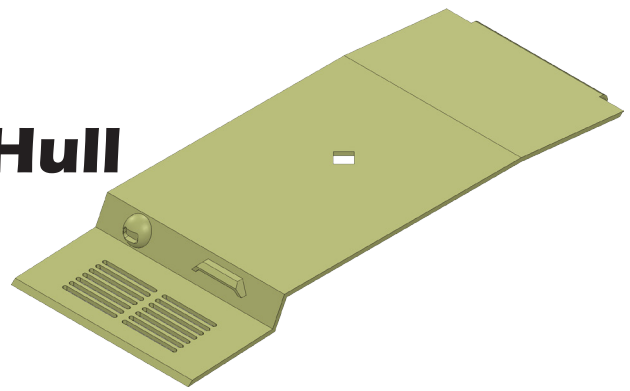







Chapter 12

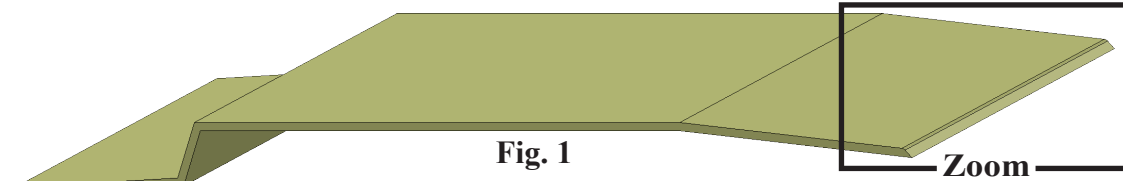
Tank Upper Hull





A. Fillet1 Rear Edge.

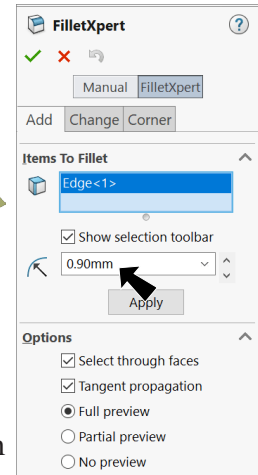
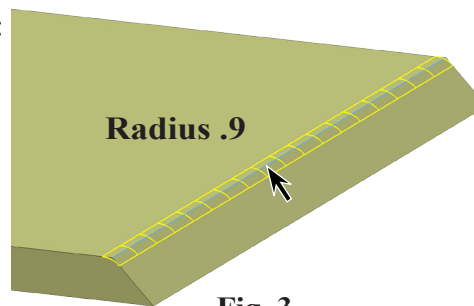
Step 1. Open your **Upper Hull** part file.

Step 2. Rotate and zoom in on rear edge, **Fig. 1**. To rotate view, click **Right**  on the Standard Views toolbar (Ctrl-4), **Left Arrow** key  twice and **Down Arrow** key  once.




Step 3. Click **Fillet**  on the Features toolbar.

Step 4. In the Fillet Property Manager set:
select **FilletXpert**, **Fig. 2**
Radius  **.9**
click **top rear edge**, **Fig. 3**
click **OK** .



B. Extrude Hinge.

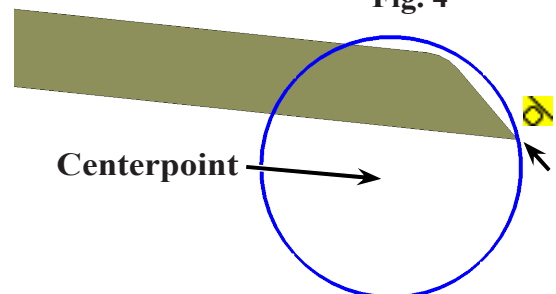
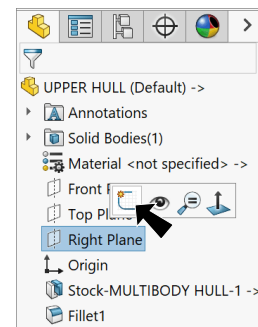
Step 1. Click **Right Plane**  in the Feature Manager and click **Sketch**  on the context toolbar, **Fig. 4**.

Step 2. Click **Normal To**  on the Standard Views toolbar. (Ctrl-8)


Step 3. Zoom on rear edge.

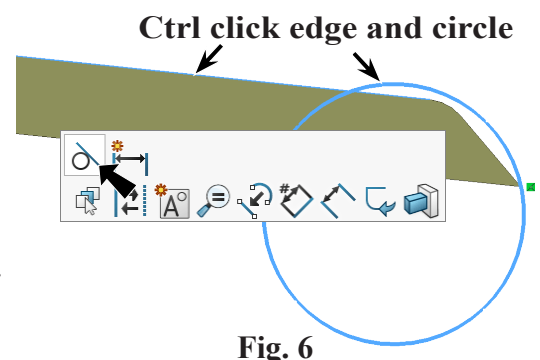
Step 4. Click **Circle**  (S) on the Sketch toolbar.


Step 5. Sketch **circle starting below and to left of rear and tangent to the bottom rear vertex**, **Fig. 5**.



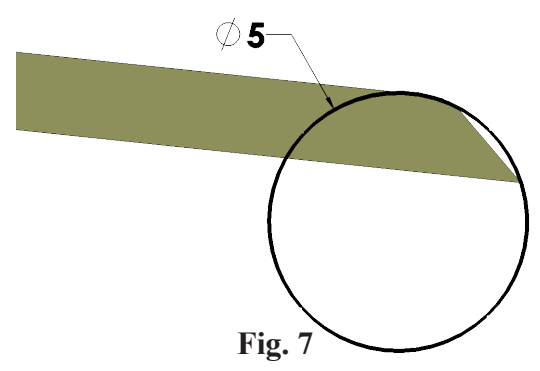
Step 6. **Right click graphics area and click Select**  from menu to unselect Circle tool.


Step 7. **Ctrl click top straight edge of Upper Hull and circle** to select both. Release Ctrl key and click **Make Tangent**  on the context toolbar, **Fig. 6**.



Step 8. Click **Smart Dimension**  (S) on the Sketch toolbar.



Step 9. Dimension **diameter 5**, **Fig. 7**.

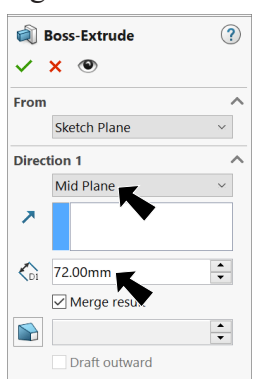


Step 10. Rotate and zoom in on rear edge, **Fig. 9**. Use **Previous View**  on the Standard Views toolbar. (**Ctrl-Shift-Z**) to return to previous zoomed in view.

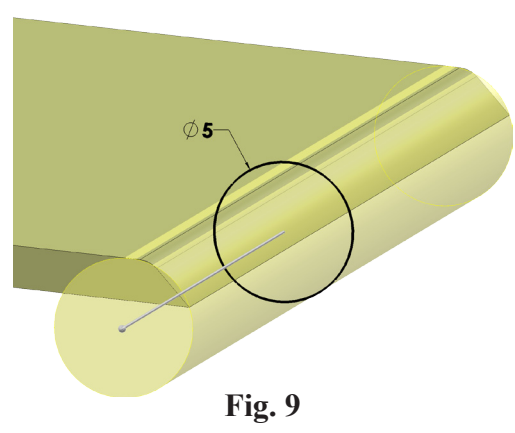
Step 11. Click **Features**  on the Command Manager toolbar.

Step 12. Click **Extruded Boss/Base**  on the Features toolbar.


Step 13. In the Boss-Extrude Property Manager set:
under Direction 1, **Fig. 8**
End Condition **Mid Plane**
Depth  **72**
click **OK** .



Step 14. Save  (**Ctrl-S**).



C. Cut Hinge.

Step 1. Click the **side face** and click **Sketch**  on the context toolbar, **Fig. 10**.

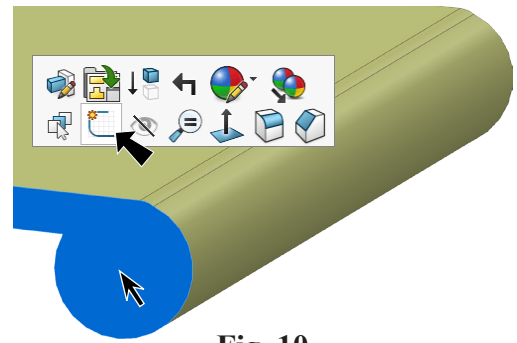


Fig. 10

Step 2. **Unselect face** and click **Offset Entities**  on the Sketch toolbar.

Step 3. In the Offset Entities Property Manager set: under Parameters, **Fig. 11**

Distance  **.3**

Expand the flyout Feature Manager design tree in top left corner of the graphics area, **expand Boss-Extrude1** and click **Sketch1**, **Fig. 12**

Click in the Property Manager to display preview, **Fig. 13**

click OK .

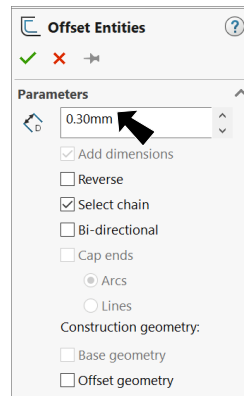


Fig. 11

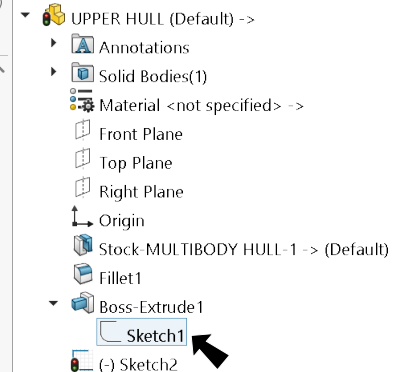


Fig. 12

Step 4. Click **Features**  on the Command Manager toolbar.

Step 5. Click **Extruded Cut**  on the Features toolbar.

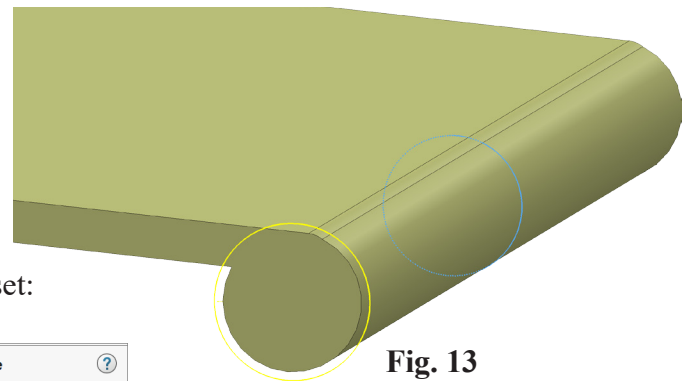


Fig. 13

Step 6. In the Cut-Extrude Property Manager set: under Direction 1, **Fig. 14**

Depth  **10**

click OK .

Step 7. Save  (**Ctrl-S**).

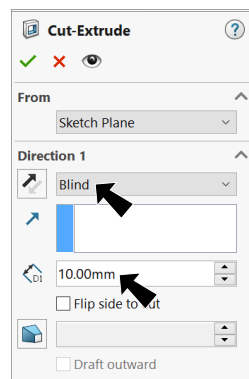


Fig. 14

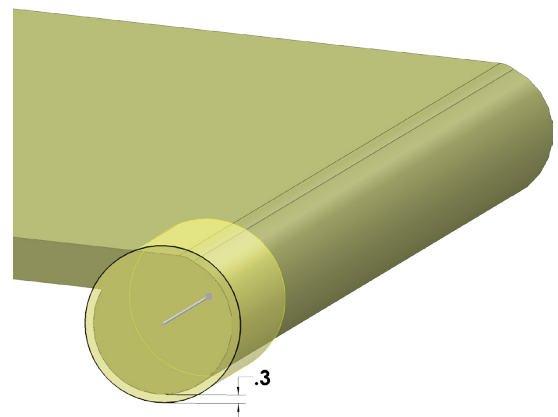



Fig. 15

D. Dome for Hinge.

Step 1. Click the **side face** and click **Sketch**  on the context toolbar, **Fig. 16**.

Step 2. Click **Circle**  (S) on the Sketch toolbar.

Step 3. Sketch circle at centerpoint of cut, **Fig. 17**. To wake up centerpoint, hover cursor over circular edge of cut.

Step 4. Click **Smart Dimension**  (S) on the Sketch toolbar.

Step 5. Dimension **diameter 3**, **Fig. 17**.

Step 6. Click Insert Menu > Curve > Split Line.

Step 7. In the Split Line Property Manager:
under Type of Split, **Fig. 18**

select **Projection**

under Selections 

Sketch is selected

in Faces to Split field 

click **side face**, **Fig. 19**

click OK .

Step 8. Click **Dome**  **Dome** on the Features toolbar.

Step 9. In the Dome Property Manager set:
under Parameters, **Fig. 20**

click **split line face**, **Fig. 21**

Distance .7

click OK .

Step 10. Save  (Ctrl-S).

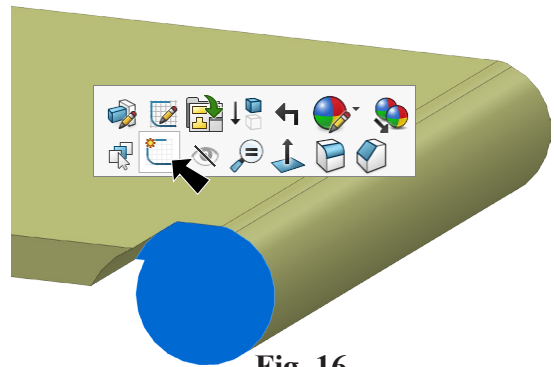


Fig. 16

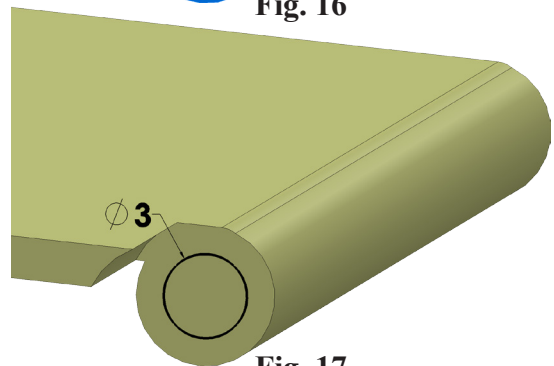


Fig. 17

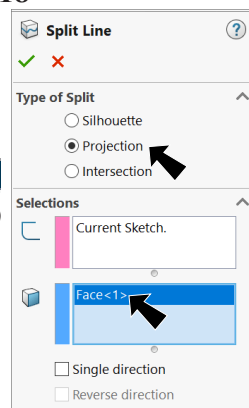


Fig. 18

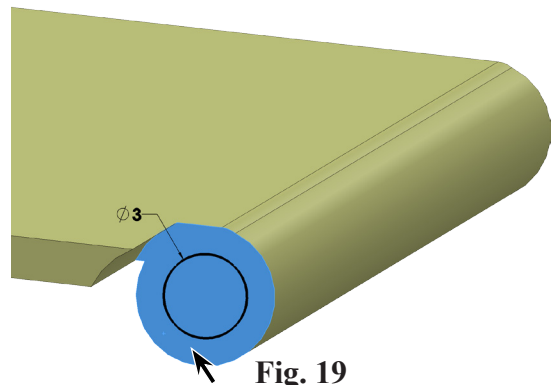


Fig. 19

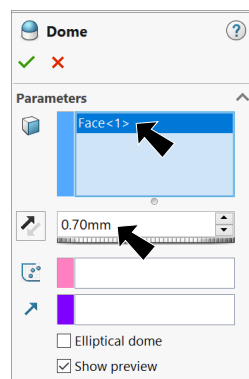


Fig. 20

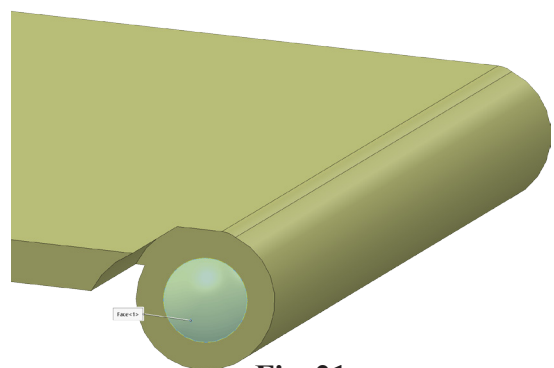


Fig. 21

E. Mirror1 Hinge.

Step 1. **Ctrl** click **Right Plane**, **Cut-Extrude1**, **Split Line1** and **Dome1** features to select Plane and features, **Fig. 22**.

Step 2. Click **Mirror** on the Features toolbar.

Step 3. In the Mirror Property Manager click **OK**, **Fig. 23**.

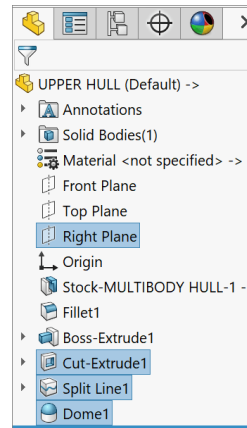


Fig. 22

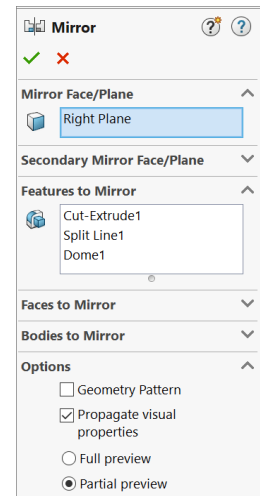


Fig. 23

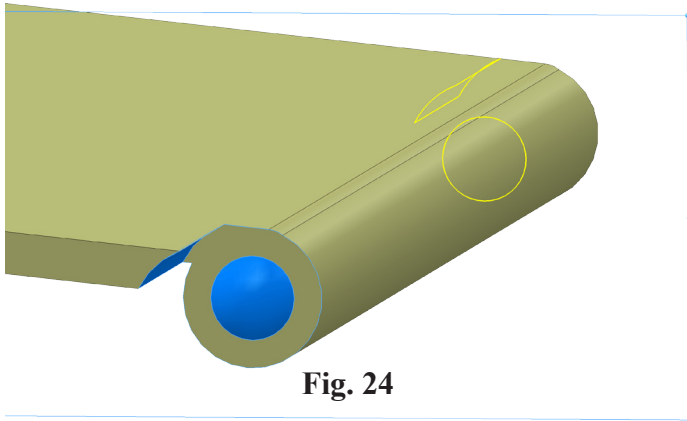


Fig. 24

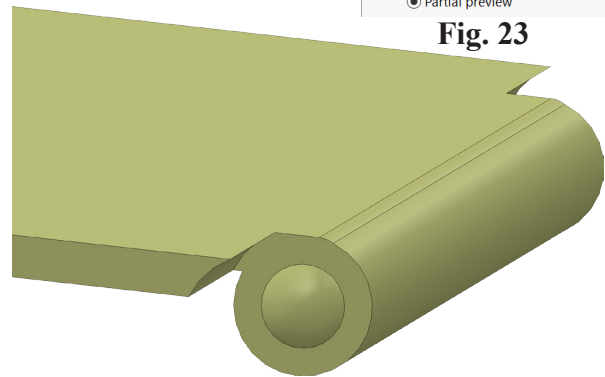


Fig. 25

F. Cut-Extrude2 Shaft Square Hole.

Step 1. Click **Top Plane** in the Feature Manager and click **Sketch** on the context toolbar, **Fig. 26**.

Step 2. Click **Normal To** on the Standard Views toolbar. (**Ctrl-8**)

Step 3. Click **Polygon** on the Sketch toolbar.

Step 4. In Polygon Property Manager set: under Parameter, **Fig. 27**

Number of Sides 4

Step 5. Sketch polygon, **Fig. 28**.

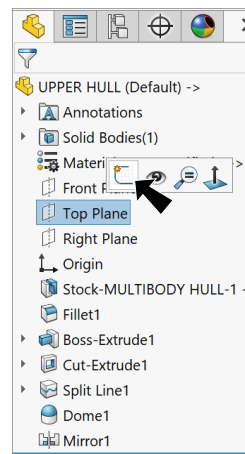


Fig. 26

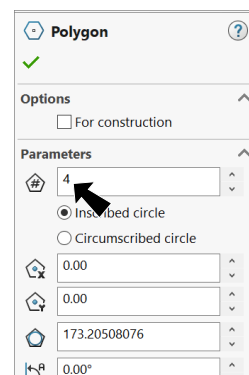


Fig. 27

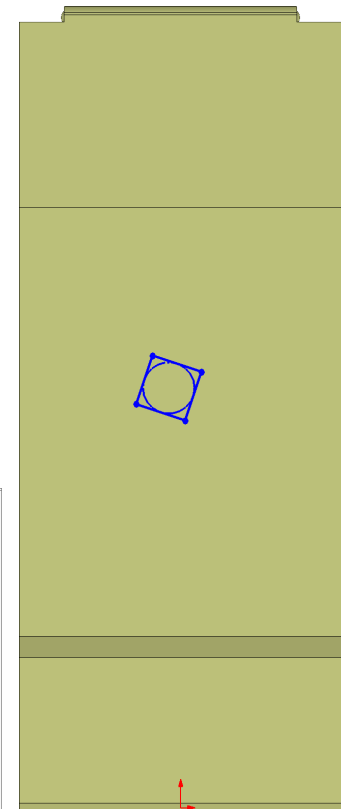





Fig. 28

Step 6. **Right click graphics area and click Select**  from menu to unselect Polygon tool.

Step 7. Click **two opposite vertices of polygon** and click **Make Horizontal**  on the context toolbar, **Fig. 29**.

Step 8. **Ctrl click centerpoint of polygon** and **Origin**  to select both. Release Ctrl key and click **Make Vertical**  on context toolbar, **Fig. 30**.

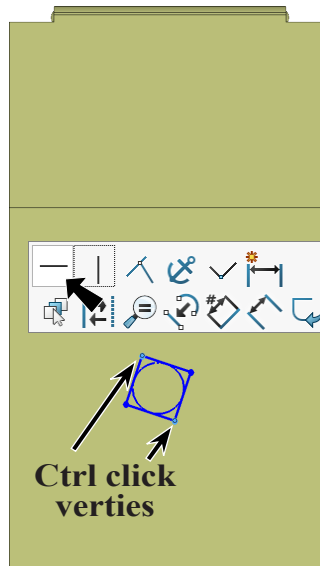


Fig. 29

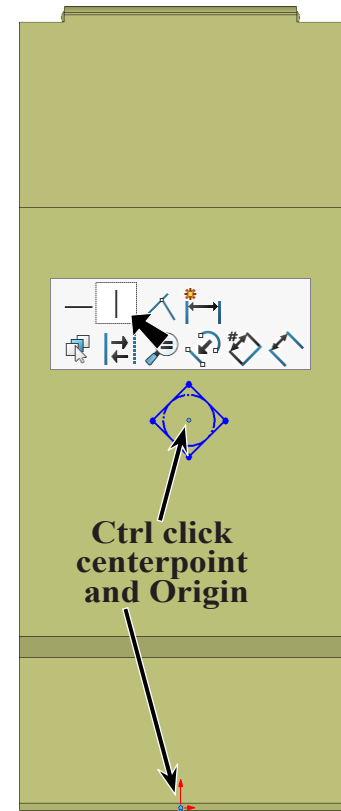



Fig. 30



Step 9. Click **Smart Dimension**  (S) on the Sketch toolbar.

Step 10. Dimension segment 6 and **centerpoint to Origin 98.6**, **Fig. 31**.

Step 11. Click **Trimetric**  on the Standard Views toolbar.

Step 12. Click **Features**  on the Command Manager toolbar.

Step 13. Click **Extruded Cut**  on the Features toolbar.

Step 14. In Cut-Extrude Property Manager: under Direction 1, **Fig. 32**
 End Condition **Through All**
Reverse Direction 
 click OK .

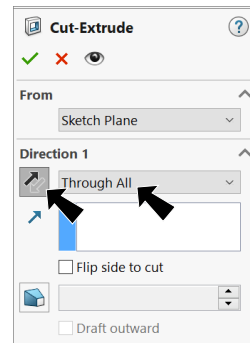


Fig. 32

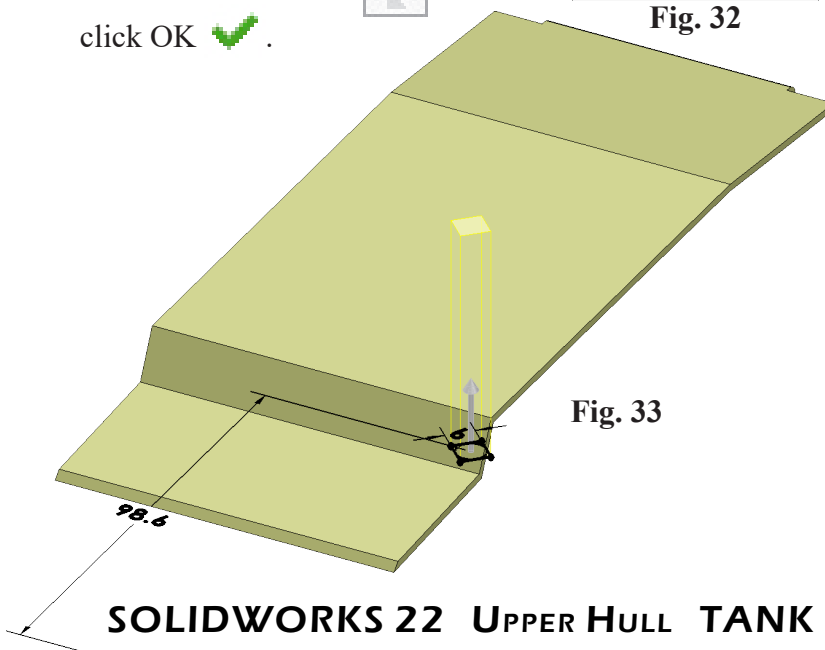


Fig. 33

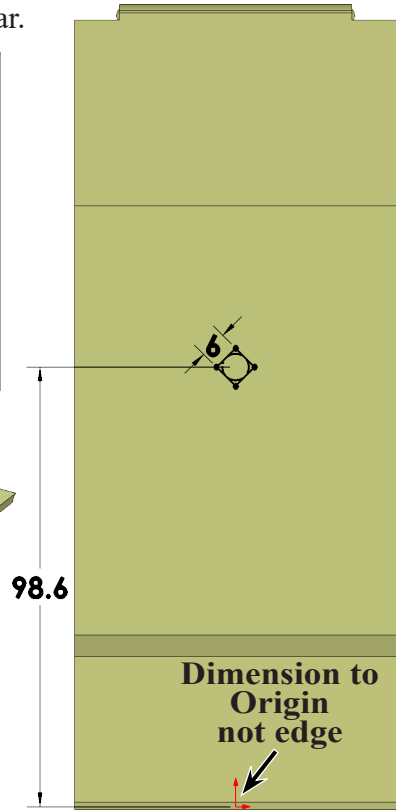


Fig. 31

G. Dome2 for MG Mount.

Step 1. Click the **front face of front plate** and click **Sketch**

 on the context toolbar, **Fig. 34**.

Step 2. Click **Centerline**  in the **Line flyout**

 on the Sketch toolbar.

Step 3. Sketch vertical centerline between the top and bottom edges of face, **Fig. 35**.

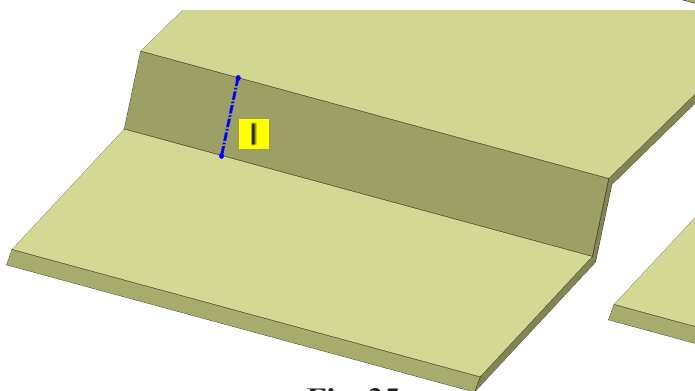


Fig. 35

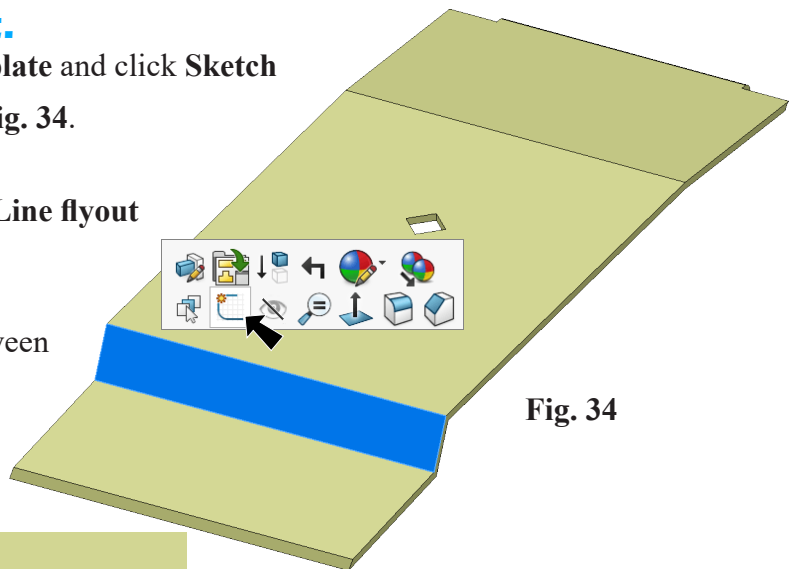


Fig. 34

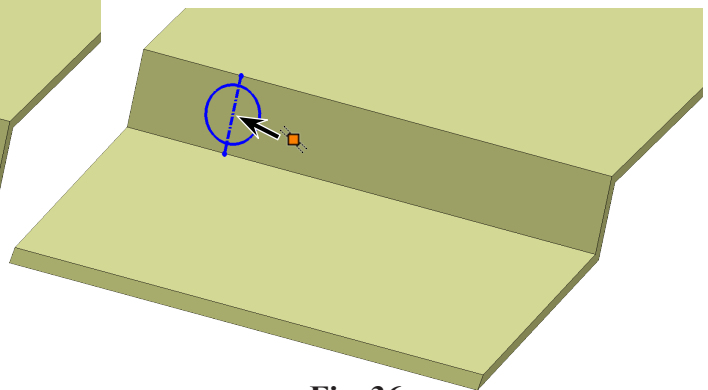
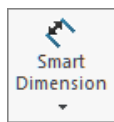


Fig. 36


Step 4. Click **Circle**  (S) on the Sketch toolbar.

Step 5. Sketch circle at **midpoint**  of centerline, **Fig. 36**.

Step 6. Click **Smart Dimension** (S) on the Sketch toolbar.



Step 7. Dimension **diameter 10** and **21** to

Origin  (blue), **Fig. 37**.

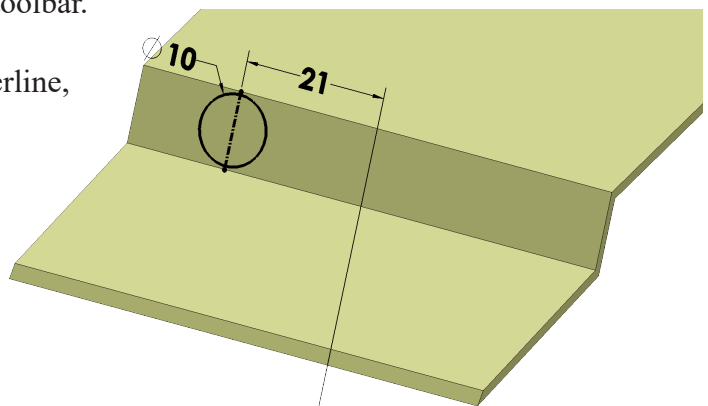


Fig. 37

Step 8. Click Insert Menu > Curve > Split Line.

Step 9. In the Split Line Property Manager:

under Type of Split, **Fig. 38**
select **Projection**

under Selections 
Sketch should be selected

in the Faces to Split field 
click **face, Fig. 39**

click OK .

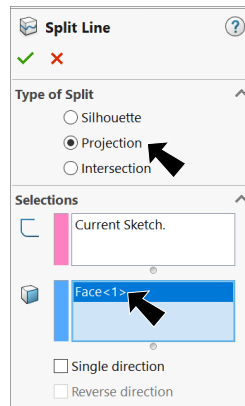


Fig. 38

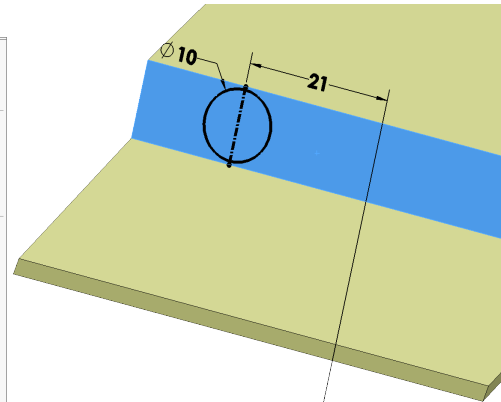


Fig. 39

Step 10. Click **Dome**  **Dome** on the Features toolbar.

Step 11. In the Dome Property Manager:

under Parameters, **Fig. 40**

click **split line face, Fig. 41**

Distance 4

click OK .

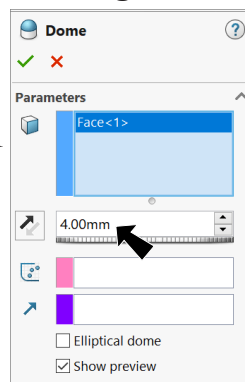


Fig. 40

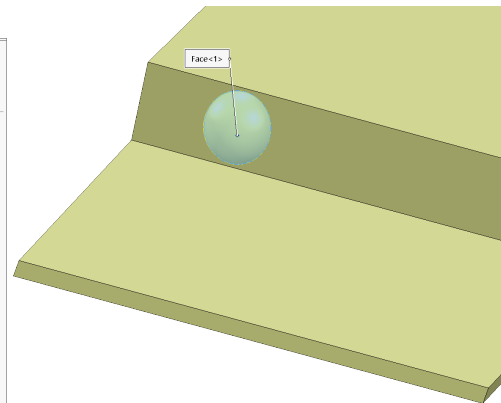







Fig. 41

Step 12. Save  (Ctrl-S).

H. Cut MG Mount.

Step 1. Click **Front Plane**  in the Feature Manager and click **Sketch**  on the context toolbar, **Fig. 42**.

Step 2. Click **Normal To**  on the Standard Views toolbar. (Ctrl-8)

Step 3. Click **Centerline**  in the **Line flyout**  on the Sketch toolbar.

Step 4. Sketch **vertical centerline at midpoint**  of dome edge, **Fig. 43**.

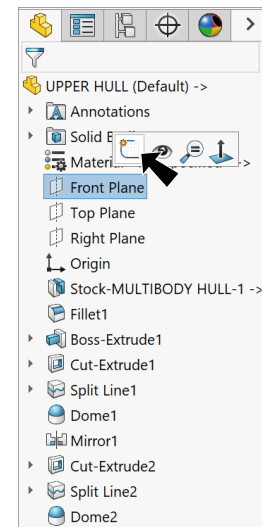




Fig. 42



Fig. 43

Step 5. Click **Center Rectangle**  in the **Rectangle flyout**  on the Sketch toolbar.

Step 6. Sketch center rectangle at **midpoint**  of centerline, **Fig. 44**.

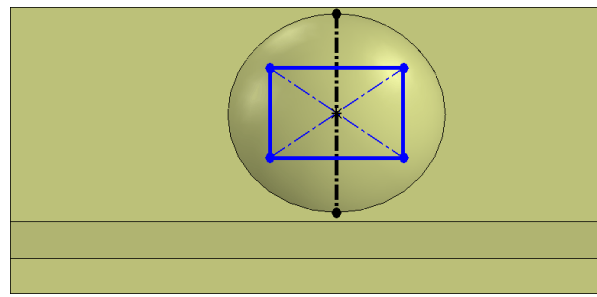


Fig. 44

Step 7. Click **Smart Dimension**  (S) on the Sketch toolbar.

Step 8. Dimension rectangle **3.5 by 5.8**, **Fig. 45**.

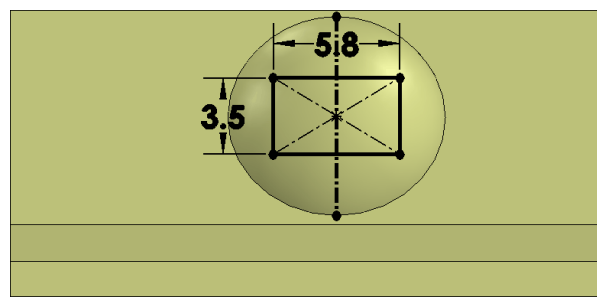




Fig. 45

Step 9. Click **Sketch Fillet**  on the Sketch toolbar.

Step 10. In the Sketch Fillet Property Manager set: under Fillet Parameters, **Fig. 46**

Radius  **1**
 click **drag selection across rectangle** or **Ctrl-A**, **Fig. 47**
 click **OK**  **twice**.

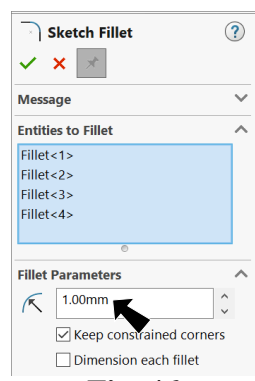


Fig. 46

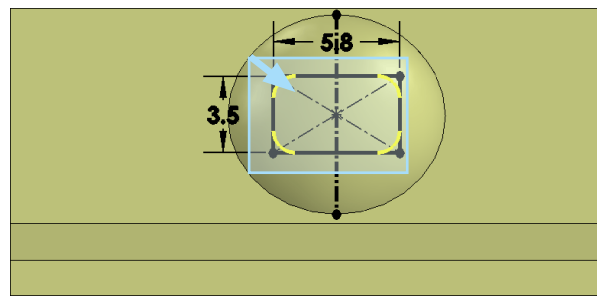



Fig. 47

Step 11. Click **Right**  on the Standard Views toolbar. (**Ctrl-4**)

Step 12. Click **Features**  on the Command Manager toolbar.

Step 13. Click **Extruded Cut**  on the Features toolbar.

Step 14. In the Cut-Extrude Property Manager set: under Direction 1, **Fig. 48**

Depth  **34**
 click **OK**  .

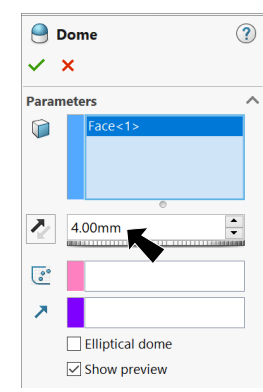


Fig. 48

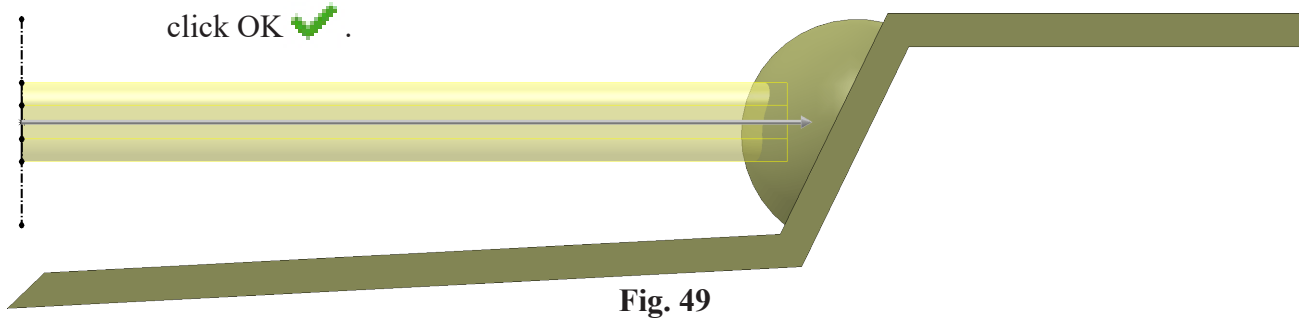



Fig. 49

I. Periscope.

Step 1. Click **Front Plane**  in the Feature Manager and click **Sketch**  on the context toolbar, **Fig. 50**.

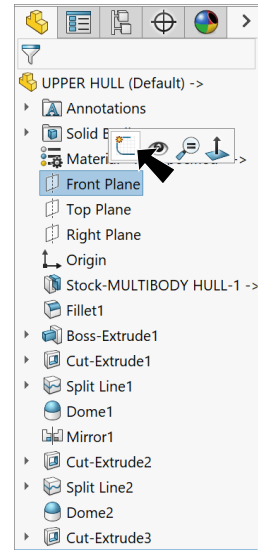





Fig. 50

Step 2. Click **Normal To**  on the Standard Views toolbar. (**Ctrl-8**)

Step 3. Click **Centerline**  in the **Line flyout**  on the Sketch toolbar.

Step 4. Sketch vertical centerline to right of center, **Fig. 51**.

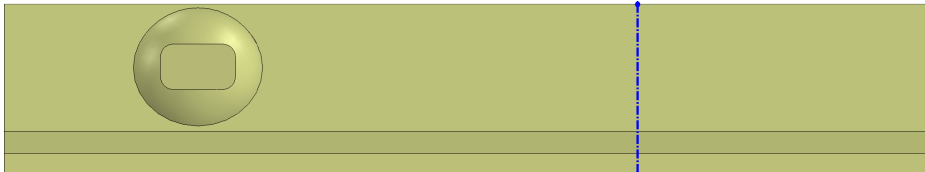


Fig. 51

Step 5. Click **Line**  (L) on the Sketch toolbar.

Step 6. Sketch **5 chained lines starting from centerline**, **Fig. 52**.

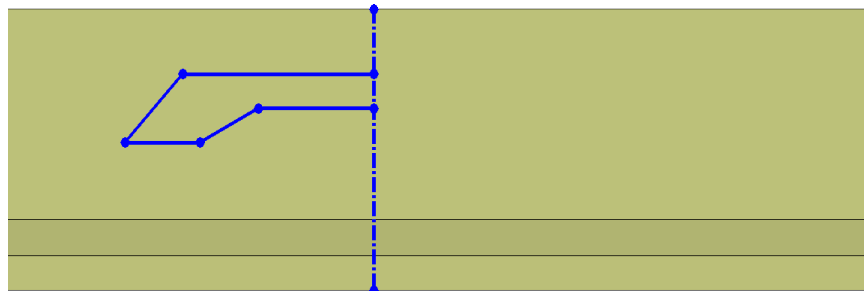




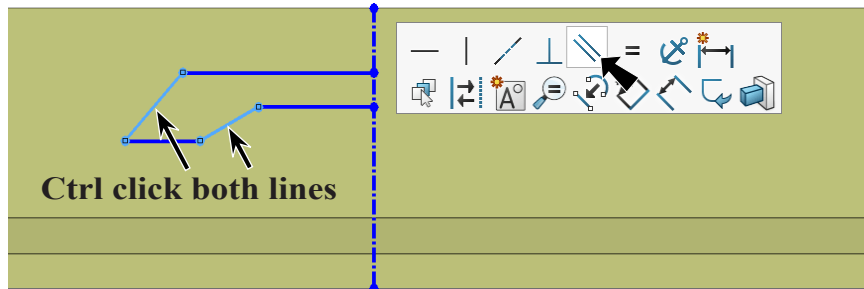
Fig. 52

Step 7. **Right click graphics area and click Select**  from menu to un-select Line tool.

Step 8. **Ctrl click both angled lines** to select both.

Release Ctrl key and click **Make Parallel**

 on the context toolbar, **Fig. 53**.



Ctrl click both lines

Fig. 53

Step 9. Drag a selection to select all geometry or use **Ctrl-A**, **Fig. 54**.

Step 10. Click **Mirror Entities**  on the Sketch toolbar.

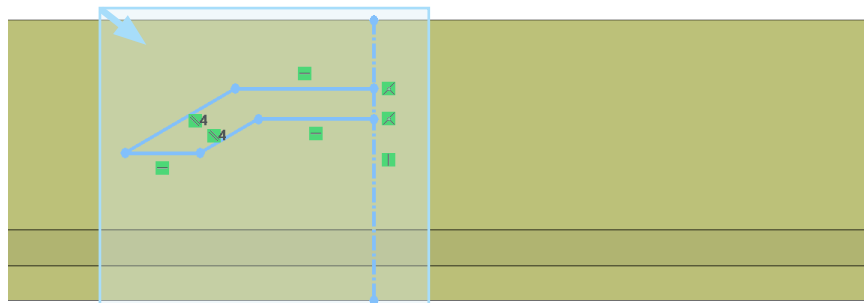
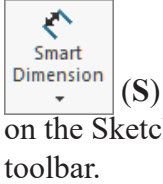


Fig. 54

Step 11. Click **Smart Dimension**



on the Sketch toolbar.

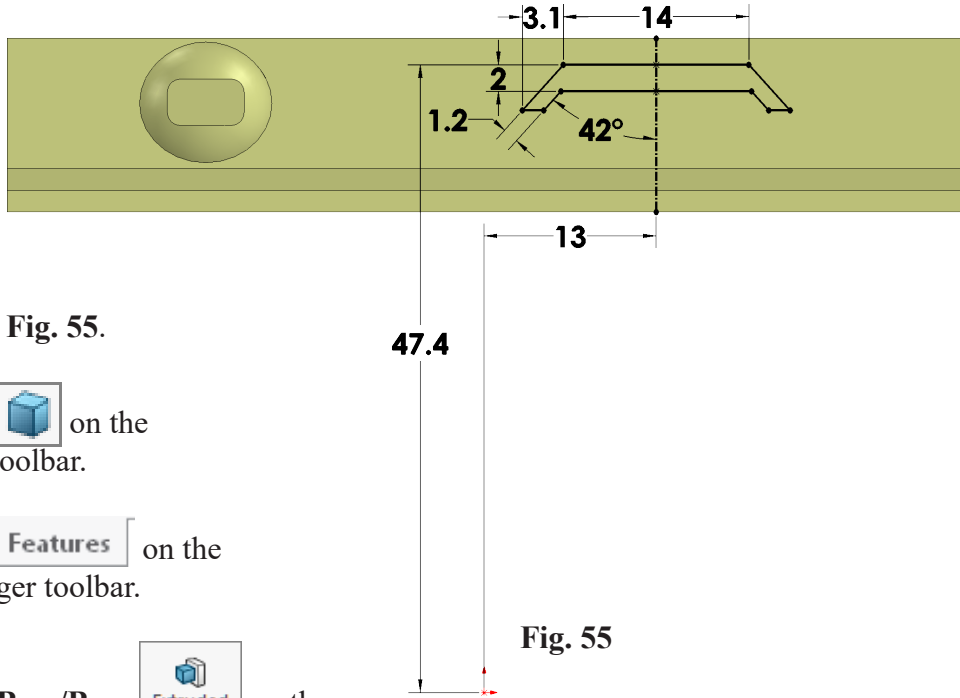
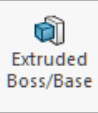


Fig. 55



Step 12. Add dimensions, **Fig. 55**.

Step 13. Click **Trimetric**  on the Standard Views toolbar.

Step 14. Click **Features**  on the Command Manager toolbar.

Step 15. Click **Extruded Boss/Base**  on the Features toolbar.

Step 16. In the Boss-Extrude Property Manager set:

- under From, **Fig. 56**
- select **Surface/Face/Plane**
- click **front plate**, **Fig. 57**
- under Direction 1
- Depth**  **4**
- click **OK** .

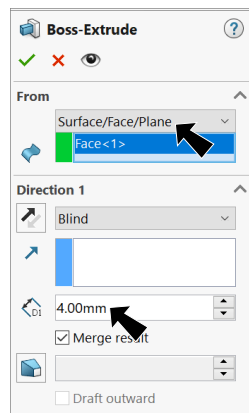


Fig. 56

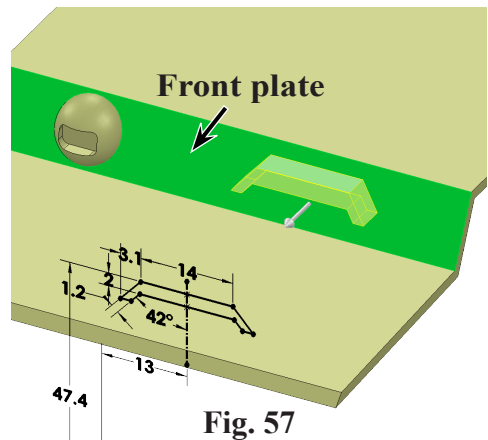




Fig. 57

J. Draft Periscope.

Step 1. Click **Draft**  on the Features toolbar.

Step 2. In the Draft Property Manager set:

- under Type of Draft, **Fig. 58**
- select **Neutral plane**
- under Draft Angle
- 6°**
- Neutral Plane**
- click **top face of Periscope**
- Reverse Direction** 
- Faces to Draft**
- click **front face of Periscope**
- click **OK** .

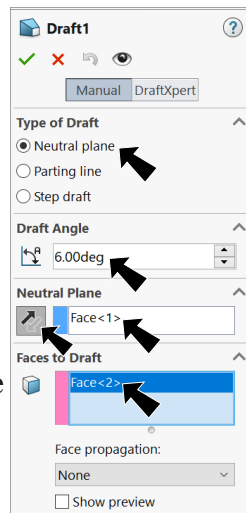


Fig. 58

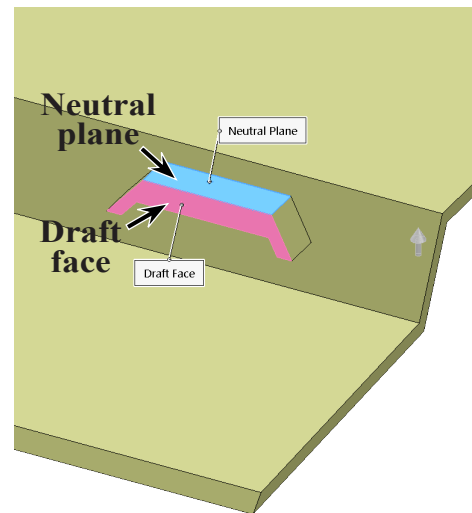



Fig. 59


K. Chamfer 1.

Step 1. Click **Chamfer**  in the **Fillet flyout**  on the Features toolbar.

Step 2. In the Chamfer Property Manager set:
 under Chamfer Type, **Fig. 60**
 select **Angle Distance** 
 under Chamfer Parameters

Distance  1.2

Angle  62°

click **top front edge**, **Fig. 61**
 Direction arrow (blue) 
 should point **down**. If arrow is pointing in wrong direction, **click arrow to flip**.

Click OK .

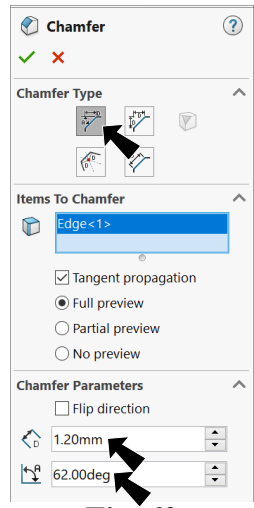


Fig. 60

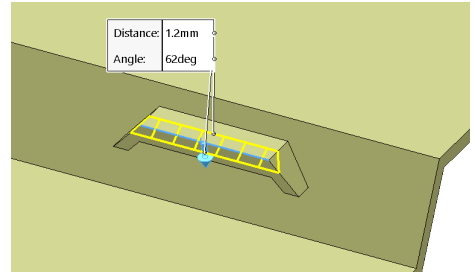


Fig. 61

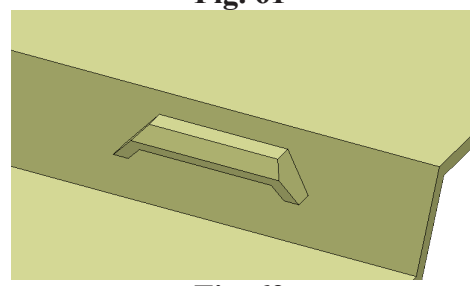






Fig. 62

L. Vent.

Step 1. Click the **face of Glacis plate** and click **Sketch**  on the context toolbar, **Fig. 63**.

Step 2. Click **Normal To**  on the Standard Views toolbar. (**Ctrl-8**)

Step 3. Click **Corner Rectangle**  in the **Rectangle flyout**  on the Sketch toolbar.

Step 4. Sketch corner rectangle, **Fig. 64**.

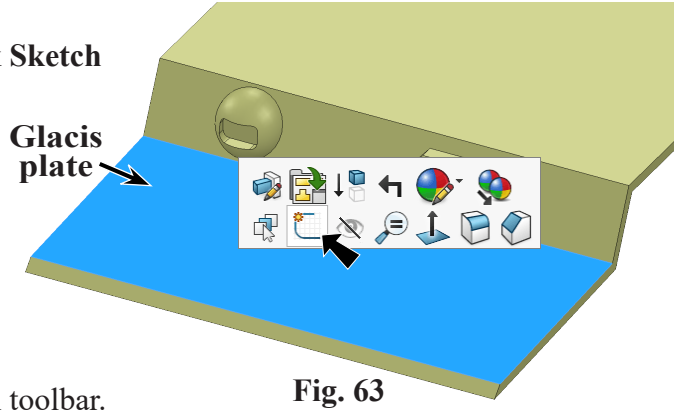


Fig. 63

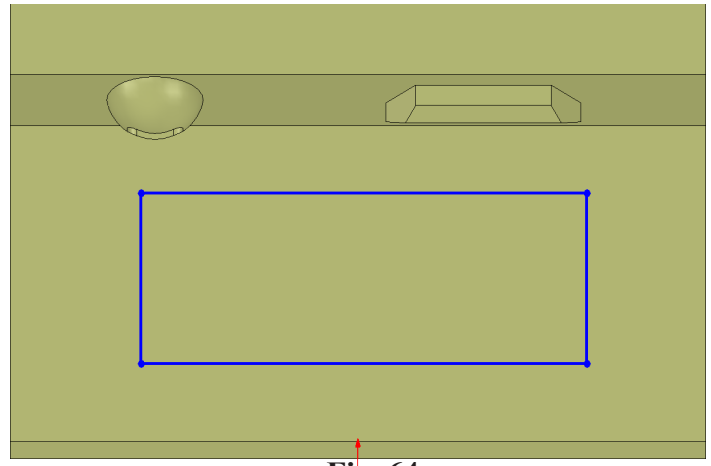






Fig. 64

Step 5. Click **Line**  (L) on the Sketch toolbar.

Step 6. Sketch **horizontal line across rectangle and a vertical line at midpoint**, Fig. 65.

Step 7. **Right click graphics area and click Select**  from menu to un-select Line tool.

Step 8. **Ctrl click vertical line and Origin**  to select both. Release Ctrl key and click **Make Coincident**  on the context toolbar, Fig. 66.

Step 9. Click **Smart Dimension**  (S) on the Sketch toolbar.

Step 10. Add dimensions, Fig. 67.

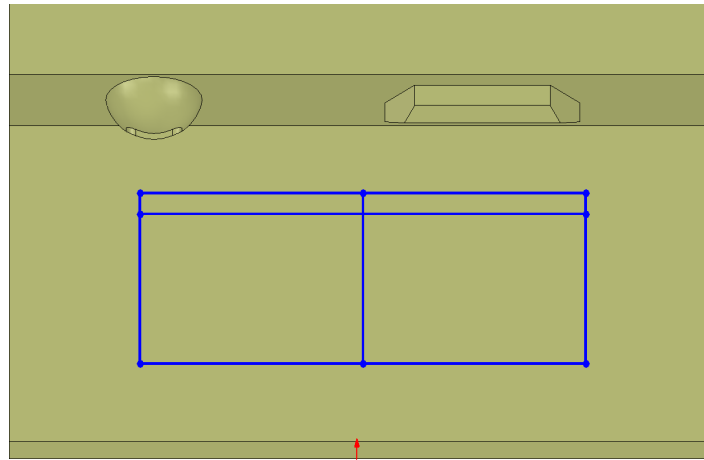


Fig. 65

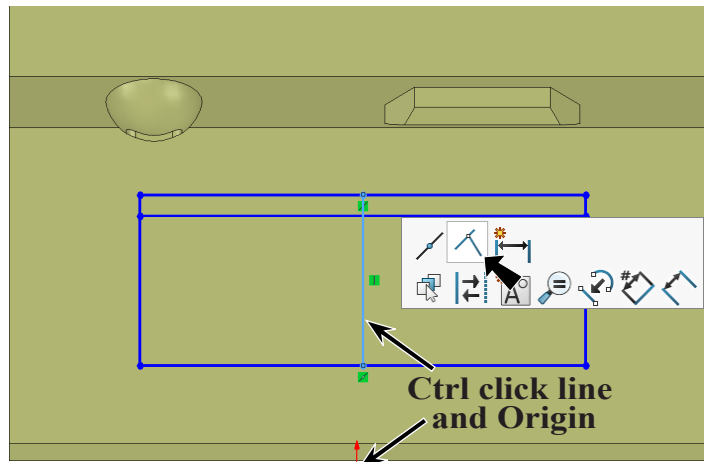


Fig. 66

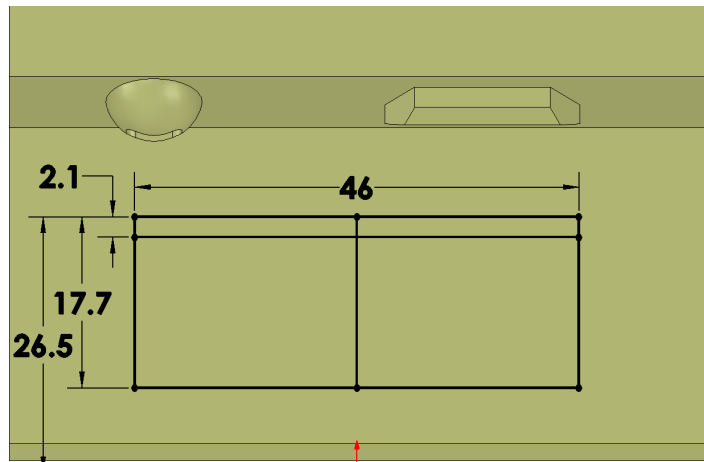


Fig. 67

Step 11. Click **Linear Sketch Pattern**  on the Sketch toolbar.

Step 12. In the Linear Sketch Pattern Property Manager set:

under Entities to Pattern, **Fig. 68**
click **Line below top line**, **Fig. 69**
under Direction1

Number of Instances  # **1**

under Direction2

Number of Instances  # **6**

Reverse Direction 

Distance2  **2.7**

click OK .

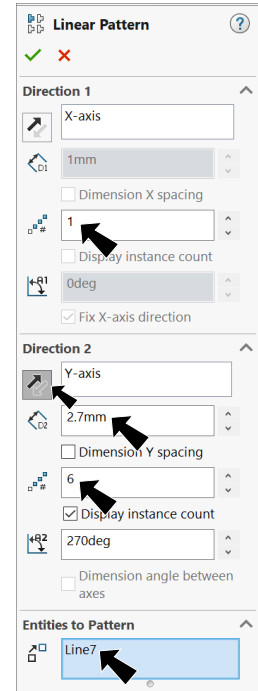


Fig. 68

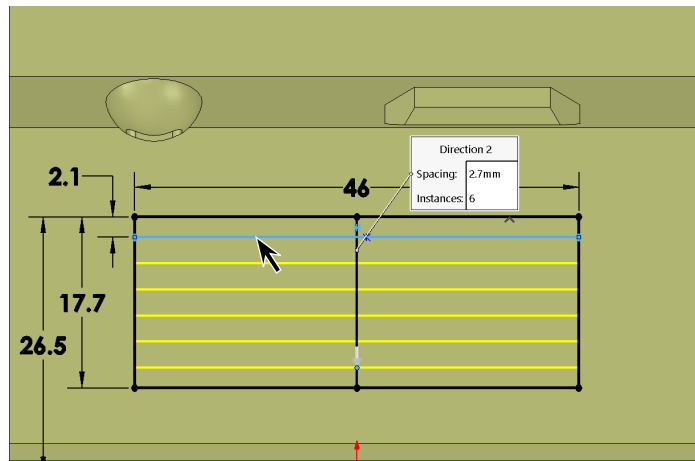


Fig. 69

Tip: You can add dimension to fully define sketch, **Fig. 70**.

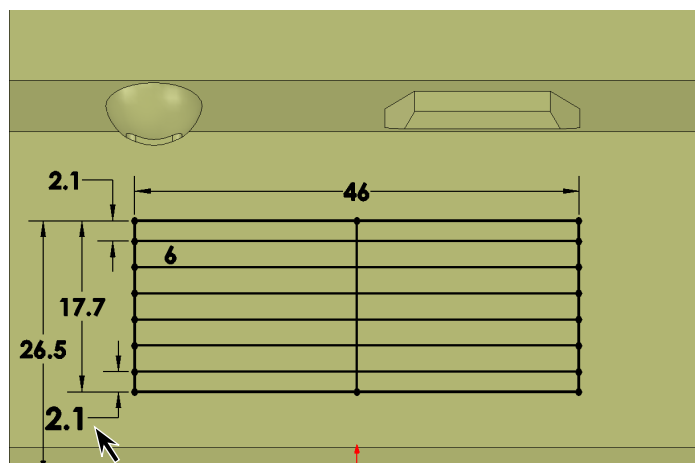


Fig. 70

Step 13. Click Insert Menu > Fastening Feature > Vent.

Step 14. In the Vent Property Manager:

under Boundary, **Fig. 71**

click **side lines of rectangle (4)**, **Fig. 72**

under Ribs

click in box

click **vertical center line**

Distance1  1.5

Distance2  2.5

under Spars

click in box

click the **6 lines between top and bottom lines of rectangle**

Distance1  1.5

Distance2  1.2

click OK .

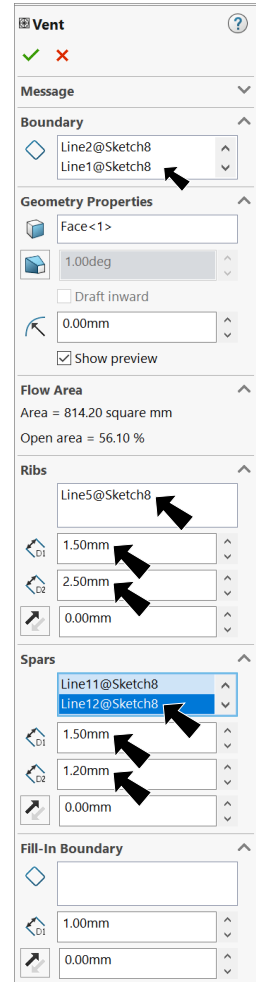



Fig. 71

Step 15. Save 
(Ctrl-S).

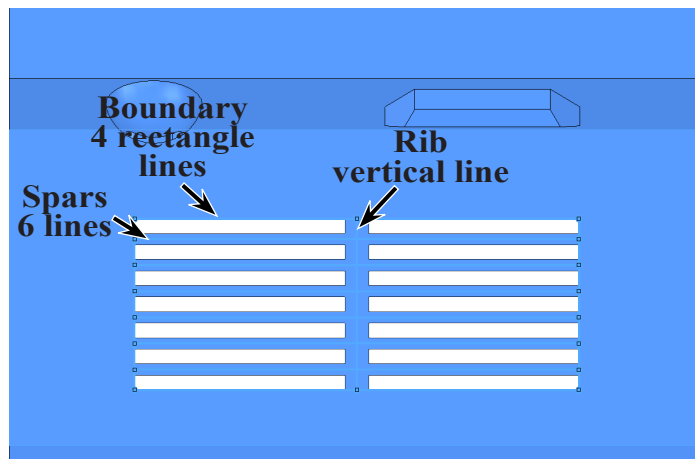


Fig. 72

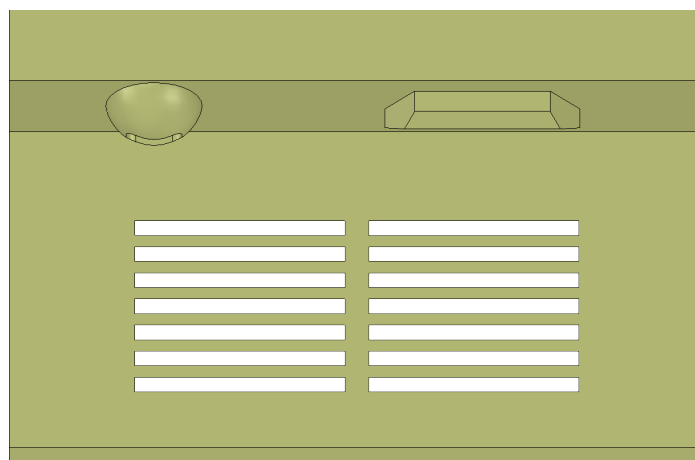


Fig. 73

M. Fillet2 Vent Edges.

Step 1. Click **Trimetric**  on the Standard Views toolbar.

Step 2. Click **Fillet**  on the Features toolbar.

Step 3. In the Fillet Property Manager set:
select **FilletXpert**, Fig. 74

Radius  **.8**

click a **corner edge of vent**, Fig. 75

click **Connected to start internal loops**  **55 edges** on the
Fillet pop-up

click OK .

Step 4. Save  (Ctrl-S).

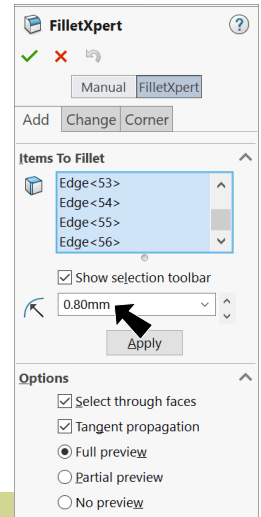


Fig. 74

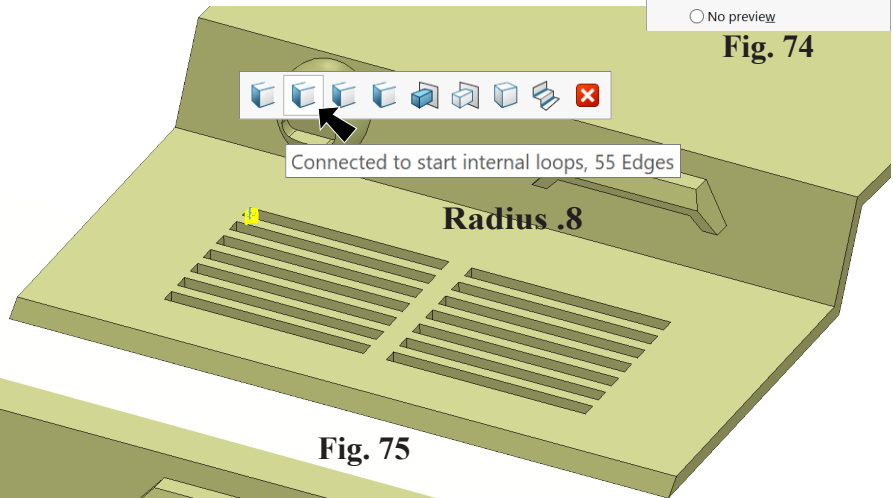


Fig. 75

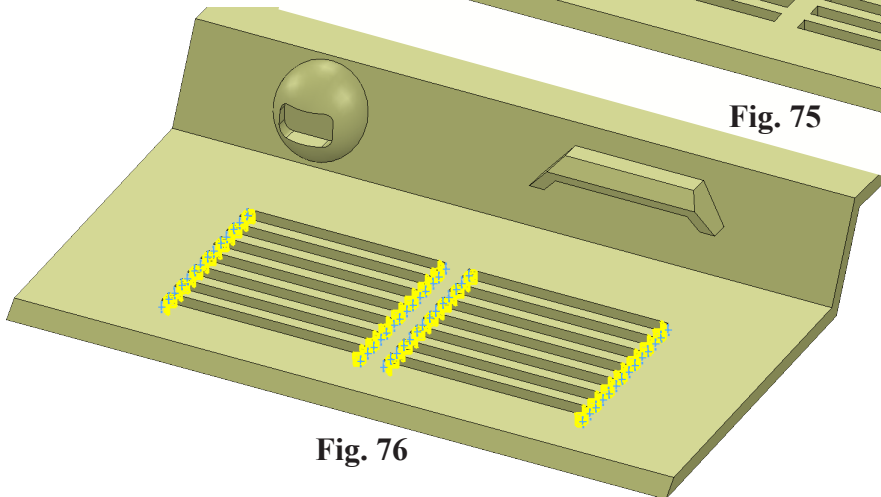


Fig. 76

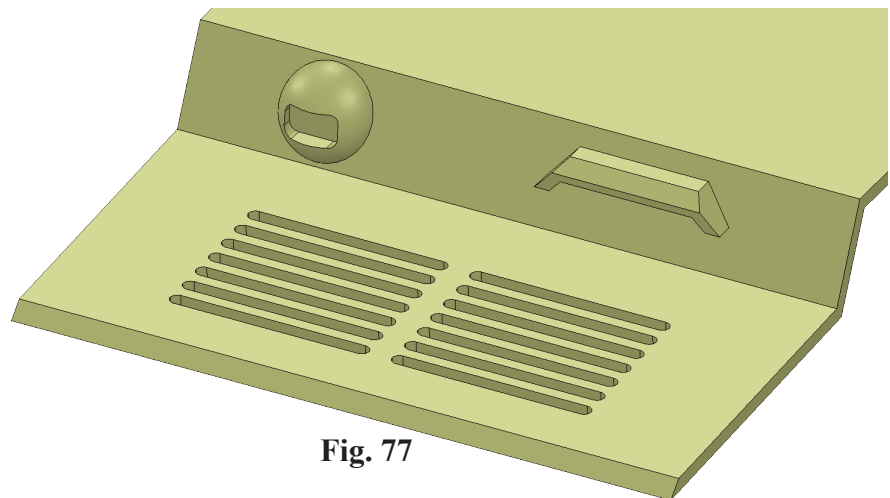





Fig. 77

N. Catch.


Step 1. Click **Right Plane**  in the Feature Manager and click **Sketch**  on the context toolbar, **Fig. 78**.

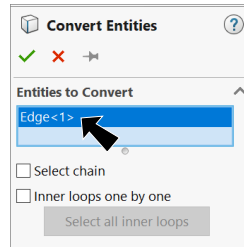
Step 2. Click **Normal To**  on the Standard Views toolbar. (**Ctrl-8**)

Step 3. Zoom in around **front of body**, **Fig. 79**.




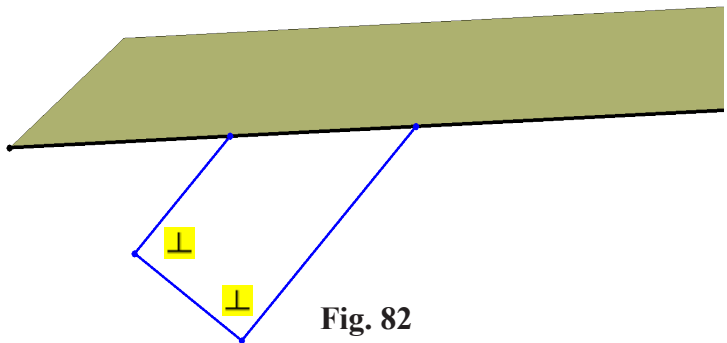
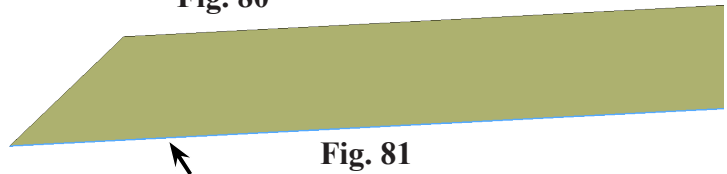
Step 4. Click **Convert Entities**  on the Sketch toolbar.

Step 5. In the Convert Entities Property Manager:
 under Entities to Convert, **Fig. 80**
 click **bottom edge of body**, **Fig. 81**
 click OK .



Step 6. Click **Line**  (**L**) on the Sketch toolbar.

Step 7. Sketch the **3 chained lines off of the converted edge line and make the corners perpendicular**  using the inferencing highlighting, **Fig. 82**.



Step 8. Click **Smart Dimension**  (**S**) on the Sketch toolbar.

Step 9. Add dimensions, **Fig. 83**.

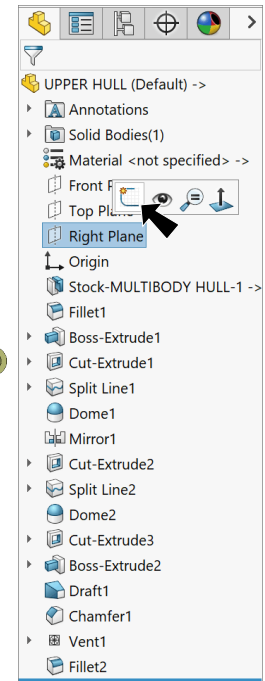
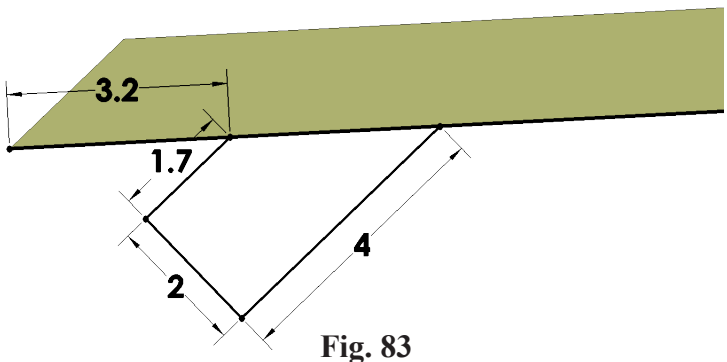





Fig. 78

Fig. 80

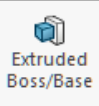
Fig. 81




Fig. 82

Fig. 83

Step 10. Rotate view. Click  on the Standard Views toolbar (Ctrl-1),  once and  once.

Step 11. Click **Features**  on the Command Manager toolbar.

Step 12. Click **Extruded Boss/Base**  on the Features toolbar.

Step 13. In the Boss-Extrude Property Manager set:
 under From, **Fig. 84**
 Start Condition: **Offset 34**
 under Direction 1
Depth  **6.5**
Reverse Direction 
 under Selected Contours
 click the **contour**, **Fig. 85**
 uncheck **Thin Feature**
 click OK .

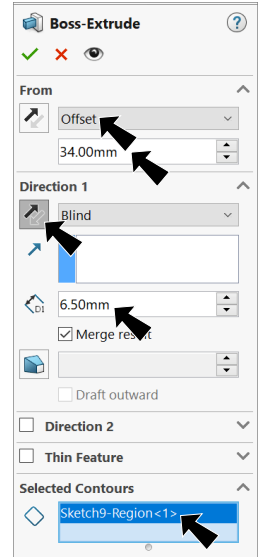


Fig. 84

Step 14. Save  (Ctrl-S).

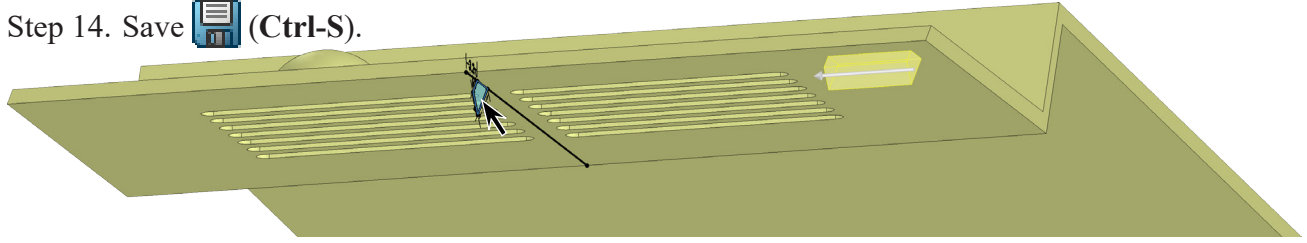
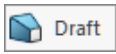




Fig. 85

O. Draft1 Catch.

Step 1. Click **Draft**  on the Features toolbar.

Step 2. In the Boss-Extrude Property Manager set:
 under Type of Draft, **Fig. 86**
 select **Neutral plane**
 under Draft Angle
Draft Angle 35°
 Neutral Plane
 click **bottom face of body**,
Fig. 87
 Faces to Draft
 click **both side faces of**
catch. Use **Right arrow key**
 to rotate..
 click OK .

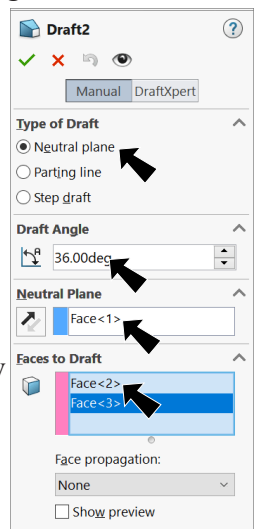


Fig. 86

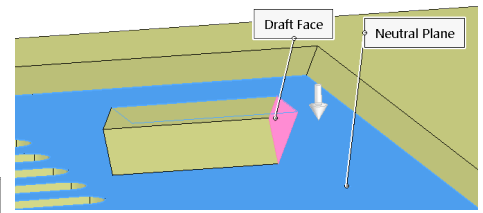


Fig. 87

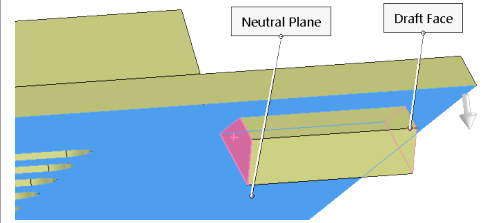


Fig. 88

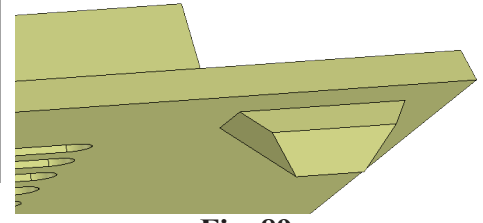



Fig. 89

P. Fillet Catch Edges.

Step 1. Click **Fillet**  on the Features toolbar.

Step 2. In the Fillet Property Manager set:
select **FilletXpert**, **Fig. 90**

Radius  **1**

click **both bottom edges of catch**, **Fig. 91**

click **Apply**

Radius  **.3**

click **both side edges**,
Fig. 92

click **OK**  .

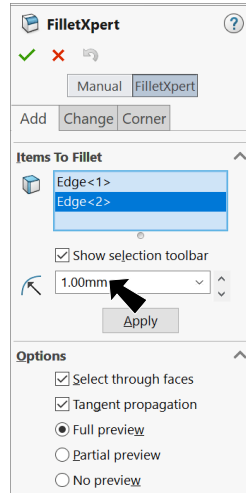


Fig. 90

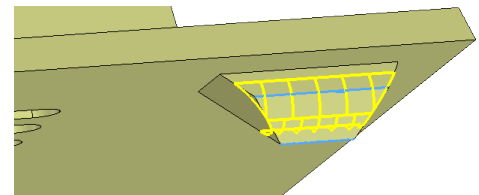
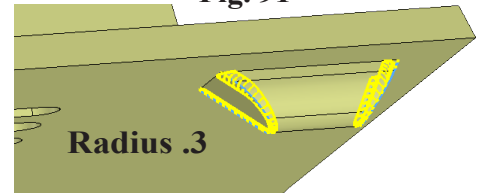


Fig. 91



Radius .3

Fig. 92

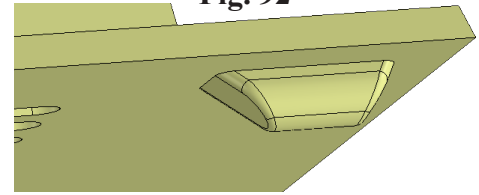


Fig. 93

Q. Mirror2 Catch.

Step 1. Select **Right Plane** and the 4 features of catch in Feature Manager.
To select, **Ctrl click Right Plane** , **Boss-Extrude3**, **Draft2** and **both Fillets** features to select Plane and features, **Fig. 94**.

Step 2. Click **Mirror**  on the Features toolbar.

Step 3. In the Mirror Property Manager click **OK**  .

Step 4. Save  (**Ctrl-S**).

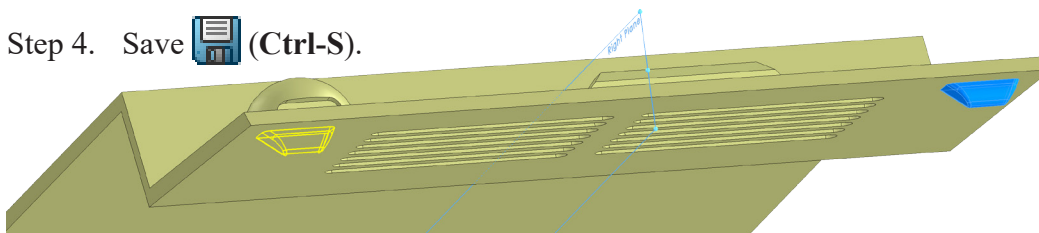


Fig. 95

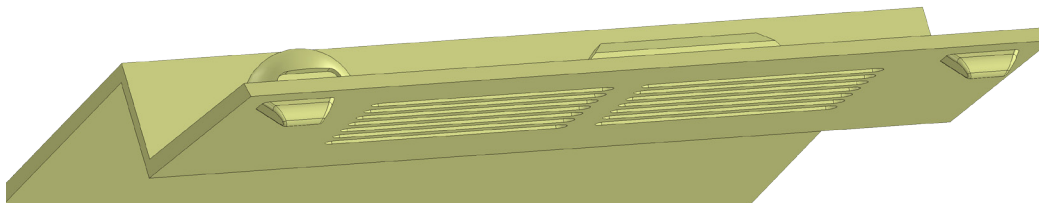


Fig. 96

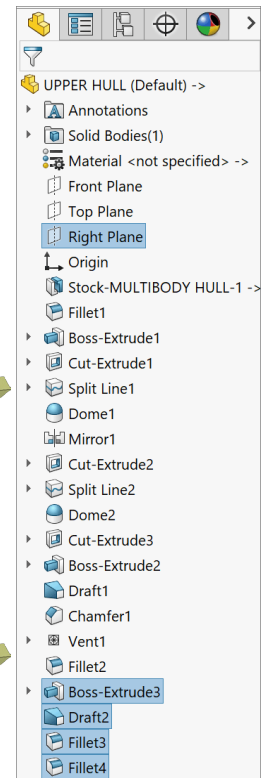


Fig. 94

R. Create Axis Sketch.

Step 1. Click **Isometric**  on the Standard Views toolbar. (Ctrl-7)

Step 2. **Show Sketch4.** To show, expand **Cut-Extrude2** in the Feature Manager, click **Sketch4** and **Show**  on the context toolbar, **Fig. 97.**

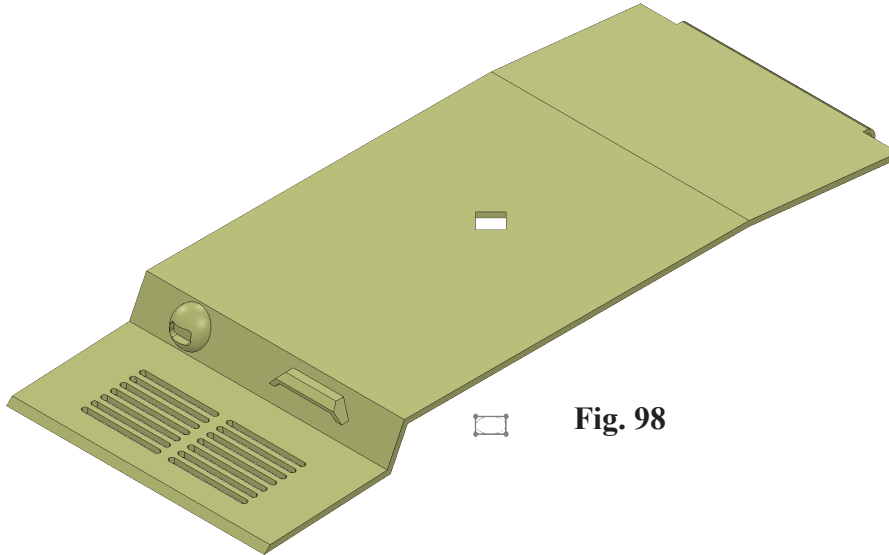


Fig. 98

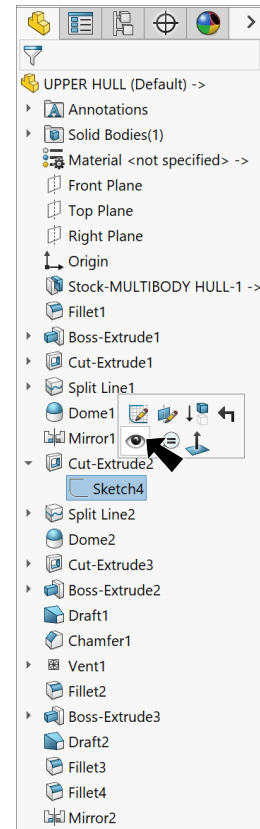


Fig. 97

Step 3. Click **Top Plane**  in the Feature Manager and click **Sketch**  on the context toolbar, **Fig. 99.**

Step 4. Click **Point**  on the Sketch toolbar.

Step 5. Sketch **point at centerpoint of construction circle** in Sketch4, **Fig. 100.**

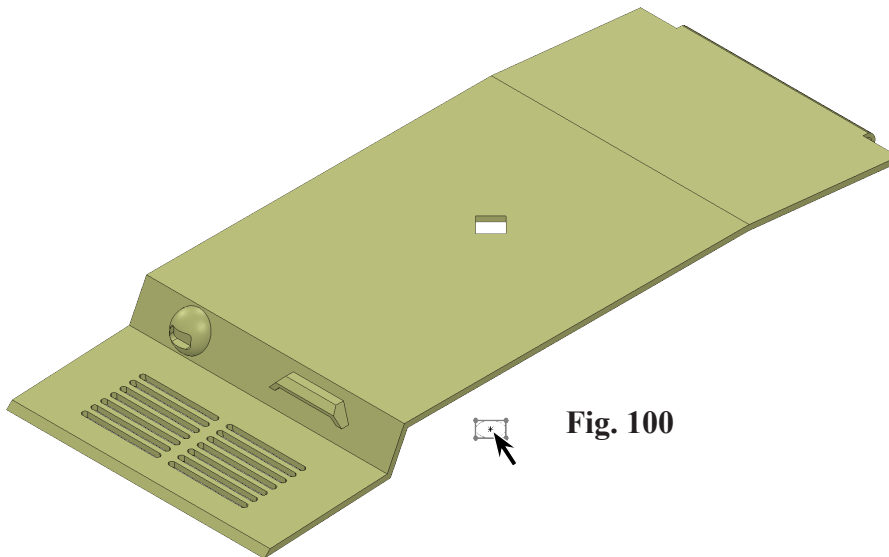


Fig. 100

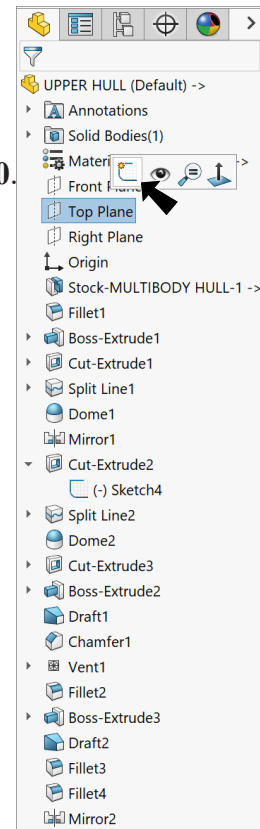

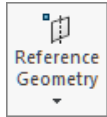



Fig. 99


Step 6. Click **Exit Sketch**  on the Sketch toolbar.

S. Create Axis.

Step 1. Click **Top Plane**  in Feature Manager to preselect plane, **Fig. 101**.

Step 2. Click **Reference Geometry**  on the Features toolbar and **Axis** from the menu.

Step 3. In the Axis Property Manager:
 under Selections, **Fig. 102**
Top Plane were preselected
 click the **point in sketch**, **Fig. 103**
 click OK .

Step 4 **Hide Sketch4 and Sketch10**. To hide, click **Sketches** in graphic area and **Hide**  on the context toolbar, **Fig. 104**. Don't hide Axis.

Step 5. Save  (Ctrl-S).

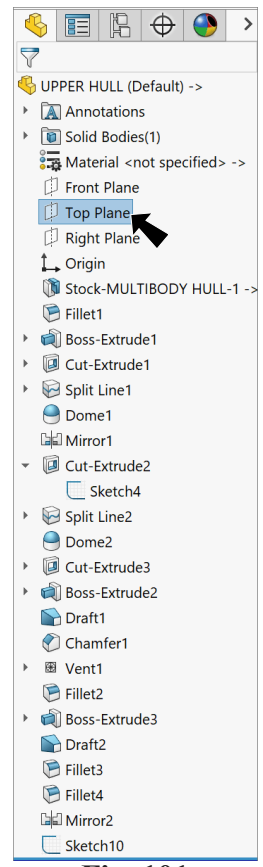


Fig. 101

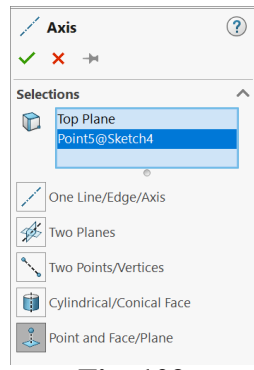


Fig. 102

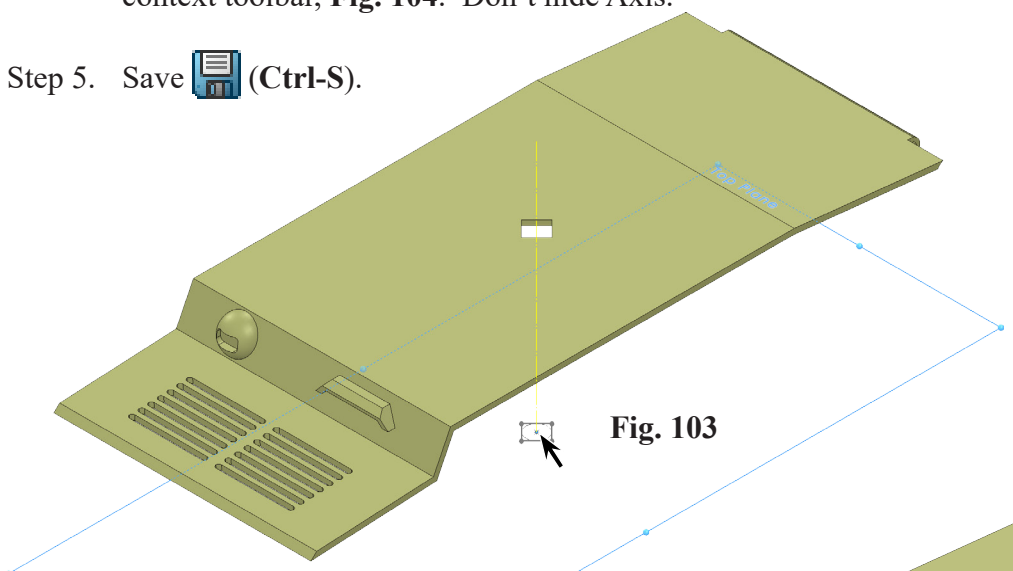


Fig. 103

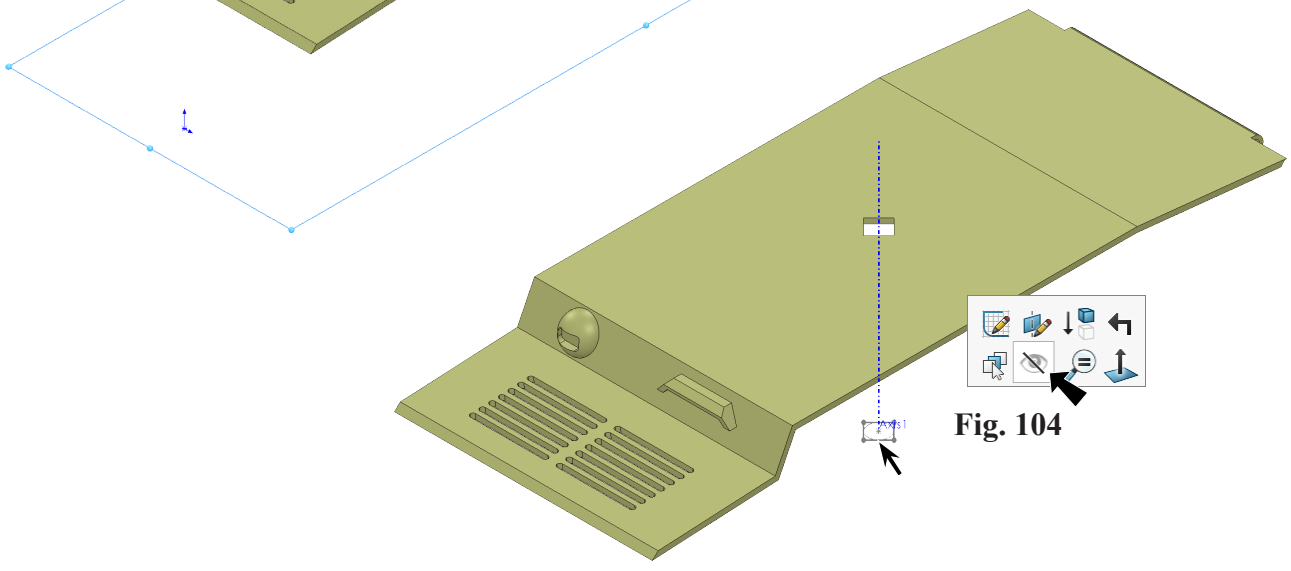


Fig. 104