AUTODESK UNIVERSITY

Fabrication Parts in REVIT: Understanding how Design to Fabrication works in REVIT

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Learning Objectives

- Understanding the theory of Design Line
- Learn to maximize the use of minimal button mappings with Design Line
- Modifying Service Templates to make Design to FAB work effectively
- Learn to use the configuration and profiles for the Design to Fabrication Revit Environment

Description

In this class we will discuss converting Generic REVIT Parts into Fabrication Parts or Design to Fabrication. We will cover setting up services and service templates in the Fabrication Products to get the best results inside of REVIT. This class will focus on the importance of Design Line setup to make the Design to Fabrication process most effective.

Your AU Experts

William Tucker
William is currently working at Comfort Systems USA, a Premier Mechanical Systems Installation and Service provider, as BIM Trainer and Product Specialist. CSUSA is a national organization with 24 companies, 7 Sheet Metal Fabrication Shops and 190 users currently sharing the Autodesk Fabrication Products with one database. William is responsible for implementing, training, and advising on best practices for these companies, developing standards within the organization, and providing technology recommendations for the future. In the past, William has trained and Implemented Autodesk Fabrication CADmep, ESTmep, and CAMduct as well as utilized it as a 3D detailing and coordination package. William has been using Autodesk Products for 29 years. William enjoys helping others utilize the software to its fullest extent.

Kevin Allen
Kevin is currently employed at Comfort Systems USA, a Premier Mechanical Systems Installation and Service provider with annual revenue of $1.6B, as Director of BIM and Productivity. CSUSA is a national organization with over 7K employees and 36 operating companies, with some being service only. Currently 24 of these locations utilize Virtual Design/Construction, with 7 Sheet Metal Fabrication Shops, numerous pipe and plumbing shops, with 190 employees utilizing the Autodesk Fabrication Suite of Products on ONE database. Kevin is responsible for implementing, training, and advising on best practices for these companies, developing standards within the organization, and providing technology recommendations for the future, along with numerous other tasks. In the past, Kevin has trained Autodesk Fabrication CADmep, as well as utilized it as a 3D detailing and coordination package. Kevin enjoys helping others utilize the software to its fullest extent.

For many years I have heard many negative comments about Design Line:

- "I do not use Design Line because it does not work"
- "I do not use Design Line because it does not work all the time"
- "Design Line did not fill ALL of my fittings"
- "Design Line is not setup correctly"

Well people, if you plan to use "Design to Fabrication" in REVIT and you are one that made any of these comments, then you have some work to do. If you will look at Design Line to be a rough-in tool, then it works great. We try to setup our services in Fabrication to where we can get at least 80% of Design Line to fill, I would say that we actually get about 90% to fill. In REVIT depending on who drew it, I feel that we will be lucky to get 80% to fill.

The Theory of Design Line

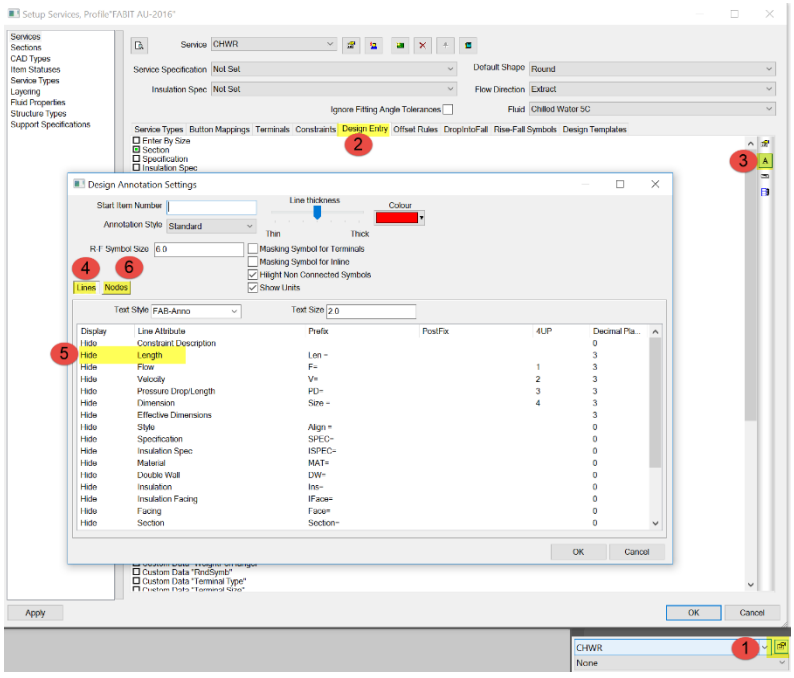
In REVIT, the "*Design to Fabrication*" button works from the functionality of Autodesk Fabrication products "*Design Line*" setup. If you do not have design line setup in the fabrication products, *Design to Fabrication* will not work in REVIT.

I have noticed over the years of working with Design Line setup that a lot of people cannot grasp the theory of how design line functions. To me it is very simple and I will try to explain it to you the simplest way I can.

For further information, you can refer to Autodesk Fabrication User's Guide" http://help.autodesk.com/view/FABRICATION/2017/ENU/?guid=GUID-CBB49F4A-DDD9-4056-8965-5D92396468D7

I am going to use a Chilled Water piping service for this example, Sheet Metal is almost the same strategy, just a bit more complicated (I will get to that later).
Let's look at the Design Line annotation settings.

1. Click on edit service button
2. Select the "Design Entry" tab
3. Select the "Design Annotations Settings" button on the right
4. On the "Lines" window
5. In the lower section you can select (Toggle Show/Hide) any fields that you want to be annotated on the Design Line.
6. Design Line "Node Keywords", Elevations are in the "Nodes" window; I am just interested in the "Node keywords" for now, I will leave them set to "Show".

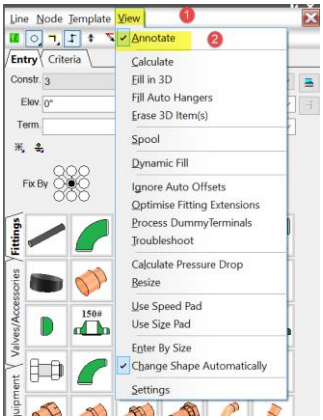


I am going to hide everything in the "Lines" window for now to remove some clutter from the screen.

I am going to draw a new small Design Line using a size of 6" with one 90 degree turn and one 6" branch line and one 3" branch line like the image below.

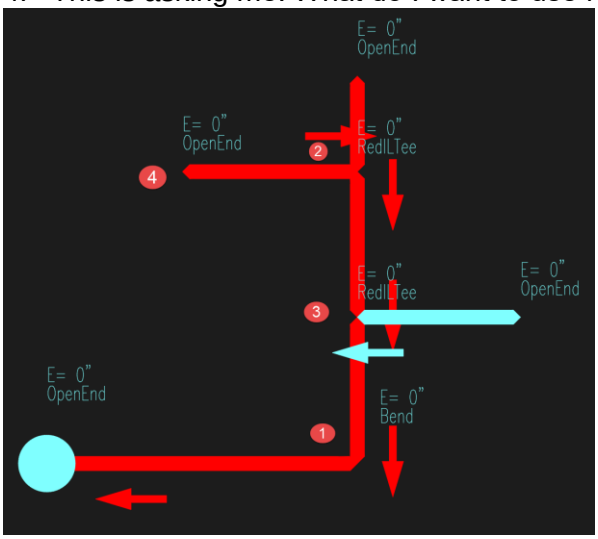
Go to the Design Line interface and"

1. Select View
2. Select annotate



Notice the "Node Keywords" on the annotation. The way that I like to look at this is: *What is Design Line asking for?*

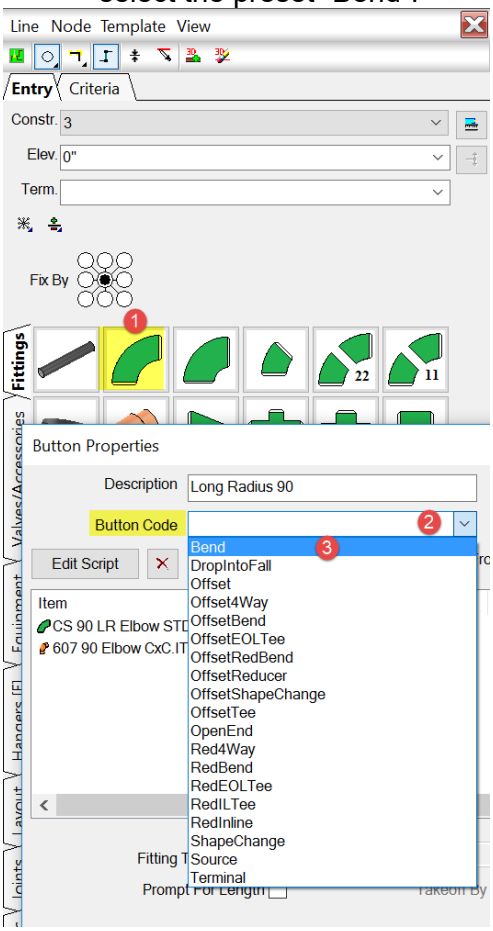
1. This is asking me: What do I want to use for a "Bend"
2. This is asking me: What do I want to use for a "RedILTee"(Tee)
3. This is asking me: What do I want to use for a "RedILTee"(Tee)
4. This is asking me: What do I want to use for an "Open End"



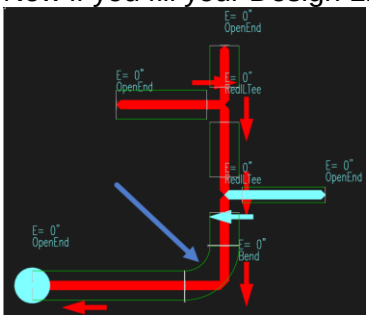
At this point if you fill your Design Line and it is not setup properly, you will not get any fittings but you should get pipe.
Now let's work on the bend. In this case I want to use a 90-degree long radius elbow. We now need to add a "Button Code" to the 90-degree long radius elbow.

1. Right click on the 90-degree long radius elbow on your service temple and select button properties.

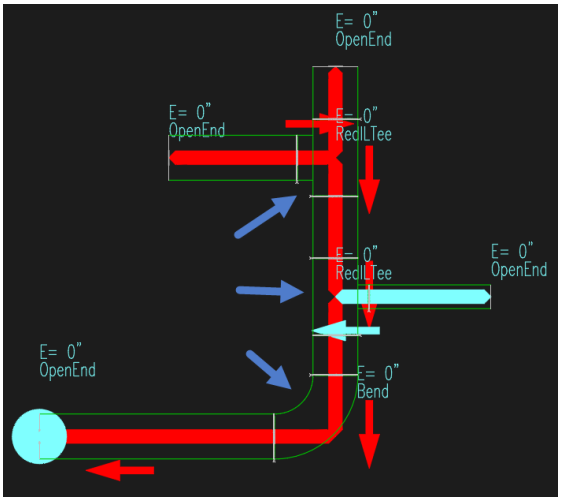
2. Use the pull down for the button codes.
3. Notice the preset button codes that will match the Design line “Keywords” I am going to select the preset “Bend”.



Now if you fill your Design Line you should get your 90-degree long radius elbow to fill.



I am now going to assign a Tee and a Reducing Tee as a “RedILTee” and fill the design line again, now I have all three fittings filled.



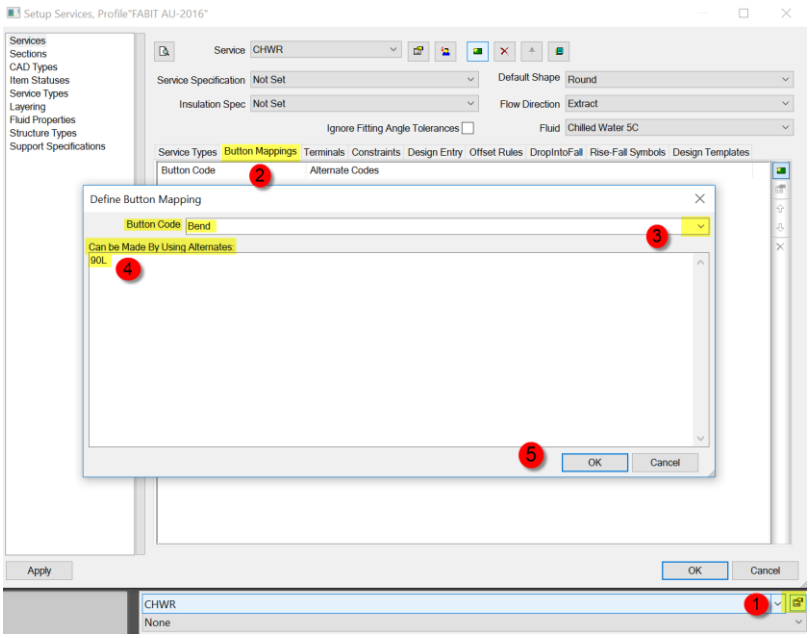
Now that is about as simple as it can get.
Using the default “Button Codes” will work, but if you want efficiency, it can get a little more complicated. Instead if using the default button codes, I like to use “Alternate Button Codes” and “Button Mappings” for more control over what fittings I want to use in certain places.

Let’s reassign the button codes on those same fittings.

- For the 90 I will Assign it as “90L”
- For the Straight Tee I will Assign it as “T”
- For the Reducing Tee I will Assign it as “TR”
- I have a short Radius 90 I will Assign it as “90”

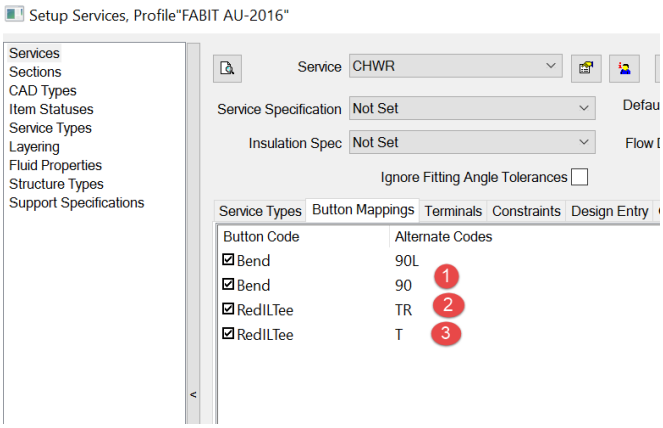
I will now assign some Button Mappings.

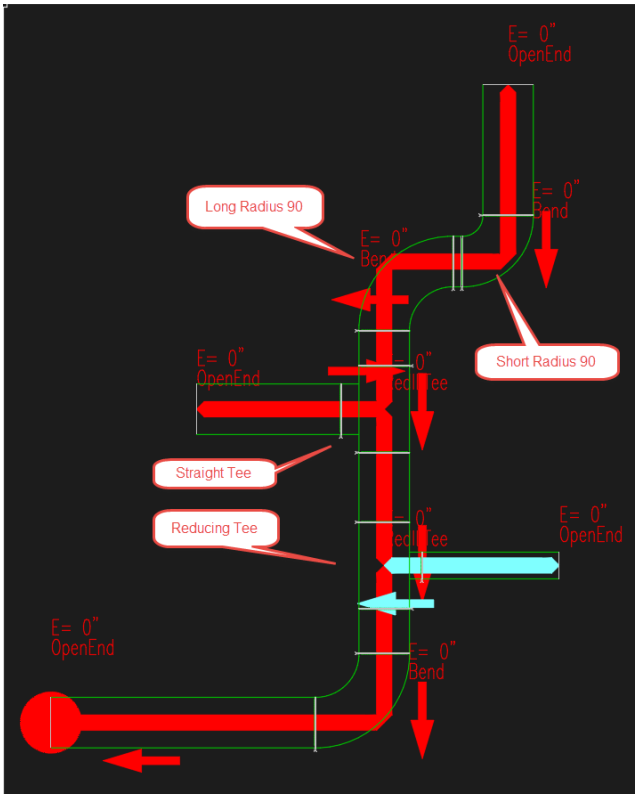
1. Select the “Edit Service” button
2. Select the “Button Mappings” tab
3. Select “Bend” from the pulldown
4. Assign “90L” for the “Alternate Button Code” this will take care of the Long radius 90.
5. Select “OK”



Now I will assign the short radius 90 and the two tees
Design Line will read the button mappings from top to bottom.

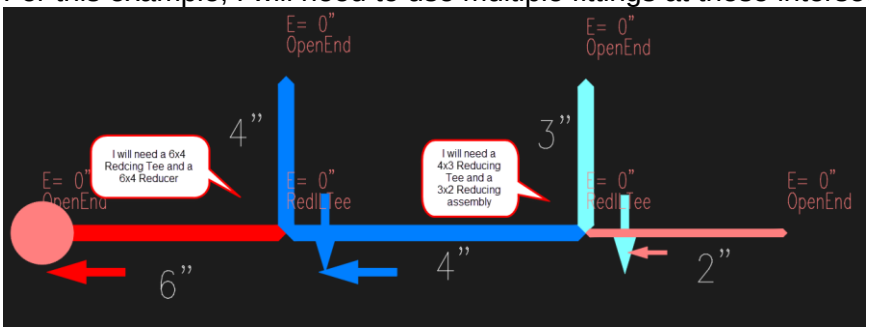
- For the bends it will try to place the long radius 90 first if it fits, but if not it will place the short radius 90.
- For the tees it will try to place the reducing tee before it tries to place the straight tee.



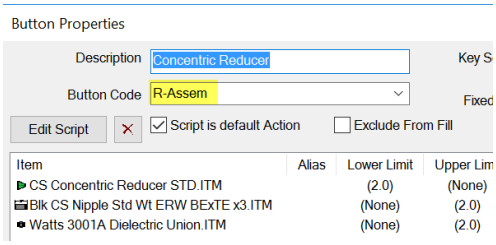


Let's setup some button mappings to place multiple fittings

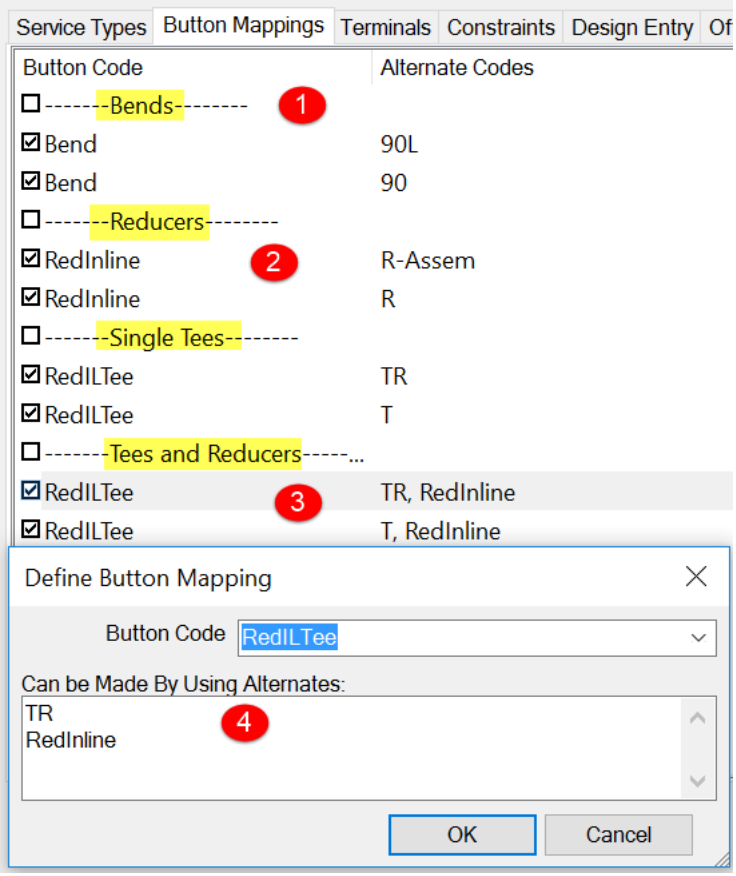
For this example, I will need to use multiple fittings at these intersections.

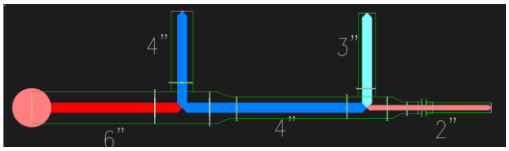


In my service I have a button setup that will use a Concentric Reducer + a nipple with threads on one end + Dielectric Union. I have a button code of "R-Assem" assigned to it. This assembly will only be placed if it is 2" or under.



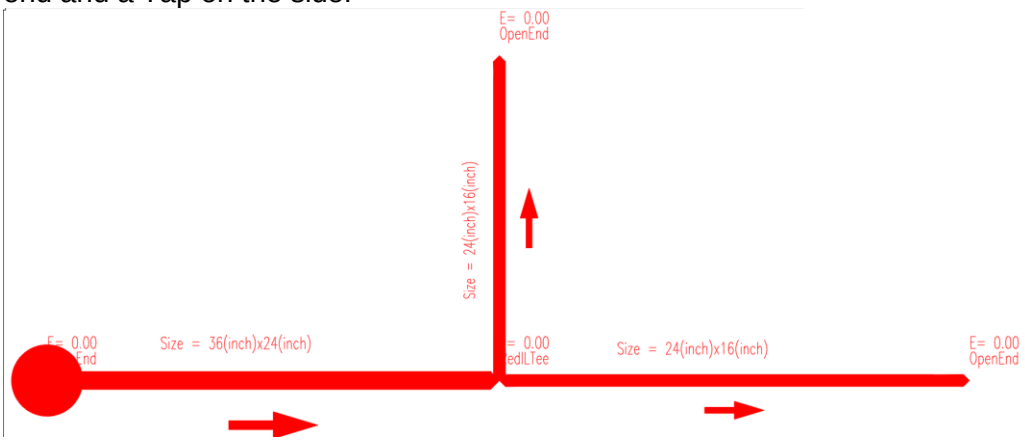
1. I have added some blank Button mappings in as separators for clarity.
2. I have added the two reducers in as “RedInlines”, one for my concentric reducer and one for my reducing assembly. Notice that the reducing assembly is above the concentric reducer and remember that I said that the Reducing assembly would only place for 2” and under.
3. I have added a group in for “Tees and Reducers” and added some more RedILTees I assigned The “TR” for my reducing tee, hit enter and added “RedInLine” this will cause a recursion to where now I am telling Design Line that I want to use my reducing tee and one of my reducers, I will do the same for my R-Assem.
4. For these alternate button mappings type in the TR, press enter and then add the second line. Notice that under the button mappings it reads “TR,RedInline”….DO NOT type it in that way!





Sheet Metal Strategy

For this example, I want to show how to get Design Line place a piece of duct, transition on the end and a Tap on the side.



To create a Tee with a tap you cannot use the Tap alone, you will need a piece of straight duct and a tap. Looking at the Image below we have “1” for a button code for any “straight” in our services (Rectangular, Round or Oval).

Note: Design Line knows the difference between Rectangular, Round and Oval, there is no need to assign them different button codes.

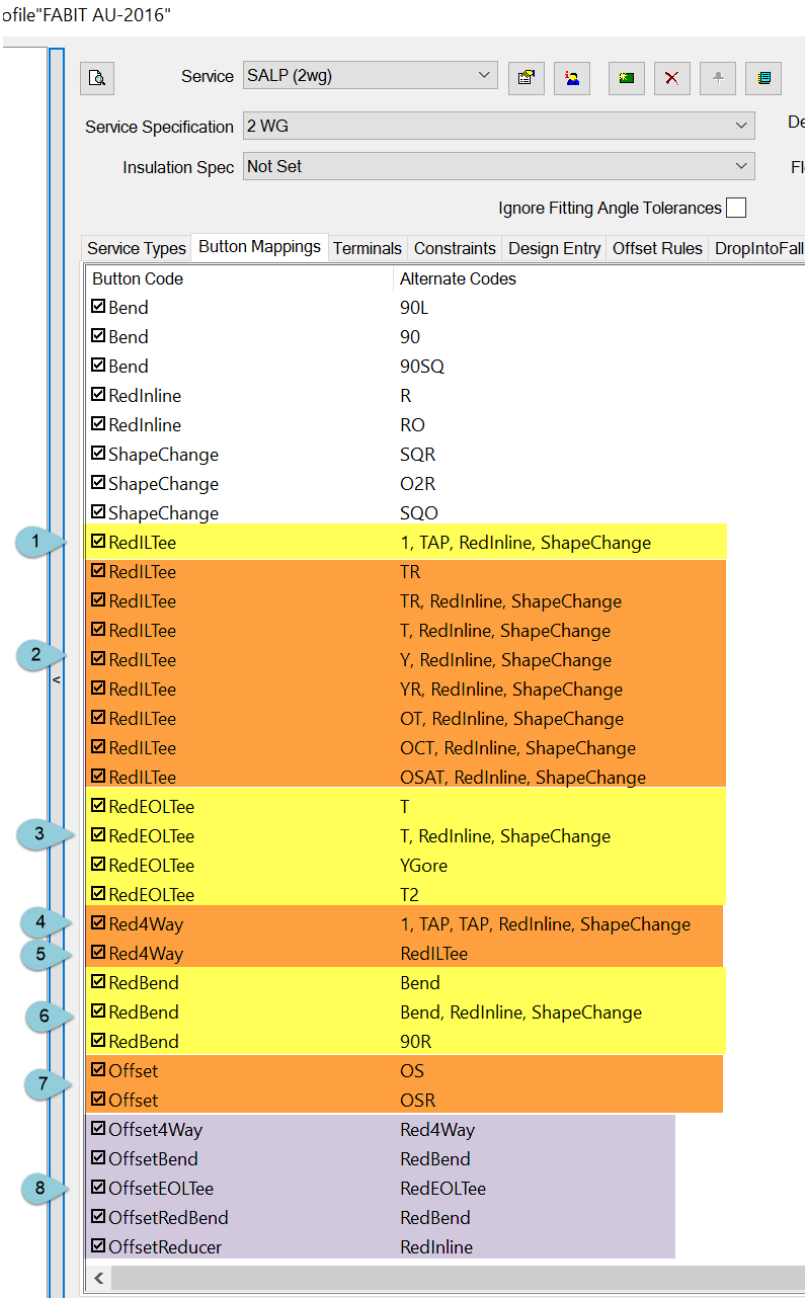
What I am asking Design Line to give me here for a RedILTee is;

1. Give me a piece of Straight duct (1) and a Tap and if I need it give me a RedInline (Transition) or a ShapeChange (Square-To-Round).

☑ RedInline	R
☑ RedInline	RO
☑ ShapeChange	SQR
☑ ShapeChange	O2R
☑ ShapeChange	SQO
☑ RedILTee	1, TAP, RedInline, ShapeChange

In the image below I will try to explain my strategy for these button mapping;

1. This should take care of all of my Straights and TAPs for a RedILTee
2. These will take care of all of my Rectangular, Round and Oval Tee fittings
3. These will take care of all of my Rectangular, Round and Oval End of line Tee fittings
4. This one should take care of all of my Straights with Taps. Red4Way can get a little tricky, in this case I am asking Design Line to give me a piece of straight, a Tap for side A and a Tap for side B and if I need it give me a RedInline (Transition) or a ShapeChange (Square-To-Round).
5. This is a recursion to take care of all of my Rectangular, Round and Oval 4 way fittings, (I have all of my 4 way fittings assigned the same button codes as my Tee fittings for similar fittings)
6. RedBend, this one could be a bit of a strategy depending on how your shop wants to fabricate. Most of our companies do not want to make a Drop Cheek Elbow if they don't have to. All of our square elbows in our service will change width and angle, so we have that one is set as our default reducing bend, if that will not fill we want an elbow and a transition or a square-to-round. The drop cheek elbow is our last option.
7. This one will take care of our Offsets
8. These offset button mappings are recursions going back to their predecessors

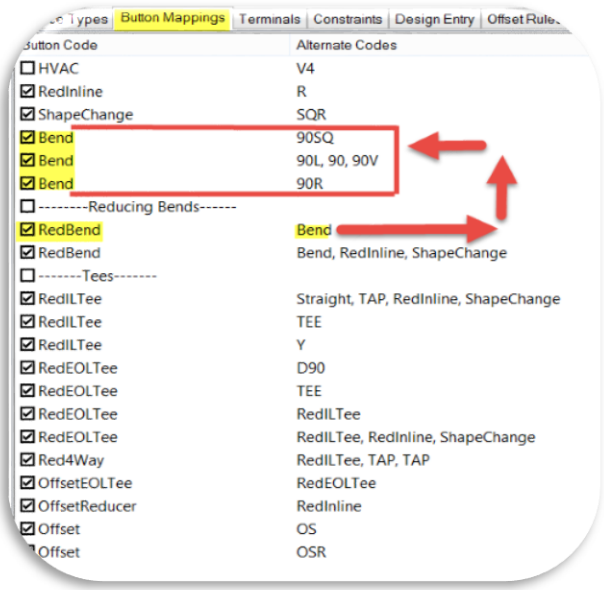


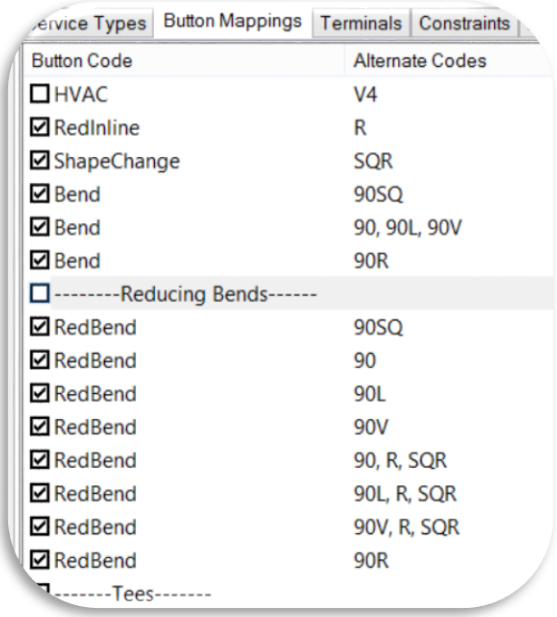
Maximize the use of minimal button mappings

You can setup your services to use as many button mappings/line items as you want or need. You can also set them up with as few as needed.
We like to use the KISS method “Keep It Simple, Stupid”

We like to use recursions to minimize the number of button mappings that we use.

Here is the same Service as an example side by side, one with recursions and one without. They will both work, but as you can see, utilizing recursion simplifies things tremendously. On the left, there are two (2) lines in the Button Mappings for RedBend, but on the right, it takes eight (8) lines to achieve the same results, and this is just for a Node Keyword of RedBend.



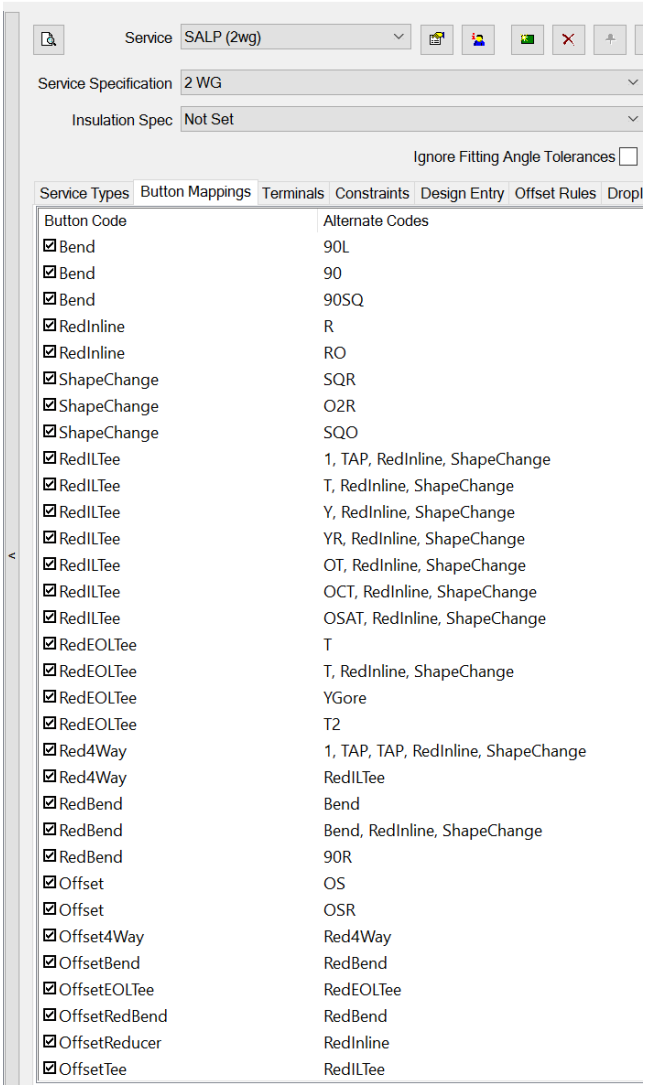


In our CSUSA National database we have 336 services and we basically have 4 different strategies that we use for button mappings.

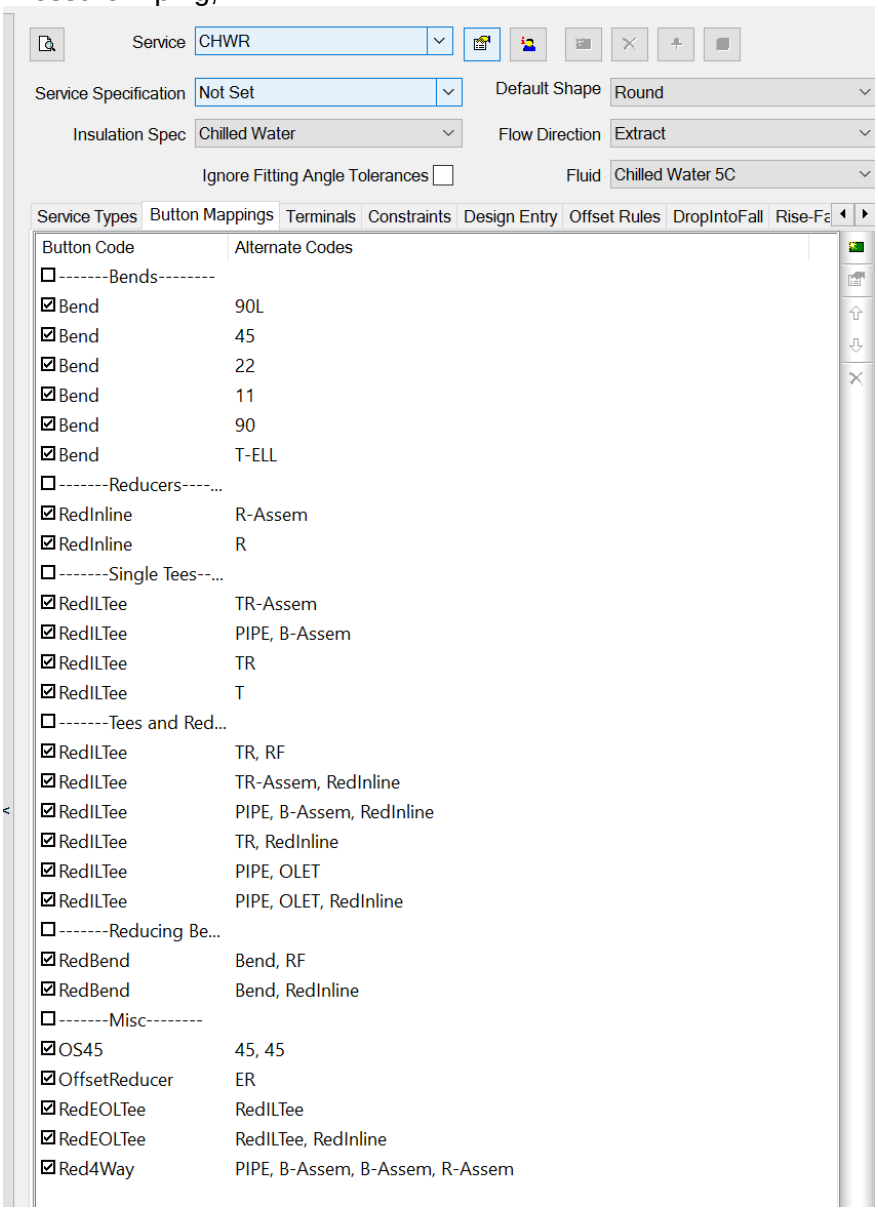
1. Sheet Metal
2. Pressure Piping
3. Sanitary Drain Piping
4. Sanitary Vent Piping

MSF21097

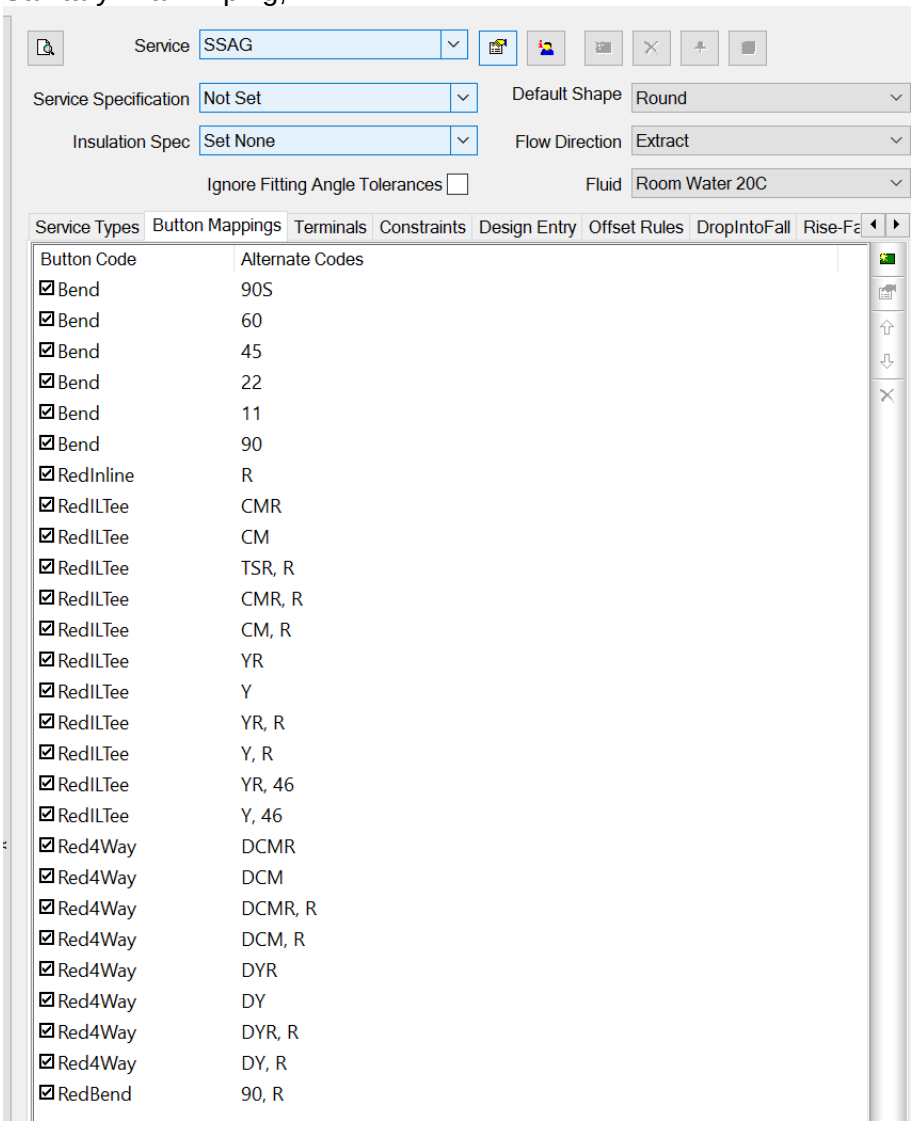
Sheet Metal;


Service
SALP (2wg)
Service Specification
2 WG
Insulation Spec
Not Set
Ignore Fitting Angle Tolerances
Service Types
Button Mappings
Terminals
Constraints
Design Entry
Offset Rules
Button Code
Alternate Codes
Bend 90L
Bend 90
Bend 90SQ
RedInline R
RedInline RO
ShapeChange SQR
ShapeChange O2R
ShapeChange SQO
RedILTee 1, TAP, RedInline, ShapeChange
RedILTee T, RedInline, ShapeChange
RedILTee Y, RedInline, ShapeChange
RedILTee YR, RedInline, ShapeChange
RedILTee OT, RedInline, ShapeChange
RedILTee OCT, RedInline, ShapeChange
RedILTee OSAT, RedInline, ShapeChange
RedEOLTee T
RedEOLTee T, RedInline, ShapeChange
RedEOLTee YGore
RedEOLTee T2
Red4Way 1, TAP, TAP, RedInline, ShapeChange
Red4Way RedILTee
RedBend Bend
RedBend Bend, RedInline, ShapeChange
RedBend 90R
Offset OS
Offset OSR
Offset4Way Red4Way
OffsetBend RedBend
OffsetEOLTee RedEOLTee
OffsetRedBend RedBend
OffsetReducer RedInline
OffsetTee RedILTee

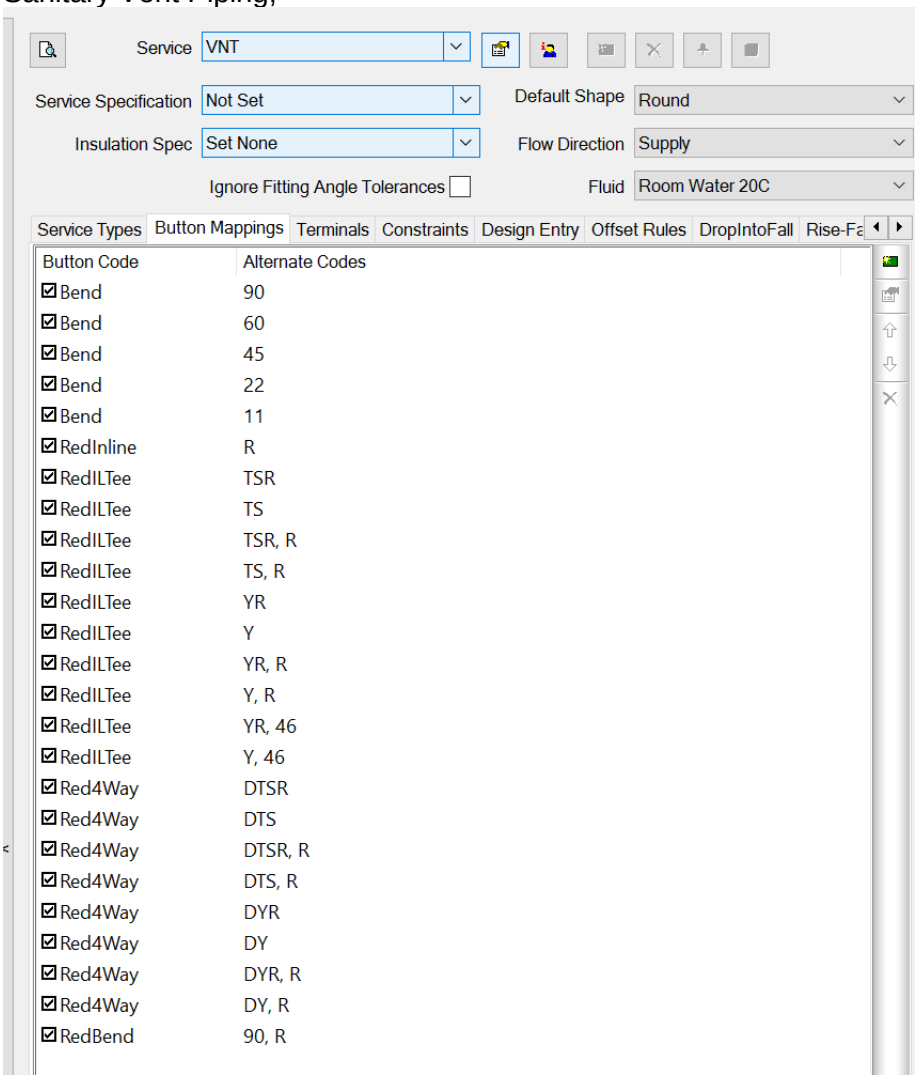
Pressure Piping;



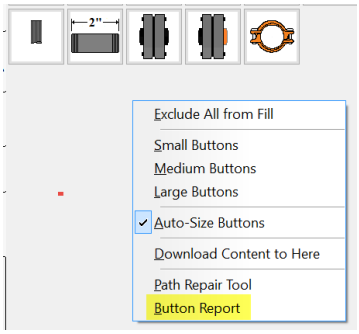
Sanitary Drain Piping;



Sanitary Vent Piping;



Assigning button codes to the fittings can be done by right clicking on the fitting and select “Button Properties”
This can also be accomplished in a more efficient method by right clicking in an open space on the service pallet and select button report, you can enter your button codes in the button code column.



Button Viewer

Tab	Name	Button Code	Exclude From Fill
Fittings	Trimmed Elbow (11.25)	11	N
Fittings	45 Elbow	45	N
Fittings	Short Radius 90	90	N
Fittings	607R Reducing 90 Elbow CxC	90	N
Fittings	Long Radius 90	90L	N
Fittings	Reducing Elbow	90R	N
Fittings	Short Radius Return Bend	180	N
Fittings	Long Radius Return Bend	180L	N
Fittings	603-2 Adapter FPTxFtg	603-2	N
Fittings	604-2 Adapter FtgxMPT	604-2	N
Valves/Accessories	Auto Air Vent	AAV	N
Fittings	603 Adapter CxFPT	AF	N
Fittings	604 Adapter CxM	AM	N
Fittings	Weld-O-Let	B-Assem	N
Fittings	Stub In (A53 ERW Sch 40 PE) - Copy	B-Assem	N
Assem	Std Blk Stl Nipple x 3	B-Assem	N
Hangers	CT138R Split Ring Hanger Cu	BH	[Y]
Hangers	Fig 2WON Adjustable Band Hanger	BH	[Y]
Joints	150 # Bolt Set	BS	N
Valves/Accessories	T-580-70 Ball Valve	BV	N
Fittings	Standard Cap	C	N
Hangers	Fig 1 Clevis Hanger Blk	CH	[Y]
Hangers	Fig 260 Clevis Hanger	CH	Y
Valves/Accessories	F-910-B Silent Check	CHECK	N
Valves/Accessories	S-413-W Check Valve	CHECK	N
Valves/Accessories	S-413-W Check Valve	CHECK	N

Modifying Service Templates to make Design to FAB work effectively

The way that we handle unwanted fittings on our service templates is with the feature “Exclude from Fill”. When I submitted this topic the only way that I knew to set a priority on Items was to move them to the front on the service templates: For example, all of our sheet metal taps have a button code of “Tap”.
So with the logic of Design Line the order that it will read to place a tap is;

1. The first tab
a. The first Button
b. The second Button
c. Etc..
2. The Second tab
a. The first Button
b. The second Button
c. Etc..
3. Etc..

Design line will place the first item that it can find that will work…

My suggestion for this would be to set the Taps in the order of priority and remove the items from the service template that you do not plan to use for that project. (make sure that you are using Profiles (MSF21096), (FAB22940) or Job Specific Services and service templates.

Well….Autodesk just added a new feature to Revit in 2017.1, “Exclude From Fill”
So the strategy above is not necessary, it can still be done if you choose.

Button Viewer

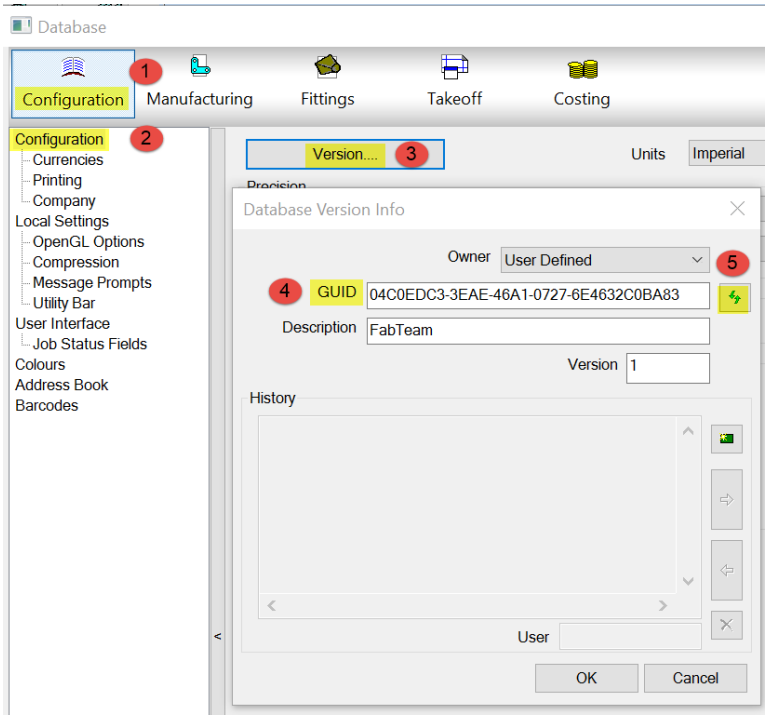
Tab	Name	Button Code	Exc
Rect	Angled Branch	TAP	N
Rect	Square Tap	TAP	Y
Rect	Rect on Round	TAP	Y
Rect	Rect Shoe on Rnd	TAP	N
Rect	Double Offset		N
Heto	HET With RPD	TAP	N
Heto	HET With Damper	TAP	N
Heto	LE HET With RPD	TAP	N
Heto	LE HET With Damper	TAP	N
Heto	Conical HET With RPD	TAP	N
Heto	Conical HET With Damper	TAP	N
Heto	LE Conical HET With RPD	TAP	N
Heto	LE Conical HET With Damper	TAP	N
Heto	STO-LDS HETO		N
Heto	STOD-LDS HETO		N
Spiral	Spiral Pipe	1	N
Spiral	90 Pressed EI	90L	N
Spiral	45 Pressed EI	90L	N
Spiral	Gored Elbow LR	90L	N
Spiral	Gored Elbow	90	N
Spiral	Reducer (CL)	R	N
Spiral	Offsetting Reducer 2 Way Offset	RO	N
Spiral	End Cap	CAP	N
Spiral	Coupling (Pipe)	CP	N
Spiral	Mitered Offset		N
Spiral	Offset Multi Segments		N
Spiral	Conical Tap (VD)	TAP	Y
Spiral	90 Tap	TAP	N
Spiral	45 Tap	TAP	N
Spiral	Conical Tap	TAP	N
Spiral	Shoe Tee Tap	TAP	N
Spiral	Flex 5'	X55	N
Spiral	Y Gore	YGore	N
Spiral	Breeches T2	T2	N
Spiral	AirTight-D	TAP	N
Spiral	Conical Tap	TAP	Y

Learn to use the configuration and profiles for the Design to Fabrication REVIT Environment

At CSUSA we choose to use Profiles (MSF21096), (FAB22940) and they are setup as “Job Specific Profiles” This will eliminate the need for Job specific services, service templates and various specifications. When Fab Parts in REVIT was included in REVIT we also saw that Profiles would be the most efficient way to utilize this feature. No reason to load the “entire” database, ONLY what is being used on this project.

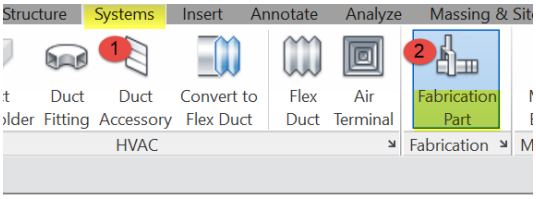
For a Configuration to work in REVIT the Fabrication database must have a GUID. To determine if your database has a GUID go to “Edit the Database”

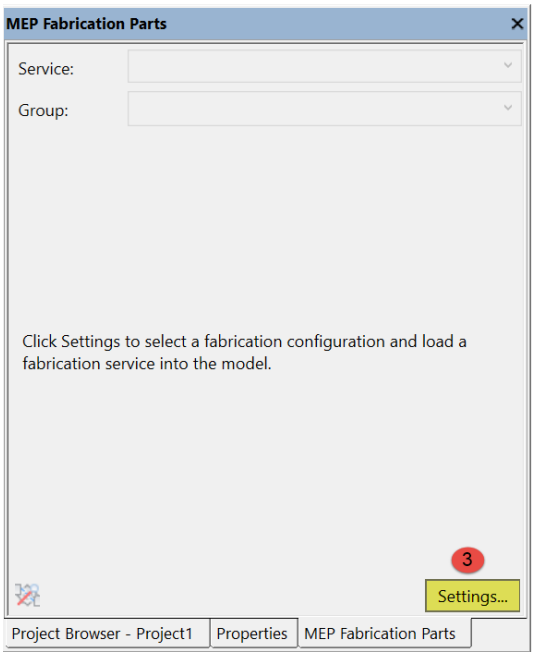
1. Click the “Configuration Tab”
2. Select the “Configuration” section
3. Click “Version”
4. If you see a value in the “GUID” field, you should be OK
5. If you do not see a value in the “GUID” Field, click the Green button on the right and one will be generated.



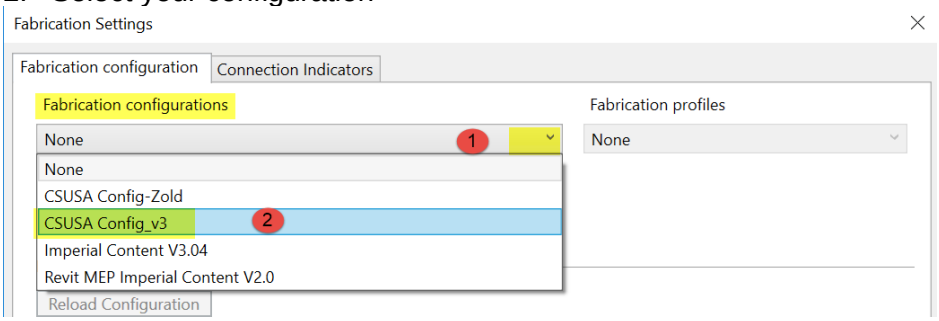
To load your Fabrication configuration in Revit

1. Click on the “System” tab
2. Click on the “Fabrication Part” button on the ribbon to open MEP Fabrication Parts pallet
3. Click “Settings”

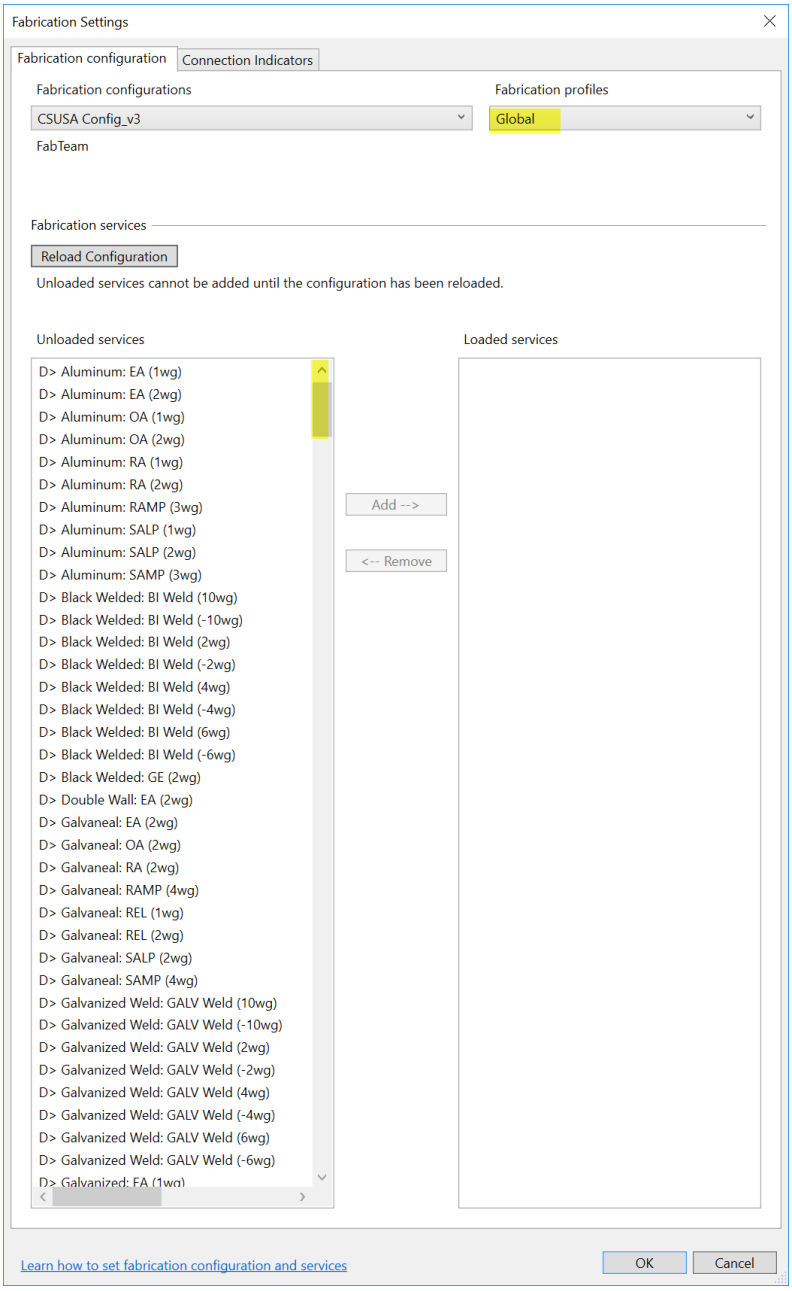




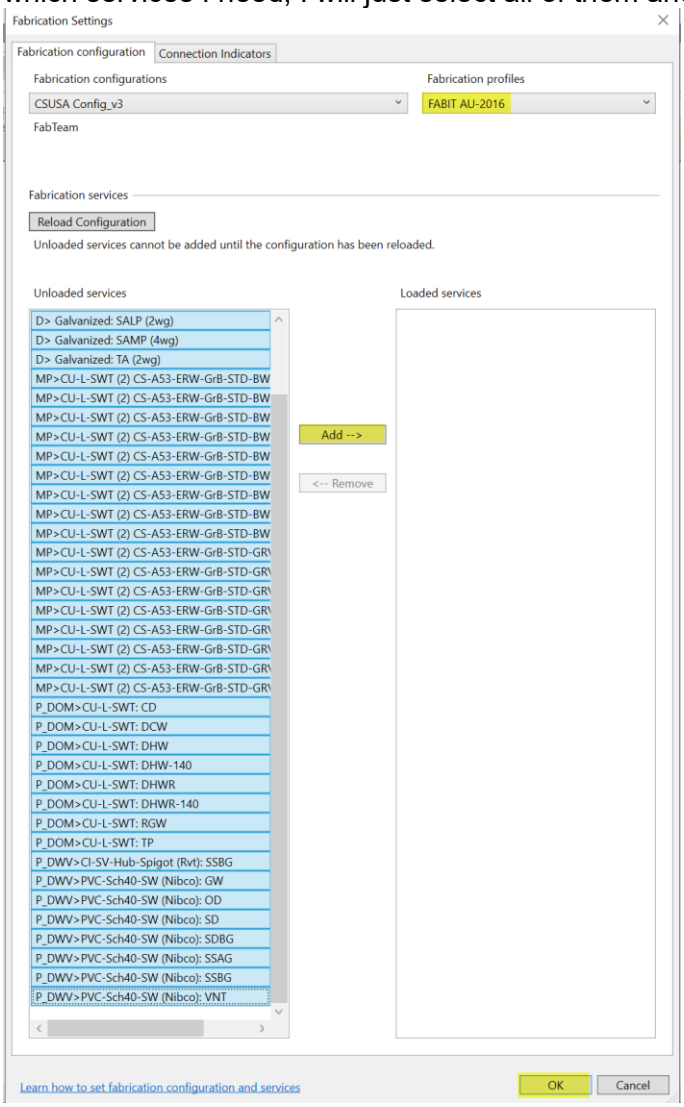
1. Use the pulldown under “Fabrication Configurations”
2. Select your configuration



This will take a little bit of time to load and It will default to your “Global” Profile.
Notice that if you use your global profile you may have a long list of services to choose from.

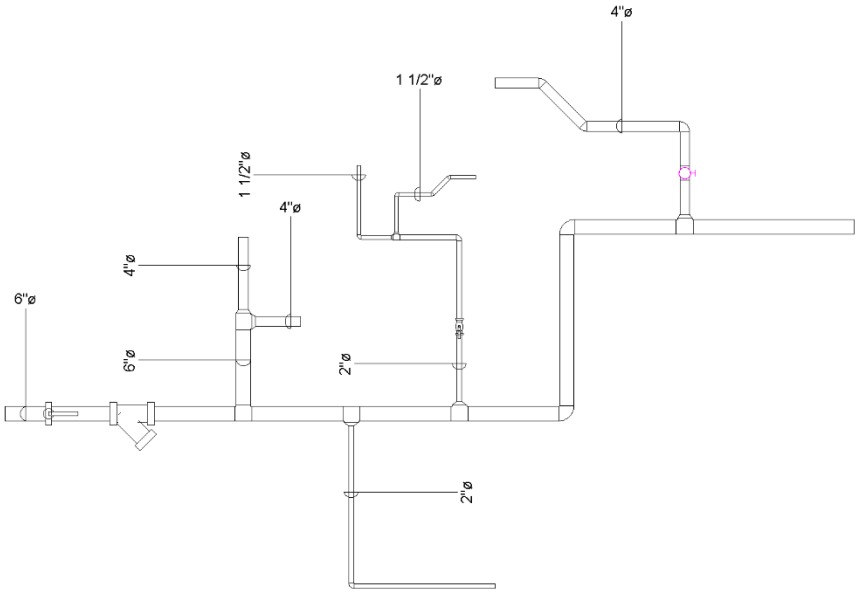

Fabrication Settings
Fabrication configuration
Connection Indicators
Fabrication configurations
CSUSA Config_v3
FabTeam
Fabrication profiles
Global
Fabrication services
Reload Configuration
Unloaded services cannot be added until the configuration has been reloaded.
Unloaded services
D> Aluminum: EA (1wg)
D> Aluminum: EA (2wg)
D> Aluminum: OA (1wg)
D> Aluminum: OA (2wg)
D> Aluminum: RA (1wg)
D> Aluminum: RA (2wg)
D> Aluminum: RAMP (3wg)
D> Aluminum: SALP (1wg)
D> Aluminum: SALP (2wg)
D> Aluminum: SAMP (3wg)
D> Black Welded: BI Weld (10wg)
D> Black Welded: BI Weld (-10wg)
D> Black Welded: BI Weld (2wg)
D> Black Welded: BI Weld (-2wg)
D> Black Welded: BI Weld (4wg)
D> Black Welded: BI Weld (-4wg)
D> Black Welded: BI Weld (6wg)
D> Black Welded: BI Weld (-6wg)
D> Black Welded: GE (2wg)
D> Double Wall: EA (2wg)
D> Galvaneal: EA (2wg)
D> Galvaneal: OA (2wg)
D> Galvaneal: RA (2wg)
D> Galvaneal: RAMP (4wg)
D> Galvaneal: REL (1wg)
D> Galvaneal: REL (2wg)
D> Galvaneal: SALP (2wg)
D> Galvaneal: SAMP (4wg)
D> Galvanized Weld: GALV Weld (10wg)
D> Galvanized Weld: GALV Weld (-10wg)
D> Galvanized Weld: GALV Weld (2wg)
D> Galvanized Weld: GALV Weld (-2wg)
D> Galvanized Weld: GALV Weld (4wg)
D> Galvanized Weld: GALV Weld (-4wg)
D> Galvanized Weld: GALV Weld (6wg)
D> Galvanized Weld: GALV Weld (-6wg)
D> Galvanized: EA (1wg)
Add -->
<-- Remove
Loaded services
Learn how to set fabrication configuration and services
OK
Cancel

Now select the profile that you want to use, I am using a profile that I have setup for Autodesk University “FABIT AU-2016”. Notice that I do not have such a massive list of services because I setup my profile for only the services needed for this project. I don’t have to pick and choose which services I need, I will just select all of them and select “Add” when it finishes click “OK”



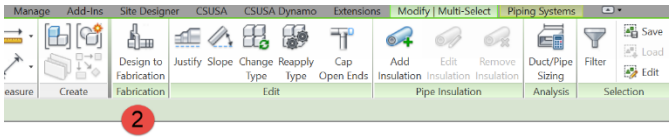
Design to Fabrication

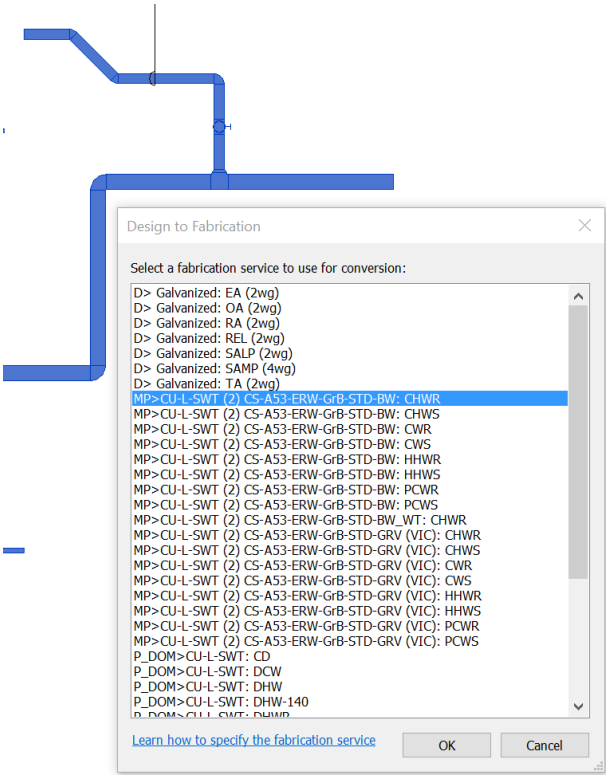
This is a feature in REVIT to convert generic elements to Fabrication parts using Design Line technology.
I have drawn a small piping system with generic REVIT elements, generic valves and accessories that I will convert to Fabrication Parts Using Design to Fabrication.
Note: Do NOT try to convert an entire Large Model

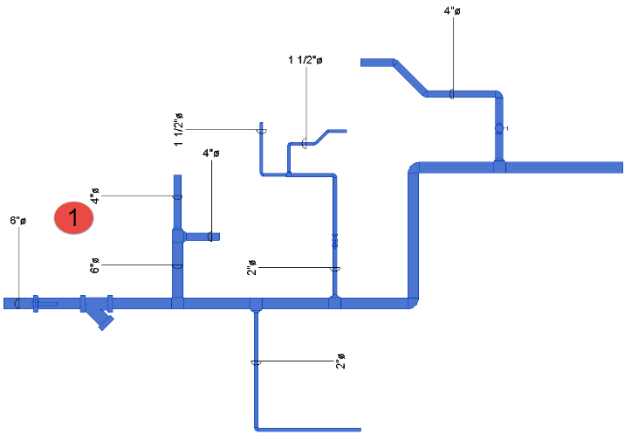


To Convert this;

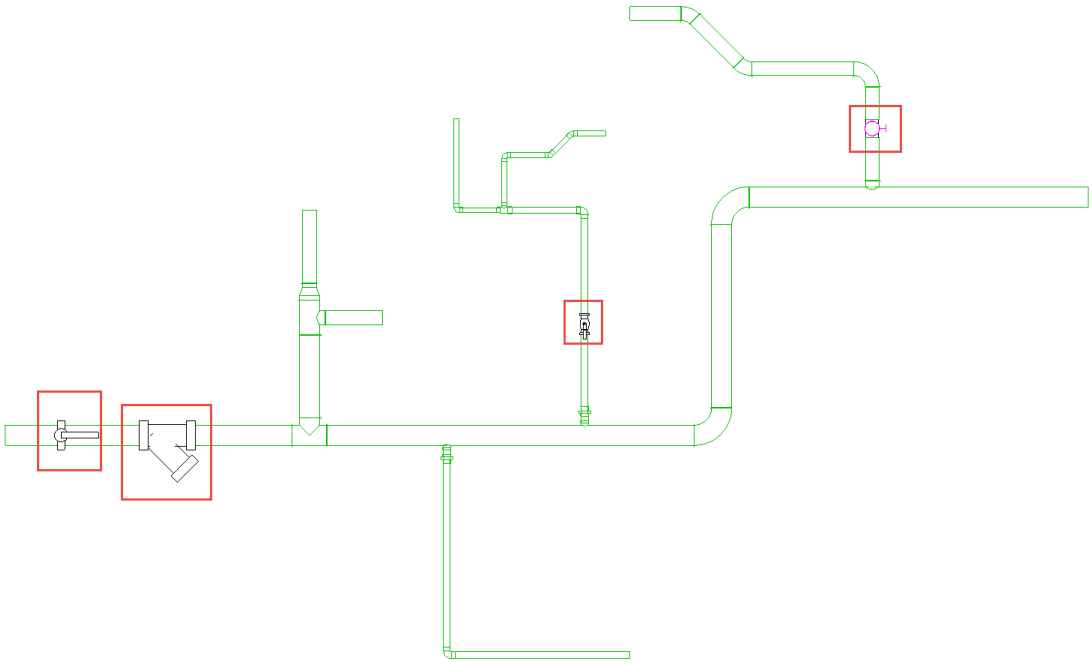
1. Select the parts that you want to convert, when selected the “Modify” ribbon panel will show up
2. Select the “Design to Fabrication” button
3. Select the service that you want to fill with and select “OK”



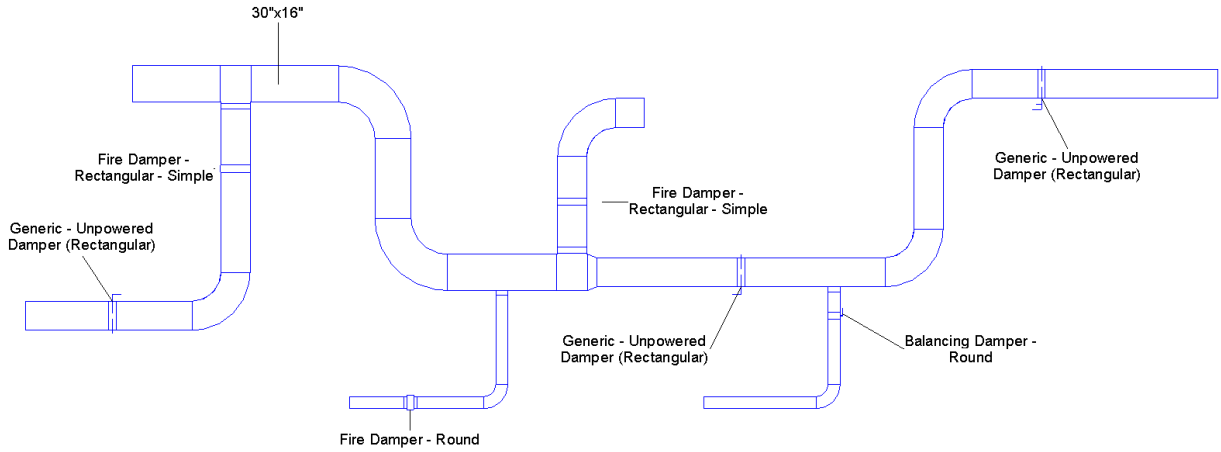




Notice that when it converted it left my generic accessories and did not convert them (prior to 2017.1 these would have been deleted)



Here is a same scenario for some Ductwork

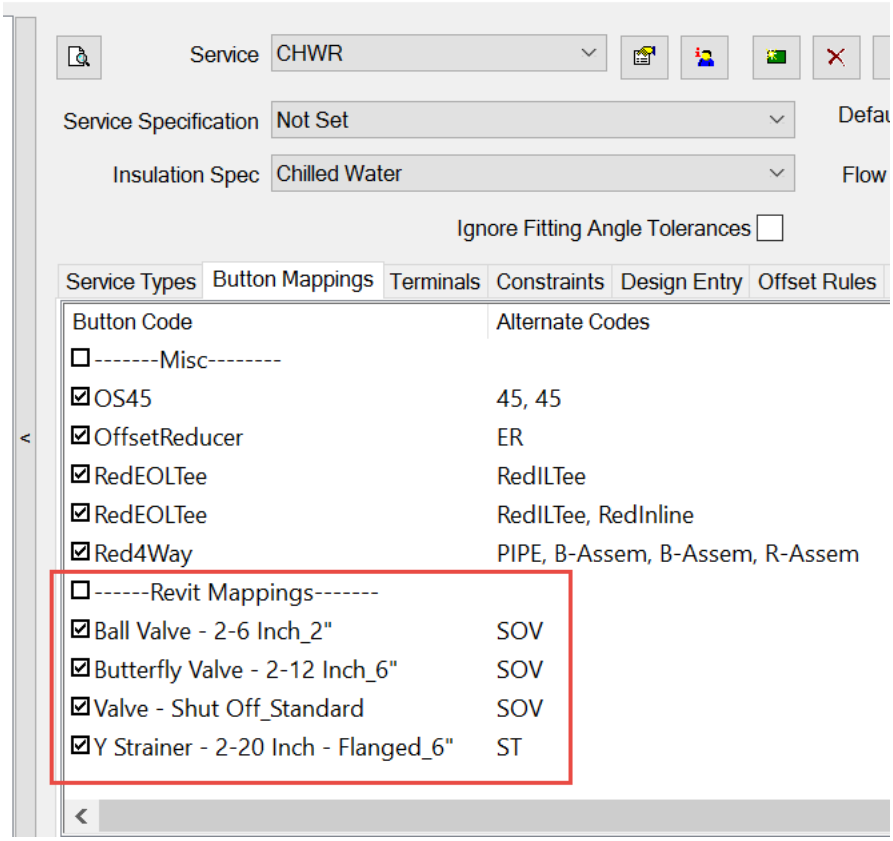


Let's take this a step further and convert them to Fabrication Parts…
Prior to converting I will need to add these items into my button mappings.

1. You will need to generate a schedule for Piping Accessories using one field "Family and Type" and condense this schedule to only show one instance by sorting by "Family and Type" and unchecking "Itemize every Instance" on the Sorting and grouping tab of the schedule properties.
2. Export the schedule out to a text file
3. Edit the text file or import into excel to edit the text. As an example The generic ball vale text will be (Ball Valve - 2-6 Inch: 2") I will need to replace the (":" and "space") with an "_" the result being (Ball Valve - 2-6 Inch_2")
4. Edit the service/s in Fabrication to include these button Mappings and assign the button code for the fabrication part that you want to replace it with.

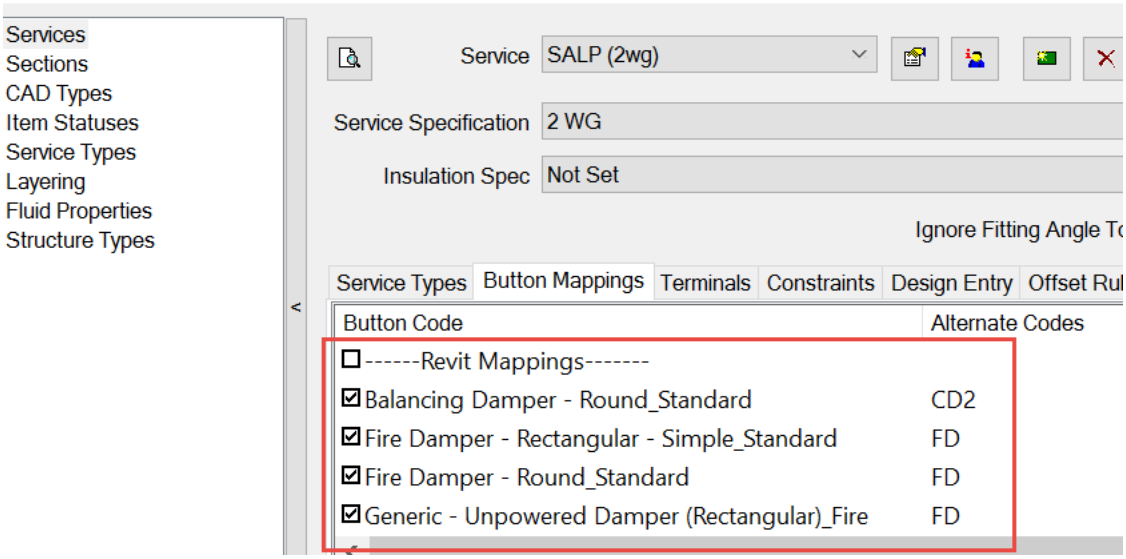
Pipe Accessories

'FABIT AU-2016"



Duct Accessories

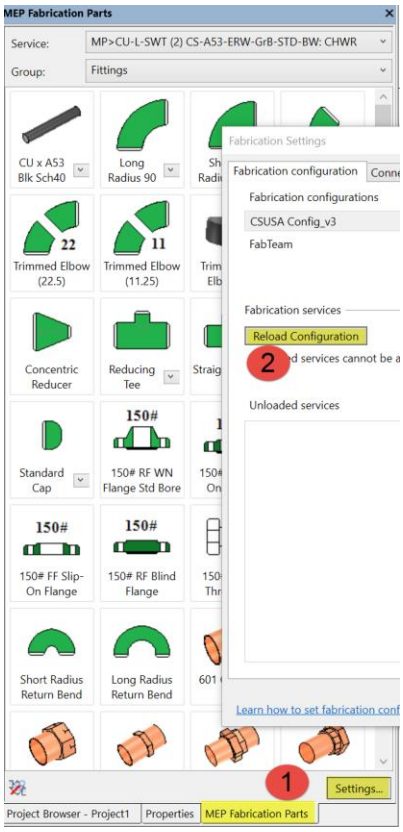
Setup Services, Profile"FABIT AU-2016"



Click OK on the service editor to save changes to your service database

In REVIT you will need to go to the MEP Fabrication Parts pallet

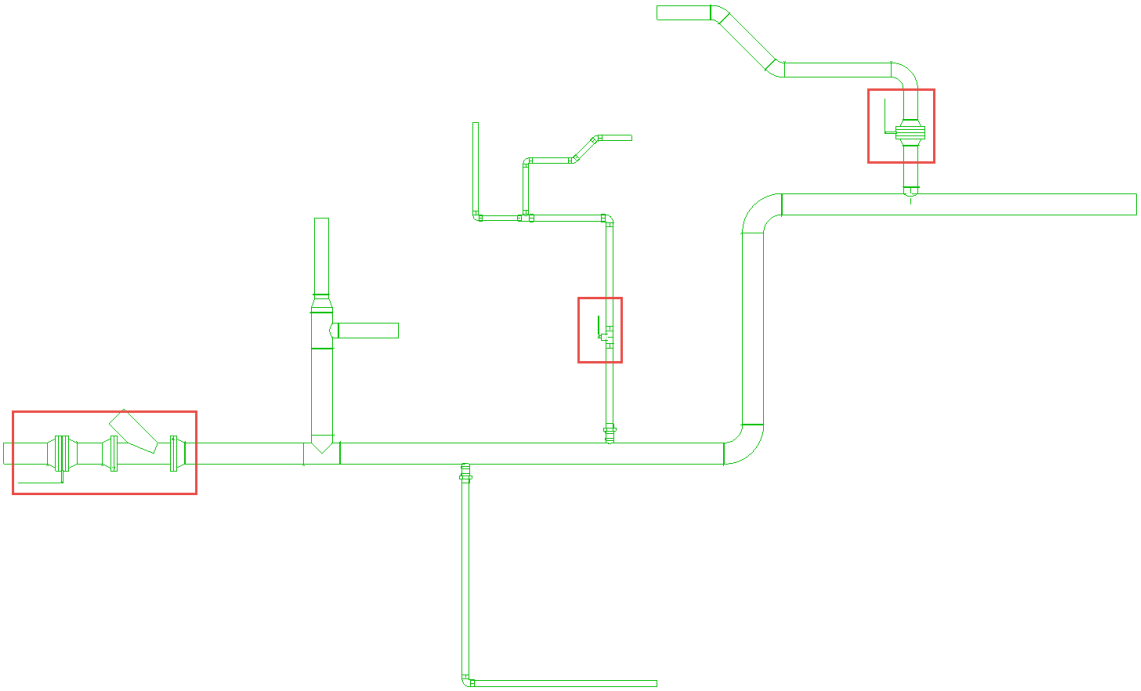
1. Click on “Settings”
2. Click “Reload Configuration”



I will convert the run of pipe again

Notice that now I have Fabrication Parts with the require connectors…

Piping Converted to Fabrication Parts



Duct converted to Fabrication Parts