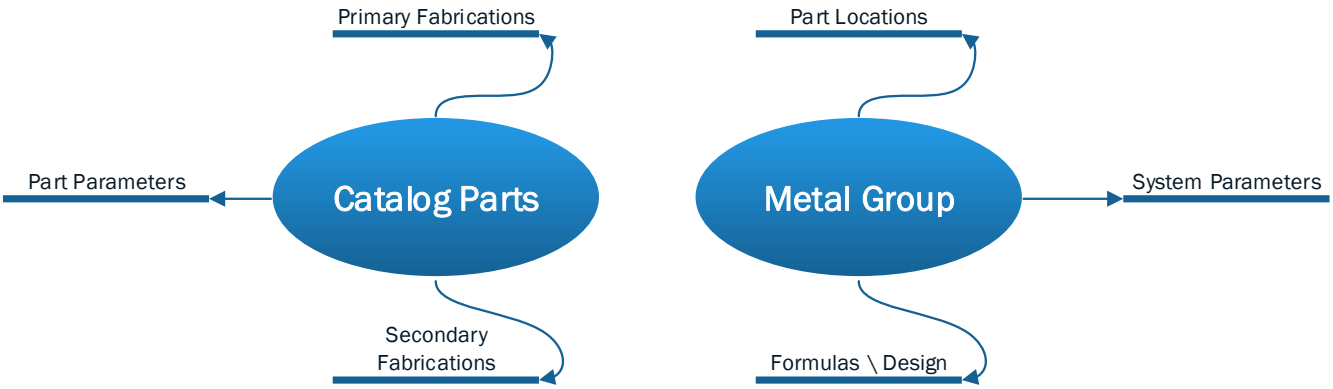
Glazier Studio –Fabrication

Overview: Fabrications are used with the RhinoFAB fabrication center. System Parameters and Settings, Metal Groups, Catalog Parts and Metal Fabrication are reviewed to understand how fabrications are exported from PartnerPak Studio to the RhinoFAB for processing. Also provided is an overview of the initial troubleshooting of fabrication issues.



Catalog Parts

Part Parameters – Tells us about the part – width, glass pocket, lengths, offsets.

Primary Fabrications – Holes and fabrications that get fabricated on this part based on metal group parameters, designs and formulas.

Secondary Fabrications – Holes that need to be drilled in adjoining mullions to attach this specific part. These hole fabrications will show up on the penetrating vertical or horizontal based on the design style of the metal system.

Metal Groups

Part Locations – Where parts go in an elevation. Jambs, Head, Sill, Horizontals and Verticals.

System Parameters – Type of system, Shear block, outside glazed, ssg etc.

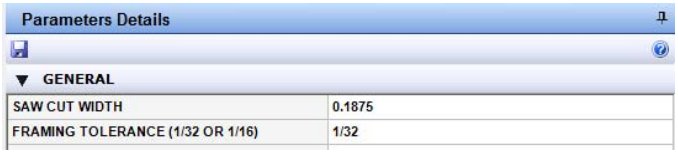
Formulas and Designs – Defines the way a system goes together, which mullion penetrates and which stops at the different joints. Formulas are other ways to add multiple holes to a mullion based on a formula. Formulas are used to drill holes a specific distance from each end, or for weep holes.

SET GENERAL PARAMETERS

Overview: The software must be set up to mirror your machines settings to ensure that the estimating and fabrication steps stay in sync.

- DROPDOWN MENU > TOOLS > OPTIONS > GENERAL
- **FRAMING TOLERANCE**

Should be set to 1/32” (.03125).



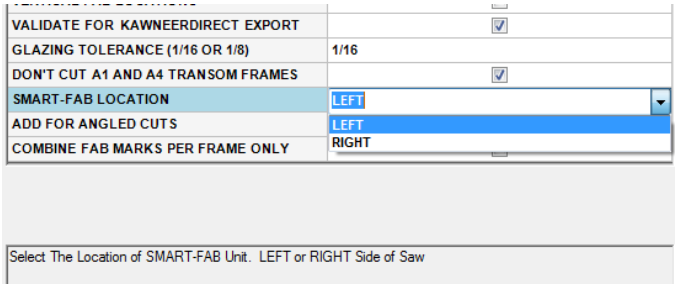
- **SMART-FAB LOCATION**

  Should be set to direction that material is fed into the Rhino Fab: **LEFT** or **RIGHT**.

  <u>The default setting is RIGHT</u>.

  Missing or incorrect machine direction can cause missing holes and/or fabrications being backwards or in the wrong place.

These settings are critical for the fabrication output to the Rhino Fab



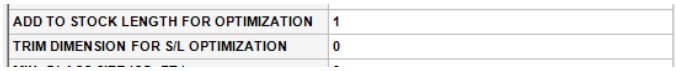
- **ADD to STOCK LENGTH for OPTIMIZATION**

  Should be set to the appropriate stock size you want to optimize.

- **TRIM DIMENSION FOR STOCK LENGTH OPTIMIZATION**

  Should be set to the trim size you want to cut from the stock length.

Default Stock Length 288 + ADD – TRIM = Optimizable material



Example: 288” Stock Length + 1” Add is 289” of optimizable material, - 1.5” Trim optimizes 287.5” out of the stock length.

If you optimize your material at the software at 289”, but only get 287.5” out of the RhinoFAB, you might be short material from the estimating to the fabrication. **It is important that these match each other.**

Note: These settings can be adjusted without having to open and resave frame info or details.

Just re-run the Bid Recap or re-import Metal Fabrications.

METAL GROUP

Overview: The metal group organizes the parts and applies formula based fabrications on specific mullions. Keywords for the metal systems tell us what fabrication types to look for and can tell us how to orient the secondary fabrications. There are 2 ways to get fabrications from the metal system.

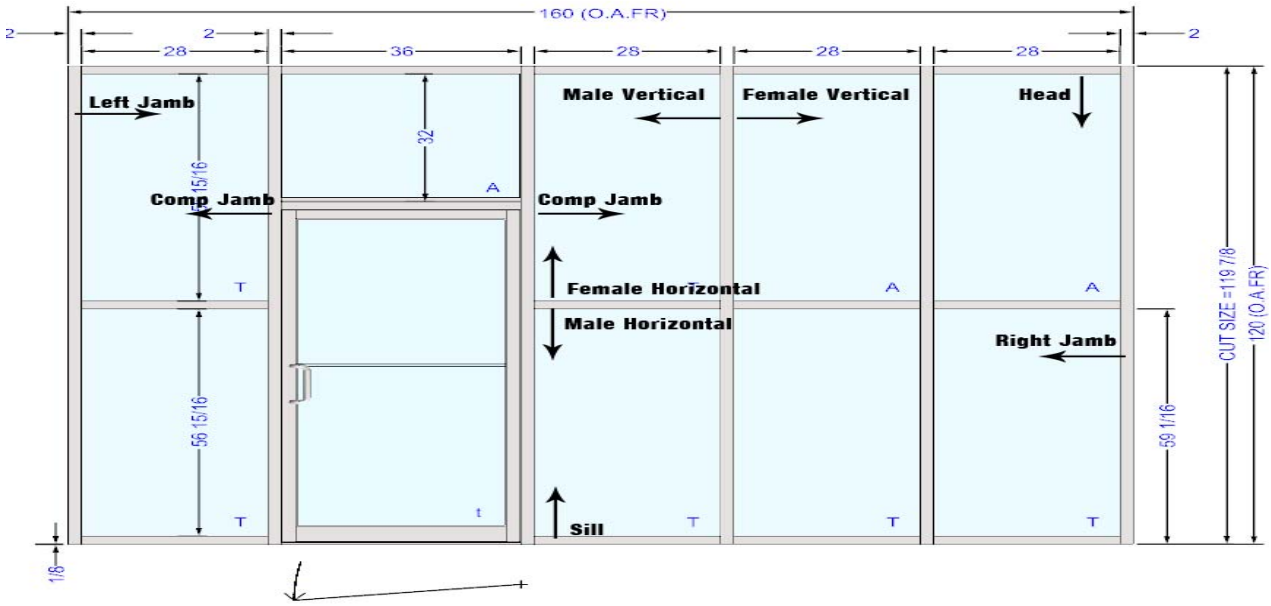
1) Part Location/Orientation – pulling fabrications from the primary and secondary fabrications, and

2) Formula based fabrications that are entered in the metal system under Primary Metal.

In order to understand how the metal systems play a part in fabrications, you will need to understand the terminology and layout.

PRIMARY FRAMING

	NAME	PRODUCT CODE	FINISH	DESCRIPTION
Faces Right	LEFT JAMB	451CG001	DEFAULT	MULLION/JAMB/SILL
Faces Left	RIGHT JAMB	451CG001	DEFAULT	MULLION/JAMB/SILL
Faces Right	FEMALE VERTICAL	451CG001	DEFAULT	MULLION/JAMB/SILL
Faces Left	MALE VERTICAL	451CG002	DEFAULT	POCKET FILLER
Faces Right	FEMALE EXPAN MULL	451CG010	DEFAULT	FEMALE EXPANSION MULLION
Faces Left	MALE EXPAN MULL	451CG540	DEFAULT	MALE EXPANSION MULLION W/WEATHERING 27-8
Faces Outside of Door Jamb	DOOR JAMB COMPANION	451CG002	DEFAULT	POCKET FILLER
	HEAD CHANNEL	NULL	DEFAULT	
Faces Down	HEAD	451CG003	DEFAULT	HEAD
	SILL CHANNEL	450037	DEFAULT	TRIFAB II 450/451 SILL FLASHING
Faces UP	SILL	451CG001	DEFAULT	MULLION/JAMB/SILL
Faces UP	FEMALE HORIZONTAL	451CG011	DEFAULT	TUBE HORIZONTAL
Faces Down	MALE HORIZONTAL	NULL 3/8 GD	DEFAULT	3/8 GLAZING DEPTH



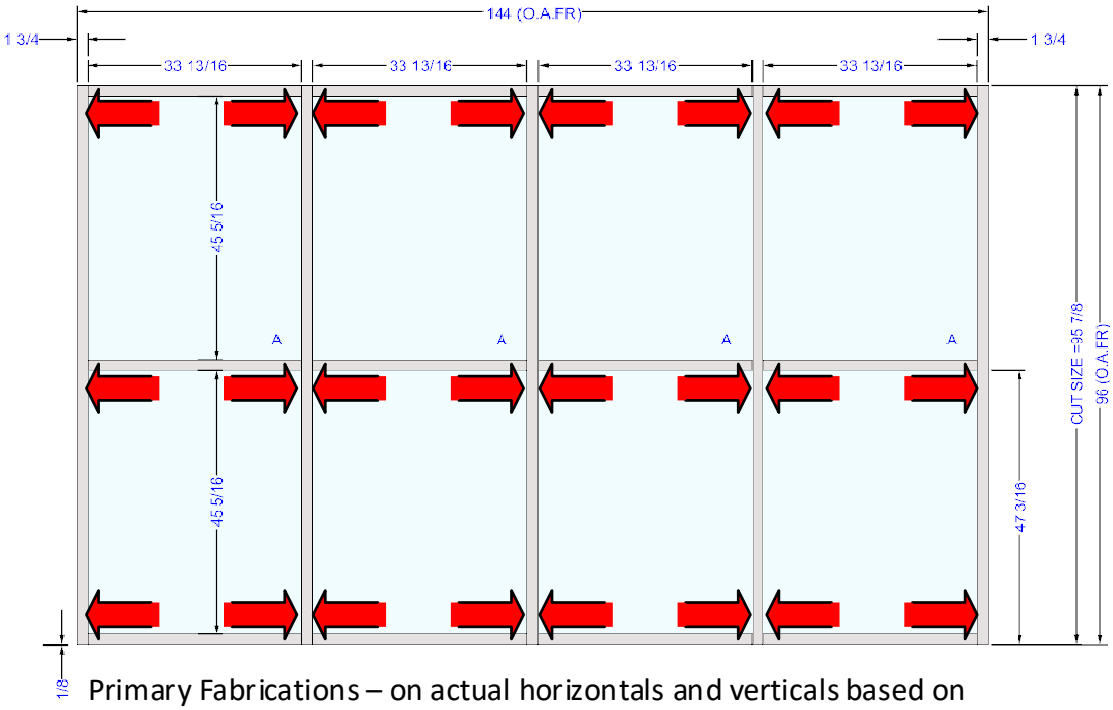
TERMINOLOGY

- **FAB STYLE**:
    - **SCREW SPLINE** or **SHEAR BLOCK** - This directs us to look for shear block or screw spline fabrications in the catalog parts primary and secondary fabrications.
- **KEY WORDS** Required for metal group: These keywords also guide us on which fabrications to import based on the metal system.
    - **SCREW SPLINE** or **SHEAR BLOCK** (all system fall under one)
    - **OUTSIDE** or **INSIDE** (if system can be glazed either way)
    - **STOPS UP** or **STOPS DOWN** (if system can be glazed either way)

  ***NOTE**: The software will only bring in one of each of the Keywords above, so if you have mixed systems of screw spline and shear block we will only bring in one or the other.*

  Example: Screw Spline – Outside Glazed – Stops Up.
- **DESIGN STYLE** (required for metal group): This determines fabrications by matching which parts pass secondary fabrications and which are just look for primary fabrications.

Design Style –
Verticals Penetrate all Horizontals

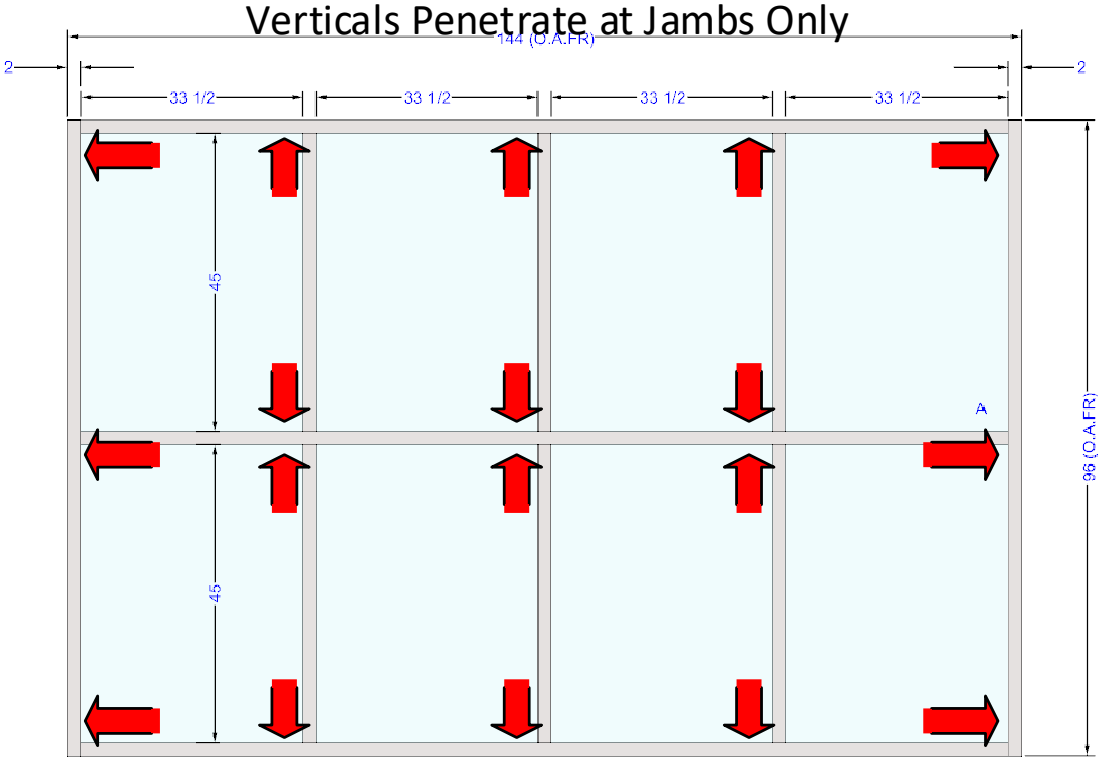


Primary Fabrications – on actual horizontals and verticals based on condition and formula.

Secondary Fabrications transfer from Horizontal joints to verticals.

- **Verticals Penetrate all Horizontals** - This design style will import primary fabrications for the verticals and receive secondary fabrications from the opposing horizontal members.
- **Example:** A 451 Stops Up system would pass fabrications of the 451CG003 from the sill to the 451CG001 Vertical by reading the 451CG003 secondary fabrications.

Design Style –
Verticals Penetrate at Jambs Only



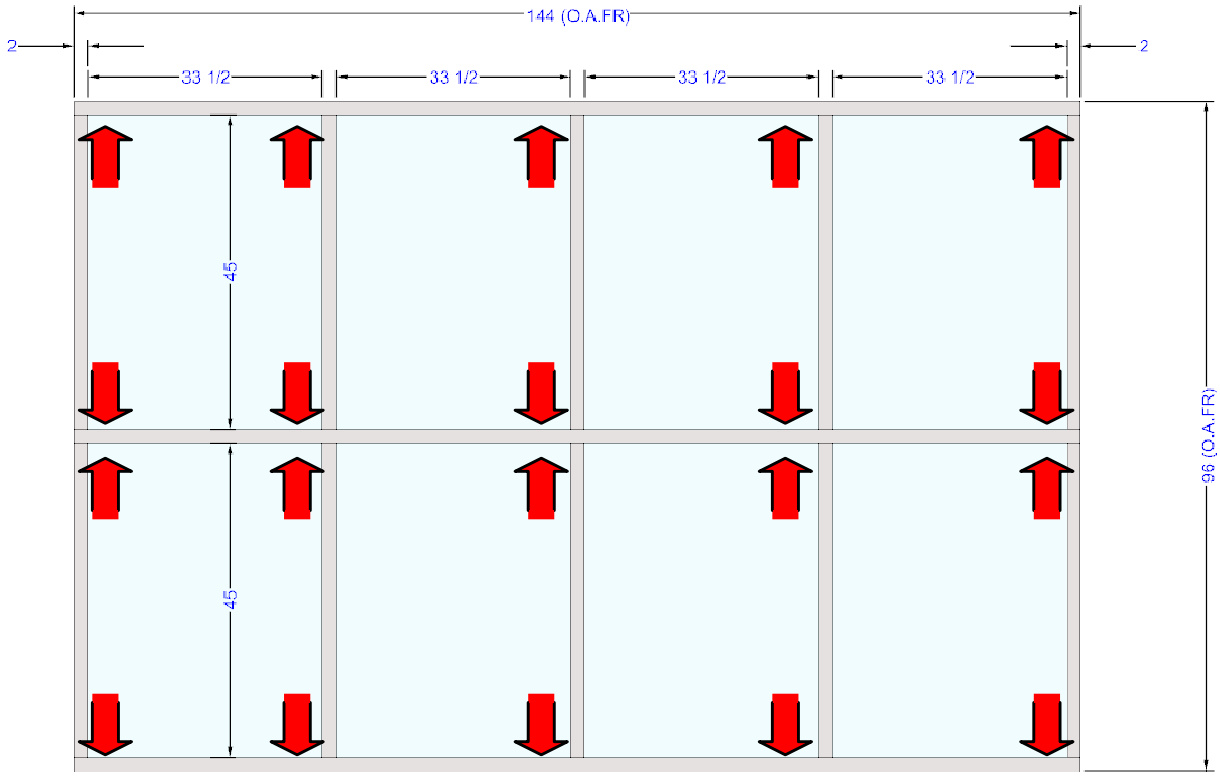
Primary Fabrications – on actual horizontals and verticals based on condition and formula.

Secondary Fabrications transfer from Horizontal at jambs and from verticals everywhere else.

- **Verticals Penetrate at Jambs Only** - This design style will import primary fabrications for the verticals and receive secondary fabrications from the opposing horizontal members at the jambs only. All other locations will have the verticals passing secondary fabrications to the horizontals.

- **Example**: A 451 Stops Up system would pass fabrications of the 451CG003 from the sill to the 451CG001 Vertical by reading the 451CG003 secondary fabrications at the jamb, but the 451CG001 would pass secondary fabrications to the 451CG003 at the sill for all the intermediate verticals.

Design Style –
Horizontals Penetrate all Verticals



Primary Fabrications – on actual horizontals and verticals based on condition and formula.

Secondary Fabrications transfer from verticals to horizontals.

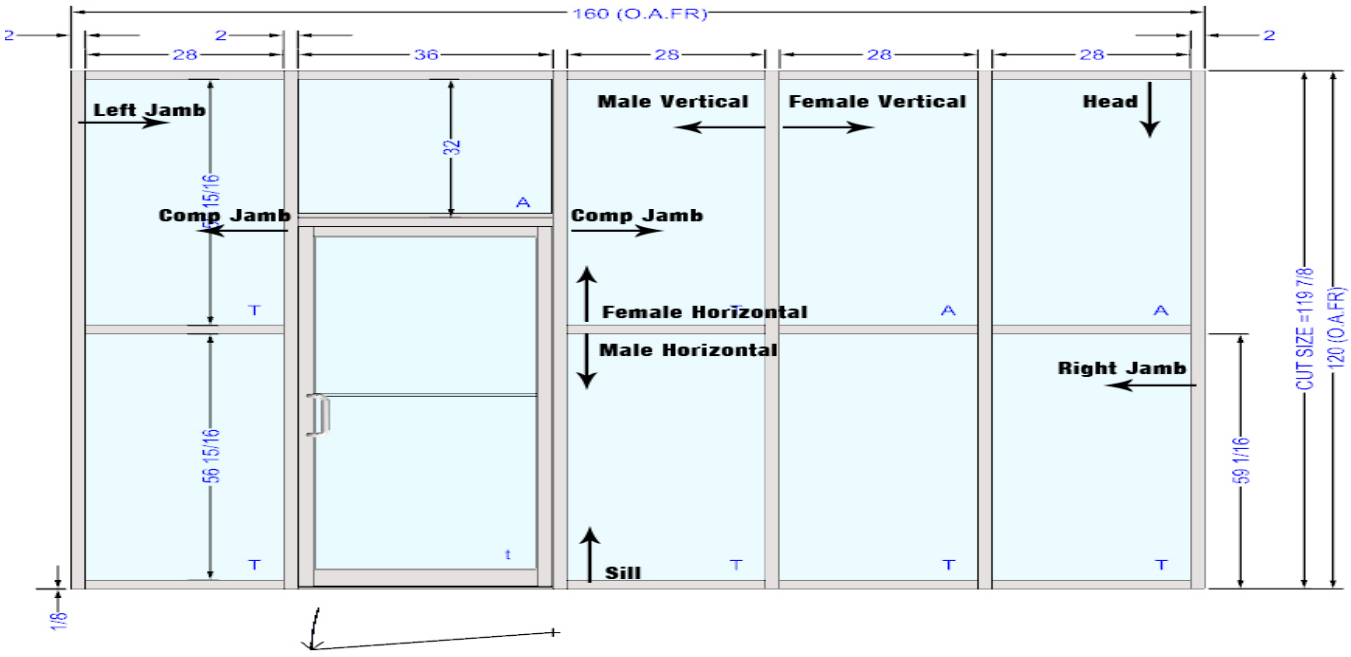
- **Horizontals Penetrate all Verticals -** This design style will import primary fabrications for the horizontals and receive secondary fabrications from the opposing vertical members.

Primary Metal

Example of 451 CG/SS/OG Stops Up Metal System

PRIMARY FRAMING

	NAME	PRODUCT CODE	FINISH	DESCRIPTION
Faces Right	LEFT JAMB	451CG001	DEFAULT	MULLION/JAMB/SILL
Faces Left	RIGHT JAMB	451CG001	DEFAULT	MULLION/JAMB/SILL
Faces Right	FEMALE VERTICAL	451CG001	DEFAULT	MULLION/JAMB/SILL
Faces Left	MALE VERTICAL	451CG002	DEFAULT	POCKET FILLER
Faces Right	FEMALE EXPAN MULL	451CG010	DEFAULT	FEMALE EXPANSION MULLION
Faces Left	MALE EXPAN MULL	451CG540	DEFAULT	MALE EXPANSION MULLION W/WEATHERING 27-8
Faces Outside of Door Jamb	DOOR JAMB COMPANION	451CG002	DEFAULT	POCKET FILLER
	HEAD CHANNEL	NULL	DEFAULT	
Faces Down	HEAD	451CG003	DEFAULT	HEAD
	SILL CHANNEL	450037	DEFAULT	TRIFAB II 450/451 SILL FLASHING
Faces UP	SILL	451CG001	DEFAULT	MULLION/JAMB/SILL
Faces UP	FEMALE HORIZONTAL	451CG011	DEFAULT	TUBE HORIZONTAL
Faces Down	MALE HORIZONTAL	NULL 3/8 GD	DEFAULT	3/8 GLAZING DEPTH



Verticals:

Left Jamb – Oriented with the glass pocket facing into the frame. Receives fabrications or passes fabrications (depending on design style) from the horizontals to Right side of jamb.

Left Jamb Perimeter Filler – Always facing outside the frame and receives only primary fabrications from the catalog part of the filler (if required).

Right Jamb - Oriented with the glass pocket facing into the frame. Receives fabrications or passes fabrications (depending on design style) from the horizontals to Left side of jamb.

Right Jamb Perimeter Filler – Always facing outside the frame and receives only primary fabrications from the catalog part of the filler (if required).

Male Intermediate Vertical – Oriented with the pocket facing Left and receives or passes fabrication info to the horizontals on the left of the vertical.

***Note**: If product code is NULL x/x GD where x/x is the glass depth, the program transfers the fabrications to the opposite mullion. i.e if you have a tubular mullion in the Female Vertical, then it will put the fabrication holes from the Male Vertical onto the left side of the Female Vertical.*

Female Intermediate Vertical– Oriented with the pocket facing Right and receives or passes fabrication info to the horizontals on the Right of the vertical.

Male Expansion Mullion – Oriented with the pocket facing Left and receives or passes fabrication info to the horizontals on the left of the vertical.

Female Expansion Mullion– Oriented with the pocket facing Right and receives or passes fabrication info to the horizontals on the Right of the vertical.

Door Jamb Companion - Orientation always faces away from the door. So a Left Door Jamb would pass the horizontal secondary fabrications from the left of the door to the Door Jamb Companion. Exactly the opposite from the right side.

***Note**: The program will not automatically flip the vertical male and female parts after the door frame, so you may have to manually switch the Male and Female verticals so there aren't two shallow pockets facing each other. i.e if the right door jamb companion is the 451CG002, and the Male Vertical is also a 451CG002, you would not be able to glaze the opening. Select all intermediate verticals after the door and move the 451CG001 to the Male Vertical (left) and the 451CG002 to the Female Vertical (right).*

Door Jamb – Door Jambs always face in towards the door and do not automatically get fabrications.

Horizontals:

Sill Channel – Always oriented up from the floor and can receive fabrications from both the primary fabrications and formula based fabrications.

Sill – Oriented facing with the glass pocket up but receives fabrication data from the design style and keywords. i.e If you used a metal system with Stops Down, it would put the 451CG001 at the sill facing pocket up. If the stops down system were used but a 451CG003 were placed in the sill, it would orient the holes with the glass pocket down because of the Keyword STOPS DOWN. You would need to use a Stops Up system to have a 451CG003 at the sill or manually correct the hole locations in the Metal Fabrications.

Sill Perimeter Filler - Always facing outside the frame and receives only primary fabrications from the catalog part of the filler (if required)

Male Intermediate Horizontal – Orientation facing down at the intermediate horizontal. Receives fabrication from primary fabrications.

***Note**: If the product code is NULL x/x GD where x/x is the glass depth, the program transfers the fabrications to the opposite mullion. i.e if you have a tubular mullion in the Female Horizontal, then it will put the fabrication holes from the Male Horizontals onto the bottom side of the Female Horizontal.*

Female Intermediate Horizontal – Orientation facing up at the intermediate horizontal. Receives fabrication from primary fabrications and secondary vertical fabrications depending on the design style.

***Note**: If the product code is NULL x/x GD where x/x is the glass depth, the program transfers the fabrications to the opposite mullion. i.e if you have a tubular mullion in the Male Horizontal, then it will put the fabrication holes from the Female Horizontals onto the top side of the Male Horizontal.*

Head – Oriented facing with the glass pocket down but receives fabrication data from the design style and keywords. i.e If you used a metal system with Stops Up, it would put the 451CG001 at the Head facing pocket down. If the Stops Up system were used but a 451CG003 were placed in the head, it would orient the holes with the glass pocket up because of the

Keyword STOPS UP. You would need to use a stops down system to have a 451CG003 at the head or manually correct the hole locations in the Metal Fabrications.

Head Perimeter Filler – Always facing outside the frame and receives only primary fabrications from the catalog part of the filler (if required).

Head Channel – Always oriented down from the ceiling and can receive fabrications from both the primary fabrications and formula based fabrications.

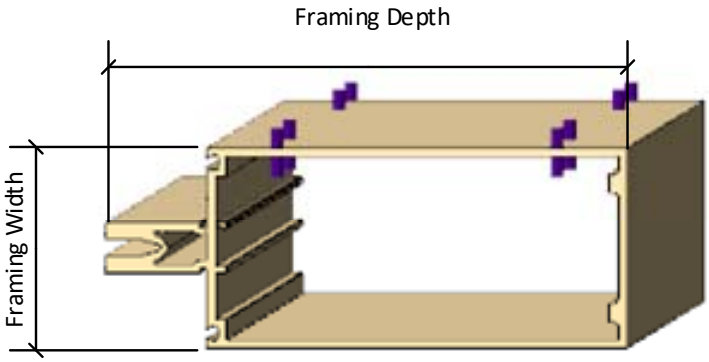
Threshold - Door components do not pass fabrications, however fabrications can be added manually at Metal Fabrications.

Door Header - Door components do not pass fabrications, however fabrications can be added manually at Metal Fabrications.

Frame Header - Door components do not pass fabrications, however fabrications can be added manually at Metal Fabrications.

CATALOG PARTS

Overview: The catalog parts is the most important starting point for fabrications. If we have no primary or secondary fabrications specified, then we get no fabrications, even if we laid everything out on the metal system correctly. Part parameters tell us about the extrusion itself, then primary and secondary fabrications tell us where to put the holes and/or routs.



EXTRUSION DESIGN PARAMETERS

- FRAMING WIDTH – Width across face of extrusion
- FRAMING DEPTH – Dimension from front to back of extrusion
- REVERSE ORIENTATION – Used when width and depth must be reversed because of how parts is positioned in Rhino. (i.e. curtain wall face member)

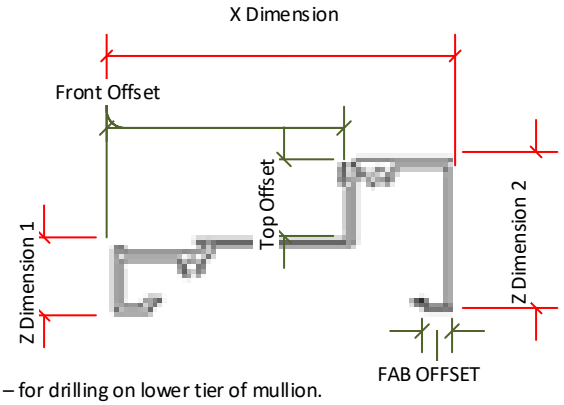
FAB ORIENTATION

- TOP- Top or front holes or slots (90% of fabrications)
- BOTTOM- For bottom holes

FAB I-PLANE (Drill stages itself ¼" off of part or I-PLANE)

- I-PLANE: is the "box" that surrounds a non-rectangular part.

OFFSET

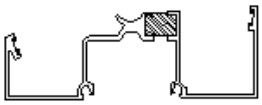


Z Dimension 1 – for drilling on lower tier of mullion.
Z Dimension 2 – for drilling on upper tier of mullion.
FAB OFFSET – Used to move the pocket filler out the appropriate distance to fabricate.

- FRONT - How far out do I have to go from the surface of the drilling to clear the part or tongue.
- TOP - How far up do I have to go to clear the top of the part.

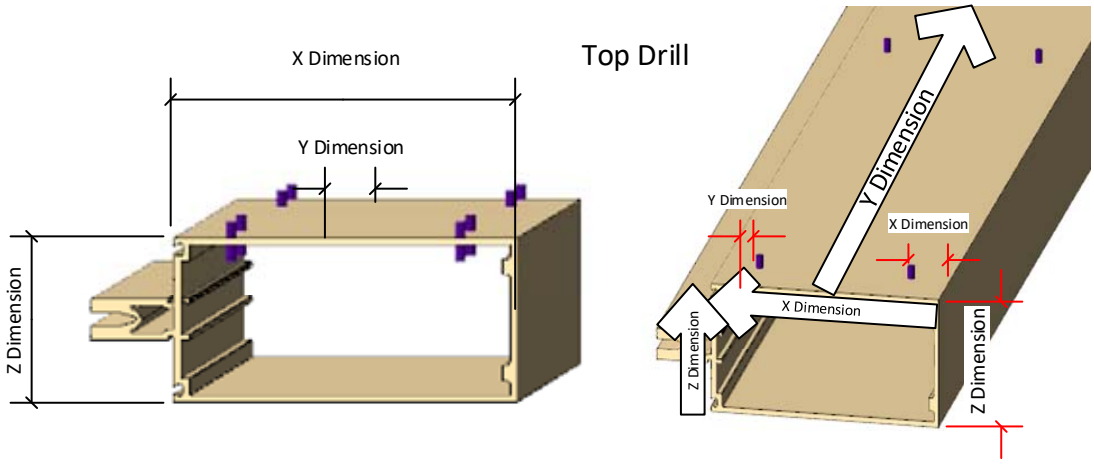
FAB OFFSET: Offset for parts, not size of system, i.e. snap in filler for a 4 ½" system (3.5625" snap-in filler for 4.5" = .46875" offset at back fence).

FAB LEG OFFSET: When a part has uneven legs and must be set on its face and fabricated from the bottom of the part instead of top.



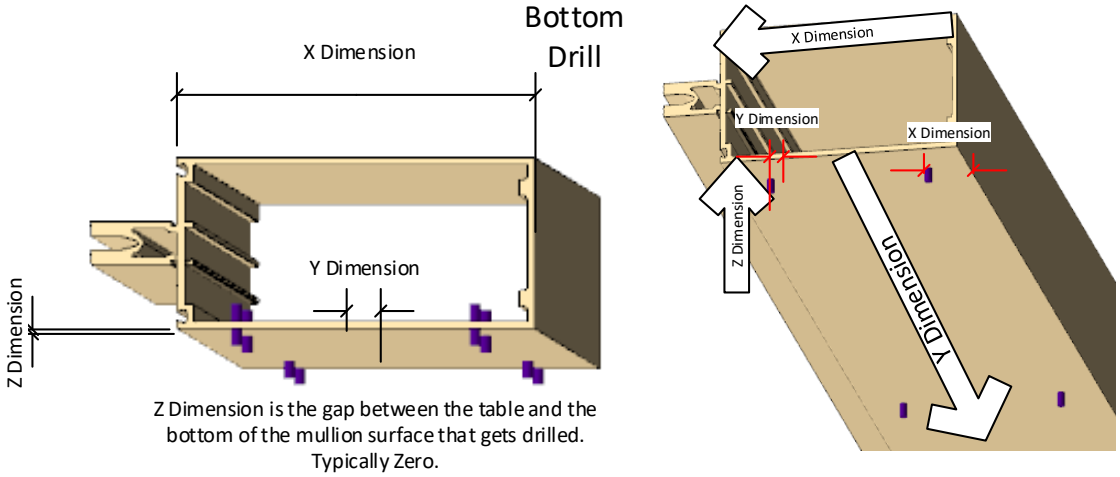
Since this product cannot sit on the table flat without the glass pocket down, the product code has to have the fab leg offset selected to tell us to flip the fabrications from top to bottom drill.

- **Part Orientation (Top Drill)**



  - X Dimension is from back of part out to the location of the hole
  - Y Dimension is the horizontal dimension along the length of the part
  - Z Dimension is from the bottom of the part to the surface where the drilling starts. On square mullions it typically is the height of the part unless we need to drill into the pocket or it has an uneven surface. If so, the iplane will prevent us from scratching or breaking the bits or extrusion by alerting the RhinoFAB to go up and over extrusion.

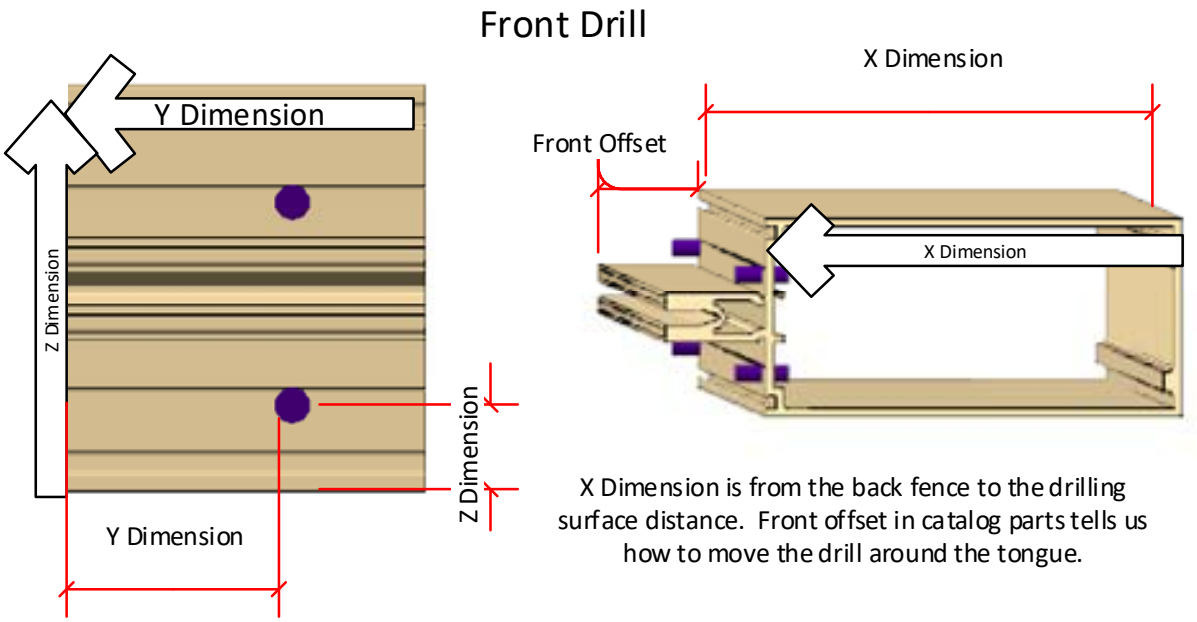
- **Part Orientation (Bottom Drill)**



  - X Dimension is from back of part out to the location of the hole
  - Y Dimension is the horizontal dimension along the length of the part

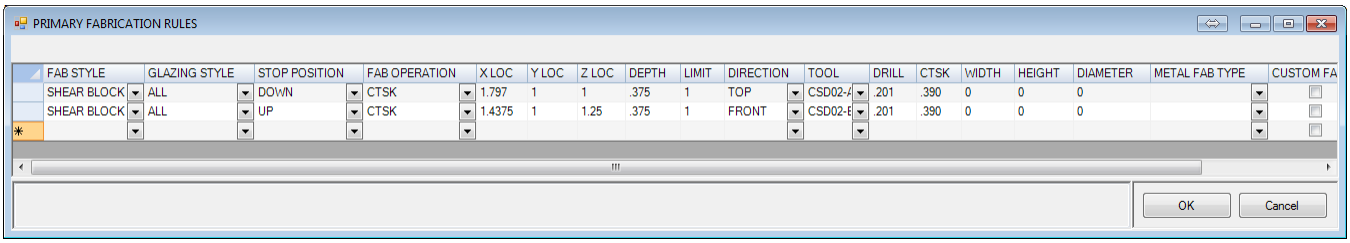
- Z Dimension is from the bottom of the part to the surface where the drilling starts. On square mullions it typically is zero unless we need to drill into the pocket or it has an uneven surface. If so, the iplane will prevent us from scratching or breaking the bits or extrusion by alerting the RhinoFAB to go down and around the extrusion.

- **Part Orientation (Front Drill)**



- X Dimension is from back of part out to the surface where we start drilling. Typically this is the depth of the part from the back fence to the front of the part. Unless we need to drill into a fin or offset part of the extrusion. Then the iplane will allow us to move the drill back away from the mullion to position to the next hole (if necessary)
- Y Dimension is the horizontal dimension along the length of the part
- Z Dimension is from the bottom of the part to the hole location on the face of the part.

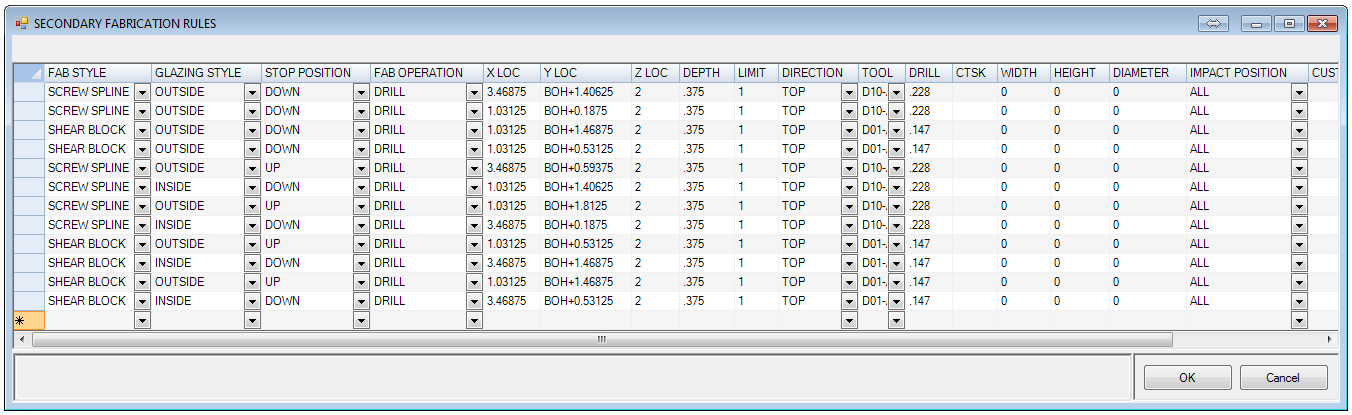
PRIMARY FABRICATION RULES:



Fabrications; drilling, counter sinking, routing, performed on that part.

- Primary Fabrications are always symmetrical (same fab on both ends of part).
- Glazing style and stop position set to **ALL** if same for all applications.
- Metal Fab type selection is required in primary fabrications for any product code that has a formula in the metal system.
- Layout:
  - FAB STYLE – Screw Spline or Shear Block.
  - GLAZING STYLE – All, Inside or Outside
  - STOP POSITION – All, Up, Down, Left, Right, Impact
  - FAB OPERATION – Drill, CTSK (countersink) or Rout (slot, box or circle).
  - X LOC – Measurement from back fence to centerline or face of hole.
  - Y LOC - Measurement along length of extrusion to centerline of hole.
  - Z LOC – Measurement from bottom of part to centerline or face of hole.
  - DEPTH – Hole depth, default = .375”.
  - LIMIT – Drill depth limit, default 1”, (used with step drill bit to make sure cavity is deep enough).
  - DIRECTION – Which drill head is used. (Top, Bottom or Front)
  - TOOL – Drill or end-mill from Rhino library (see Databases > Fab Tools for complete list).
  - DRILL – Drill diameter
  - CTSK – Countersink diameter (if applicable).
  - SPEED and FEED – Not currently used.
  - LENGTH – Slot or rout length (Rhino900 only).
  - WIDTH – Rout width (Rhino900 only)
  - DIAMETER – Rout circle diameter (Rhino900 only).
  - ANGLE – Countersink angle (not needed if defined under Fab Tools).
  - METAL FAB TYPE – None, End/Center, Weep or Fixed (set to None if standard assembly hole).
  - CUSTOM FAB – Custom or modified fab by user (will not be overwritten by update if checked).
  - BOTTOM Z LOC – Amount to offset fab into opposing member (needed for “captured” systems).

SECONDARY FABRICATION RULES:



FAB STYLE	GLAZING STYLE	STOP POSITION	FAB OPERATION	X LOC	Y LOC	Z LOC	DEPTH	LIMIT	DIRECTION	TOOL	DRILL	CTSK	WIDTH	HEIGHT	DIAMETER	IMPACT POSITION	CUST
SCREW SPLINE	OUTSIDE	DOWN	DRILL	3.46875	BOH+1.40625	2	.375	1	TOP	D10-	.228		0	0	0	ALL	
SCREW SPLINE	OUTSIDE	DOWN	DRILL	1.03125	BOH+0.1875	2	.375	1	TOP	D10-	.228		0	0	0	ALL	
SHEAR BLOCK	OUTSIDE	DOWN	DRILL	1.03125	BOH+1.46875	2	.375	1	TOP	D01-	.147		0	0	0	ALL	
SHEAR BLOCK	OUTSIDE	DOWN	DRILL	1.03125	BOH+0.53125	2	.375	1	TOP	D01-	.147		0	0	0	ALL	
SCREW SPLINE	OUTSIDE	UP	DRILL	3.46875	BOH+0.59375	2	.375	1	TOP	D10-	.228		0	0	0	ALL	
SCREW SPLINE	INSIDE	DOWN	DRILL	1.03125	BOH+1.40625	2	.375	1	TOP	D10-	.228		0	0	0	ALL	
SCREW SPLINE	OUTSIDE	UP	DRILL	1.03125	BOH+1.8125	2	.375	1	TOP	D10-	.228		0	0	0	ALL	
SCREW SPLINE	INSIDE	DOWN	DRILL	3.46875	BOH+0.1875	2	.375	1	TOP	D10-	.228		0	0	0	ALL	
SHEAR BLOCK	OUTSIDE	UP	DRILL	1.03125	BOH+0.53125	2	.375	1	TOP	D01-	.147		0	0	0	ALL	
SHEAR BLOCK	INSIDE	DOWN	DRILL	3.46875	BOH+1.46875	2	.375	1	TOP	D01-	.147		0	0	0	ALL	
SHEAR BLOCK	OUTSIDE	UP	DRILL	1.03125	BOH+1.46875	2	.375	1	TOP	D01-	.147		0	0	0	ALL	
SHEAR BLOCK	INSIDE	DOWN	DRILL	3.46875	BOH+0.53125	2	.375	1	TOP	D01-	.147		0	0	0	ALL	

Fabrication instructions carried on a part to attach to a second part. (I.E. Horizontal to a Jamb or Vertical Mullion) These holes transfer to the penetrating mullion. When verticals run through, the horizontal secondary fabrications transfer to the vertical at the position that is set in the editor. You must set up secondary fabrications for each condition that you encounter and the appropriate hole locations. If a horizontal can be Stops Up or Stops Down, we need hole locations for each condition, we also need to know inside or outside glazing, so we would need holes for Stops Up Inside Glazed, Stops Up Outside Glazed, Stops Down Inside Glazed and Stops Down Outside Glazed. If the system is available in Shear Block and Screw Spline, we would need the above four conditions in Shear Block and in Screw Spline. Then we use the metal system to tell us which three (3) conditions the system follows and we only transfer those hole fabrication locations.

- Layout – Same as above except:
  - IMPACT POSITION – Allows for additional holes to be added to parts located in specific spots in an impact system. For example, if an IR 501 has the same part at the head and horizontal, the system can add additional holes at the horizontal only for impact system configurations.1

Assemblies – Assemblies are combination parts that get put in a specific position. The assembly data tells us what individual parts are contained in the assembly, it also designates which of these parts get the fabrication data or sends secondary fabrications.

Adding Fabrications to a Catalog Part

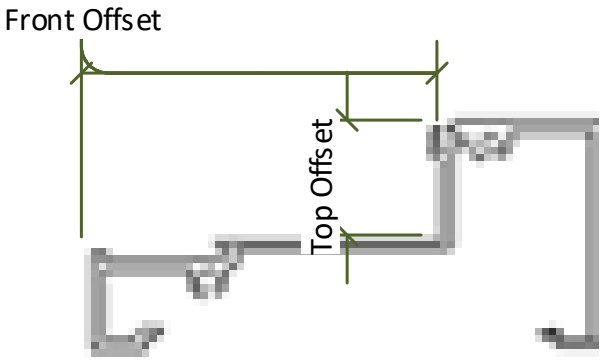
Catalog Parts Details

▼ CATALOG PARTS

NAME	451CG003
DESCRIPTION:	TRIFAB VG 451 HEAD/HORIZONTAL
FUNCTION:	EXTRUSION
MATERIAL:	ALUMINUM
UNIT OF MEASURE:	LENGTH
KEY WORDS:	1"\4 1/2" INSULATED FLUSH GL
VENDOR:	KAWNEER COMPANY INC.
PRIMARY CATALOG SECTION:	SECTION C2
FAB ORIENTATION:	TOP
FAB OFFSET:	
FAB I PLANE FRONT:	3.0625
FAB I PLANE TOP:	1
FAB LEG OFFSET:	

▼ Extrusion Options

EXTRUSION DESIGN PARAMETERS	
EXTRUSION PRICING	
ASSEMBLY DATA	
PRIMARY FABRICATION RULES	
SECONDARY FABRICATION RULES	



Fabrication Information

Fab Offset – Use to align holes with pocket filler since it clips into mullions and are shorter than the full length of the part.

Fab IPlane Offset Front – Distance from front to drillable area of mullion.

- 2 surfaces that are drillable from the front.
- Mullion is 4.5” deep – Iplane Front = Surface contact for drilling. 4.5 – 3.0625 = 1.4375 from back fence to front contact with material.

Fab IPlane Offset Top – Distance from drillable surface to top of mullion.

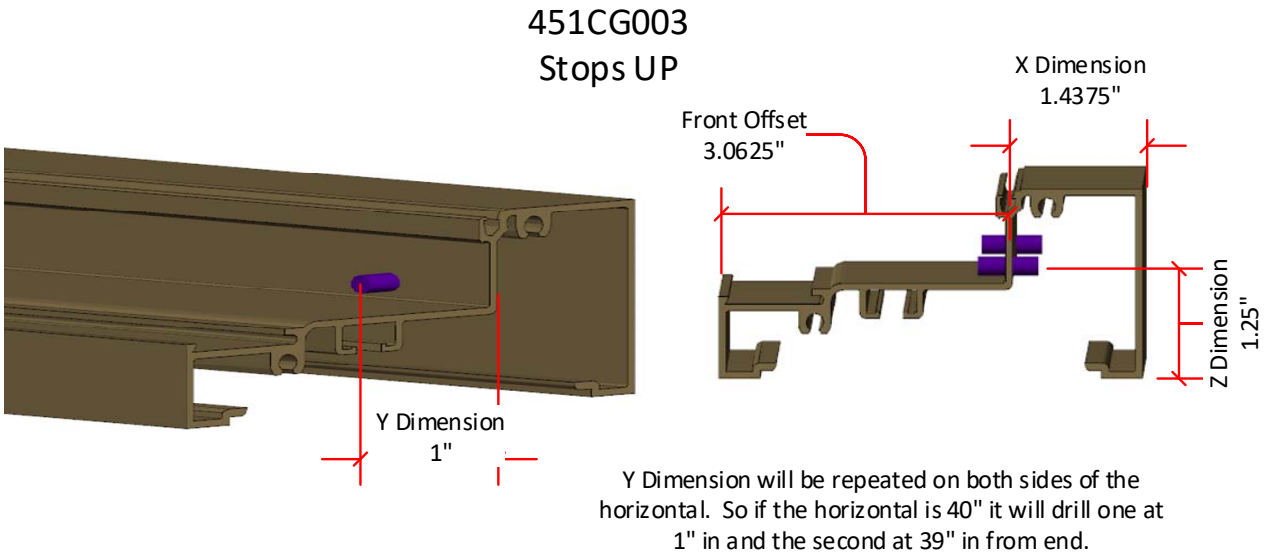
- 2 surfaces that are drillable from the top.
- Mullion is 2” tall – Iplane top = Surface contact for drilling. 2 – 1 = 1” from bottom of mullion to top drill contact with material.

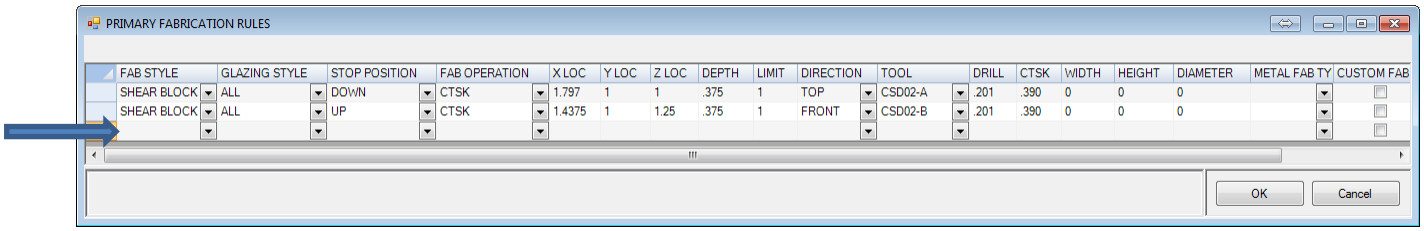
Extrusion Design Parameters – Sets width of part and depth of part.

Primary Fabrication Rules: The fabrications are duplicated on both sides of mullion unless specified as weep, end or center fabrication, then the formula tells us where to put the holes.

Example:

You need to Identify what conditions this part can be used and the differences in fabrications. For example, this part (451CG003) would not need any primary fabrications for a Screw Spline application. So we would only need to put the fabrication info for the Shear Block. We would need one for Stops Up and Stops Down because it needs a different shear block mount hole for Stops Down.

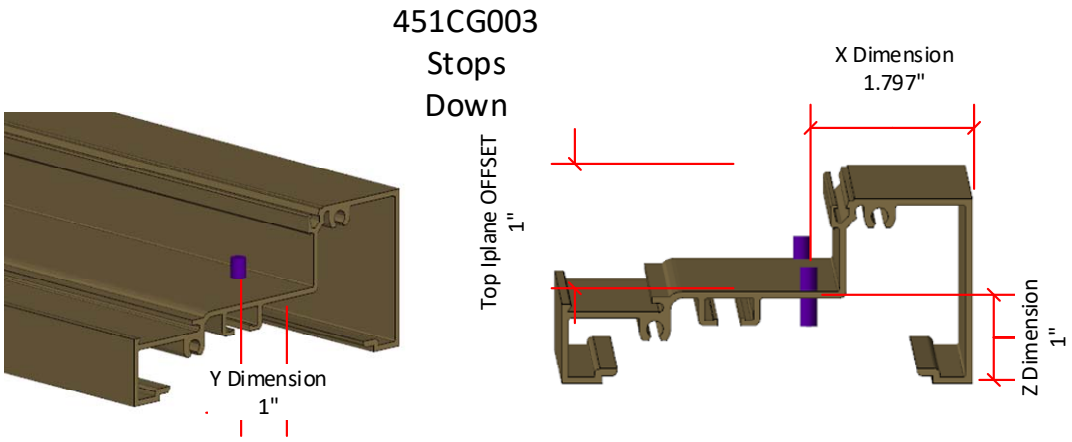




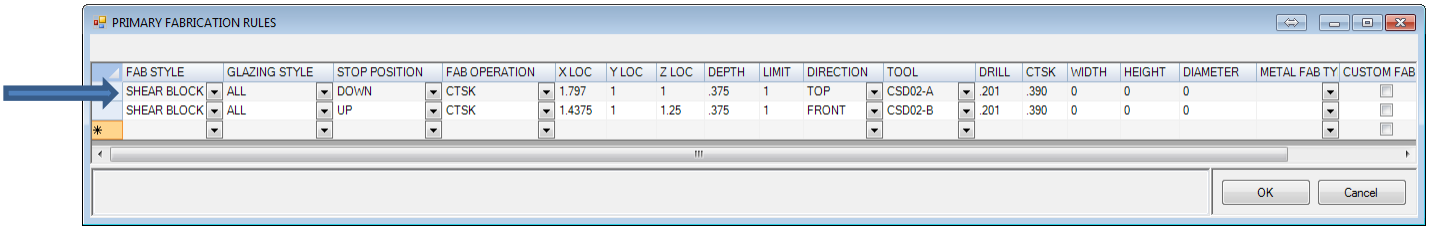
- Shear Block Stops Up:
  - FAB STYLE –Shear Block.
  - GLAZING STYLE – ALL
  - STOP POSITION – Up
  - FAB OPERATION – CTSK (countersink)
  - X LOC – 1.4375 for UP (Measurement from back fence to centerline or face of hole.)
  - Y LOC – 1 (Measurement along length of extrusion to centerline of hole.) NOTE: This will put a hole 1” from either end of horizontal
  - Z LOC – 1.25 Measurement from bottom of part to centerline or face of hole.
  - DEPTH – .375 (Hole depth, default = .375”.)

- LIMIT – 1” (Drill depth limit, default 1”, (used with step drill bit to make sure cavity is deep enough).
- DIRECTION – FRONT (Top, Bottom or Front for which drill head is used).
- TOOL – CSD02-B (Drill or end-mill from Rhino library (see Databases > Fab Tools for complete list).
- DRILL – .201 (Drill diameter)
- CTSK – .390 (Countersink diameter (if applicable).
- WIDTH –0 (Rout width) (Rhino900 only)
- HEIGHT – 0 (Rout Height) (Rhino900 only)
- DIAMETER – 0 (Rout circle diameter) (Rhino900 only).
- METAL FAB TYPE – Blank (None, End/Center, Weep or Fixed (set to None if standard assembly hole).
- CUSTOM FAB – Custom or modified fab by user (will not be overwritten by update if checked).
- BOTTOM Z LOC – Amount to offset fab into opposing member (needed for “captured” systems).

o Shear Block Stops Down:



Y Dimension will be repeated on both sides of the horizontal. So if the horizontal is 40" it will drill one at 1" in and the second at 39" in from end.

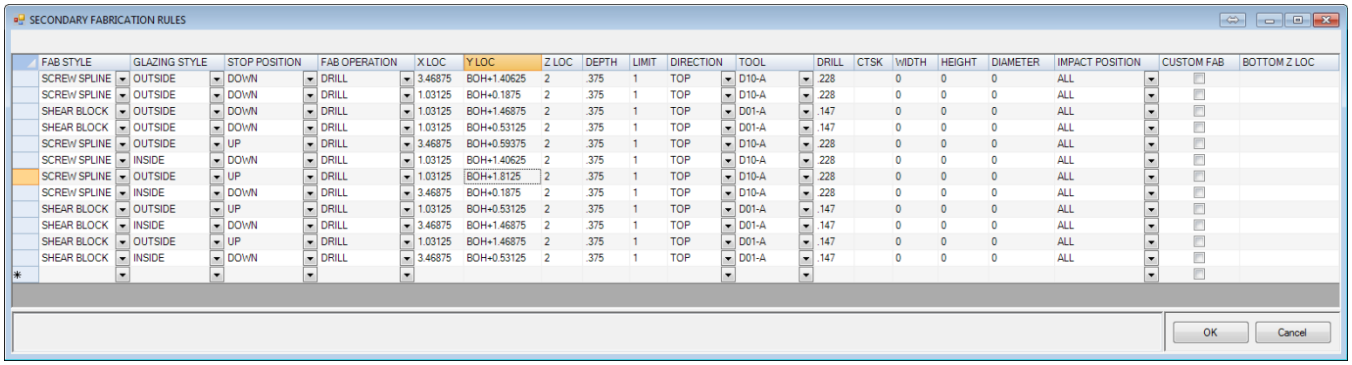


- FAB STYLE –Shear Block.
- GLAZING STYLE – ALL
- STOP POSITION – Down
- FAB OPERATION – CTSK (countersink)
- X LOC – 1.797 for UP (Measurement from back fence to centerline or face of hole.)
- Y LOC – 1 (Measurement along length of extrusion to centerline of hole.) NOTE: This will put a hole 1” from either end of horizontal
- Z LOC – 1 Measurement from bottom of part to centerline or face of hole.
- DEPTH – .375 (Hole depth, default = .375”.)
- LIMIT – 1” (Drill depth limit, default 1”, (used with step drill bit to make sure cavity is deep enough).
- DIRECTION – Top (Top, Bottom or Front for which drill head is used).
- TOOL – CSD02-A (Drill or end-mill from Rhino library (see Databases > Fab Tools for complete list).
- DRILL – .201 (Drill diameter)
- CTSK – .390 (Countersink diameter (if applicable).
- WIDTH –0 (Rout width) (Rhino900 only)

- HEIGHT – 0 (Rout Height) (Rhino900 only)
- DIAMETER – 0 (Rout circle diameter) (Rhino900 only).
- METAL FAB TYPE – Blank (None, End/Center, Weep or Fixed (set to None if standard assembly hole).
- CUSTOM FAB – Custom or modified fab by user (will not be overwritten by update if checked).
- BOTTOM Z LOC – Amount to offset fab into opposing member (needed for "captured" systems).

Secondary Fabrication Rules: These fabrications are transferred to the primary penetrating mullion. If verticals penetrate, then the horizontals pass their secondary fabrications to the verticals. If horizontals penetrate, then the vertical has to pass its secondary fabrications to the horizontal.

- X is always back of vertical to the centerline location of hole.
- Y is Bottom of Horizontal (BOH) + distance up to centerline of hole.
- Z is framing width <u>for top drill</u> and zero or distance to drilling surface from bottom drill.

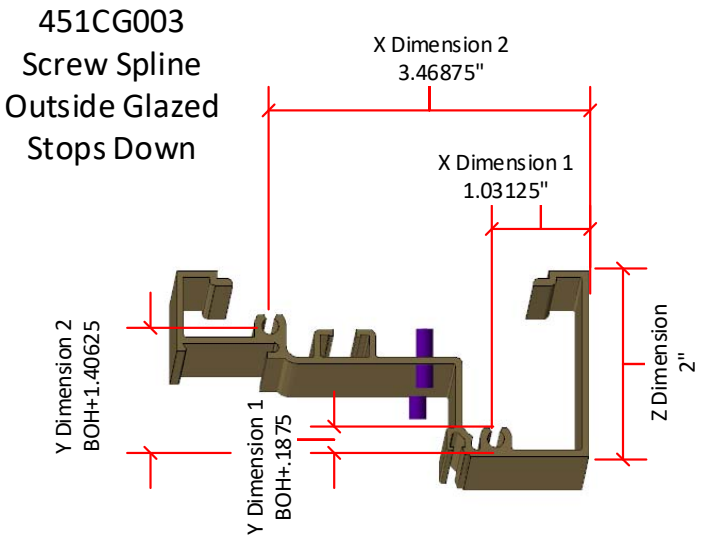


You need to identify what conditions this part can be used for and the differences in fabrications. For example, the part shown above can be fabricated using shear blocks, screw splines, stop up and stops down, and both inside and outside glazed. So we would need to set up the fabrication points for <u>all the different conditions for each hole</u>.

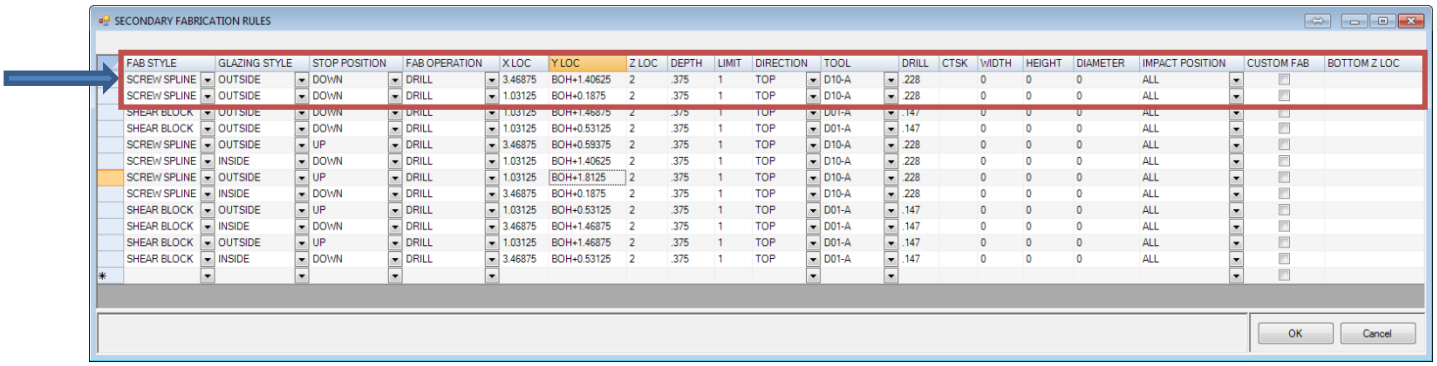
- Screw Spline – Outside Glazed – Stops Down (2 Holes)
- Screw Spline – Inside Glazed – Stop Down (2 Holes)
- Screw Spline – Outside Glazed – Stops Up (2 Holes)
- Shear Block – Outside Glazed – Stops Down (2 Holes)
- Shear Block – Inside Glazed – Stops Down (2 Holes)
- Shear Block – Outside Glazed – Stops Up (2 Holes)

Total of 12 lines of secondary fabrications.

- Screw Spline Outside Glazed Stops Down: Head Mullion



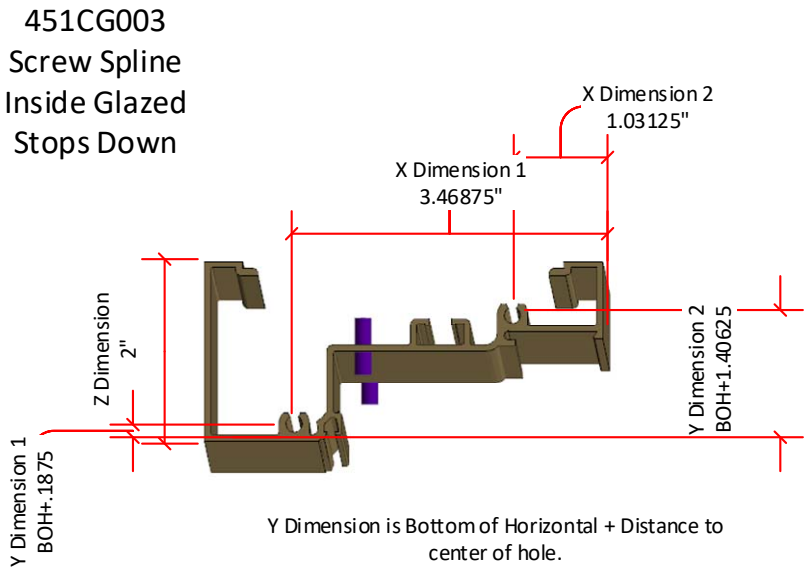
Y Dimension is Bottom of Horizontal + Distance to center of hole.

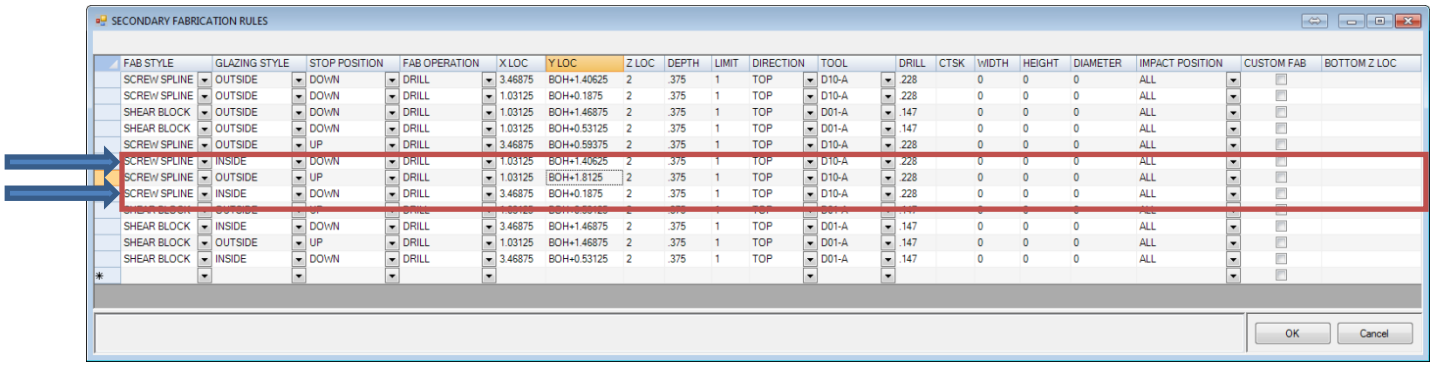


- FAB STYLE –Screw Spline.
- GLAZING STYLE – Outside
- STOP POSITION – Down
- FAB OPERATION – Drill
- X LOC – 1.03125 for 1st, 3.46875 for 2nd (Measurement from back fence to centerline or face of hole.)
- Y LOC – BOH+0.1875 for 1st, BOH+1.40625 for 2nd (Measurement from bottom of horizontal to the centerline of hole.)
- Z LOC – 2 (Measurement from bottom of horizontal to top.)
- DEPTH – .375 (Hole depth, default = .375”)
- LIMIT – 1” (Drill depth limit, default 1”. Used with step drill bit to make sure cavity is deep enough.)

- DIRECTION – TOP (Top, Bottom or Front for which drill head is used).
- TOOL – D10-A (Drill or end-mill from Rhino library. See Databases > Fab Tools for complete list).
- DRILL – .228 (Drill diameter)
- CTSK – blank (Countersink diameter, if applicable).
- WIDTH – 0 (Rout width) (Rhino900 only)
- HEIGHT – 0 (Rout height) (Rhino900 only)
- DIAMETER – 0 (Rout circle diameter) (Rhino900 only).
- IMPACT POSITION – All
- CUSTOM FAB – Custom or modified fab by user (will not be overwritten by update if checked).
- BOTTOM Z LOC – Amount to offset fab into opposing member (needed for "captured" systems).

- Screw Spline Inside Glazed Stops Down: Head Mullion

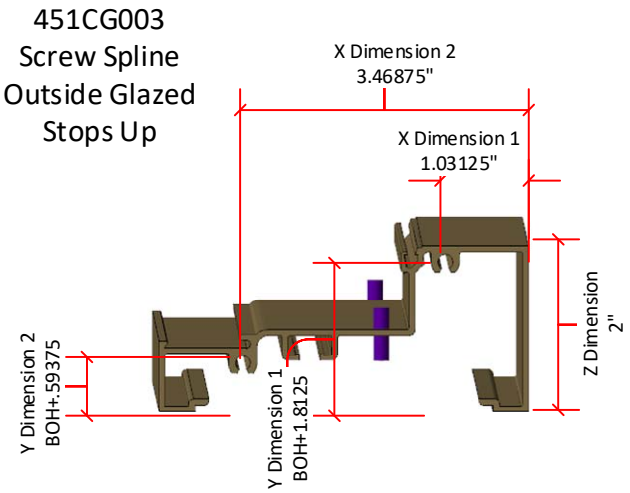




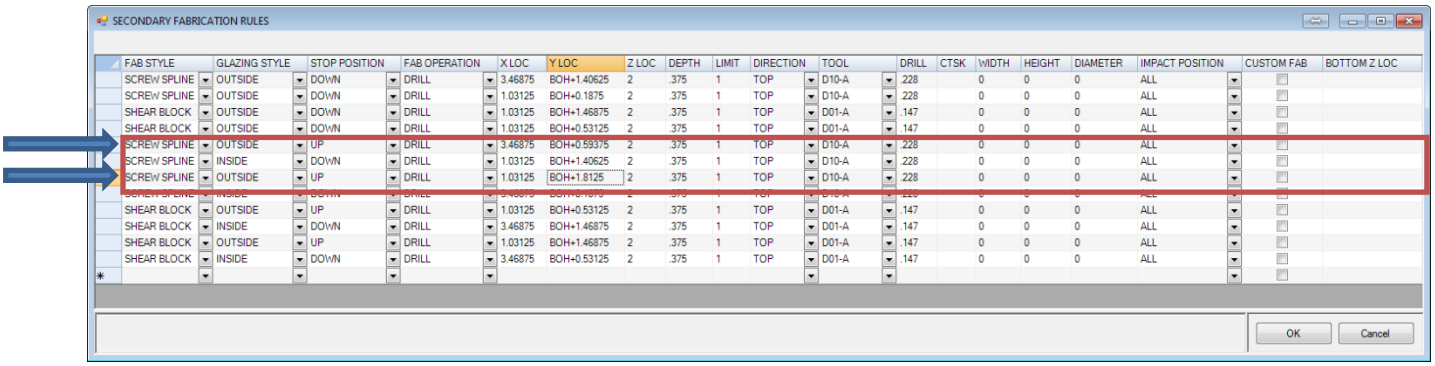
- FAB STYLE –Screw Spline.
- GLAZING STYLE – Inside
- STOP POSITION – Down
- FAB OPERATION – Drill

- X LOC – 1.03125 for 1st, 3.46875 for 2nd (Measurement from back fence to centerline or face of hole.)
- Y LOC – BOH+1.40625 for 1st, BOH+0.1875 for 2nd (Measurement from bottom of horizontal to the centerline of hole.)
- Z LOC – 2 (Measurement from bottom of horizontal to top.)
- DEPTH – .375 (Hole depth, default = .375”)
- LIMIT – 1” (Drill depth limit, default 1”. Used with step drill bit to make sure cavity is deep enough).
- DIRECTION – TOP (Top, Bottom or Front for which drill head is used).
- TOOL – D10-A (Drill or end-mill from Rhino library (see Databases > Fab Tools for complete list).
- DRILL – .228 (Drill diameter)
- CTSK – blank (Countersink diameter, if applicable).
- WIDTH –0 (Rout width) (Rhino900 only)
- HEIGHT – 0 (Rout Height) (Rhino900 only)
- DIAMETER – 0 (Rout circle diameter) (Rhino900 only).
- IMPACT POSITION – All
- CUSTOM FAB – Custom or modified fab by user (will not be overwritten by update if checked).
- BOTTOM Z LOC – Amount to offset fab into opposing member (needed for “captured” systems).

- Screw Spline Outside Glazed Stops Up: Sill Mullion



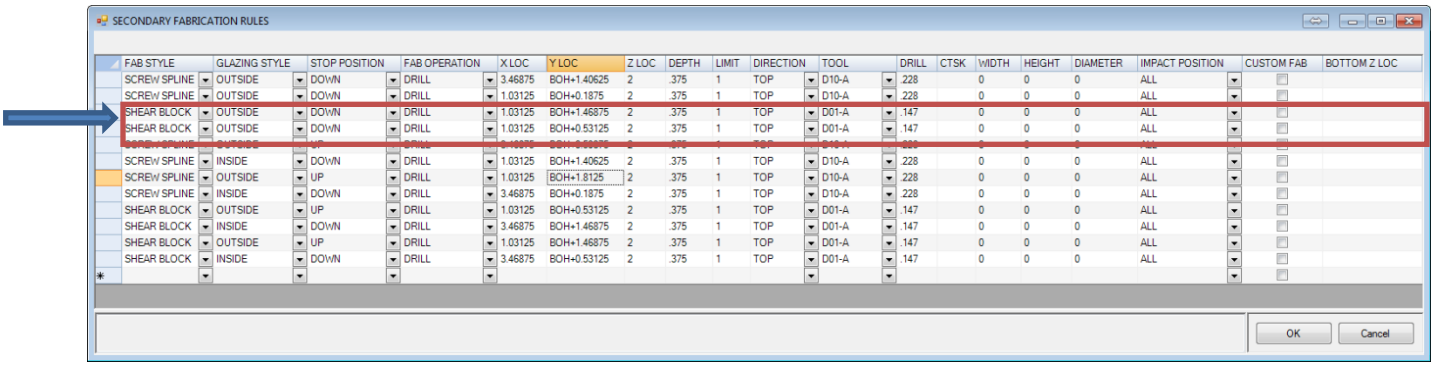
Y Dimension is Bottom of Horizontal + Distance to center of hole.



- FAB STYLE –Screw Spline.
- GLAZING STYLE – Outside
- STOP POSITION – Up
- FAB OPERATION – Drill
- X LOC – 1.03125 for 1st, 3.46875 for 2nd (Measurement from back fence to centerline or face of hole.)
- Y LOC – BOH+1.8125 for 1st, BOH+0.59375 for 2nd (Measurement from bottom of horizontal to the centerline of hole.)
- Z LOC – 2 (Measurement from bottom of horizontal to top.)
- DEPTH – .375 (Hole depth, default = .375”.)
- LIMIT – 1” (Drill depth limit, default 1”, (used with step drill bit to make sure cavity is deep enough).
- DIRECTION – TOP (Top, Bottom or Front for which drill head is used).

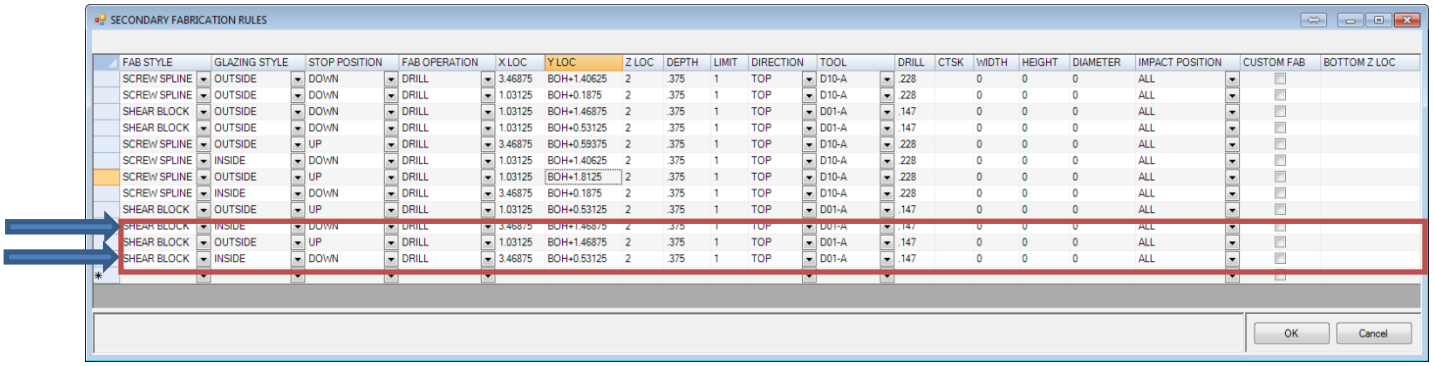
- TOOL – D10-A (Drill or end-mill from Rhino library (see Databases > Fab Tools for complete list).
- DRILL – .228 (Drill diameter)
- CTSK – blank (Countersink diameter, if applicable).
- WIDTH –0 (Rout width) (Rhino900 only)
- HEIGHT – 0 (Rout Height) (Rhino900 only)
- DIAMETER – 0 (Rout circle diameter) (Rhino900 only).
- IMPACT POSITION – All
- CUSTOM FAB – Custom or modified fab by user (will not be overwritten by update if checked).
- BOTTOM Z LOC – Amount to offset fab into opposing member (needed for “captured” systems).

- Shear Block Outside Glazed Stops Down: Head Mullion



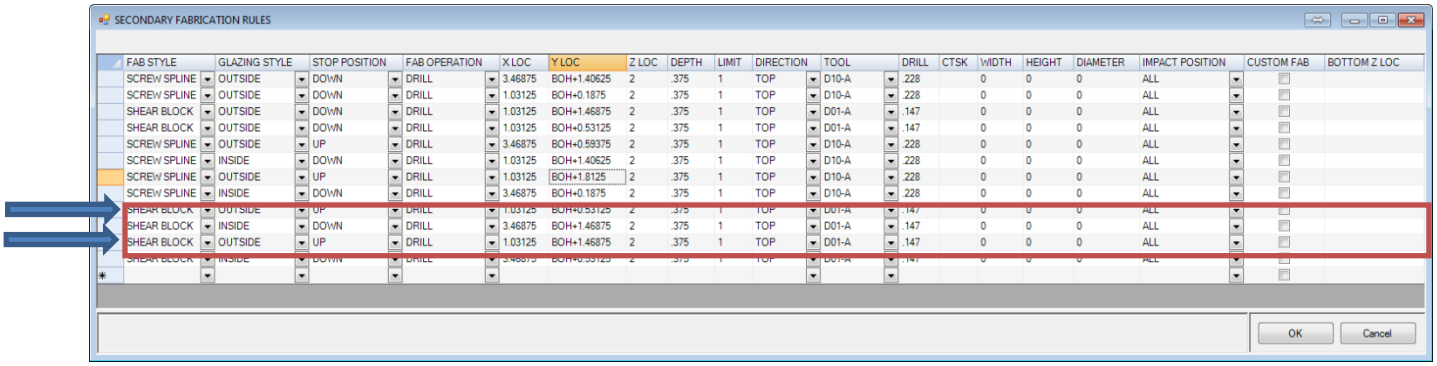
  - FAB STYLE –Shear Block
  - GLAZING STYLE – Outside
  - STOP POSITION – Down
  - FAB OPERATION – Drill
  - X LOC – 1.03125 for 1st, 1.03125 for 2nd (Measurement from back fence to centerline or face of hole.)
  - Y LOC – BOH+1.46875 for 1st, BOH+0.53125 for 2nd (Measurement from bottom of horizontal to the centerline of hole.)
  - Z LOC – 2 (Measurement from bottom of horizontal to top.)
  - DEPTH – .375 (Hole depth, default = .375”)
  - LIMIT – 1” (Drill depth limit, default 1”. Uused with step drill bit to make sure cavity is deep enough).
  - DIRECTION – TOP (Top, Bottom or Front for which drill head is used).
  - TOOL – D01-A (Drill or end-mill from Rhino library (see Databases > Fab Tools for complete list).
  - DRILL – .147 (Drill diameter)
  - CTSK – blank (Countersink diameter, if applicable).
  - WIDTH – 0 (Rout width) (Rhino900 only)
  - HEIGHT – 0 (Rout Height) (Rhino900 only)
  - DIAMETER – 0 (Rout circle diameter) (Rhino900 only).
  - IMPACT POSITION – All
  - CUSTOM FAB – Custom or modified fab by user (will not be overwritten by update if checked).
  - BOTTOM Z LOC – Amount to offset fab into opposing member (needed for “can” or “captured” systems).

- Shear Block Inside Glazed Stops Down: Head Mullion



- FAB STYLE –Shear Block
- GLAZING STYLE – Inside
- STOP POSITION – Down
- FAB OPERATION – Drill
- X LOC – 3.46875 for 1st, 3.46875 for 2nd (Measurement from back fence to centerline or face of hole.)
- Y LOC – BOH+1.46875 for 1st, BOH+0.53125 for 2nd (Measurement from bottom of horizontal to the centerline of hole.)
- Z LOC – 2 (Measurement from bottom of horizontal to top.)
- DEPTH – .375 (Hole depth, default = .375”)
- LIMIT – 1” (Drill depth limit, default 1”. Used with step drill bit to make sure cavity is deep enough).
- DIRECTION – TOP (Top, Bottom or Front for which drill head is used).
- TOOL – D01-A (Drill or end-mill from Rhino library. See Databases > Fab Tools for complete list).
- DRILL – .147 (Drill diameter)
- CTSK – blank (Countersink diameter, if applicable).
- WIDTH – 0 (Rout width) (Rhino900 only)
- HEIGHT – 0 (Rout Height) (Rhino900 only)
- DIAMETER – 0 (Rout circle diameter) (Rhino900 only).
- IMPACT POSITION – All
- CUSTOM FAB – Custom or modified fab by user (will not be overwritten by update if checked).
- BOTTOM Z LOC – Amount to offset fab into opposing member (needed for “captured” systems).

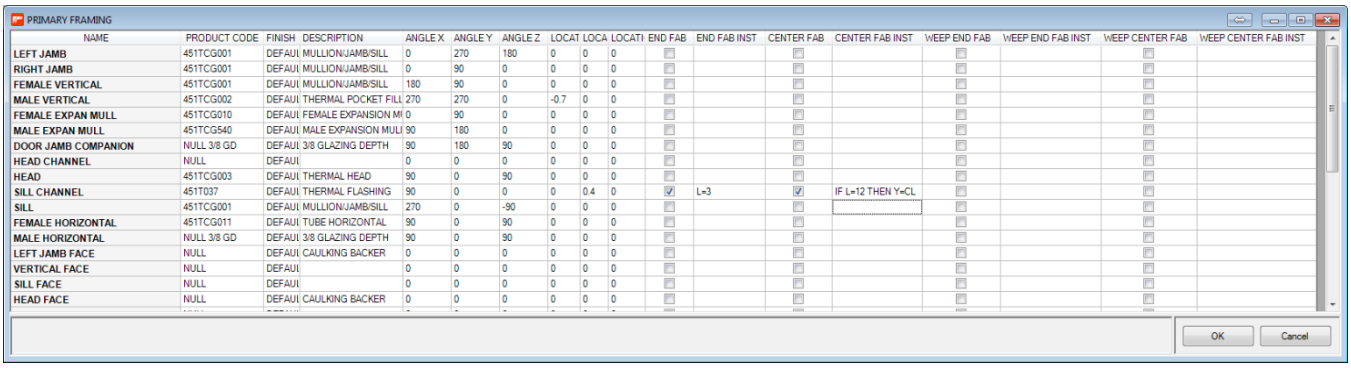
- Shear Block Outside Glazed Stops Up: Sill Mullion

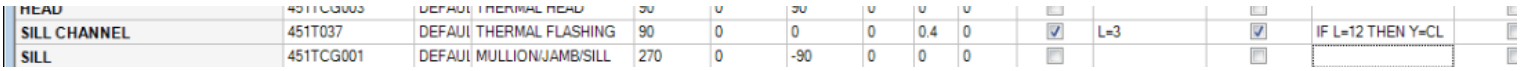


- FAB STYLE –Shear Block
- GLAZING STYLE – Outside
- STOP POSITION – UP
- FAB OPERATION – Drill
- X LOC – 1.03125 for 1st, 1.03125 for 2nd (Measurement from back fence to centerline or face of hole.)
- Y LOC – BOH+0.53125 for 1st, BOH+1.46875 for 2nd (Measurement from bottom of horizontal to the centerline of hole.)
- Z LOC – 2 (Measurement from bottom of horizontal to top.)
- DEPTH – .375 (Hole depth, default = .375”)
- LIMIT – 1” (Drill depth limit, default 1”. Used with step drill bit to make sure cavity is deep enough).
- DIRECTION – TOP (Top, Bottom or Front for which drill head is used).
- TOOL – D01-A (Drill or end-mill from Rhino library (see Databases > Fab Tools for complete list).
- DRILL – .147 (Drill diameter)
- CTSK – blank (Countersink diameter, if applicable).
- WIDTH – 0 (Rout width) (Rhino900 only)
- HEIGHT – 0 (Rout Height) (Rhino900 only)
- DIAMETER – 0 (Rout circle diameter) (Rhino900 only).
- IMPACT POSITION – All
- CUSTOM FAB – Custom or modified fab by user (will not be overwritten by update if checked).
- BOTTOM Z LOC – Amount to offset fab into opposing member (needed for “captured” systems).

Formula Based Fabrications:

Formulas allow us to add multiple fabrication holes based on a single primary fabrication line item. i.e if I want to put anchor holes on a sill channel 4" from each end, I would use a formula on the sill flashing under END \ CENTER and a single line item in the catalog parts primary fabrications to get those fabrications. The formula L=4 would tell me no matter what the length, drill 2 holes, one with the Y axis at Length + 4 and one Length – 4. In the catalog parts I would put a primary fabrication with x, y and z dimensions and tool, and fill out the usage field with END\CENTER.





End – Center Fabrications – Add a formula to call a primary fabrication in for custom distances.

Examples:

For an end fabrication to drill a hole 3" from each end, enter the formula L=3 in the END FAB INST field of the part to drill and check the box. In catalog parts there must be a primary fab with the END\CENTER designation to it for the formula to work.

Formulas for drilling on either side of a vertical would be in the CENTER FAB INST field. Place IF L>12 THEN CL-3 would drill a hole 3 inches to the left and right of the centerline of the vertical.

End – Center Weep – Add a formula to call a primary fabrication for a custom drill or rout. For an end weep you would need a primary fabrication on the part that designates WEEP and contains either a drill or a rout, then use the formulas in the end or center weep to add fabrications.

Formula Fabrication Instructions

1. **Open each Catalog Part that you want to add formula fabrications too and add Fabrications to the Primary Fabrications**

    a. **Follow the same basic instructions for entering fabrications for attachment holes.**

    b. **Set both the glazing style and stop position to ALL.**

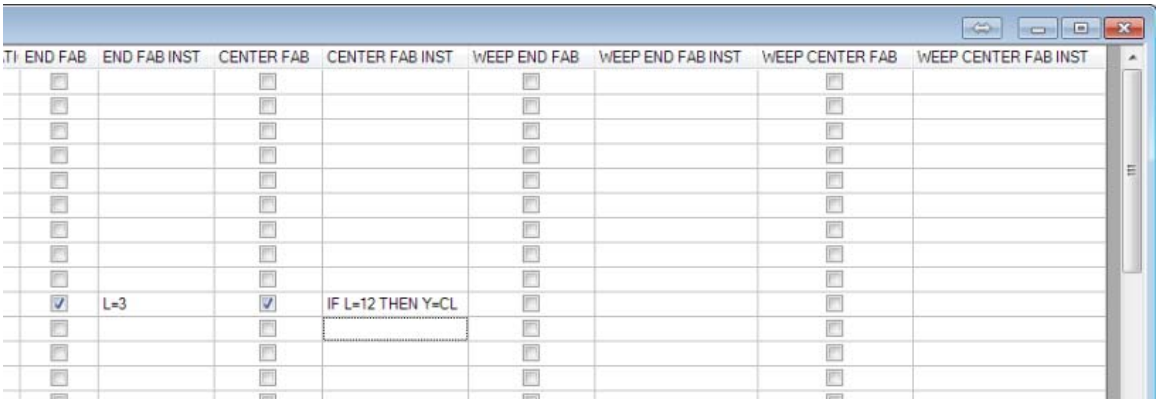
    c. **Set X as the distance from the back fence to the centerline of the hole**

    d. **Set Y as the distance from the starting end of the part centerline of the hole. (y will be replaced by the metal group value called out by the formula)**

    e. **Set Z as the distance from the table up to the centerline of the hole.**

    f. **Identify that line item fabrication as either END / Center or Weep.**

2. Open Metal Group, go to Primary Metal, check boxes and add formulas to the required end / center and / or weep fields.



    a. The **END FAB INST** or **WEEP END INST** formula allows the user to assign a hole at each end of the part. When the formula is assigned, the operation is done symmetrically on both ends. Enter formula as follows:

i. For a hole at a set distance from the End, enter **L=*(Distance Value)*.** For example, to drill a hole 3 inches from each end, you would enter **L=3.**

ii. For a hole at a ratio distance from the end, enter **L=W/*(Ratio)*.** For example, to place a hole at quarter points (1/4 the distance from each end) enter **L=W/4.** For 1/3 distance enter **L=W/3.** To place a hole at the halfway point enter **L=W/2.**

iii. **For a hole to be entered in the center of the part plus and minus a certain amount enter L=W/2+(*Distance Value*). For example, if L=W/2+6 were entered for a 36" log part, the holes would be located at 12" and 24".**

iv. For multiple end holes with the same **X** and **Z** locations and different **Y** locations, separate the commands with a **COMMA (,).** For example, entering **L=3, L=W/4** will drill a hole at 3" from each end and at ¼ the distance from each end.

v. For a hole to be entered only on part longer than a specified length, add the statement **IF L>(*Dimension*) THEN** to the beginning of the formula. For example, entering **IF L>60 THEN L=W/2** on a 72" long part will drill a hole at 36", but no hole would be drilled on a part that was only 48" long.

b. The **CENTER FAB INST** or **WEEP CENTER INST** formula allows the user to assign a series of holes down the length of the part. This formula is only applied if the part is longer than the specified dimension in the formula. Enter formulas as follows:

i. For a hole to be entered in the center of the part, enter **IF L>*(Dimension)* THEN Y=L/2 OC**. For example, if I want to put a hole at the center of a stick, I would use the formula **IF L>24 THEN Y=L/2 OC** which if the stick were 36 inches long would set the Y location for the hole at 18" or half the length.

ii. For holes to be equally spaced down the length of the part, enter **IF L>*(dimension)* THEN Y=*(Dimension)* OC**. For example, if the part is longer than 24" and a hole is needed every 18" on center, enter **IF L>24 THEN Y=18 OC**.

iii. For a hole to be located in a horizontal member, such as a Sill Channel, on either side of a vertical member, enter IF **L>12 THEN Y=CL+*(Dimension)***. For example, to put a hole 3" on either side of each intermediate vertical mullion centerline, enter **IF L>12 THEN Y=CL+3**.

(Note: the holes will be drilled symmetrically around the centerline, so holes will be drilled +3 and -3 off centerline of each vertical).

iv. For a hole to be located at the center of each DLO on a horizontal member spanning multiple openings, such as “sill flashing”, enter **IF L>(*Dimension*) THEN Y=DLO.**

c. Make sure the box next to the formula is checked and there is a corresponding primary fabrication formula in the catalog part to associate with the hole locations.

TOOLS

QTY SUPPLIED	NAME NUMBER	DRILL TYPE	DRILL LENGTH INCH	FEED INCH /REV	STEP FEED INCH /REV	RPM	STEP RPM	DIA.	STEP DIA.	STEP LENGTH	CS ANGLE DEGREE	SLOT LENGTH	ROUT LENGTH	ROUT HEIGHT	ROUT DIA.
	CSD01-A	COUNTERSINK DRILL	3.5	0.18	0.02	3300	600	0.177	0.376	0.375	82	NULL	NULL	NULL	NULL
1	CSD02-A	COUNTERSINK DRILL	3.5	0.15	0.02	3300	600	0.201	0.39	0.375	82				
1	CSD02-B	COUNTERSINK DRILL	4.8	0.15	0.02	2000	600	0.201	0.39	0.375	82	NULL	NULL	NULL	NULL
	CSD03-A	COUNTERSINK DRILL	3.5	0.15	0.02	3300	600	0.218	0.438	0.375	82	NULL	NULL	NULL	NULL
1	CSD04-A	COUNTERSINK DRILL	3.5	0.15	0.02	3300	600	0.228	0.438	0.375	82	NULL	NULL	NULL	NULL
4	D01-A	DRILL	2.5	0.18	0	3300	0	0.147	0	0	0	NULL	NULL	NULL	NULL
	D02-A	DRILL	2.5	0.18	0	3300	0	0.149	0	0	0	NULL	NULL	NULL	NULL
	D03-A	DRILL	2.5	0.18	0	3300	0	0.154	0	0	0				
	D04-A	DRILL	2.5	0.18	0	3300	0	0.159	0	0	0	NULL	NULL	NULL	NULL
4	D05-A	DRILL	2.5	0.18	0	3300	0	0.173	0	0	0	NULL	NULL	NULL	NULL
4	D06-A	DRILL	2.5	0.18	0	3300	0	0.177	0	0	0	NULL	NULL	NULL	NULL
	D06-B	DRILL	2.5	0.18	0	3300	0	0.177	0	0	0				
4	D07-A	DRILL	2.5	0.18	0	3300	0	0.182	0	0	0	NULL	NULL	NULL	NULL
	D08-A	DRILL	2.5	0.18	0	3300	0	0.191	0	0	0	NULL	NULL	NULL	NULL
4	D09-A	DRILL	2.5	0.15	0	3300	0	0.201	0	0	0	NULL	NULL	NULL	NULL
4	D10-A	DRILL	2.5	0.15	0	3300	0	0.228	0	0	0	NULL	NULL	NULL	NULL
2	D11-A	DRILL	2.5	0.15	0	3300	0	0.25	0	0	0	NULL	NULL	NULL	NULL
2	D12-A	DRILL	2.5	0.15	0	3300	0	0.257	0	0	0	NULL	NULL	NULL	NULL
2	D13-A	DRILL	2.5	0.15	0	3300	0	0.266	0	0	0	NULL	NULL	NULL	NULL
2	D14-A	DRILL	2.5	0.15	0	3300	0	0.313	0	0	0	NULL	NULL	NULL	NULL
	D15-A	DRILL	2.5	0.15	0	3300	0	0.221	0	0	0	NULL	NULL	NULL	NULL
2	D16-A	DRILL	2.5	0.15	0	3300	0	0.196	0	0	0	NULL	NULL	NULL	NULL
	D17-A	DRILL	4.5	0.18	0	3300	0	0.563	0	0	0				
	EM01-A	ROUT	2.313	0.1	0	5000	0	0.147	0	0.437	0	1	1	1	1
	EM02-A	ROUT	2.313	0.1	0	5000	0	0.149	0	0.437	0	1	1	1	1
	EM03-A	ROUT	2.313	0.1	0	5000	0	0.154	0	0.437	0	1	1	1	1
	EM04-A	ROUT	2.313	0.1	0	5000	0	0.159	0	0.437	0	1	1	1	1
	EM05-A	ROUT	2.313	0.1	0	5000	0	0.173	0	0.437	0	1	1	1	1
	EM06-A	ROUT	2.313	0.1	0	5000	0	0.177	0	0.437	0	1	1	1	1
	EM07-A	ROUT	2.313	0.1	0	5000	0	0.182	0	0.437	0	1	1	1	1
2	EM08-A	ROUT	2.5	0.1	0	5000	0	0.191	0	0.75	0	1	1	1	1
	EM09-A	ROUT	2.313	0.1	0	5000	0	0.201	0	0.437	0	1	1	1	1
	EM10-A	ROUT	2.313	0.1	0	5000	0	0.228	0	0.5	0	1	1	1	1
2	EM11-A	ROUT	2.5	0.1	0	5000	0	0.25	0	0.75	0	1	1	1	1
	EM12-A	ROUT	2.313	0.1	0	5000	0	0.257	0	0.5	0	1	1	1	1

2	EM13-A	ROUT	2.313	0.1	0	5000	0	0.266	0	0.562	0	1	1	1	1
	EM14-A	ROUT	2.5	0.1	0	5000	0	0.313	0	0.812	0	0.625	0.625	1	1
	EM15-A	ROUT	2.313	0.1	0	5000	0	0.221	0	0.5	0	1	1	1	1
	EM16-A	ROUT	2.313	0.1	0	5000	0	0.196	0	0.437	0	1	1	1	1
	SD01-A	STEP DRILL	3.5	0.18	0.1	3300	1000	0.169	0.375	0.375	0	NULL	NULL	NULL	NULL
	SD02-A	STEP DRILL	4.75	0.18	0.1	3300	1000	0.191	0.375	0.375	0				
	SD03-A	STEP DRILL	4.75	0.15	0.1	3300	1000	0.201	0.375	0.375	0				
	SD04-A	STEP DRILL	4.75	0.15	0.1	3300	1000	0.25	0.5	0.375	0				
	SD05-A	STEP DRILL	3.5	0.18	0.1	3300	1000	0.147	0.201	0.375	0				
	SD06-A	STEP DRILL	3.5	0.18	0.1	3300	1000	0.147	0.228	0.375	0				
	SD07-A	STEP DRILL	3.5	0.18	0.1	3300	1000	0.221	0.375	0.375	0				