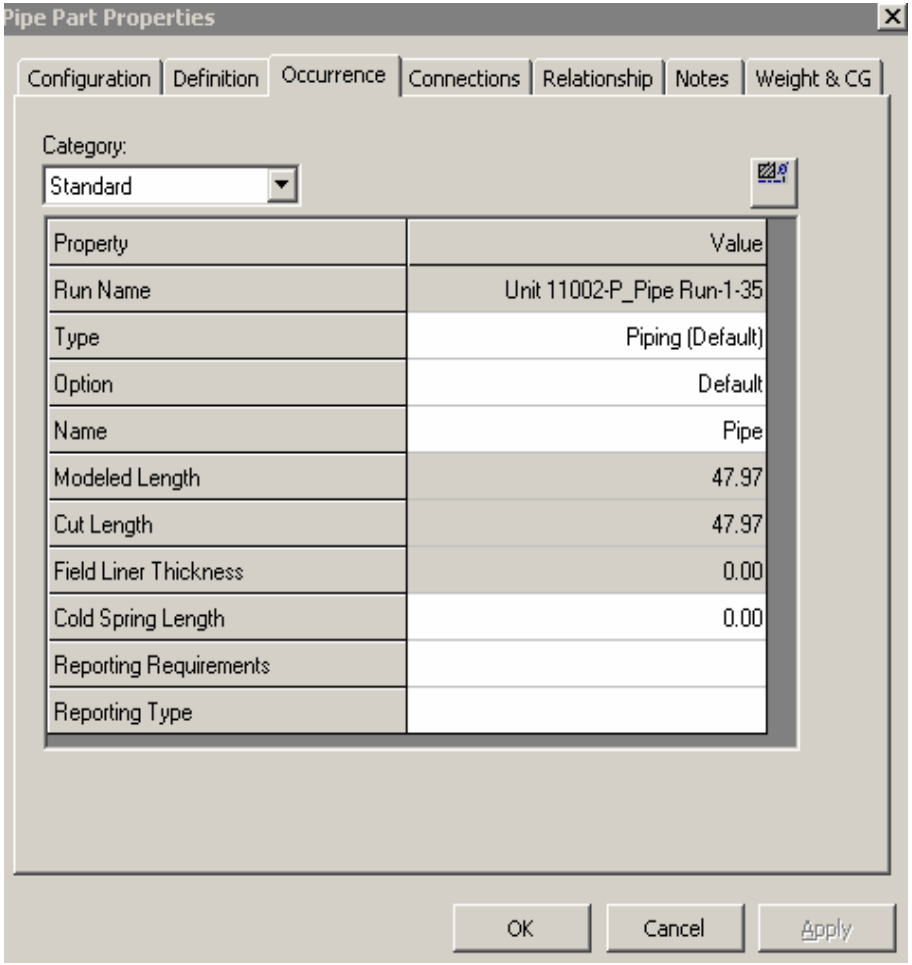
Edit Pipe Run properties

Relation Tab displays all the relationships defined for the selected pipe run.



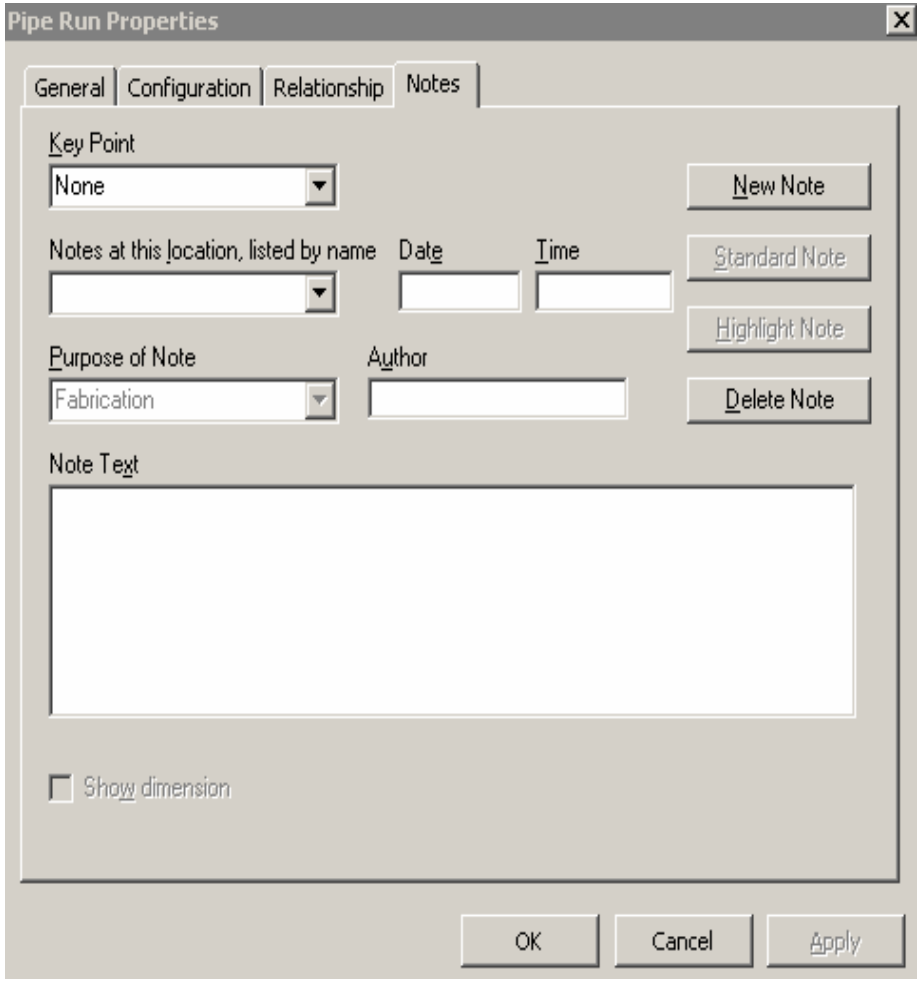
Properties Pages

- Pipe cut lengths to reflect lining & weld gap



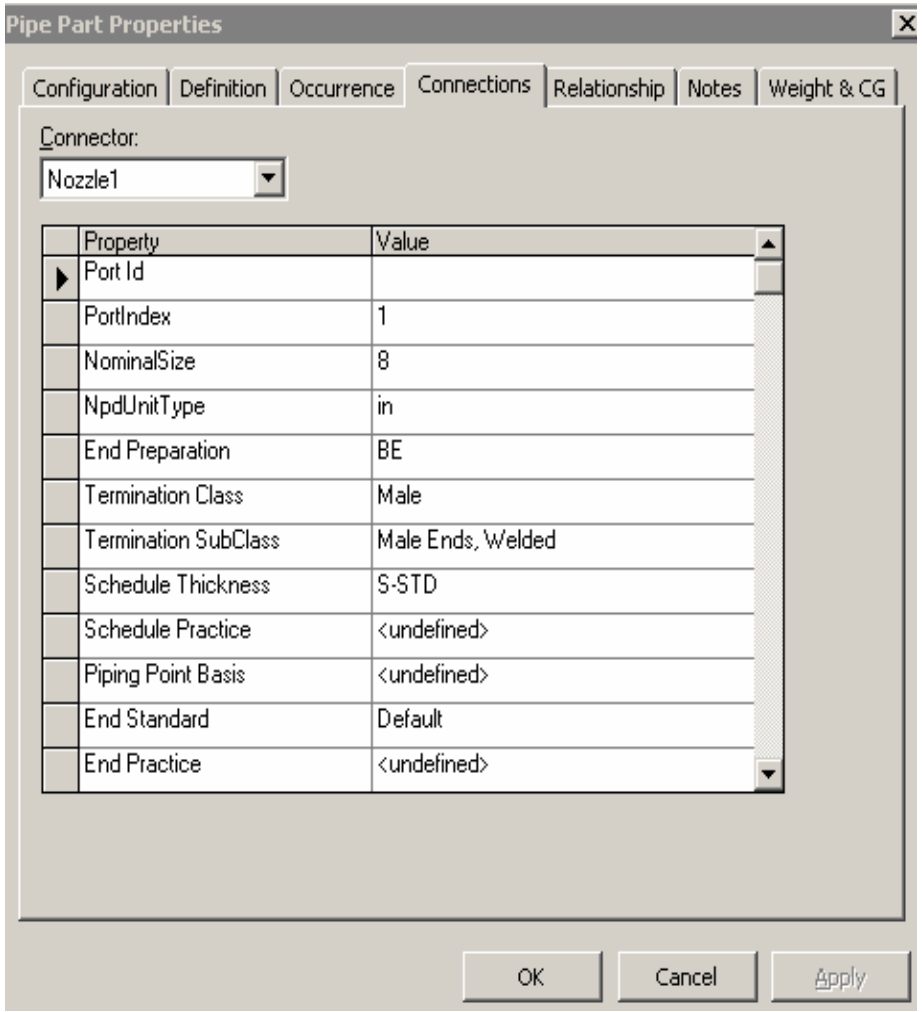
Properties Pages

- Ability to insert notes on higher level objects such as pipelines and runs



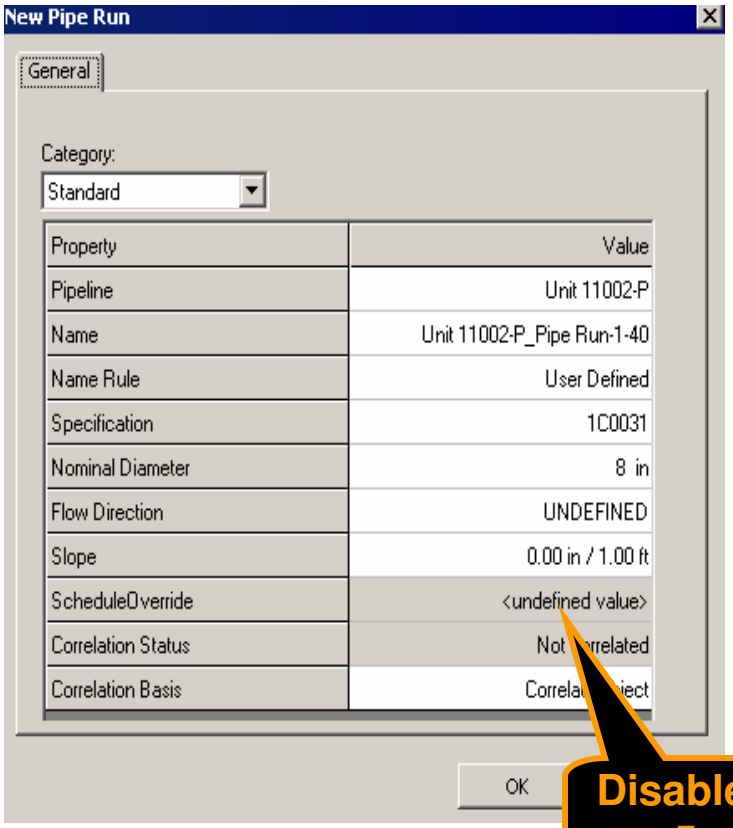
Properties Pages

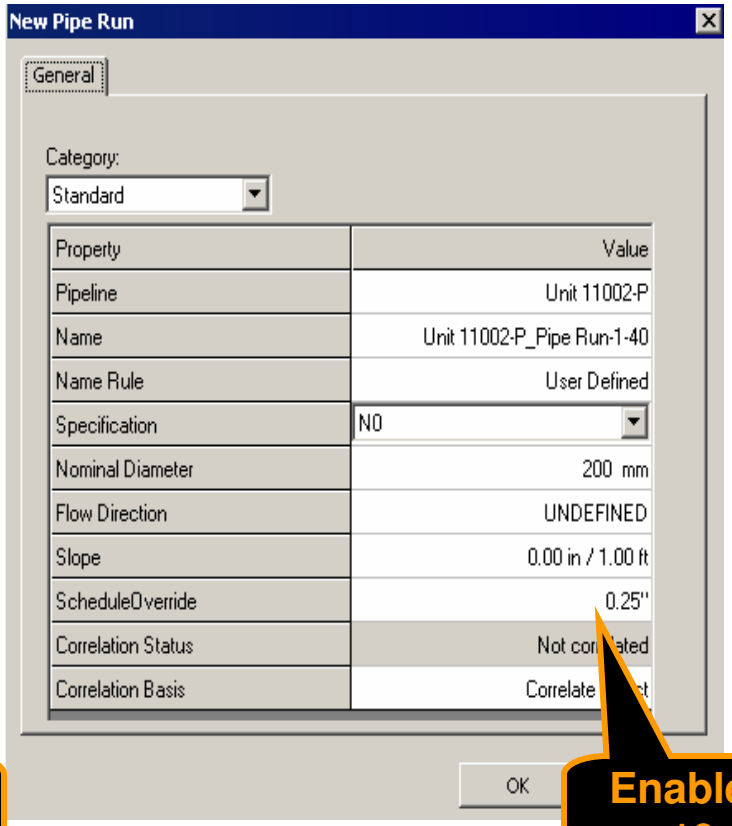
- Connections Tab is added for pipe parts



Properties Pages

Schedule/Thickness override options

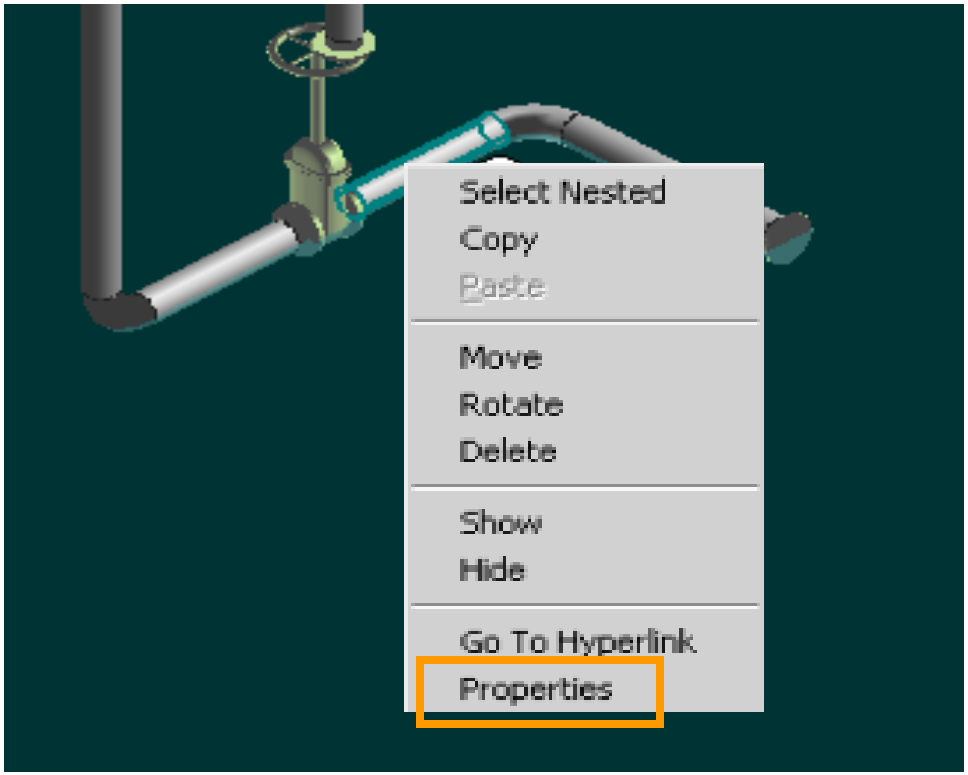




SpecName	PipingCommodityOverrideOption
1.5.1	1.5.8
1C0031	5
2C0032	5
N0	10
N1	10

Properties Pages

Right clicking on piperun or feature brings up menu when in Route Pipe environment

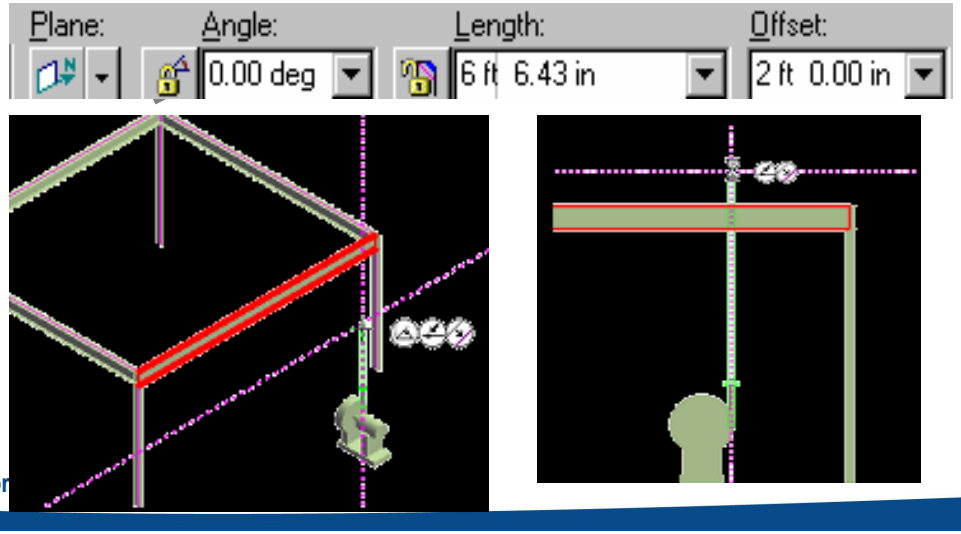


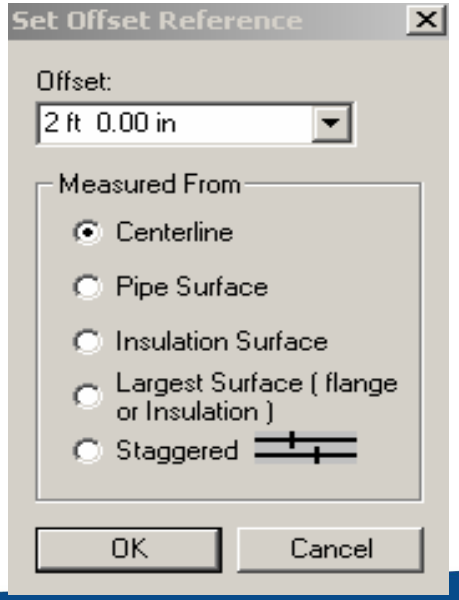
Route Pipe Run Using the Offset Value

Offset Control Tool

If the reference object is a planar surface or linear element, the offset distance is measured from the surface or line to the indicated reference plane on the pipe being routed. Five offset reference are available.

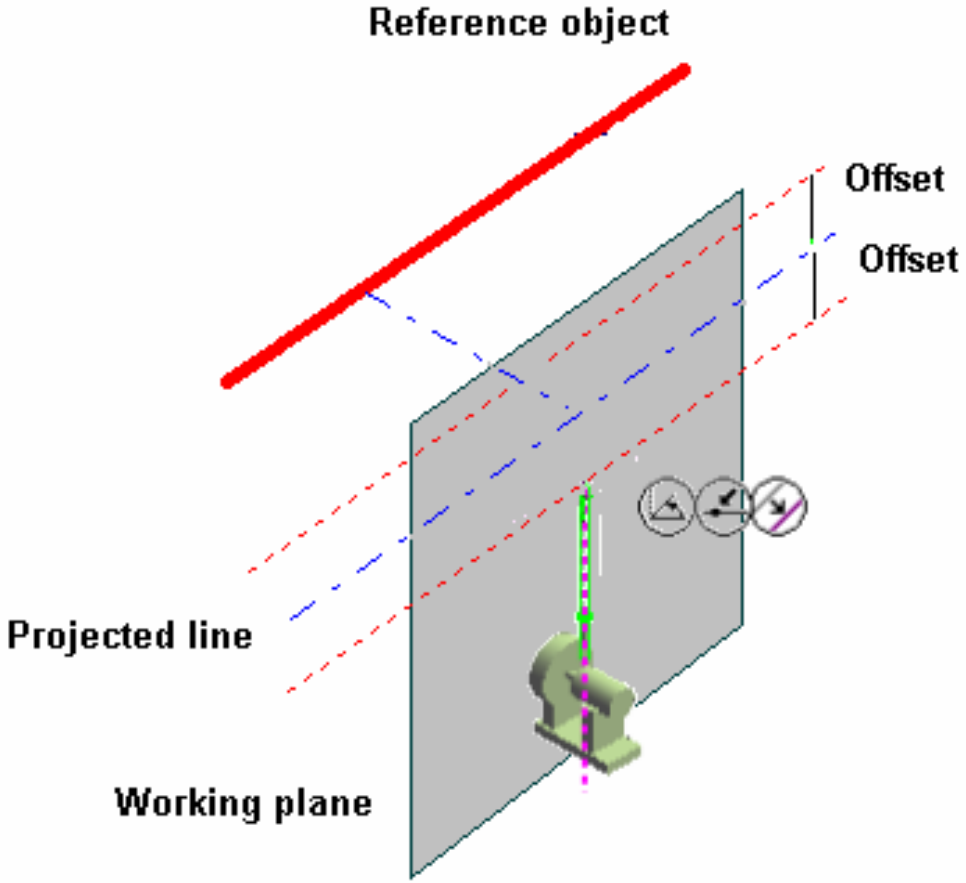
An offset SmartSketch point is found on either side of the referenced plane or linear element.





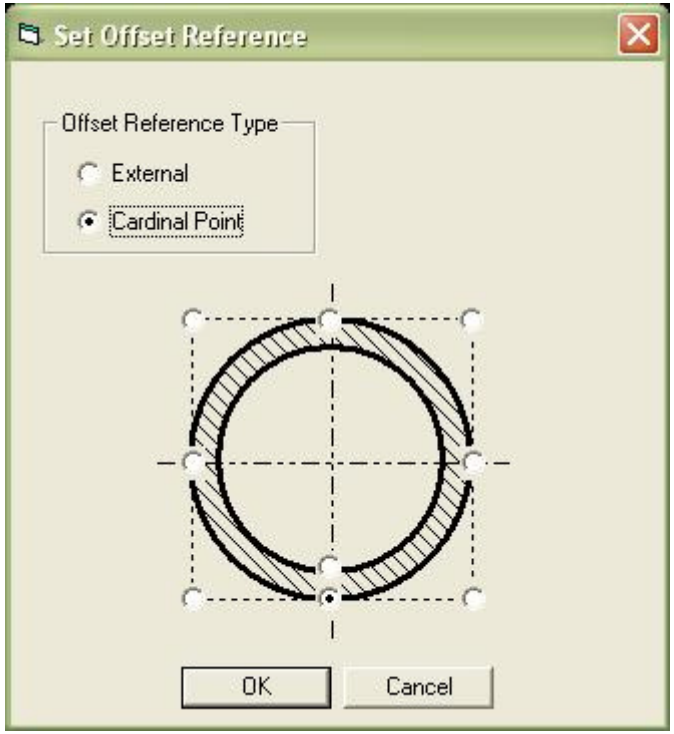
Route Pipe Run using the offset value

How the Solver finds the offset:



Route Pipe by Cardinal Points

Route a pipe by the top, sides, bottom, or invert elevation of the pipe instead of the pipe centerline.

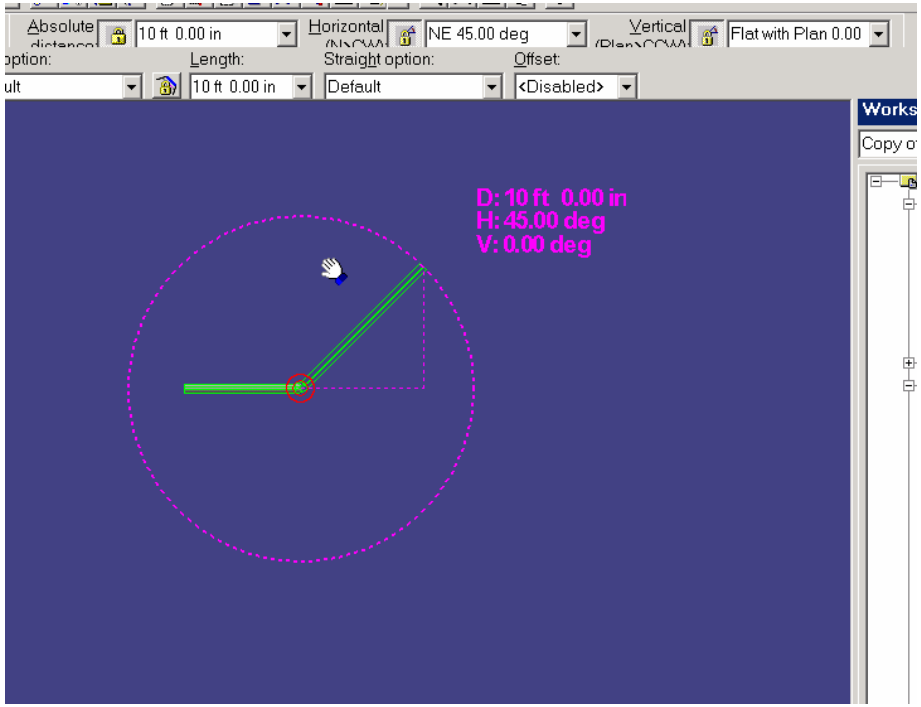


Routing by invert elevation is supported for use in modeling underground piping.

Route Using Spherical Coordinates

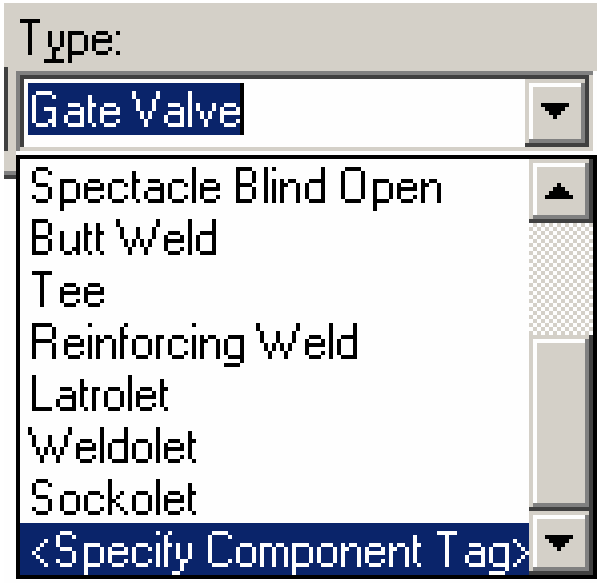
Relative Tracking Mode

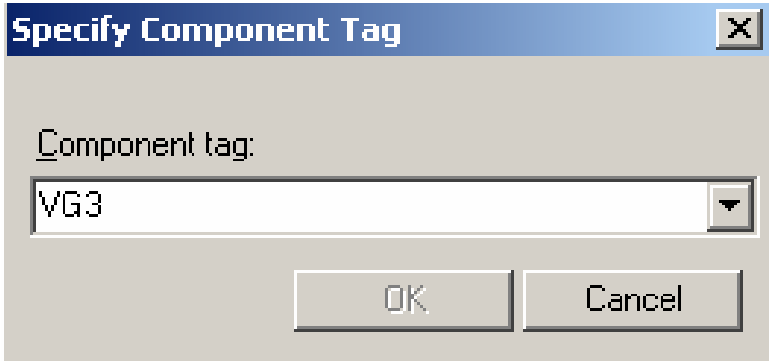
- Allows user to route pipe by defining distance and direction parameters rather than coordinates

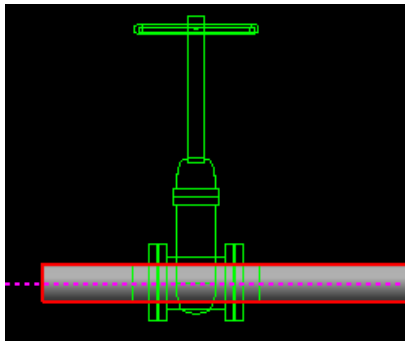


Insert Component by its Engineering Tag

The engineering tag will be available on the P&ID, and may be used to select a piping commodity from the Piping Specification.







Instrument & Piping Specialty Placement

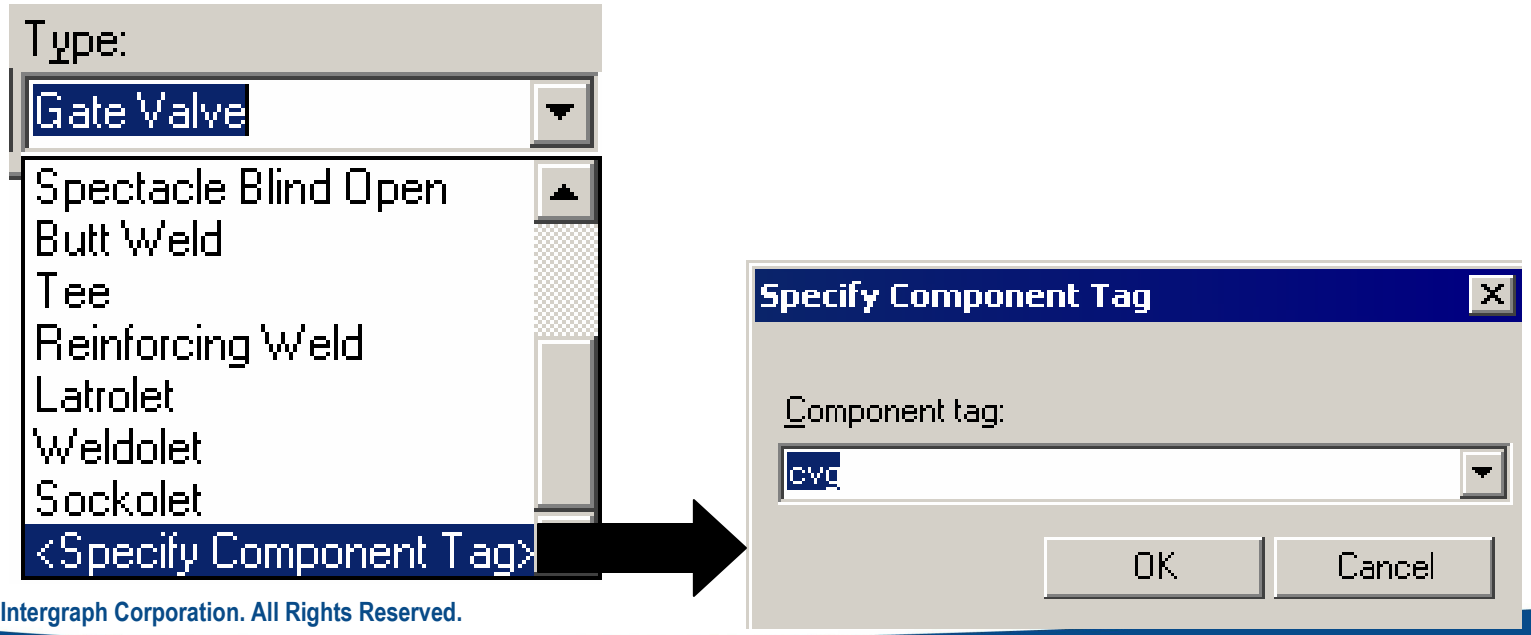
- We have two types of piping specialty/instrument Parts:

- 1. Stock item: Stock items represent those piping items that are purchased from a manufacturer's catalog, where no real engineering is required other than selecting the correct size, material, etc.
- 2. Custom-engineered item: custom engineered items are built items according to the process.

Instrument & Piping Specialty Placement

Placing piping Specialty/Instruments

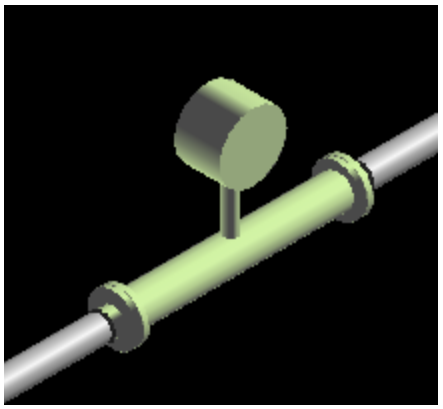
- User inputs item tag
- Using tag value, item is found in catalog and placed using catalog's part dimensions

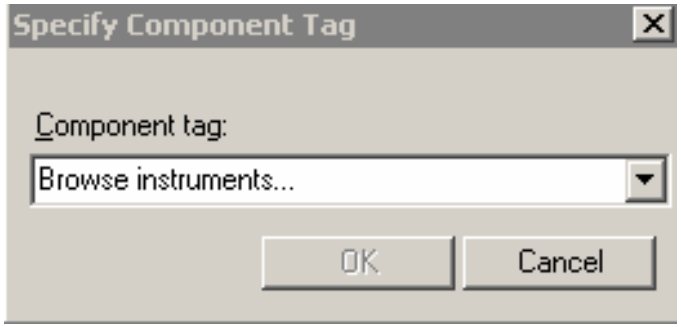


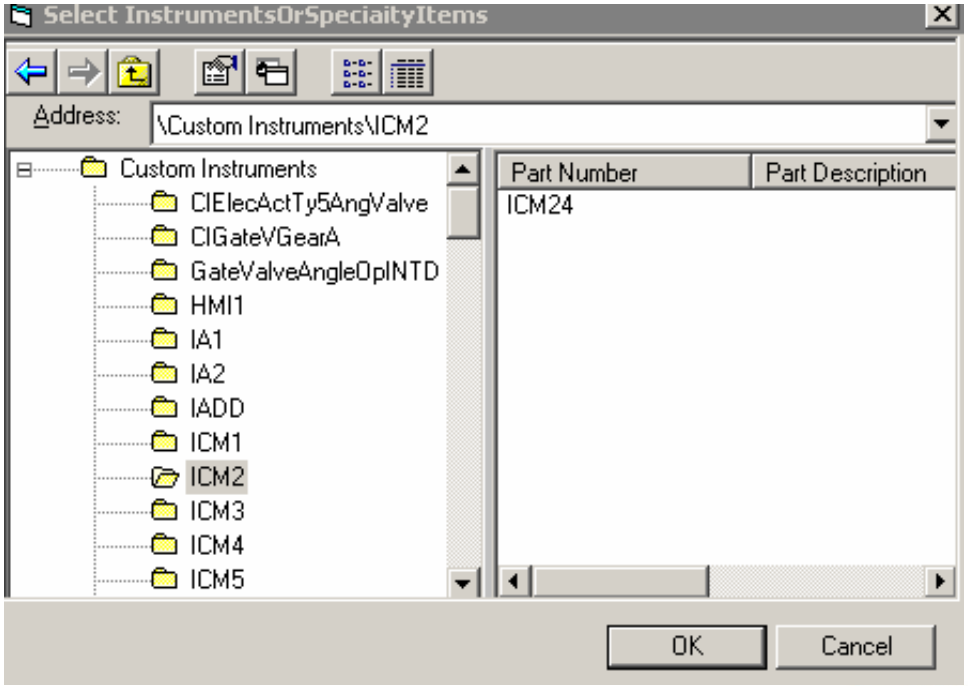
Instruments

Placement of Instrument Items On the Fly

- User Selects Instrument from menu of available items



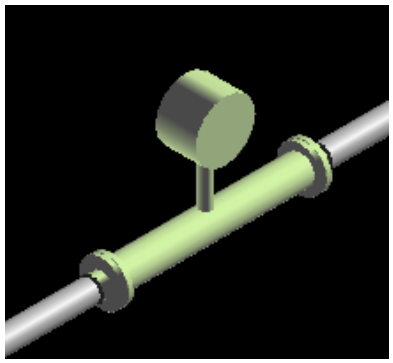


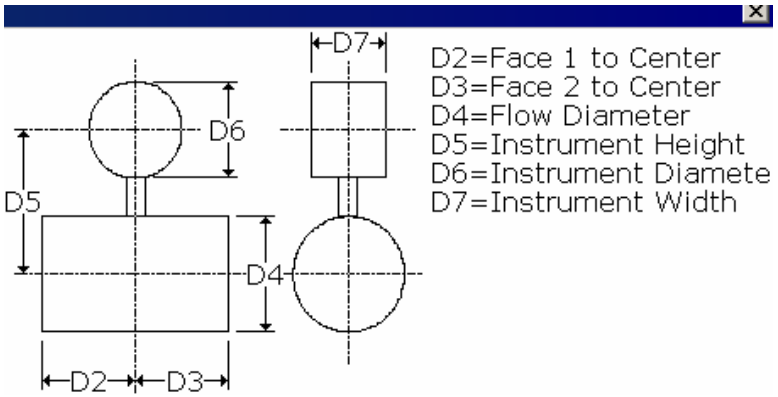


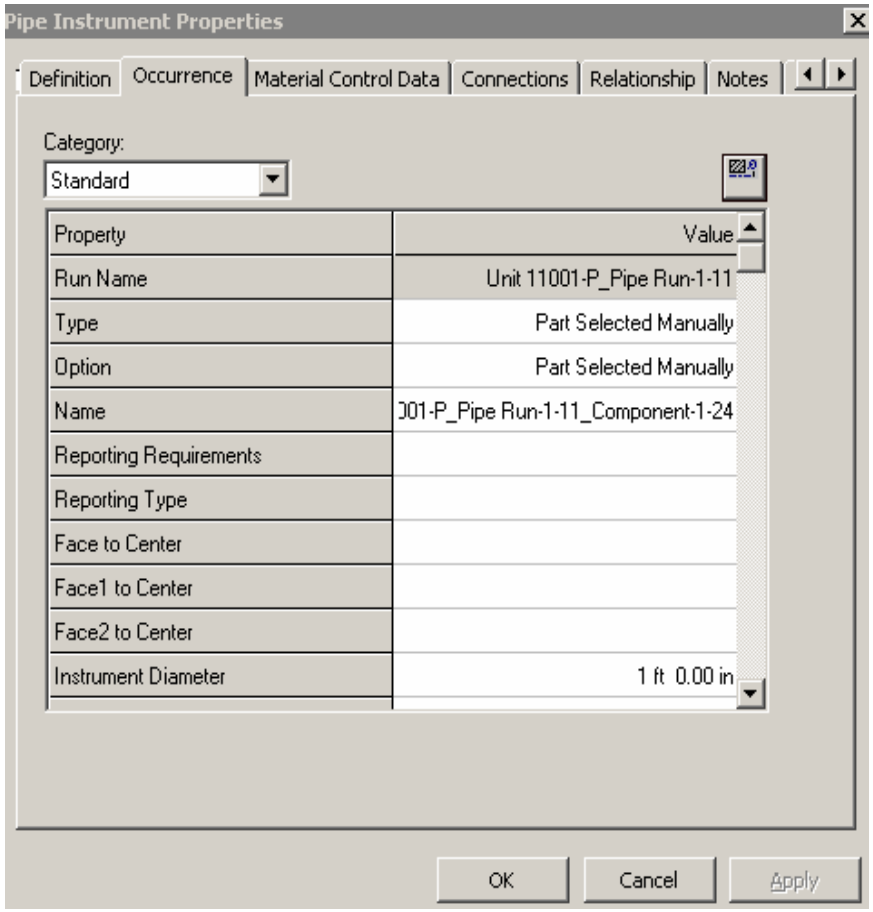
Instruments

Placement of Instrument Items On the Fly

- User is able to enter item dims



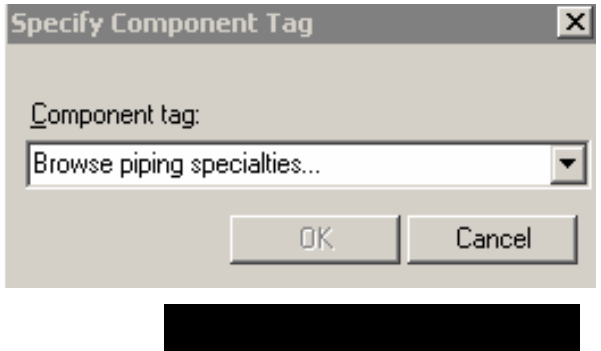


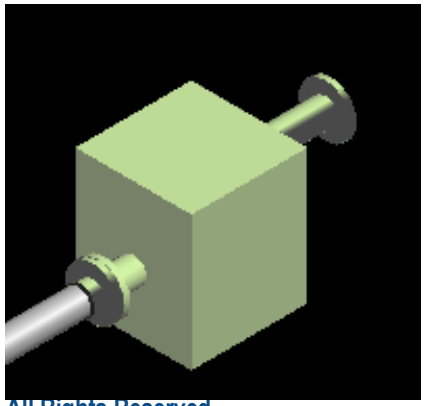


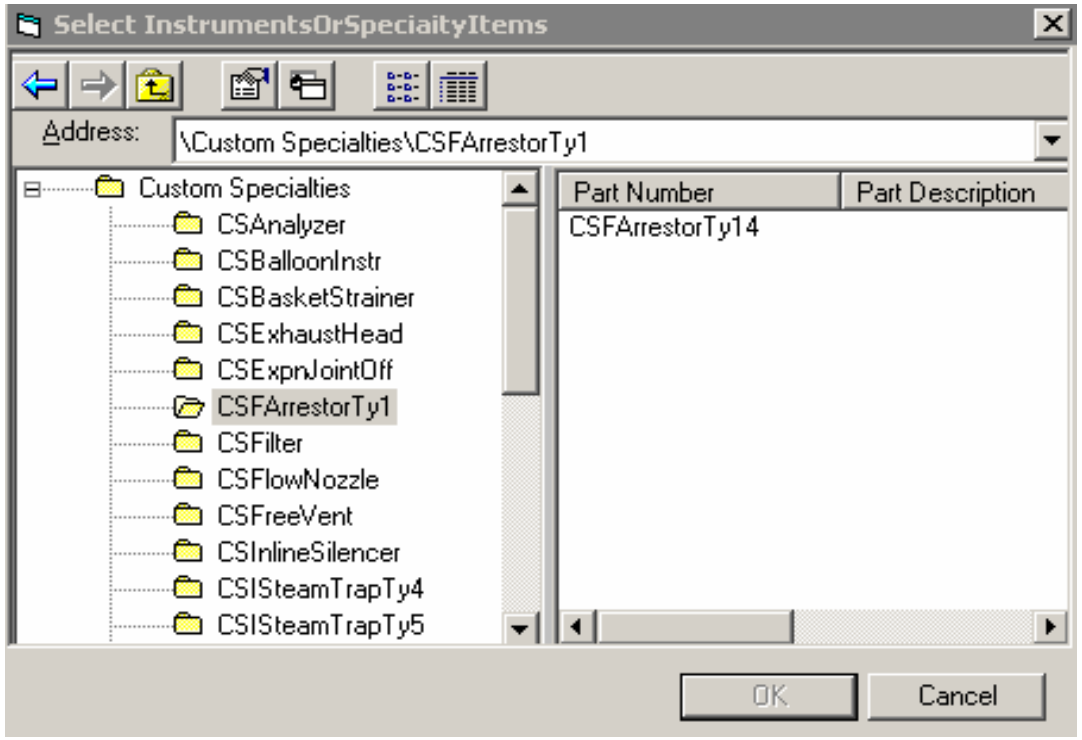
Specialty Items

Placement of Specialty Items On the Fly

- User Selects Specialty Item from menu



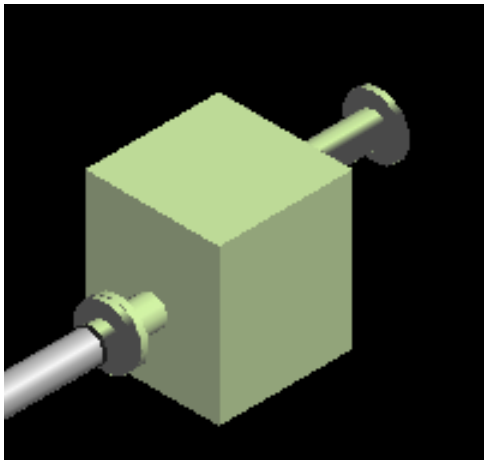


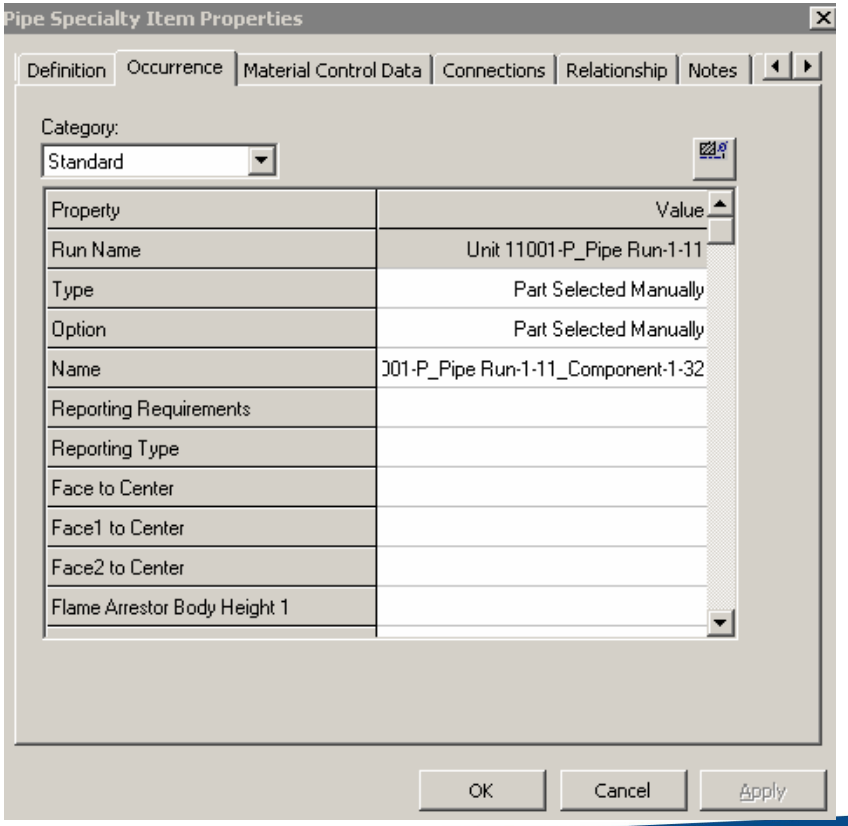


Specialty Items

Placement of Specialty Items On the Fly

- User is able to enter item dimensions





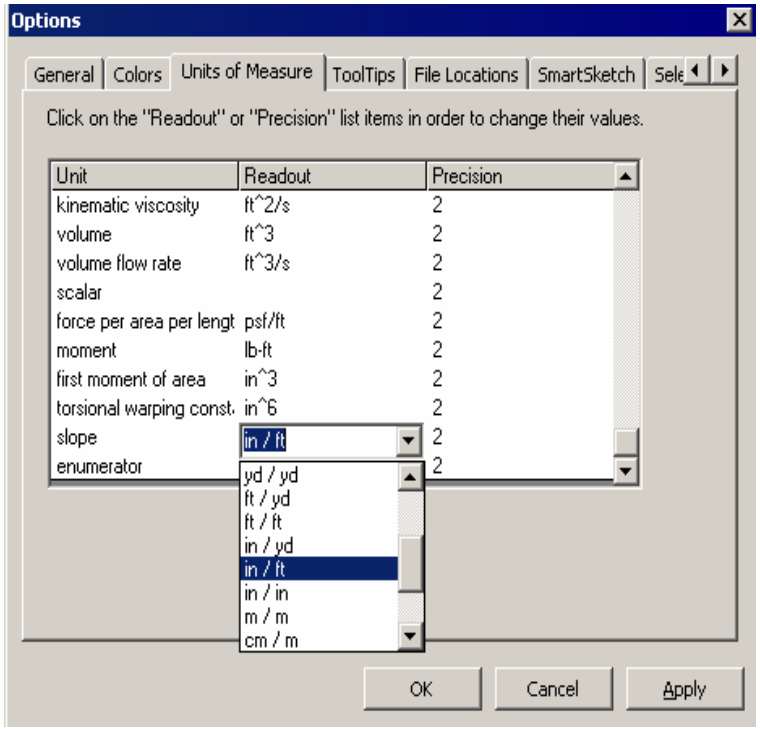
LAB – 9

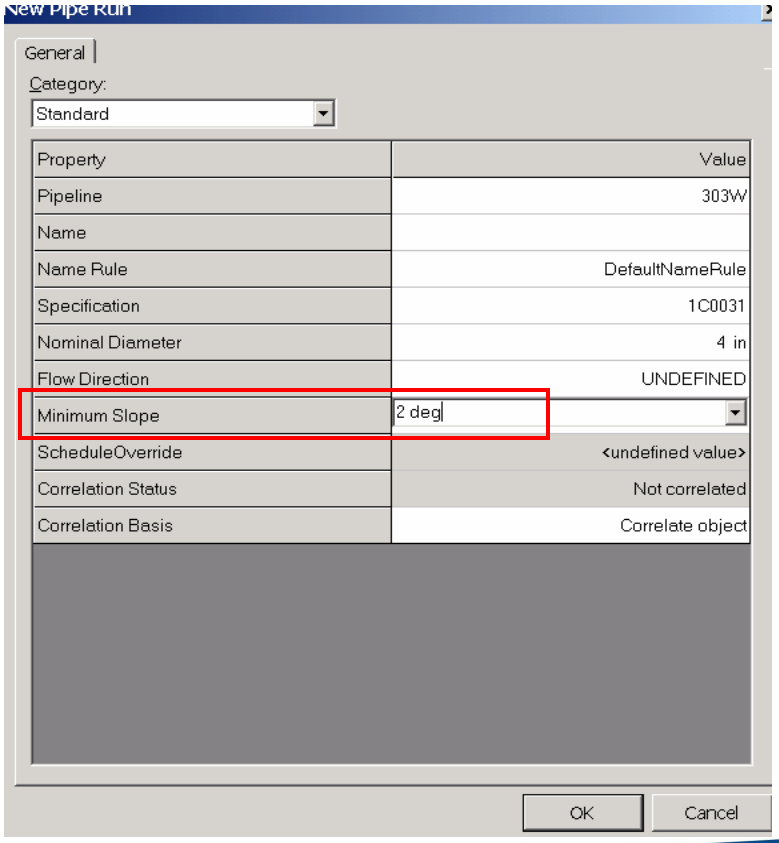
LAB – 10

LAB – 11

Sloped Pipe

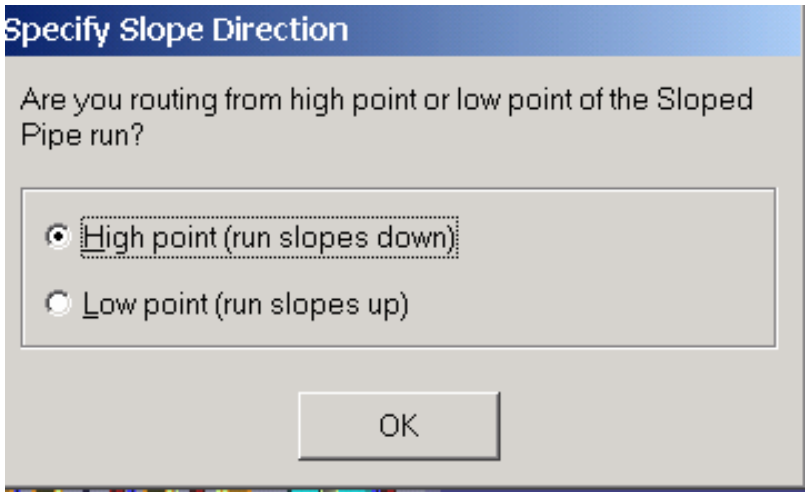
- Slope format set in Tools>Options
- Min. possible slope value for a pipeline defined in properties form at start



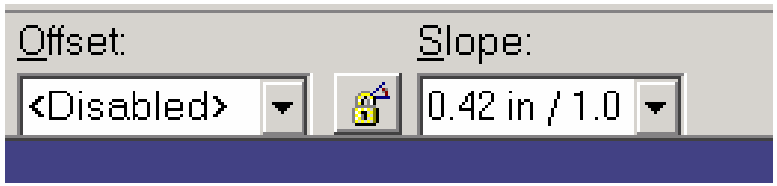


Sloped Pipe

- Specify Slope Direction

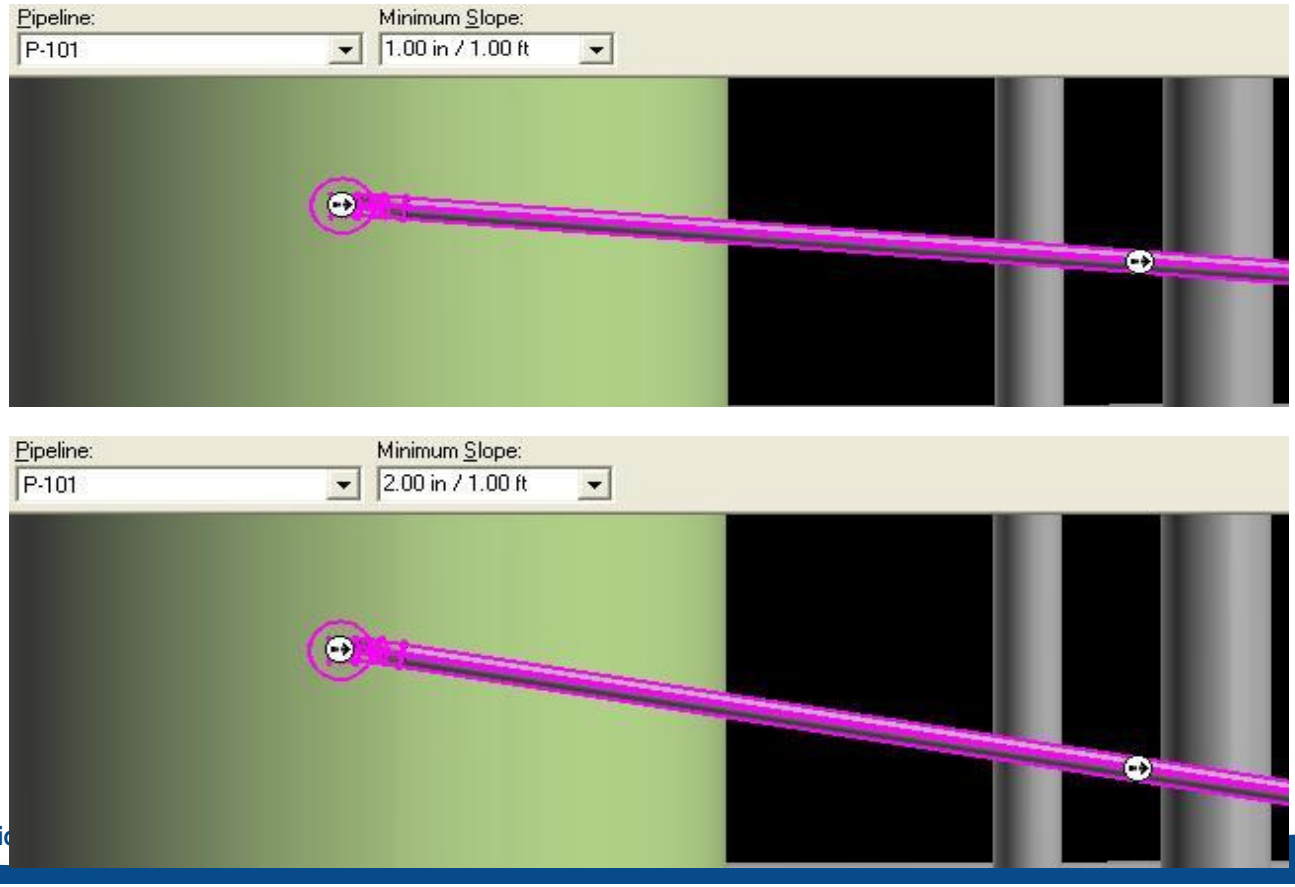


- Turn Slope Lock On/Off
  - Must be off when routing vertical runs
  - New value can be entered



Sloped Pipe

Modification of the “Slope” value will dynamically change the slope of a run as long as no vertical runs have been routed yet

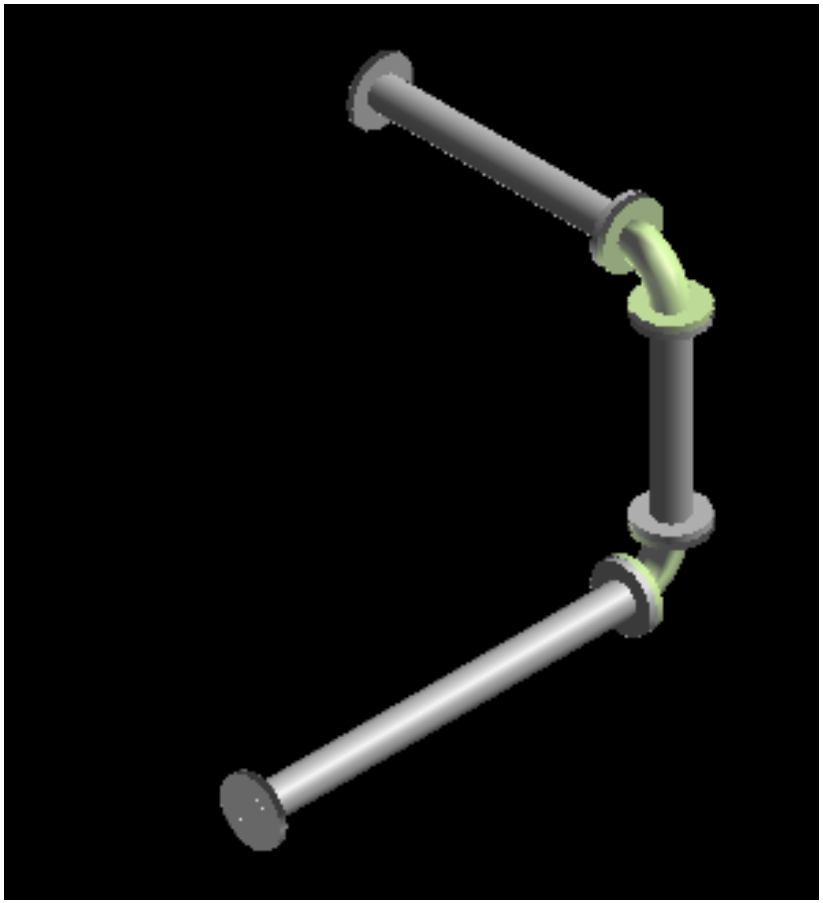


Route Flanged Pipe

Two sample flanged piping specifications:

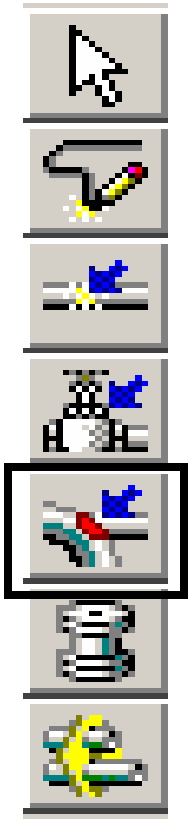
- 1C0100
- 1C0101

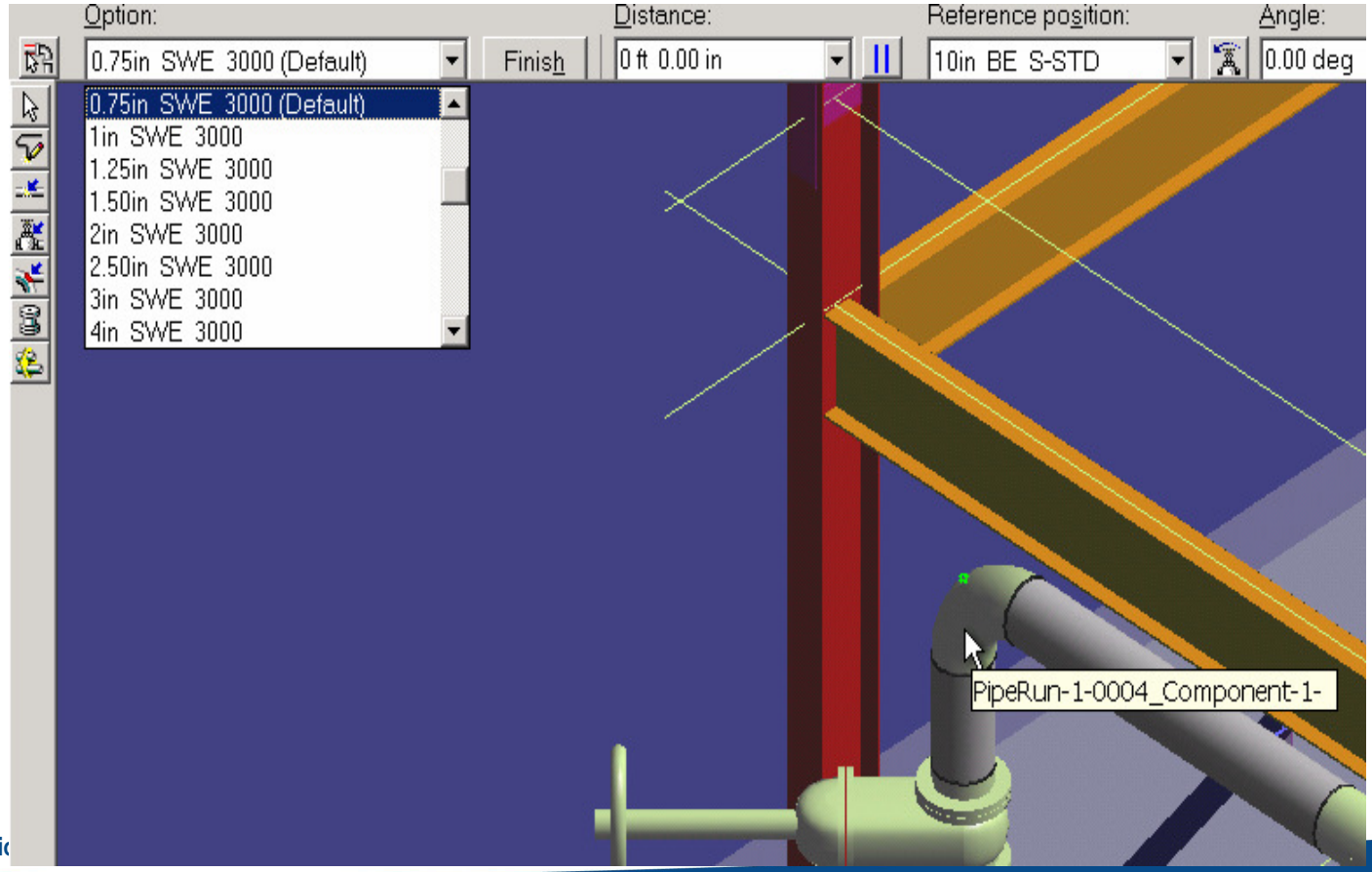
Purchase length setting controls placement of flanged ends at fixed intervals for long runs.



Insert Tap

Use this command when in need to tap a drain, vent, or instrument connection. Used to place taps on all piping components; elbows, tees, caps, valves, pipes, and so forth; except for mating parts.





LAB – 12

LAB – 13 (optional)

LAB – 14 (optional)

LAB – 15

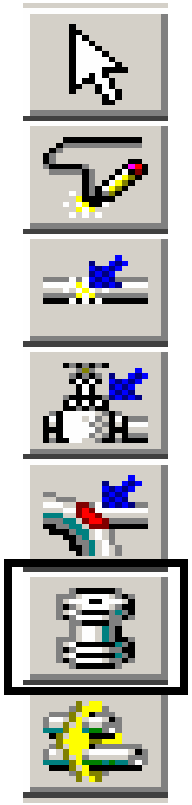
LAB – 15A

LAB – 16

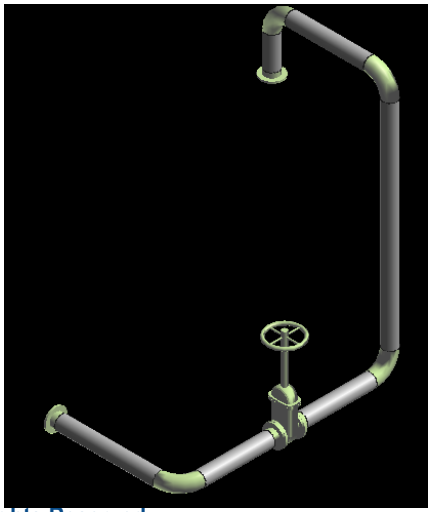
LAB – 17

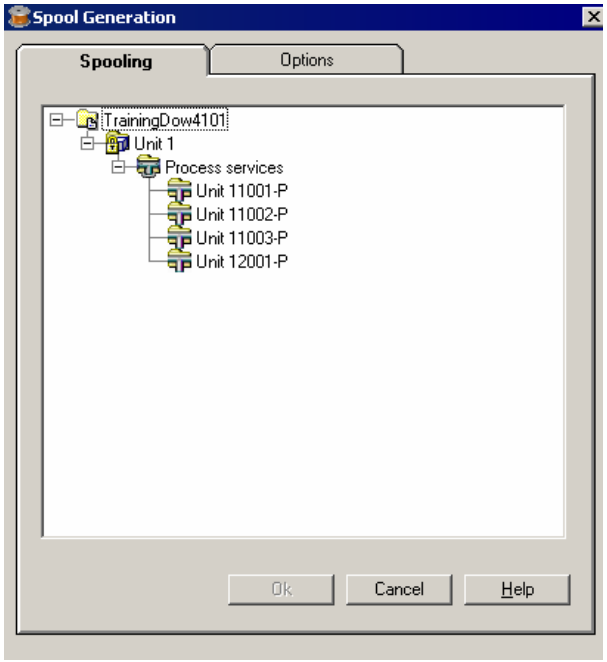
LAB – 18

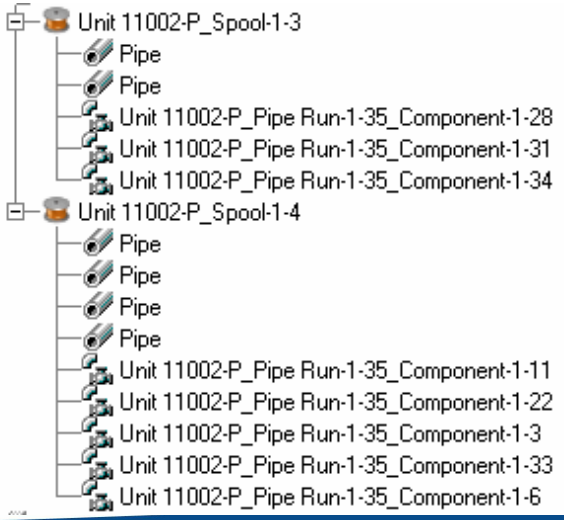
Spools



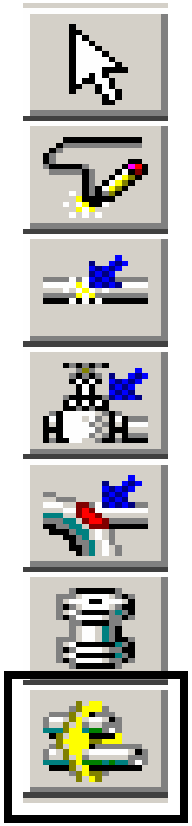
- Generation of Spools
  - Generate Spools



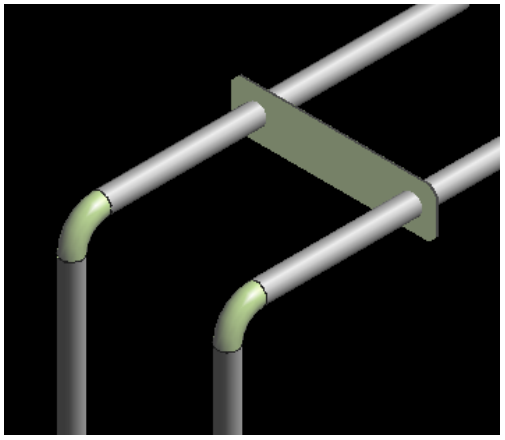


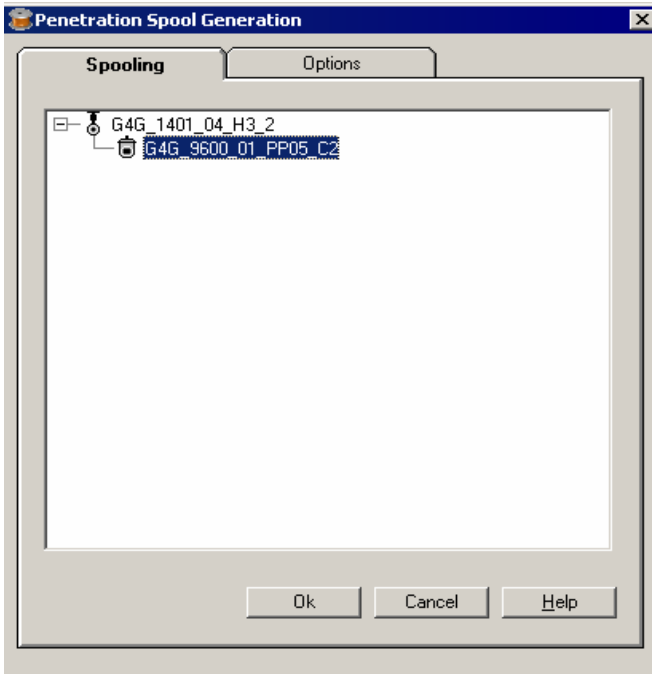


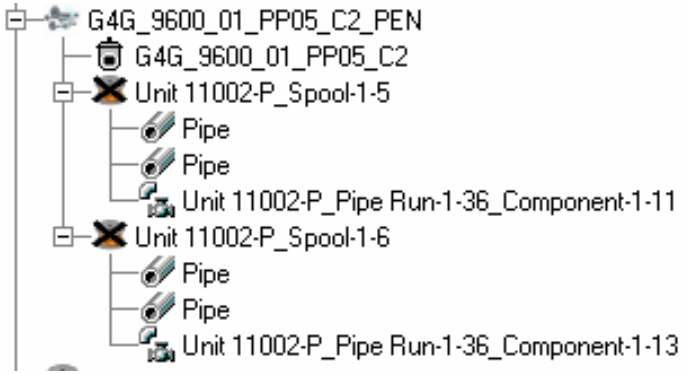
Spools



- Generation of Spools
  - Create Penetration Spools



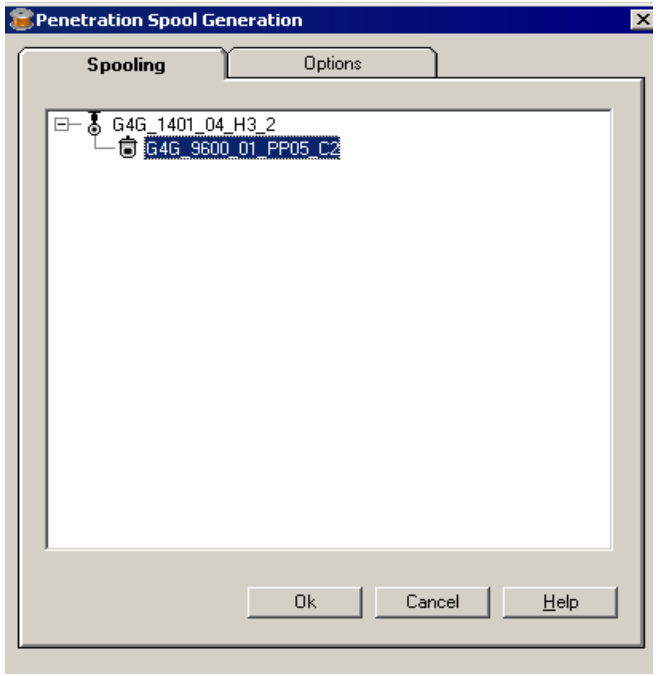


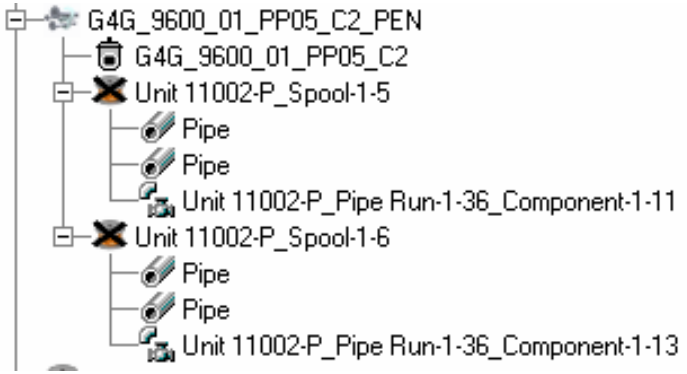


Spools

- Naming of Spools

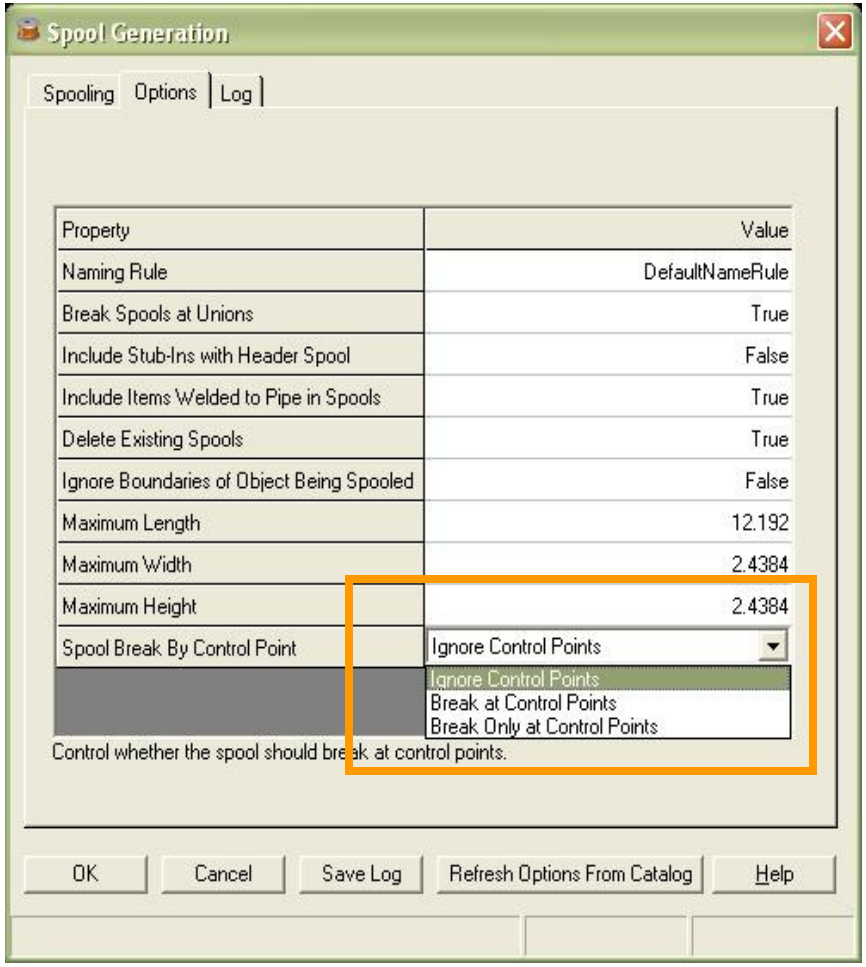
  Spooling options always default to those defined in the Catalog with interactive setting changes persisting for the current session only.





Spools

- Breaks at unions by system
- Breaks at user defined break points like field welds or take-down joints
- Breaks at user defined control points
  - Will only work when user places control point associated to a connect point

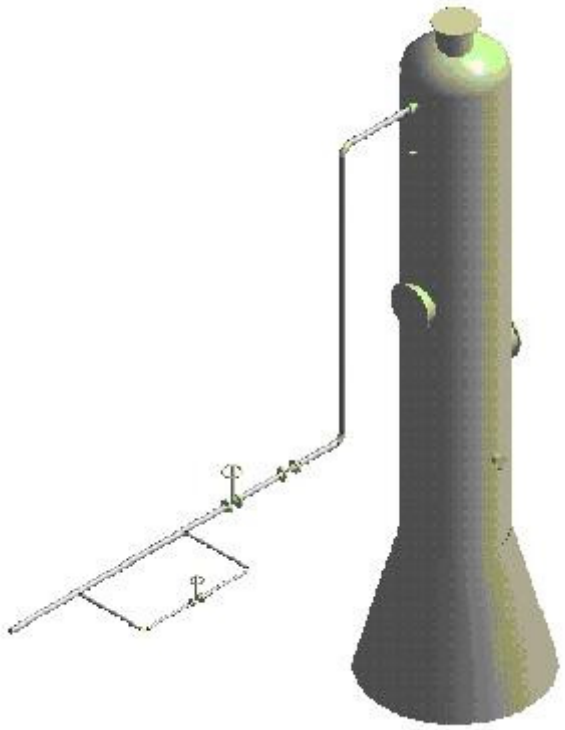


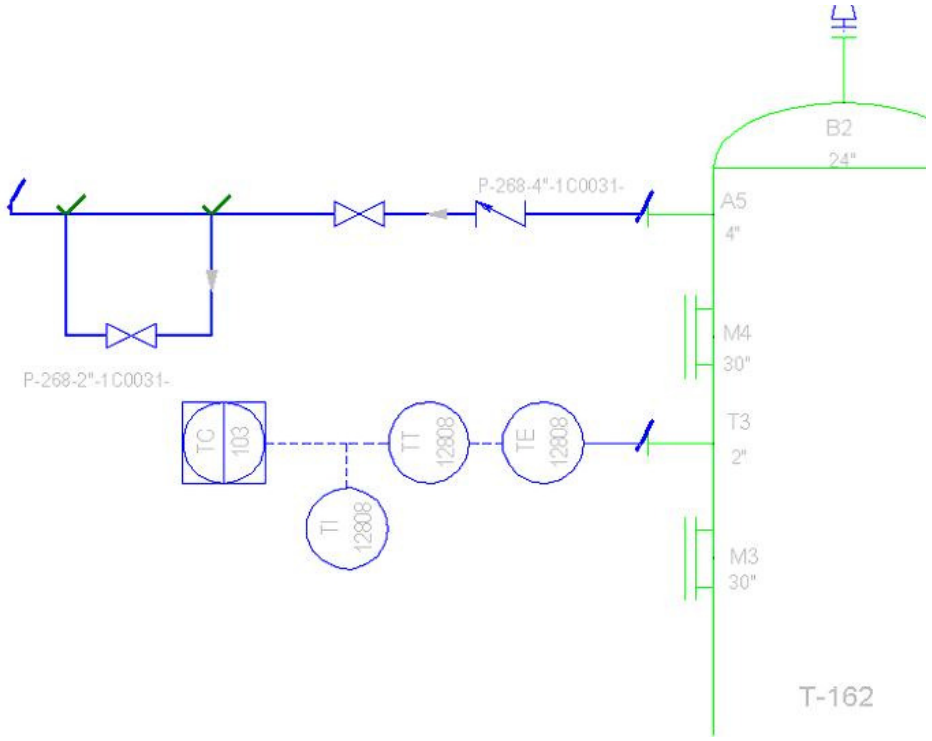
Sequence Objects

Re-numbers welds or spools in the selected pipeline, pipe run, or spool such that the names are in order. You can select to sequence the objects based on flow direction or topology.

TEF and Routing From P&ID

Users can import SmartPlant P&ID pipeline and component data into the 3D active data.





LAB – 19

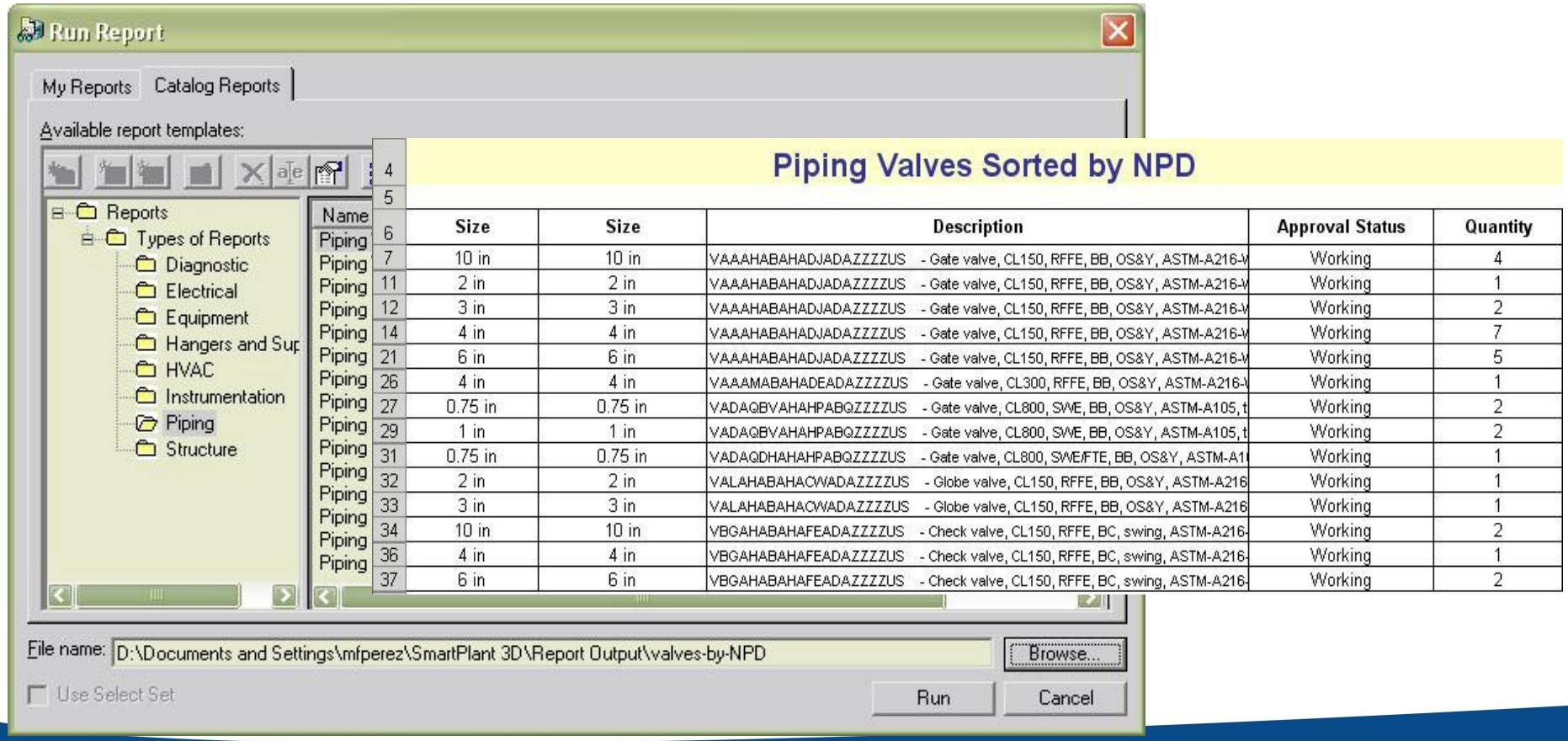
LAB – 20

LAB – 21

LAB – 22

Materials Reports

Users can easily extract piping materials lists for review from their modeled pipelines

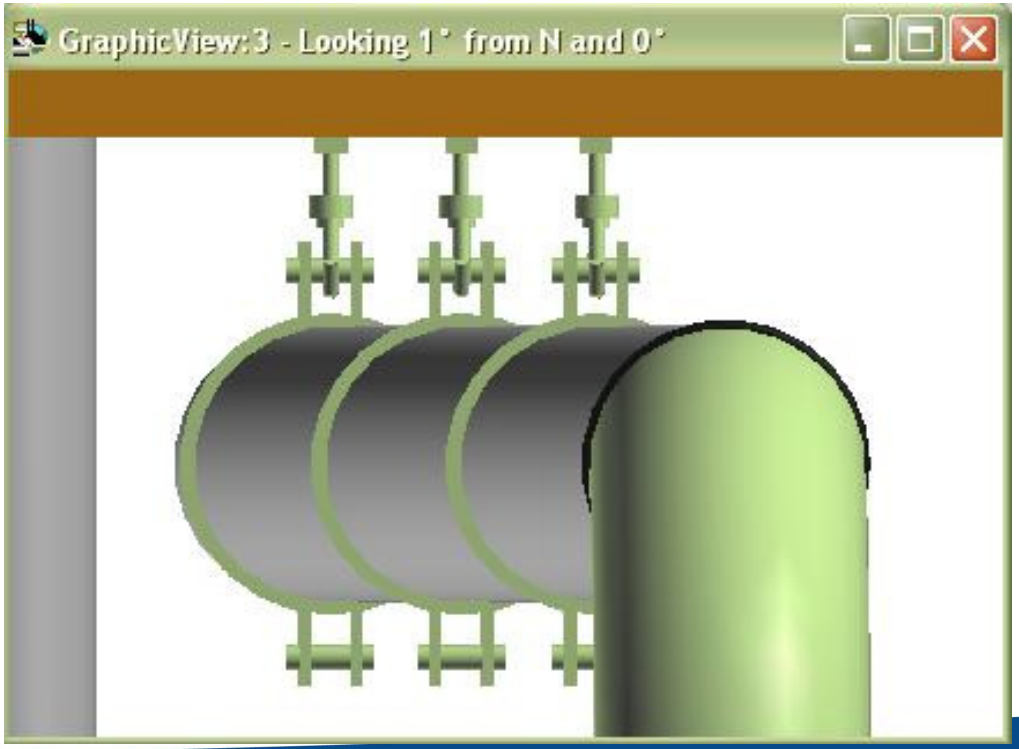


Piping Valves Sorted by NPD

	Size	Size	Description	Approval Status	Quantity
7	10 in	10 in	VAAAHABAHADJADAZZZZUS - Gate valve, CL150, RFFE, BB, OS&Y, ASTM-A216-W	Working	4
11	2 in	2 in	VAAAHABAHADJADAZZZZUS - Gate valve, CL150, RFFE, BB, OS&Y, ASTM-A216-W	Working	1
12	3 in	3 in	VAAAHABAHADJADAZZZZUS - Gate valve, CL150, RFFE, BB, OS&Y, ASTM-A216-W	Working	2
14	4 in	4 in	VAAAHABAHADJADAZZZZUS - Gate valve, CL150, RFFE, BB, OS&Y, ASTM-A216-W	Working	7
21	6 in	6 in	VAAAHABAHADJADAZZZZUS - Gate valve, CL150, RFFE, BB, OS&Y, ASTM-A216-W	Working	5
26	4 in	4 in	VAAAMABAHADEADAZZZZUS - Gate valve, CL300, RFFE, BB, OS&Y, ASTM-A216-W	Working	1
27	0.75 in	0.75 in	VADAQBVAHAHPABQZZZZUS - Gate valve, CL800, SWE, BB, OS&Y, ASTM-A105, t	Working	2
29	1 in	1 in	VADAQBVAHAHPABQZZZZUS - Gate valve, CL800, SWE, BB, OS&Y, ASTM-A105, t	Working	2
31	0.75 in	0.75 in	VADAQDHAHAHPABQZZZZUS - Gate valve, CL800, SWE/FTE, BB, OS&Y, ASTM-A1	Working	1
32	2 in	2 in	VALAHABAHACWADAZZZZUS - Globe valve, CL150, RFFE, BB, OS&Y, ASTM-A216	Working	1
33	3 in	3 in	VALAHABAHACWADAZZZZUS - Globe valve, CL150, RFFE, BB, OS&Y, ASTM-A216	Working	1
34	10 in	10 in	VBGAHABAHAFEADAZZZZUS - Check valve, CL150, RFFE, BC, swing, ASTM-A216-	Working	2
36	4 in	4 in	VBGAHABAHAFEADAZZZZUS - Check valve, CL150, RFFE, BC, swing, ASTM-A216-	Working	1
37	6 in	6 in	VBGAHABAHAFEADAZZZZUS - Check valve, CL150, RFFE, BC, swing, ASTM-A216-	Working	2

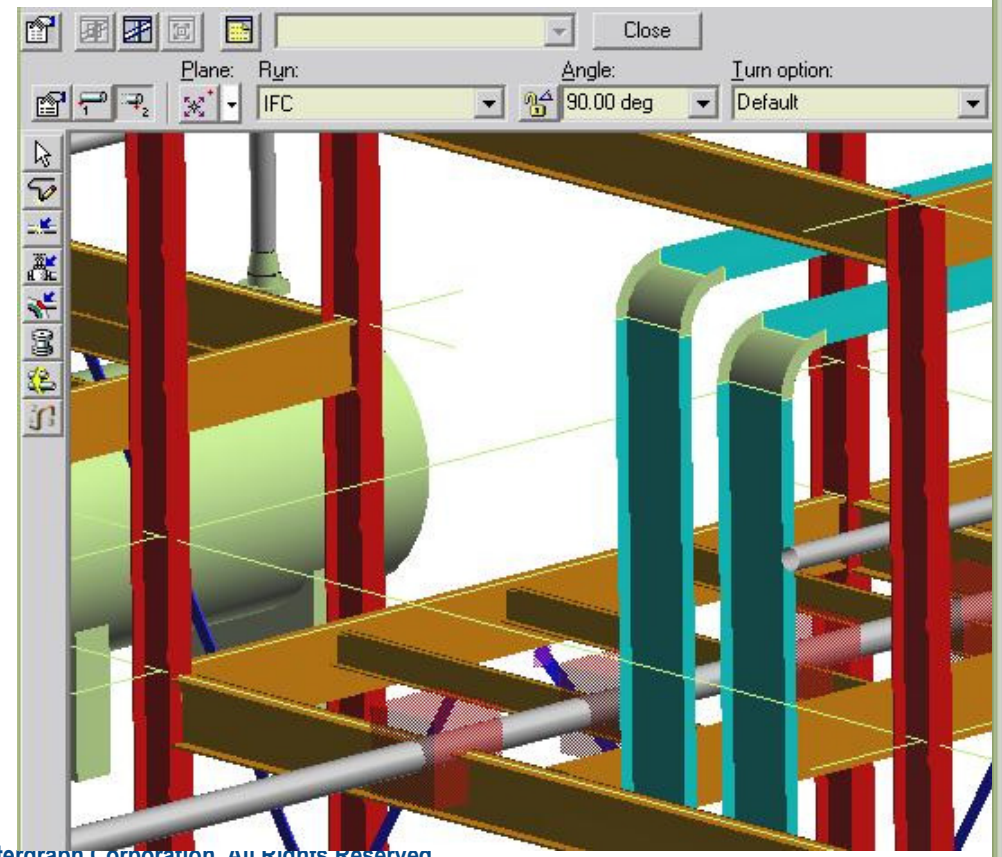
Pipe Supports

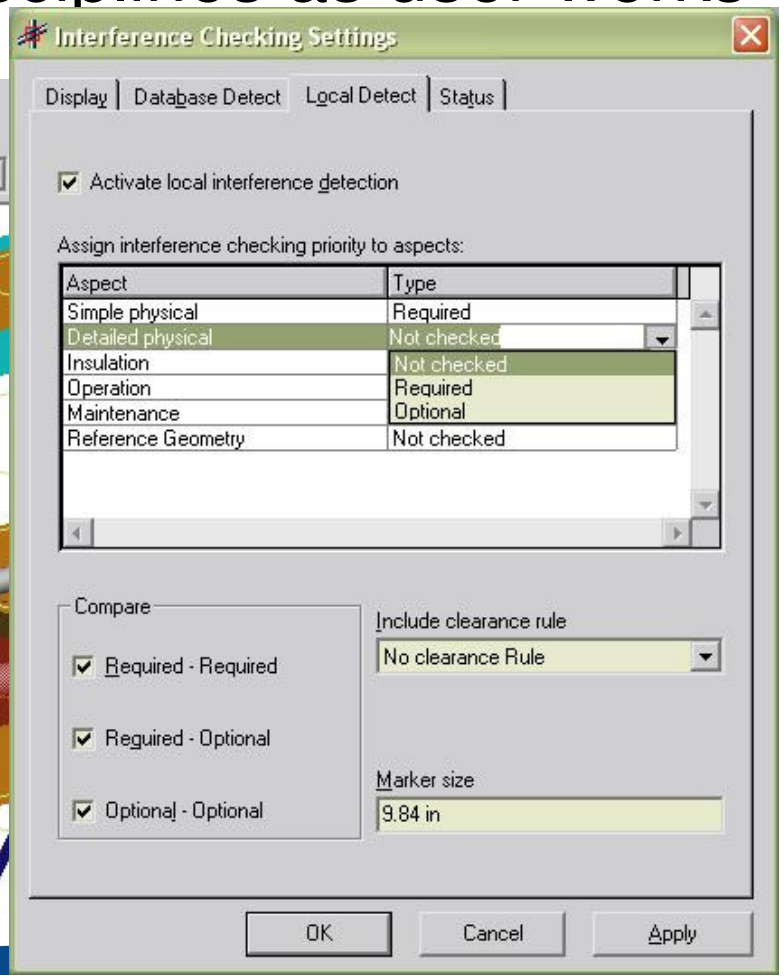
Hangers and Supports Task provides an integrated supports environment.



Interactive Clash Detection

System can check new piping for interferences with same and other displayed disciplines as user works





Checking Interferences

SP3D provides two mode of operations:

- Server-based Interference checking (Database Detect).
  - Run on a separate IFC server
  - Look for all interferences for the full model
- Interactive interference checking (Local Detect).
  - Help the designer in real time
  - Local to a session (what you see in your workspace)

Checking Interferences

Major Differences between the two methods:

Database Detect	Local Detect
Runs all the time (System Admin. choice)	Works only within the current session
Minimizes impact on users and improves performance	Provides immediate graphical feedback (works in a dynamic mode)
Creates persistent interferences that are stored in the model database	Shows interferences when the pointer is idle for a brief amount of time; based on a hesitation approach
Based on administrator settings (controlled by permission groups)	Based on individual user settings
Provides feed back on how much has been checked	Checks only created and modified items
Users can visualize the interferences (persistent items)	Clears dynamic interferences after refreshing workspace

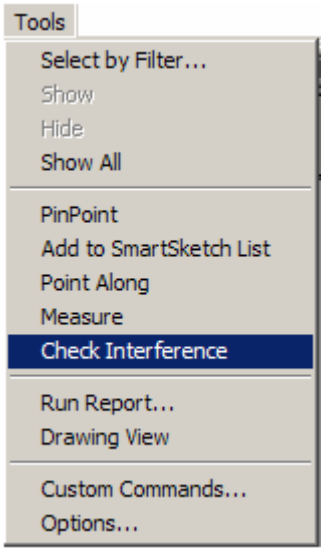
Checking Interferences

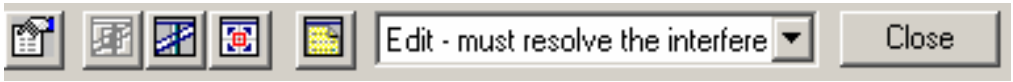
IFC is available in all Task

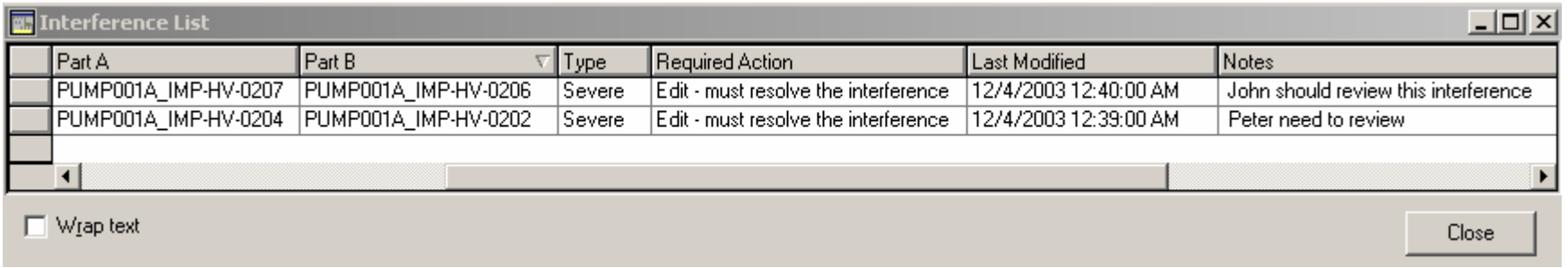
Very simple and intuitive GUI

Ribbon bar includes:

- Settings
- Visualization
- Review & Approval







Checking Interferences

Three type of checking (based on the object aspects):

- Required
- Optional
- Not Checked

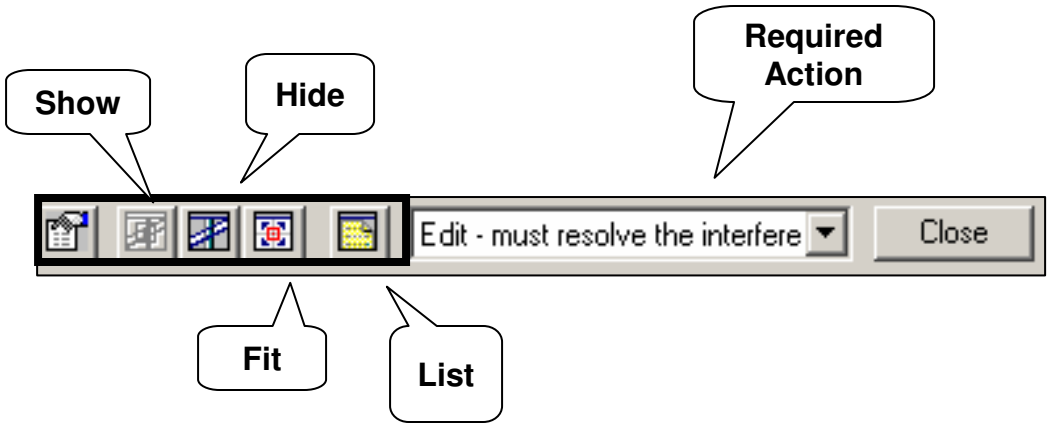
Can process:

- Required – Required
- Required – Optional
- Optional – Optional

A clearance rule can be used

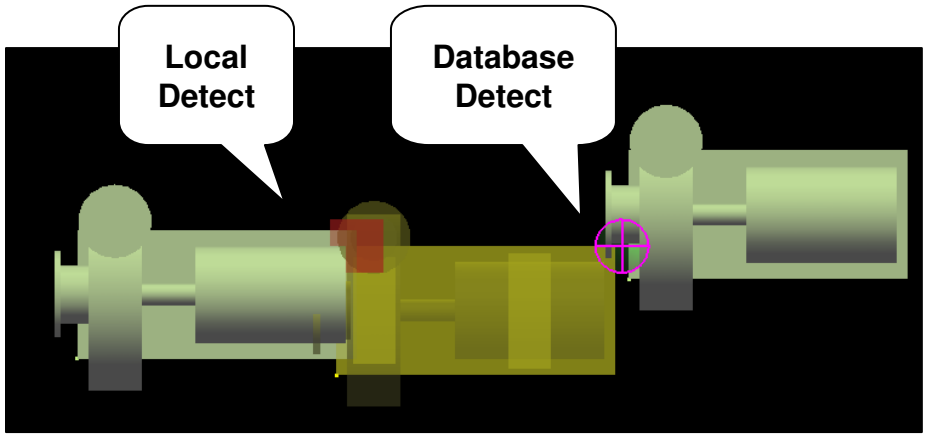
Checking Interferences

Check Interference ribbon bar



Checking Interferences

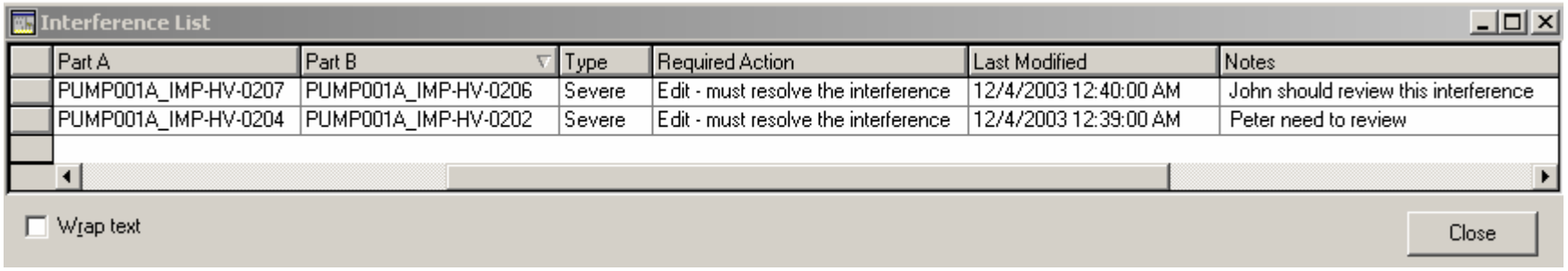
- Any persistent interference detected by the Database Detect process appears as a sphere
- Interference detected by the Local Detect process appears as a box



Checking Interferences

Interference List Dialog Box

- Resizable
- Can Sort the listed interferences
- Highlight an interference in the workspace
- Right click to open the Interference properties dialog



LAB – 23

LAB – 24

LAB – 25