Assembly of Reactor Lid

Directions for Fabrication and Assembly

Contents

Current State

- Solid models exist for the assembly. Limited drawings are complete.
- Fabrication of individual parts is nearly complete. Some additional cutting and shaping will be required.
- Welding of the flat tank surface is nearly complete.
- Some fastener/standard part purchasing remains

Decision Points

The dynamic lid, as currently designed, can be both rotated and lifted. The rotation comes from the pinned bolt design, and the lift comes from half inch slots cut in the fixed hinge mount.

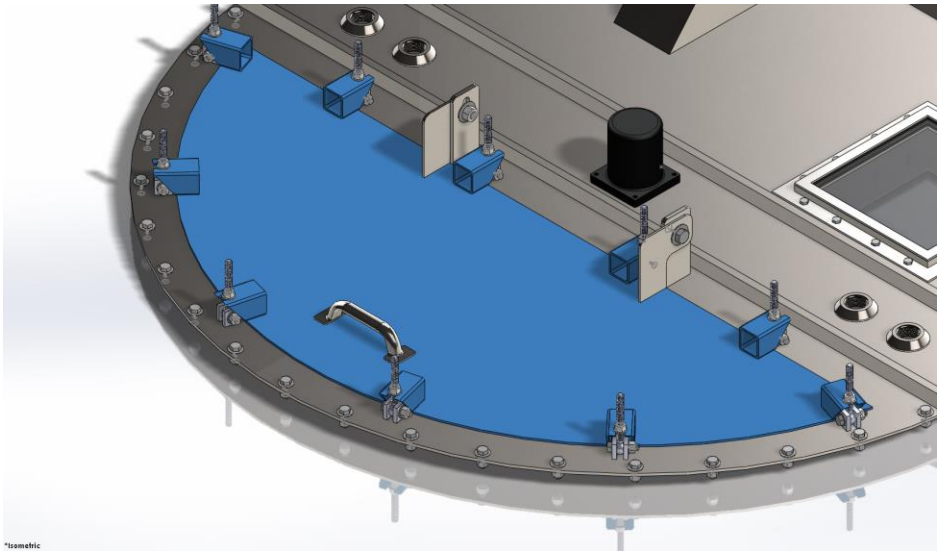


Figure 1: The dynamic lid resting on the static lid

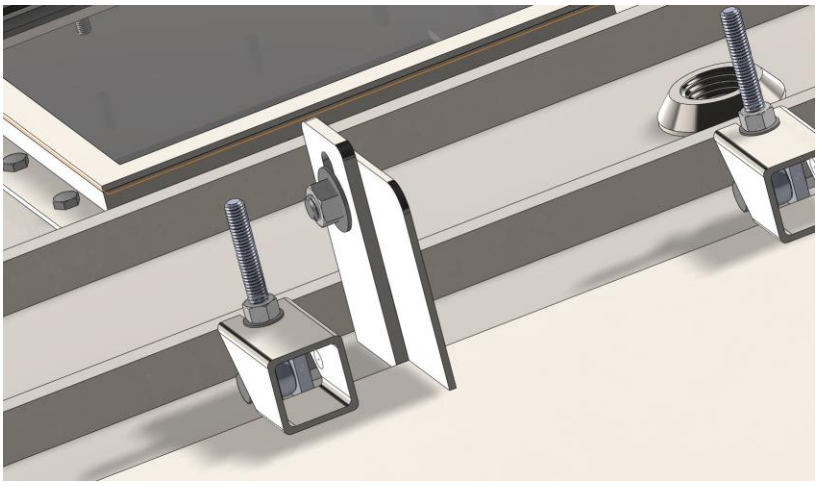


Figure 2: A view of the lid hinge mounts showing the slotted fixed mount

The design requested by the client for clamping appears below. The eyebolt is pinned to two blocks that are welded to the static lid. The box channel shown is welded onto the dynamic lid. When the lid is closed, the eyebolt latches into a groove cut into the box channel, and the bolt and washer clamp the dynamic lid down to the static one.

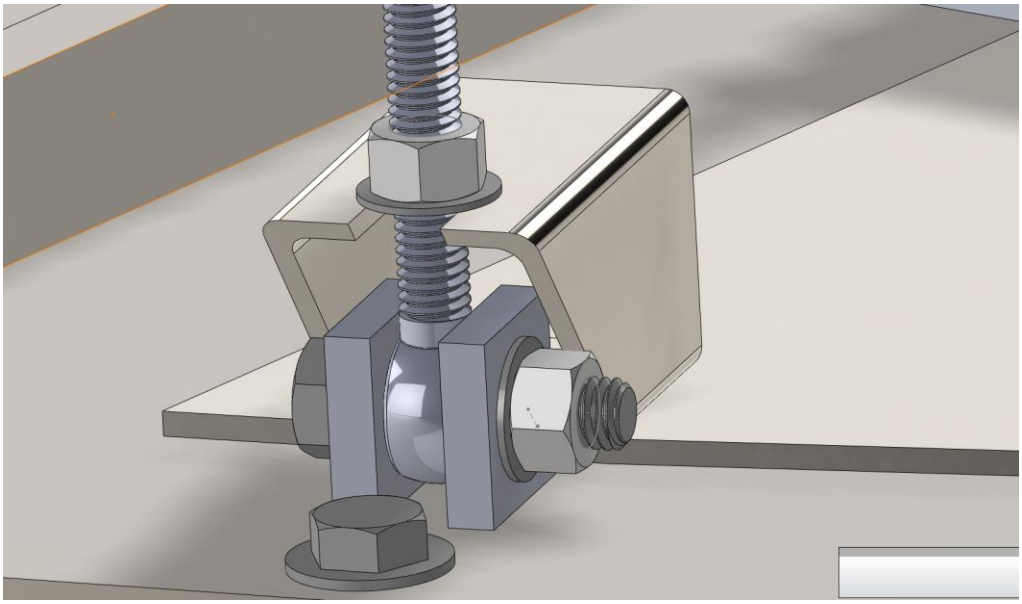


Figure 3: A closeup of the clamp view

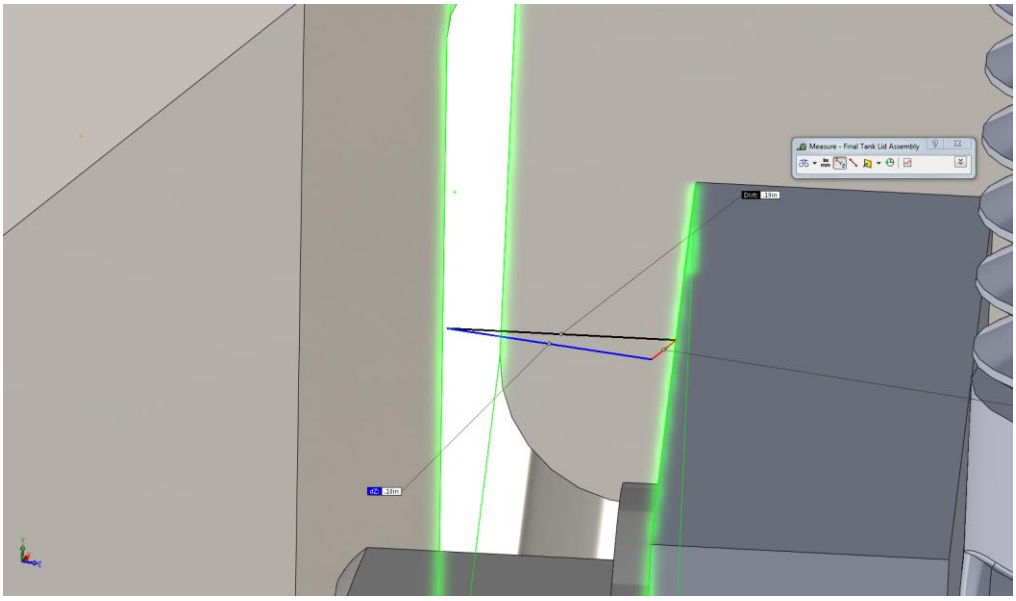


Figure 4: The clearance between the eyebolt base and the side of the box is .14 inches

This arrangement can lead to collisions between the eyebolt base blocks and the dynamic lid, if the lid is not lifted to the top of the slots prior to rotation. There are three options available to the lid fabricators.

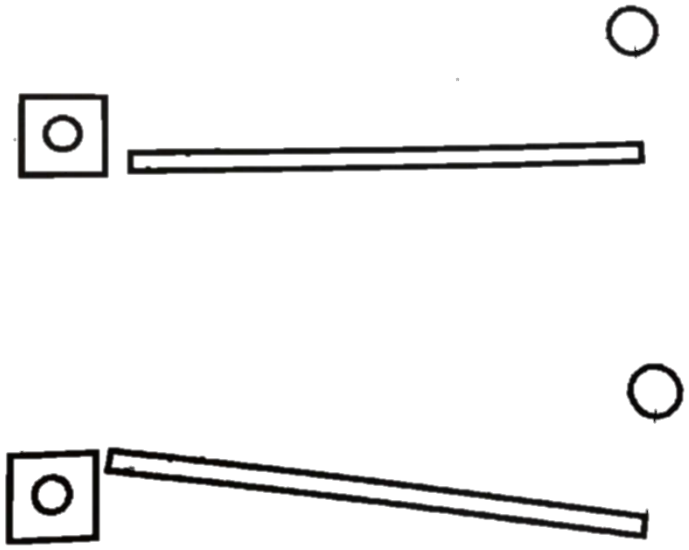


Figure 5 Shows the movement leading to collision as the dynamic lid pivots around the bolts

The current system will work, as long as the lid is lifted fully to the top of the slot. Under this scenario, the clamps are the last item that should be fitted, in order to ensure that the dynamic lid can operate smoothly even with the eyebolt blocks welded in place on the static lid. This scenario is also undesirable from an ergonomics standpoint, as the effort to both lift and rotate the lid while working at the operating height of the top of the tank will cause strain and extra work for the operator. The client should also be aware as was discussed with them earlier in the design process that the bolt clamps will be highly labor intensive.

If the owners desire to maintain the clamping action previously described, then the layout of the clamps largely eliminates the need for the hinges. The lid would then simply become a lift-on lift-off lid. While this is less ergonomic than rotation, this is more ergonomic than attempting to lift the lid a half inch before rotating it to a fully open position.

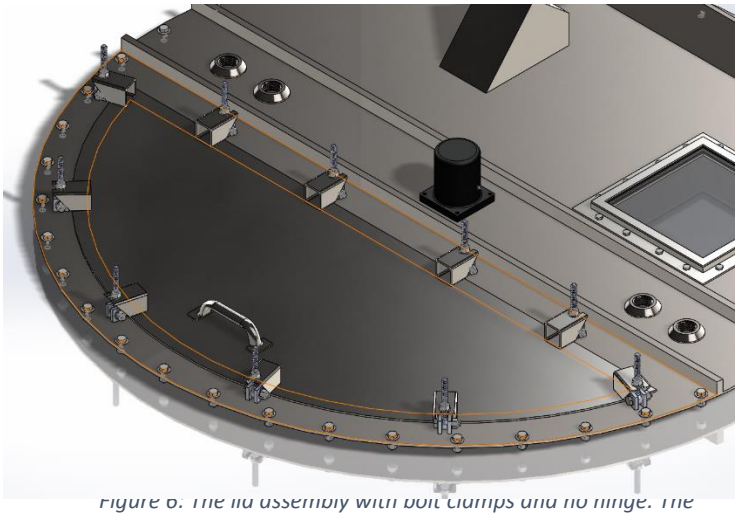


Figure 6. The lid assembly with bolt clamps and no hinge. The clamp alignment should be sufficient to keep the lid in correct location.

If the owners desire to maintain the rotating feature of the lid, and have ease of clamping, they should substitute toggle clamps for the bolt clamps. These would not be significantly difficult to implement – extra holes, bolts, and gaskets would be needed, but they could be placed in the same intervals as specified for the bolt clamps. They are available for $24.84 from McMaster-Carr, with a capacity of 200 lbs per clamp to maintain the safety factor designed into the bolt clamps.
http://www.mcmaster.com/#5128a46/=x3h6qn

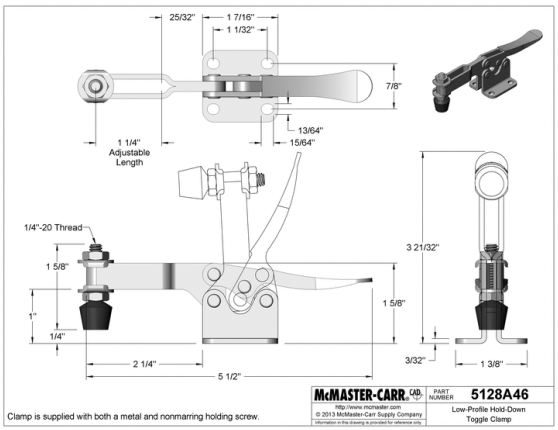


Figure 7: Toggle Clamps Available from Vendors

Fabrication Order of Operations

Static Lid Sheet Metal Work Needed

- Facilities contracted to weld the stainless steel sheet used for the static lid together. On the two joints which lie at the opening of the dynamic lid access portion, their work is unsatisfactory. Weld joint does not extend through to the back face of the weld, which is necessary for a good seal on the tank lid. On one side, the pieces welded do not align well, again leading to a poor sealing surface. Welds need to be aligned and flush on both sides to be satisfactory for final installation

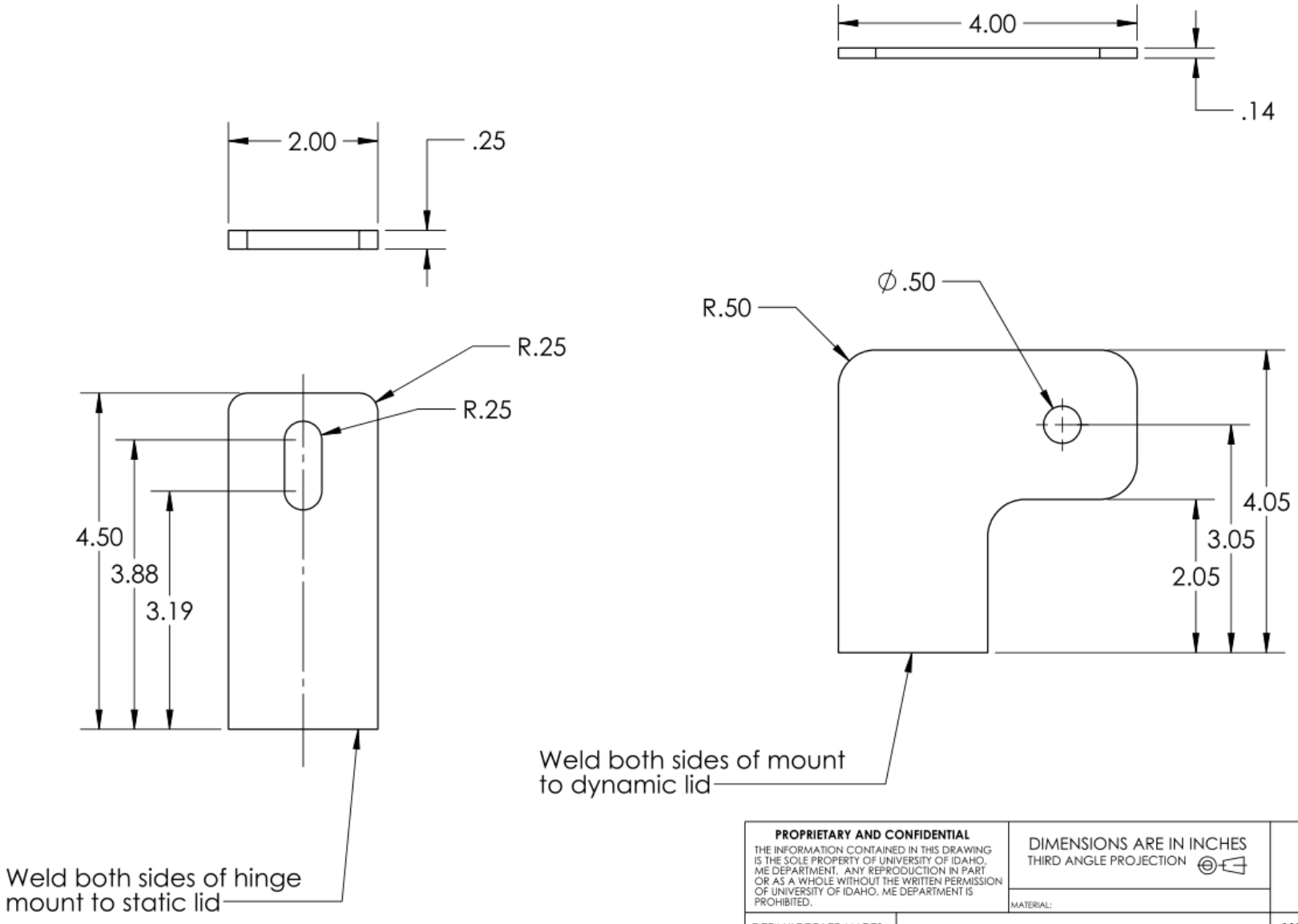
Part Purchasing

- TOGGLE CLAMPS (If decided upon)
- Bolts, washers, and nuts – lid to flange
  - 3/8" – 18-8 stainless steel bolts, nuts, and washers
    - Should be mounted with one washer above and below securing surfaces
    - See cost sheet for quantiles
- Bolts, washers, and nuts – viewport hold-down to flange
- Dynamic Lid Sealing Material Viton Sheet Gasket Material
  http://www.allstategasket.com/info_gasket_material_style-1184.asp
- Dynamic Lid Sealing Adhesive JFlex Viton Adhesive
  http://www.j-flex.co.uk/products/maintenance-products/

Dynamic Lid

- IF TOGGLE CLAMPS:
  - The lid hinge pieces need to be fabricated (Drawings Follow) and installed.
    - The dynamic hinge pieces and handle need to be welded to the dynamic lid. (Drawings follow)
  - 6 Toggle Clamps Should be spaced evenly to clamp the arc edge of the dynamic lid, while the remaining four are used to clamp the straight edge. The last drawing in the following set shows appropriate clamping intervals.
- IF BOLT CLAMPS

- Hinges may either be applied, or not – if they are, follow the same procedure as if using toggle clamps.
- WELD the box channels to the dynamic lid at specified intervals



Hinge Parts to be Fabricated

DIMENSIONS ARE IN INCHES
THIRD ANGLE PROJECTION

MATERIAL:

DEFAULT TOLERANCES:

LINEAR:
X. ± .25
X.X ± .1
X.XX ± .01
X.XXX ± .002

ANGULAR:
X. ± 2
X.X ± 1
X.XX ± 0 30'

DESCRIPTION:

CHECKED BY: XXXXXXXXX DATE: XX/XX/XX

DRAWN BY: DATE: 4/24/2015

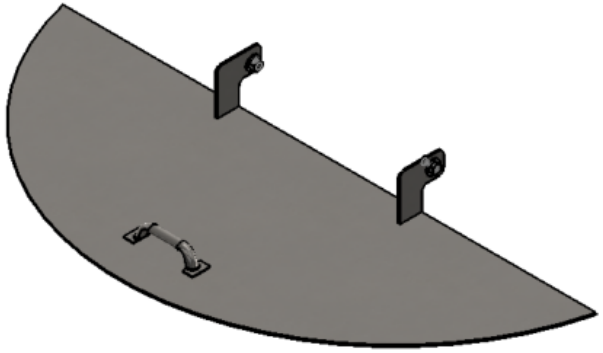
FILE NAME: Dynamic Lid mount.SLDPRT

PROJECT NAME

UNIVERSITY OF IDAHO
ME DEPARTMENT

PART #: QTY:

SCALE: 1:1 SHEET: 1 OF 3



Directions for Welding Hinges to Dynamic Lid

DIMENSIONS ARE IN INCHES
THIRD ANGLE PROJECTION

MATERIAL:

DEFAULT TOLERANCES:

LINEAR:
X. ± .25
X.X ± .1
X.XX ± .01
X.XXX ± .002

ANGULAR:
X. ± 2
X.X ± 1
X.XX ± 0 30'

DESCRIPTION:

CHECKED BY: R DATE: 5/8/2015

DRAWN BY: DATE: 5/8/2015

FILE NAME: Final Tank Lid Assembly.SLDPRT

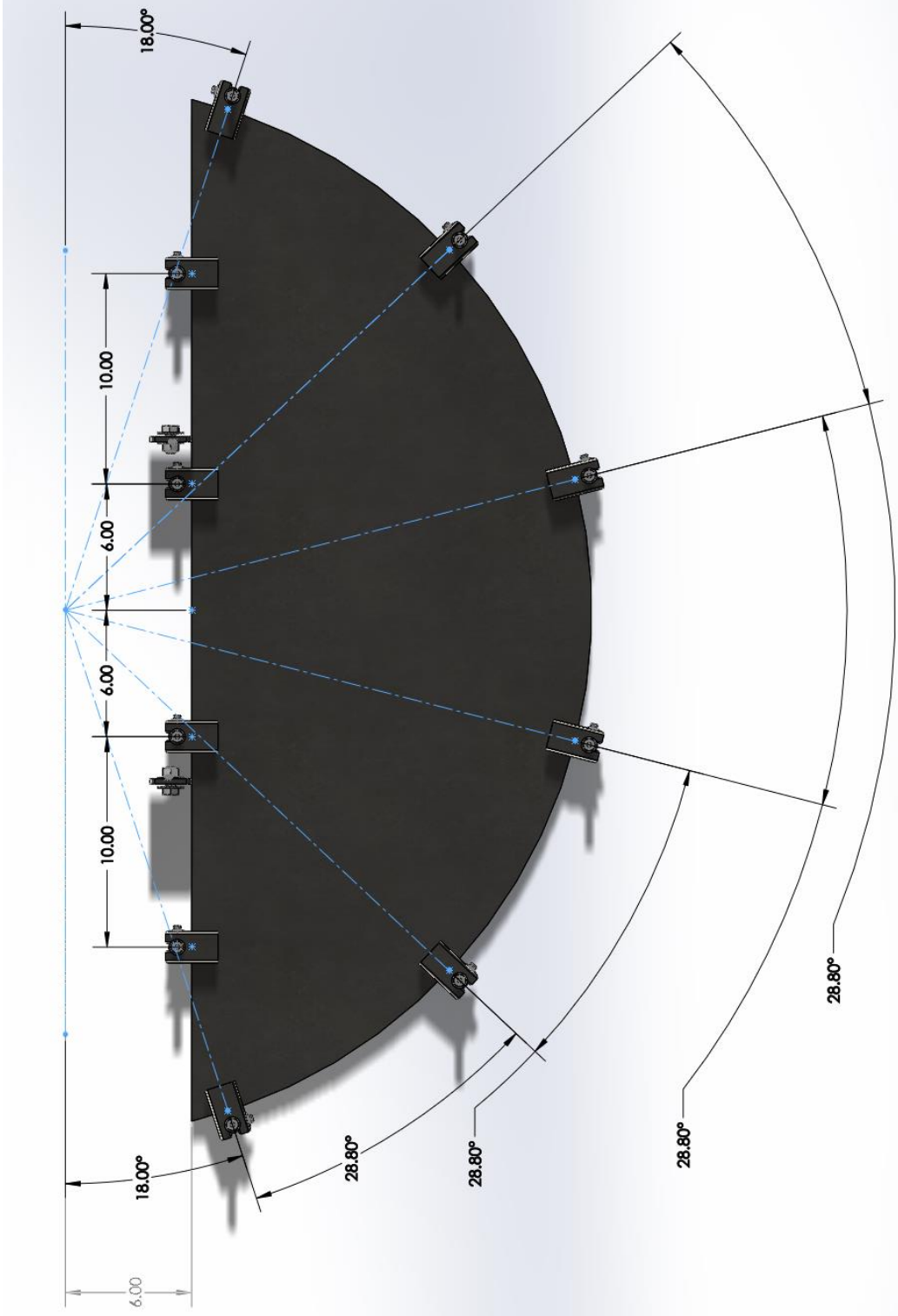
Biodiesel Reactor Lid

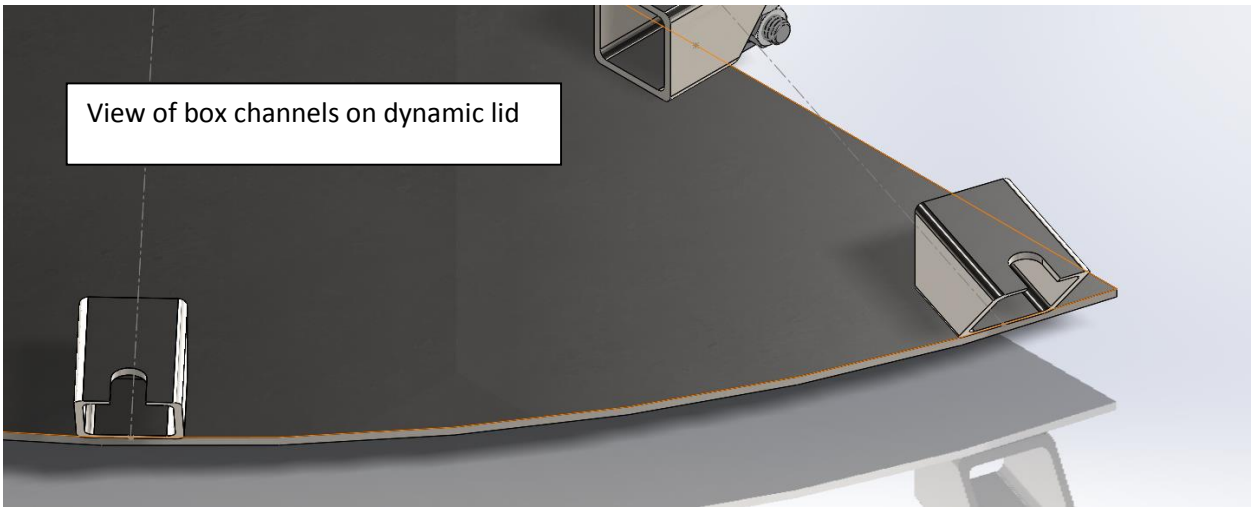
UNIVERSITY OF IDAHO
ME DEPARTMENT

PART #: QTY:

SCALE: 1:24 SHEET: 1 OF 2

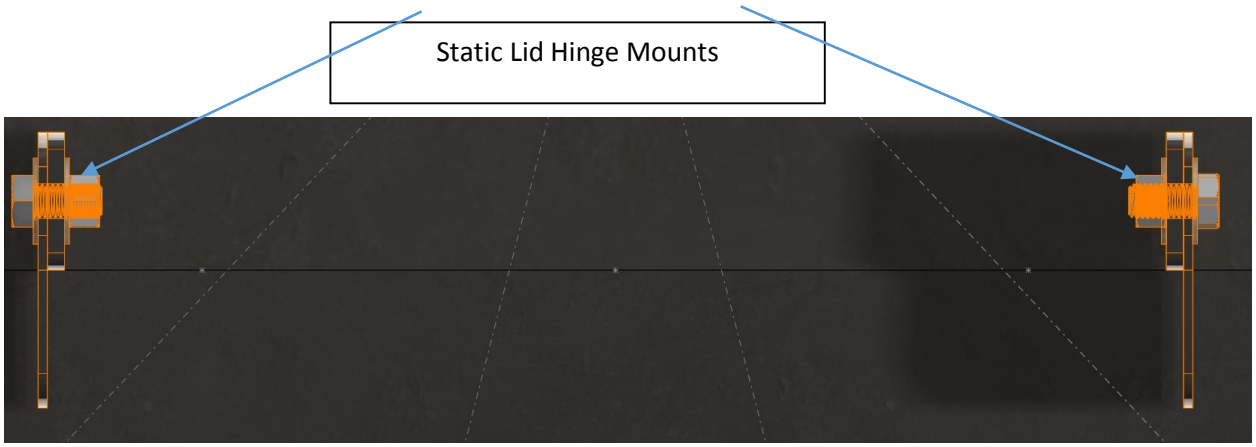
Placement of Hinge Locations around the Dynamic Lid





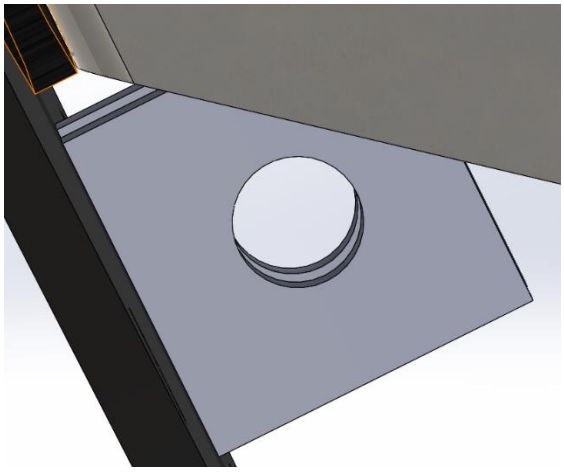
WELDING HINGE MOUNT TO STATIC LID

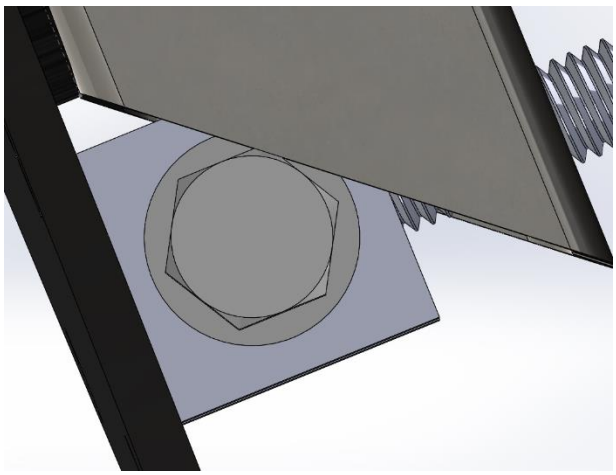
- Static lid hinge mounts should be fabricated as previously documented
- SET DYNAMIC LID IN PLACE: Fasten to prevent moving
- PLACE AND MARK LOCATION for static lid hinge mounts as shown in image:
  - ENSURE SUFFICIENT CLEARANCE FOR ROTATION WITHOUT INTERFERENCE!
- WELD BOTH SIDES of the static lid hinge mount to the static lid.



- INSTALL the bolt and lock washer assembly that pins the dynamic lid hinge mount to the static lid hinge mount

Welding Eye Bolt Blocks to Static Lid





- Set and fix dynamic lid in place so it does not move while eye bolt assemblies are placed.
- For each eyebolt assembly:
  - Align it with its corresponding box channel notch
  - MAKE SURE: minimum distance from square blocks is 0.2” from edge of dynamic lid for opening clearance
  - MARK the location of each square block and its weld
- IF HINGED: CHECK each clamp location by making sure the lid opens with the blocks in place
  - WELD each square block down to the static lid
  - CHECK AGAIN to make sure that the lid opens with the blocks in place
- IF NOT HINGED: Lid will lift clear of static blocks without issue – be sure no blocks are giving interference to any point on the lid before welding.

TOGGLE CLAMPS (If using instead of bolt clamps)

- Make sure hinges are installed and functional.
- SPACE AT SAME INTERVALS AS BOLT CLAMPS
- Ensure sufficient distance from lid to allow clearance when lid opens
- Drill appropriate holes and fasten with appropriate fasteners and gasket materials

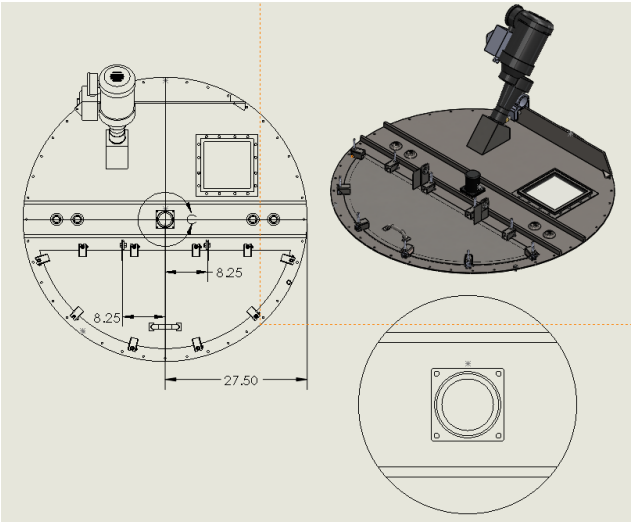
Dynamic Lid Seal

- The previously discussed sheet gasketing material needs to be purchased and cut to shape to fit the dynamic lid opening, and then sealed around the dynamic lid opening with the previously discussed sealant. This needs to be done after all welding in the region is completed – welding poses damage threat to the gasket material

Static Lid Installation and Seal

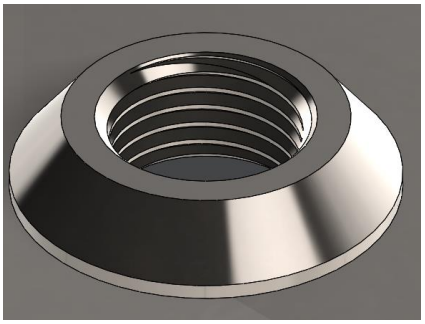
- Holes are precut in the static lid. These need to be used as guide holes to drill holes in the tank flange.
- Gasket tape material has been procured for sealing the tank-static lid edge. Install this material, and bolt the static lid to the tank flange.

Hydraulic Motor Mount (NOT NECESSARY – INSTALL IF DESIRED)



- Cut hole of appropriate diameter for motor shaft in dead center of static lid
- Measure and mark holes for bolting down the static mount
- Fasten hydraulic motor with appropriate fasteners and gasketing

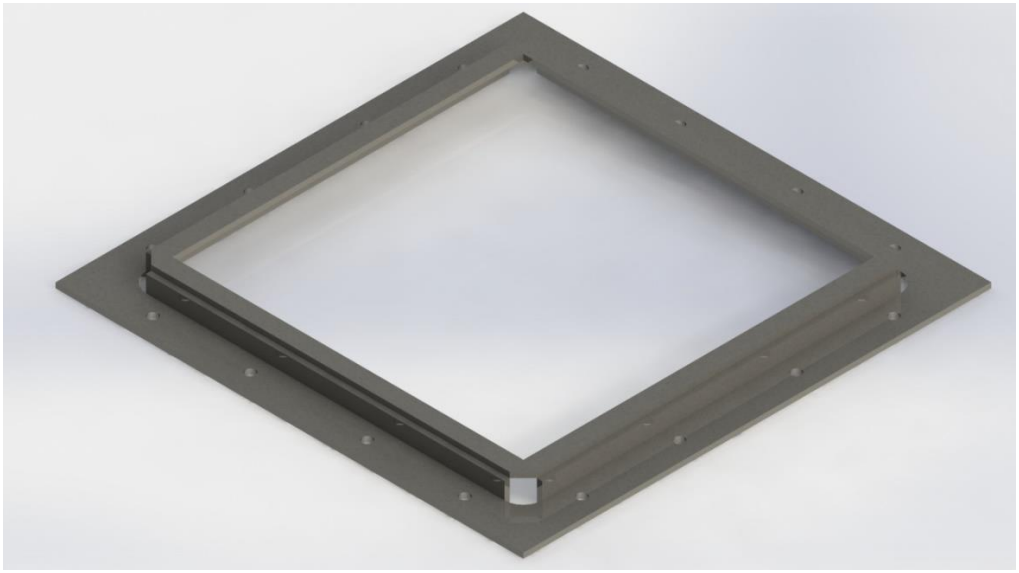
Plumbing Ports

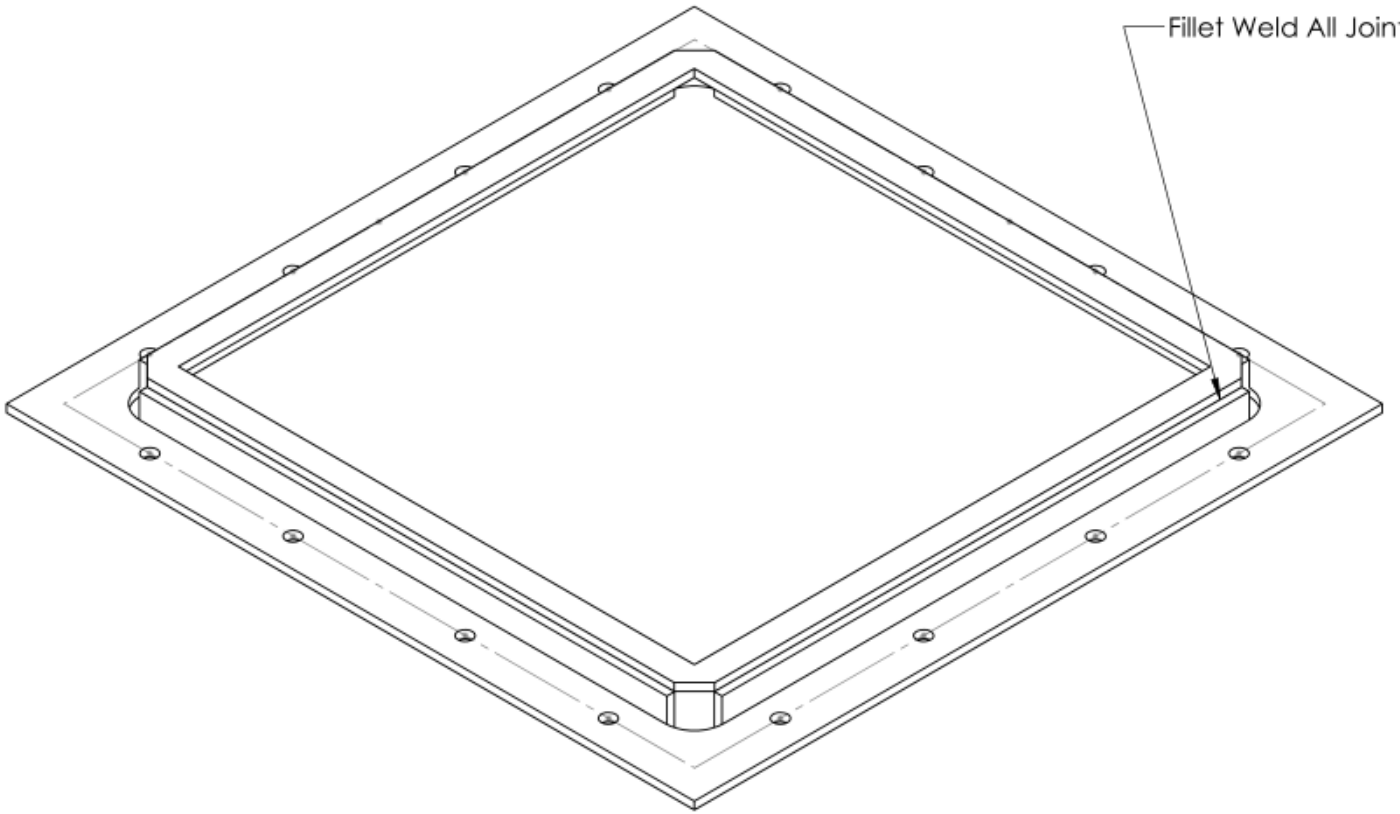


- Four holes are pre-cut in the top of the static lid for the four ports already purchased.
- Set these ports in the precut holes and weld them in place

Glass Viewport

- All components are either purchased or already cut
- Some welding is necessary to fix the hold-down tabs to the bolt-down plate.
- Fasten and seal with appropriate fasteners and gaskets
- Use all 10 gauge 304 stainless steel for manufacturing
- Designed for use of 1/8” gasket above and below the glass





DIMENSIONS ARE IN INCHES
THIRD ANGLE PROJECTION

MATERIAL: 304 Stainless Steel

Biodiesel Viewport

DEFAULT TOLERANCES:

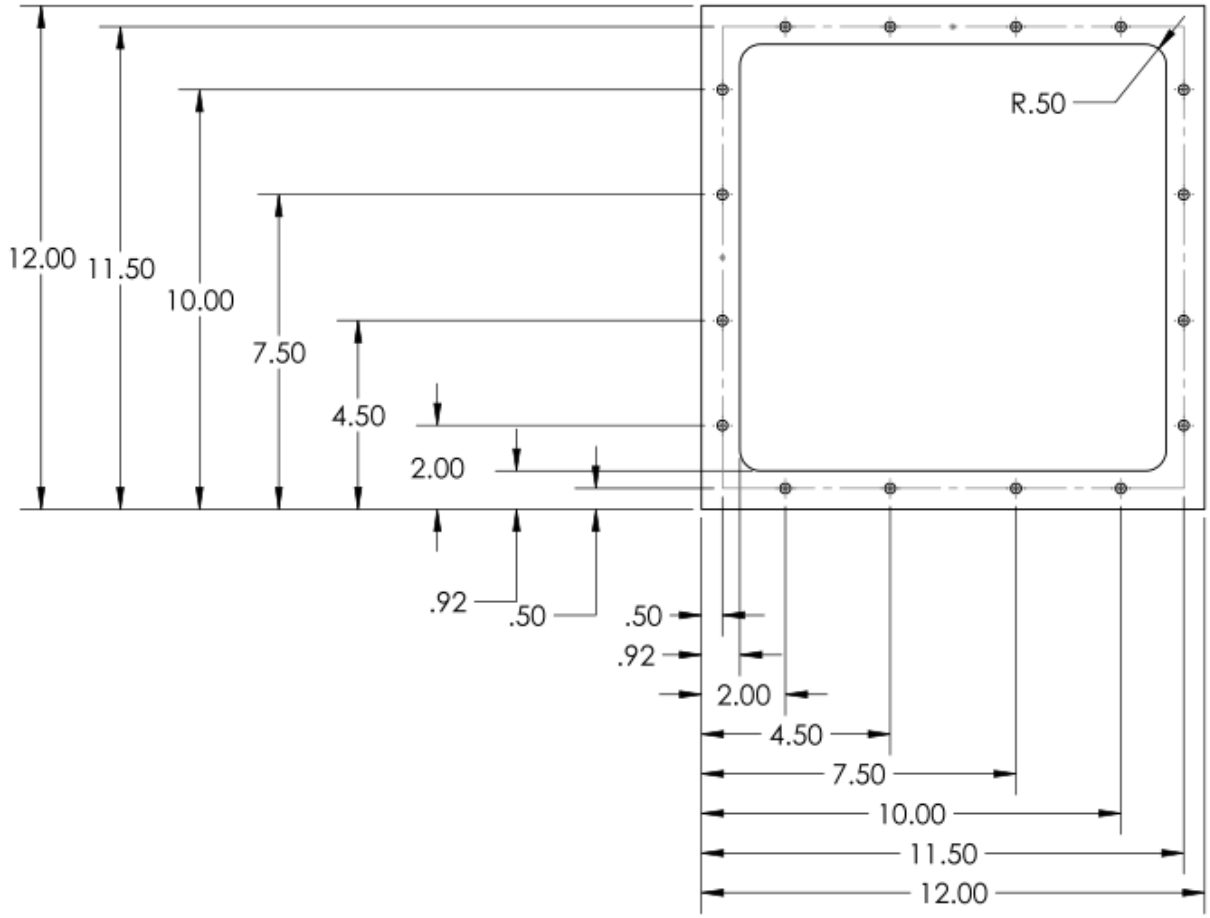
LINEAR:	ANGULAR:
X. ± .25	X. ± 2
X.X ± .1	X.X ± 1
X.XX ± .01	X.XX ± 0 30'
X.XXX ± .002	

DESCRIPTION:
CHECKED BY: DATE:
DRAWN BY: DATE: 5/10/2015
FILE NAME: Viewport Assembly.SLDPRT

UNIVERSITY OF IDAHO
ME DEPARTMENT

PART #: QTY:
SCALE: 1:4 SHEET: 1 OF 3

Base



DIMENSIONS ARE IN INCHES
THIRD ANGLE PROJECTION

MATERIAL: 304 Stainless Steel

Biodiesel Viewport

DEFAULT TOLERANCES:

LINEAR: X. ± .25, X.X ± .1, X.XX ± .01, X.XXX ± .002

ANGULAR: X. ± 2, X.X ± 1, X.XX ± 0 30'

DESCRIPTION:

CHECKED BY: DATE:

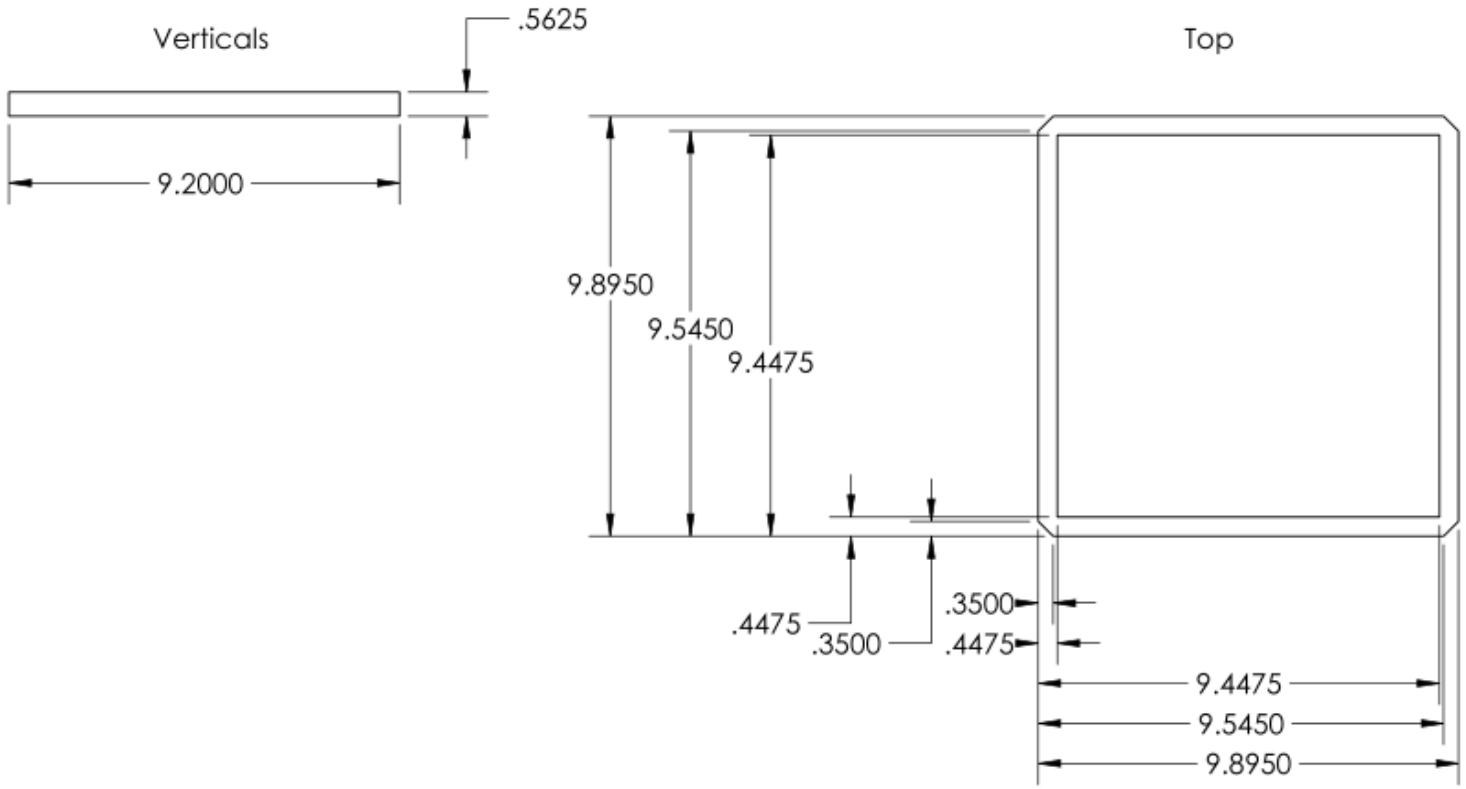
DRAWN BY: DATE: 5/10/2015

FILE NAME: Viewport Base.SLDPRT

UNIVERSITY OF IDAHO ME DEPARTMENT

PART #: QTY:

SCALE: 1:4 SHEET: 2 OF 3



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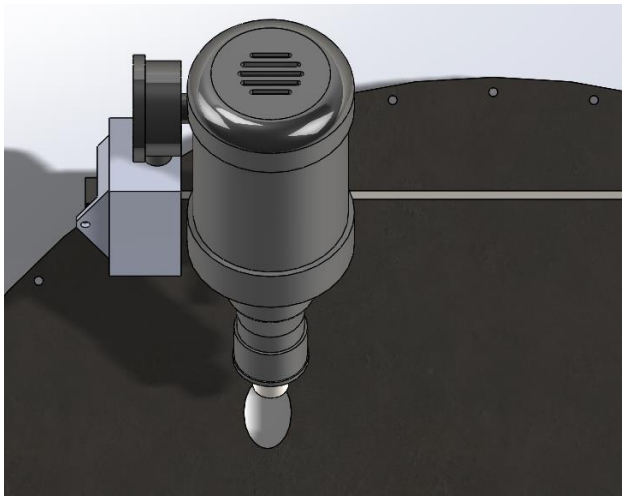
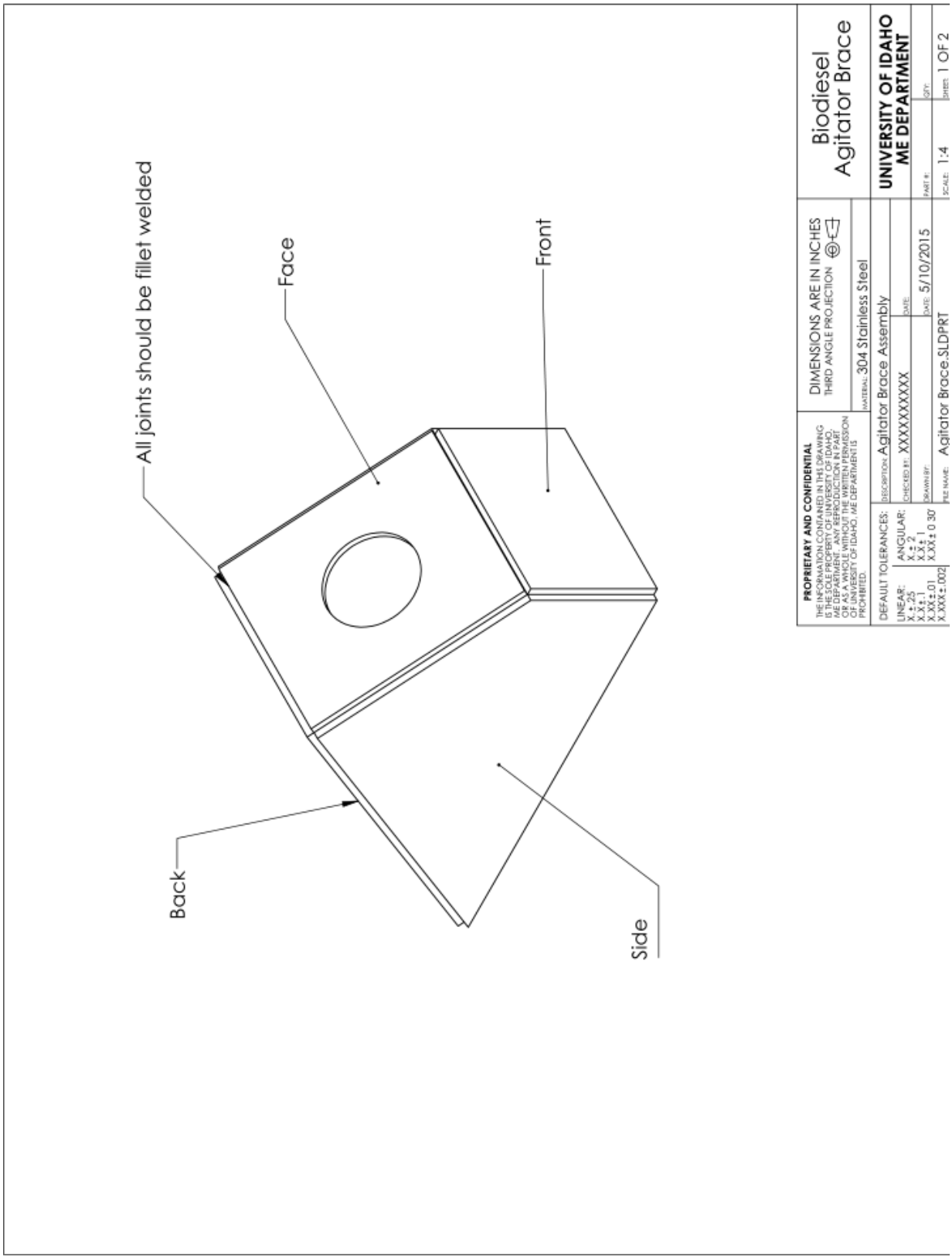
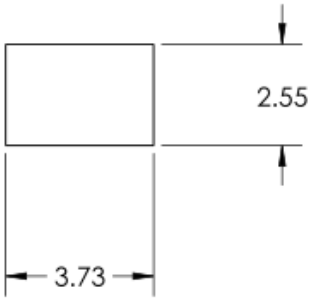
DEFAULT TOLERANCES: LINEAR: X. ± .25, X.X ± .1, X.XX ± .01, X.XXX ± .002 ANGULAR: X. ± 2, X.X ± 1, X.XX ± 0 30'	DESCRIPTION: CHECKED BY: DATE: DRAWN BY: DATE: 5/10/2015 FILE NAME: Viewport Verticals.SLDPRT	**UNIVERSITY OF IDAHO ME DEPARTMENT** PART #: QTY: SCALE: 1:4 SHEET: 3 OF 3

Gear Motor Installation

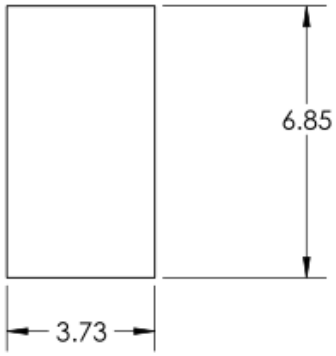
- Install the existing structural member that the gear motor mounts to. This will require drilling appropriate holes through the static lid and flange, and fastening with appropriate bolts and nuts.
- 
- Mount the gear motor at the desired spot on the structural member. Cut a hole in the static lid where the gear motor impeller shaft will pass through the static lid.
- 
- This final step is the trickiest. A box of stainless sheet metal needs to be constructed that can be fastened to the face of the gear motor, and welded to the top of the static lid. This will allow creation of a sealed input for the gear motor. The dimensions we estimate are on the following page. The proper procedure will be to make a soft mockup of the box and see how well it fits, and alter any dimensions necessary before cutting and welding the final metal box. The appearance for the final product shows on the page following the estimated box dimension drawings.
- IMPORTANT: The drawings we provide do not specify this, but a hole or other access through the side of the fabricated metal box will be necessary, so that the set screw for the agitator motor shaft can be loosened or tightened. . Some form of plug or other sealing plate with a gasket will be necessary to seal this access port. Otherwise, the gear motor shaft cannot be installed or removed once the gear motor is fastened up to the metal box build.

- Use all 10 gauge 304 stainless steel for manufacturing

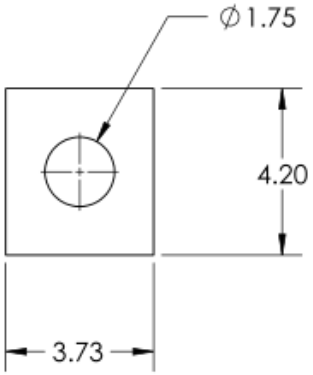




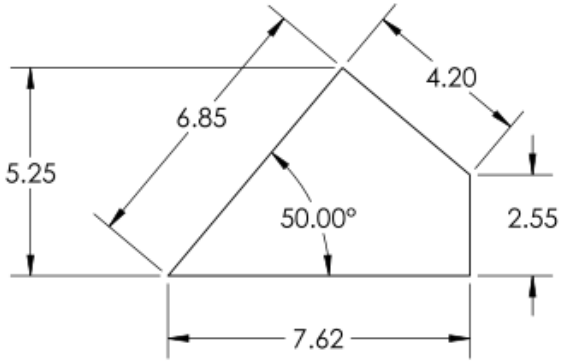
Front



Back



Face



Side

DIMENSIONS ARE IN INCHES
THIRD ANGLE PROJECTION

MATERIAL: 304 Stainless Steel

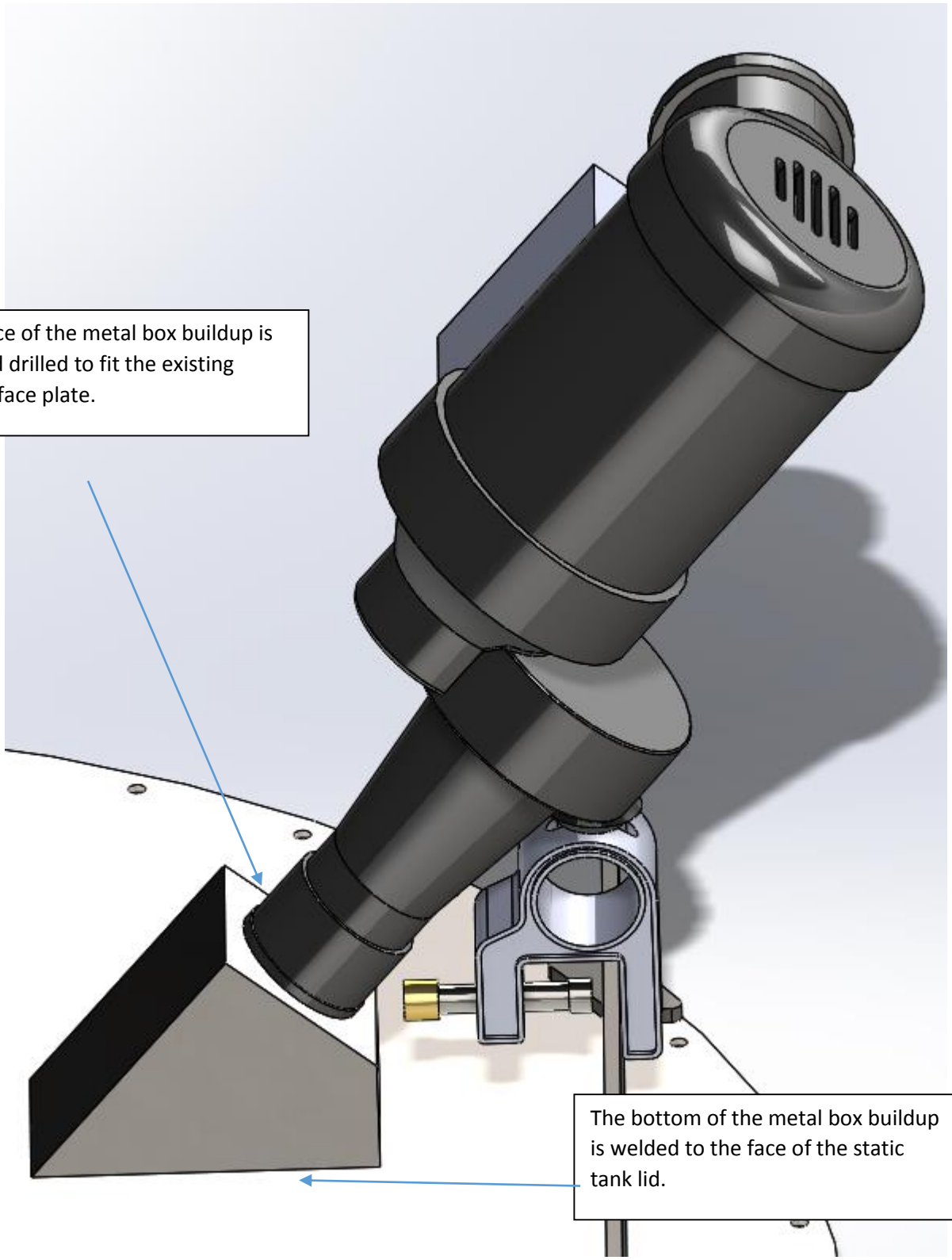
DEFAULT TOLERANCES:
LINEAR: X. ± .25, X.X ± .1, X.XX ± .01, X.XXX ± .002
ANGULAR: X. ± 2, X.X ± 1, X.XX ± 0 30'

DESCRIPTION: Components for Agitator Brace
CHECKED BY:
DATE:
DRAWN BY:
DATE: 5/10/2015
FILE NAME: Front.SLDPRT

Biodiesel Agitator Brace

UNIVERSITY OF IDAHO
ME DEPARTMENT

PART #:
QTY:
SCALE: 1:4
SHEET: 2 OF 2


This face of the metal box buildup is cut and drilled to fit the existing motor face plate.
The bottom of the metal box buildup is welded to the face of the static tank lid.