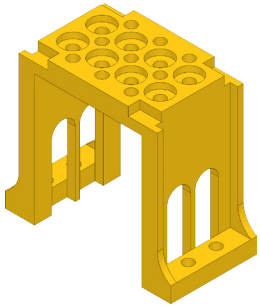
Chapter 17

Cluster Wheel Vehicle

MOTOR BRACKET



A. Extrude1.

Step 1. Click File Menu > New, click **Part Metric** and OK.

Step 2. Click **Front Plane** in the Feature Manager and click **Sketch** on the context toolbar, **Fig. 1**.

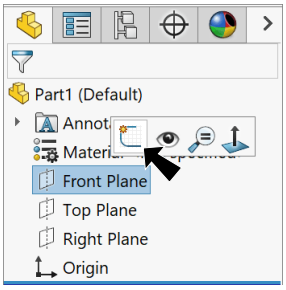


Fig. 1

Step 3. Click **Line** **(L)** on the Sketch toolbar.

Step 4. Sketch **9 lines with the last line vertical down to the Origin**, **right click vertical line at Origin** and click **Construction Geometry** on the context toolbar, **Fig. 2**.

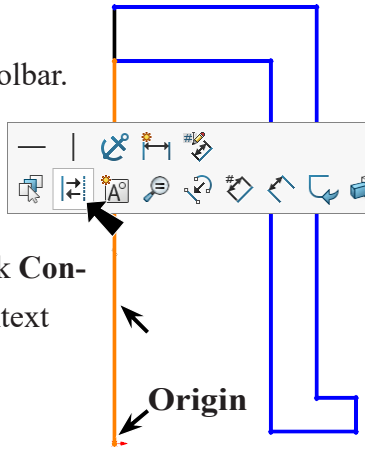


Fig. 2

Step 5. **Ctrl click Origin and bottom horizontal line**. Release Ctrl key and click **Make Coincident** on the context toolbar, **Fig. 3**.

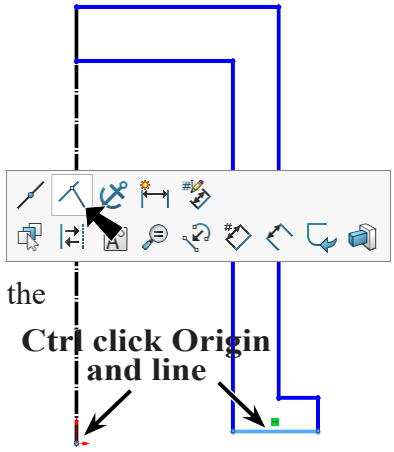


Fig. 3

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

Step 7. Add dimensions, **Fig. 4**.

Step 8. Click **Features** on the Command Manager toolbar.

Step 9. Click **Extruded Boss/Base** on the Features toolbar.

Step 10. In the Boss-Extrude Property Manager set:
under Direction 1, **Fig. 5**
End Condition **Mid Plane**
Depth **14.8**
click OK .

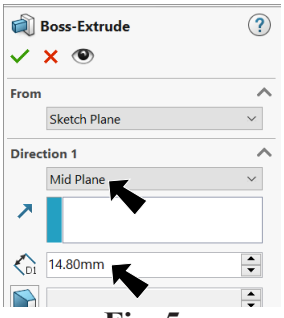


Fig. 5

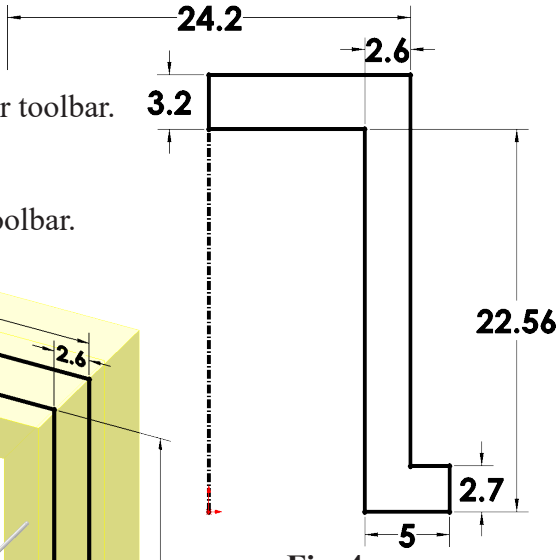


Fig. 4

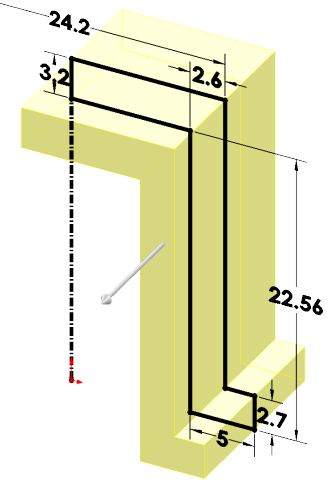


Fig. 6

B. Save as "MOTOR BRACKET".

Step 1. Click File Menu > Save As.

Step 2. Key-in **MOTOR BRACKET** for the filename and press ENTER.

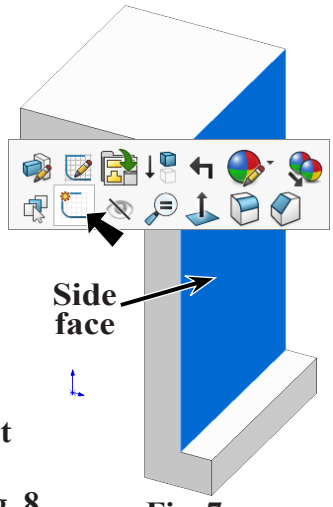


Fig. 7

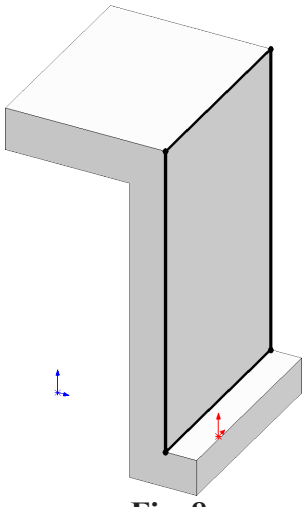


Fig. 8

C. Cut Extrude1.

Step 1. Click the **side face** and click **Sketch**  on the context toolbar, **Fig. 7**.

Step 3. With the face still selected, click **Convert Entities** 

on the Sketch toolbar, **Fig. 8**.

Step 4. Click **Offset Entities** 

on the Sketch toolbar.

Step 5. In the Offset Entities Property Manager set:
under Parameters, **Fig. 9**

Distance 1
check **Reverse**
uncheck **Select chain**
click **side converted lines**, **Fig. 10**
offset line should be on inside

click OK .

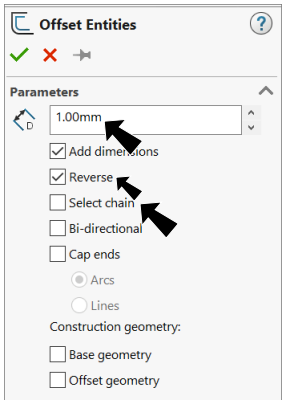


Fig. 9

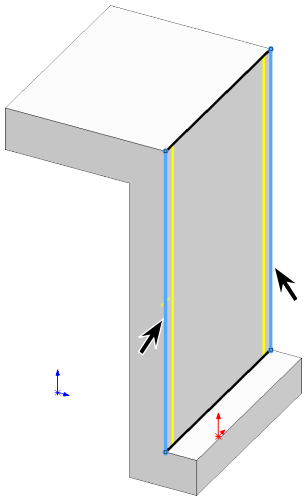


Fig. 10

Step 6. Click **Features** 

on the Command Manager toolbar.

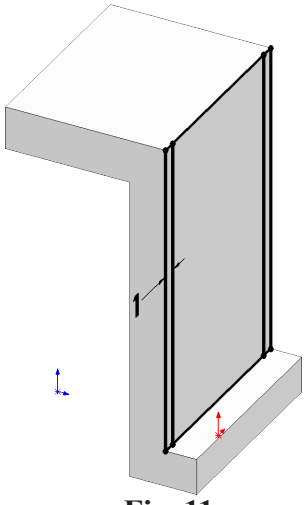
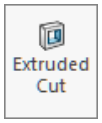


Fig. 11

Step 7. Click **Extruded Cut** 

on the Features toolbar.

Step 8. In the Cut-Extrude Property Manager set:
under Direction 1, **Fig. 12**
End Condition **Blind**
Depth  **1.3**
under Selected Contours
click **inside contour**, **Fig. 13**
click OK  .

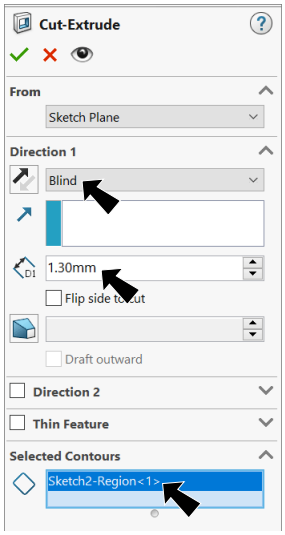


Fig. 12

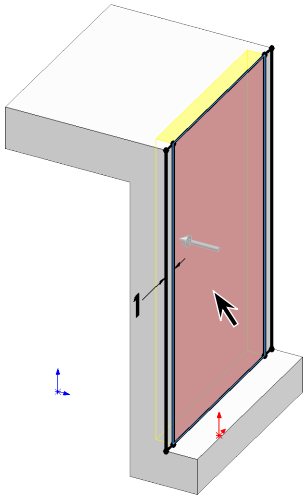


Fig. 13

D. Cut Extrude2.

Step 1. Click **Left**  on the Standard Views toolbar. **(Ctrl-3)**

Step 2. Click the **inside face** and click **Sketch**  on the context toolbar, **Fig. 15**.

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

Step 4. Sketch **vertical centerline** up from Origin  , **Fig. 16**.

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

Step 6. Sketch **corner rectangle to left of centerline and coincident with bottom edge**, **Fig. 17**.

Step 7. Click **Centerpoint Arc**  **(S)** in the **Arc flyout**  on the Sketch toolbar.

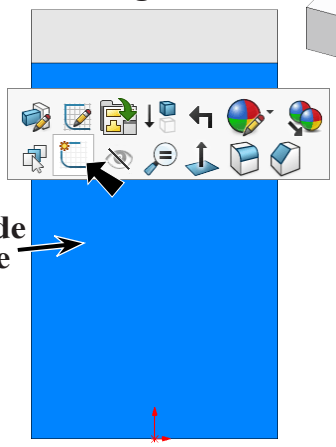


Fig. 15

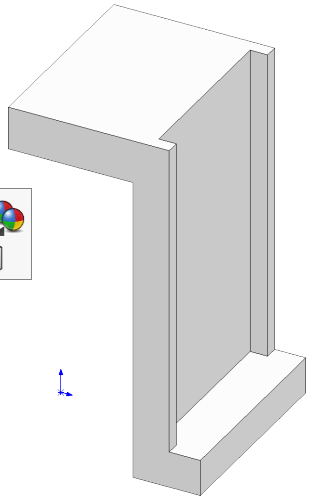


Fig. 14

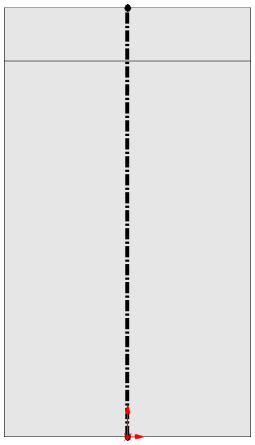


Fig. 16

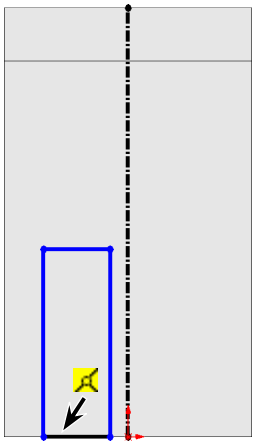


Fig. 17

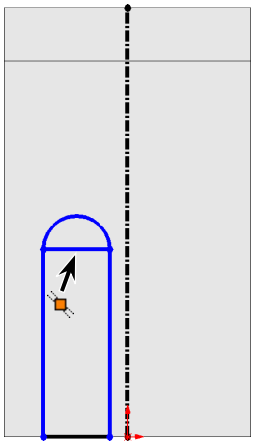


Fig. 18

Step 8. Sketch a centerpoint arc across top of rectangle centered on midpoint  of top line of rectangle, **Fig. 18**.

Step 9. Click **Smart Dimension** 

(**S**) on the Sketch toolbar.

Step 10. Add dimensions, **Fig. 19**.

Step 11. **Unselect Smart Dimension**. To unselect, right click graphics area and click Select from menu.

Step 12. Drag a selection to left to select all geometry, **Fig. 20**.

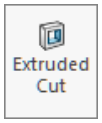
Step 13. Click **Mirror Entities** 

on the Sketch toolbar, **Fig. 21**.

Step 14. Click **Isometric**  on the Standard Views toolbar. (**Ctrl-7**)

Step 15. Click **Features** 

on the Command Manager toolbar.

Step 16. Click **Extruded Cut** 

on the Features toolbar.

Step 17. In Cut-Extrude Property Manager set:
under Direction 1, **Fig. 22**
End Condition **Up To Surface**
click **bottom face of Cut-Extrude1**, **Fig. 23**
under Selected Contours
click **inside contours** (4)
click OK ✔ .

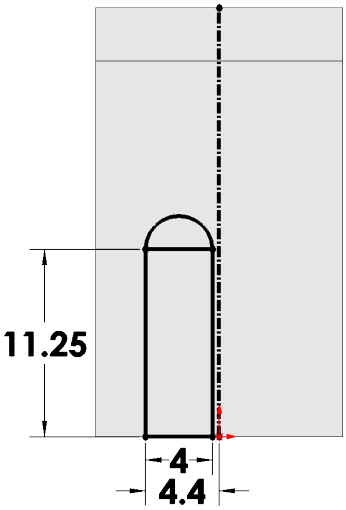


Fig. 19

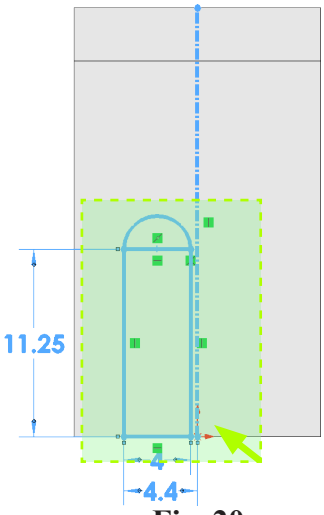


Fig. 20

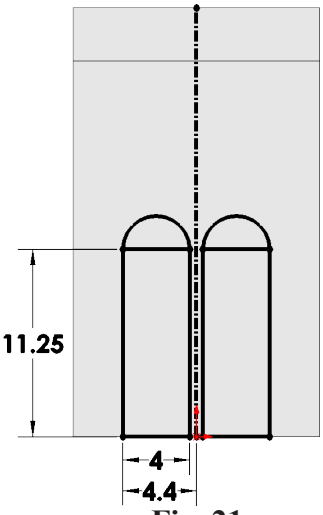


Fig. 21

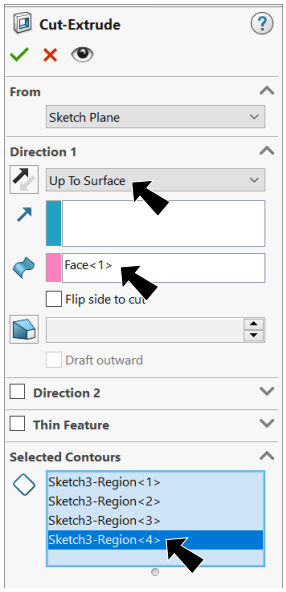


Fig. 22

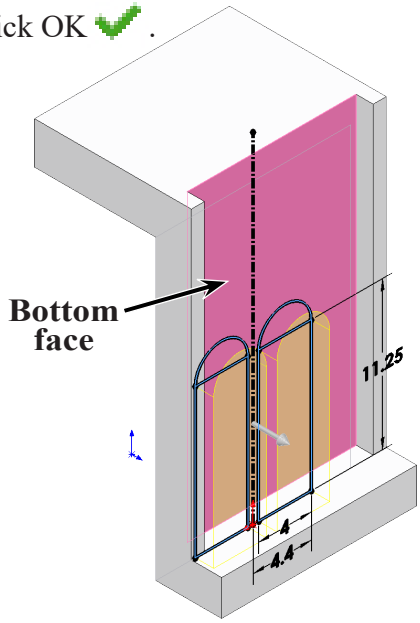


Fig. 23

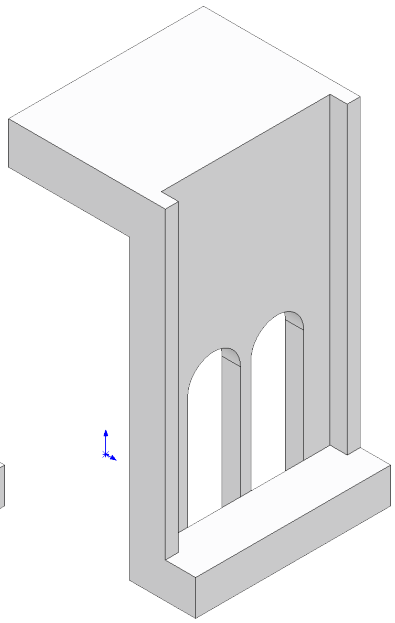


Fig. 24

E. Cut Extrude3 Holes.

Step 1. Click **top face of foot** and click **Sketch** on the context toolbar, **Fig. 25**.

Step 2. Click **Centerline** in the **Line flyout** on the Sketch toolbar.

Step 3. Sketch **horizontal centerline from Origin** **out to edge**, **Fig. 26**.

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

Step 5. Sketch circle on face of foot, **Fig. 27**.

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

Step 7. Add dimensions, **Fig. 27**.

Step 8. **Unselect Smart Dimension**. To unselect, right click graphics area and click Select from menu.

Step 9. Drag a selection to right to select all geometry, **Fig. 28**.

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

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

Step 12. Click **Extruded Cut** on the Features toolbar.

Step 13. In the Cut-Extrude Property Manager set:
under Direction 1, **Fig. 29**
End Condition **Through All**
click OK .

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

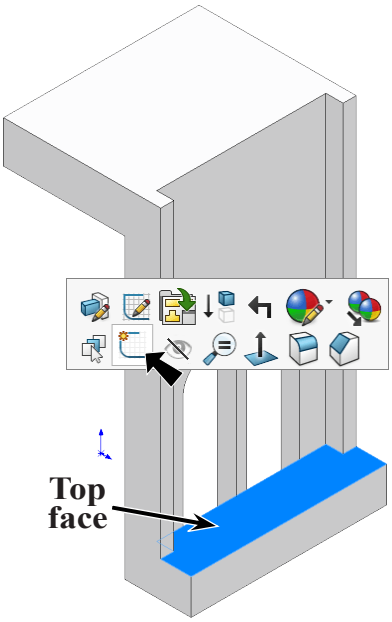


Fig. 25

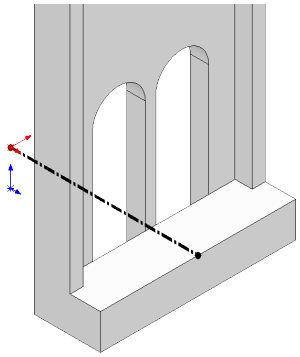


Fig. 26

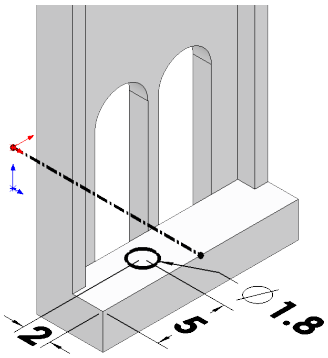


Fig. 27

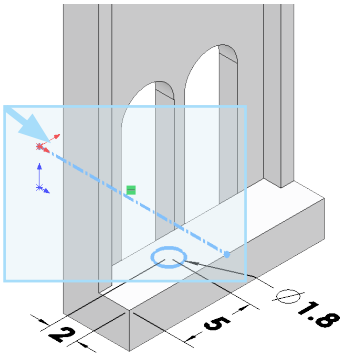


Fig. 28

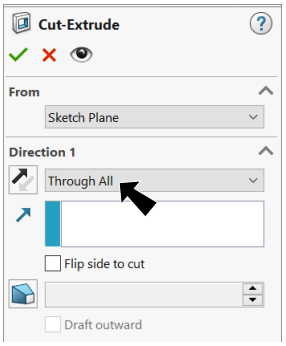


Fig. 29

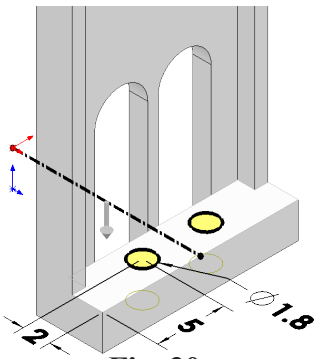


Fig. 30

F. Cut Extrude4.

Step 1. Click the **top face of body** and click **Sketch** on the context toolbar, **Fig. 31**.

Step 2. Click **Centerline** in the **Line flyout** on the Sketch toolbar.

Step 3. Sketch **horizontal centerline** across from Origin , **Fig. 32**.

Step 4. Click **Corner Rectangle** in the **Rectangle flyout** on the Sketch toolbar.

Step 5. Sketch **corner rectangle coincident with top and side edge of Cut-Extrude1**, **Fig. 33**.

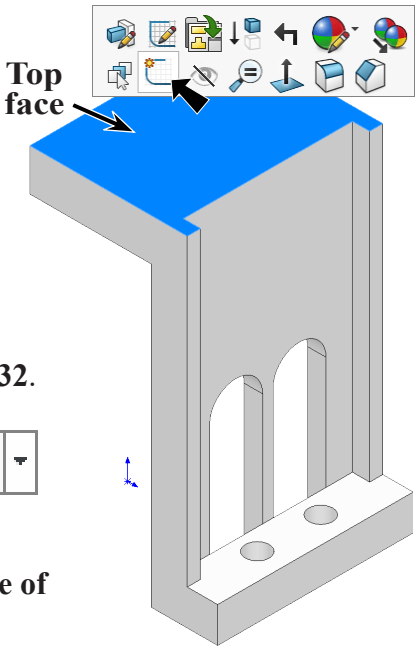


Fig. 31

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

Step 7. Add dimensions, **Fig. 34**.

Step 8. **Unselect Smart Dimension**. Right click graphics area and click Select .

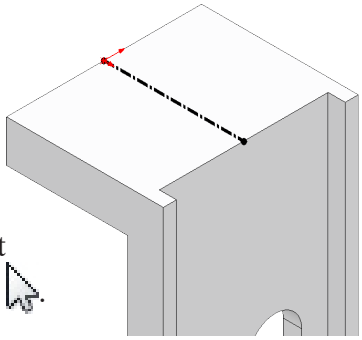


Fig. 32

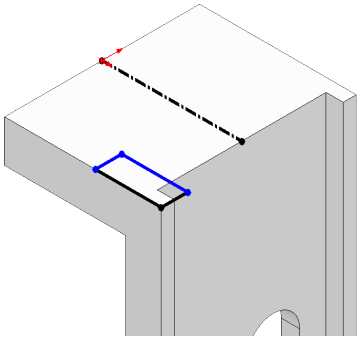


Fig. 33

Step 9. Drag a selection to select all geometry, **Fig. 35**.

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

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

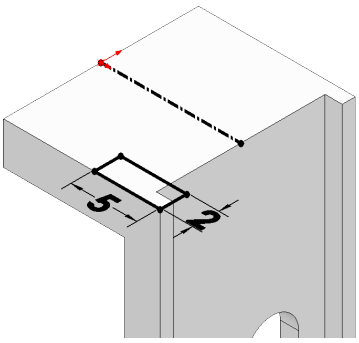


Fig. 34

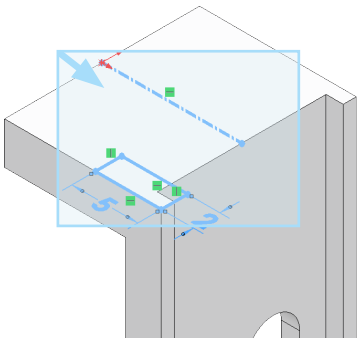


Fig. 35

Step 12. Click **Extruded Cut** Extruded Cut on the Features toolbar.

Step 13. In the Cut-Extrude Property Manager:
under Direction 1, **Fig. 36**
End Condition **Blind**
Depth 1.5
click OK .

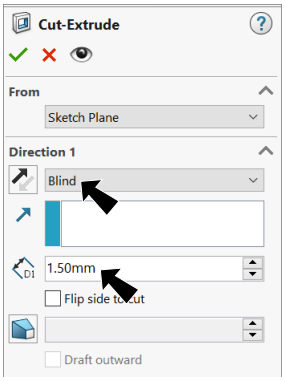


Fig. 36

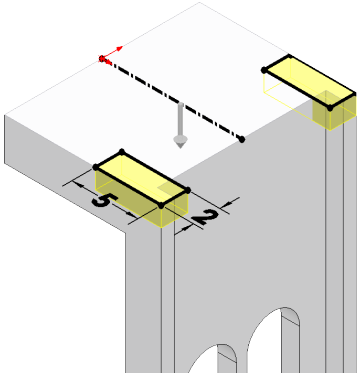


Fig. 37

G. Fillet Edges.

Step 1. Click **Fillet** 

on the Features toolbar.

Step 2. In the Fillet Property Manager set:
select **FilletXpert**, **Fig. 38**
Radius **4.5**
click **both edges of foot (2)**, **Fig. 39**
click OK .

Step 3. Save (**Ctrl-S**).

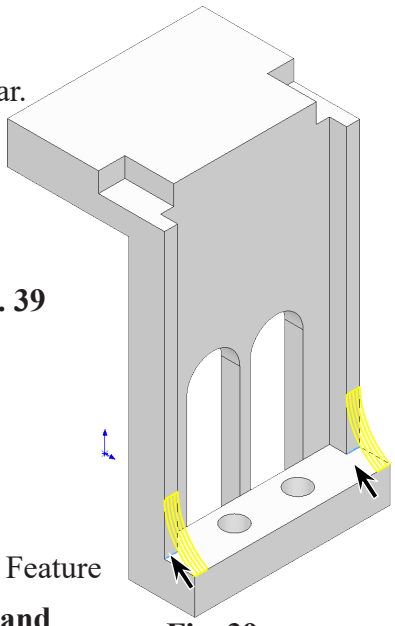


Fig. 39

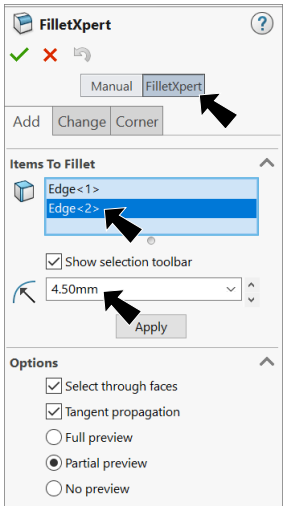


Fig. 38

H. Mirror Body.

Step 1. Expand Solid Bodies folder in the Feature Manager. **Ctrl click Fillet1 body and Right Plane** to select Body and Plane, **Fig. 40**.

Step 2. Click **Mirror** 

on the Features toolbar.

Step 3. In the Mirror Property Manager click OK .

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

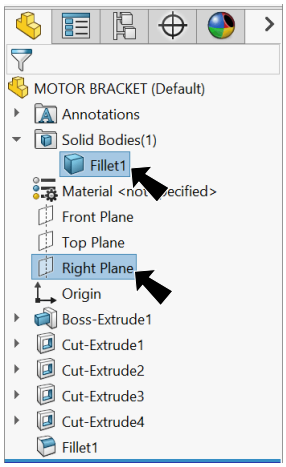


Fig. 40

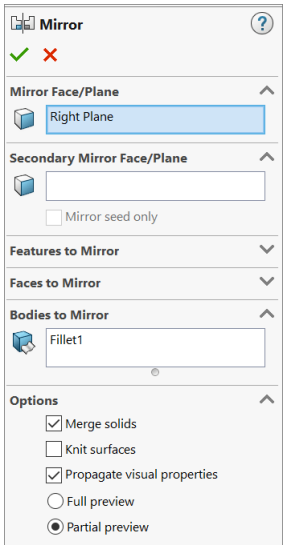


Fig. 41

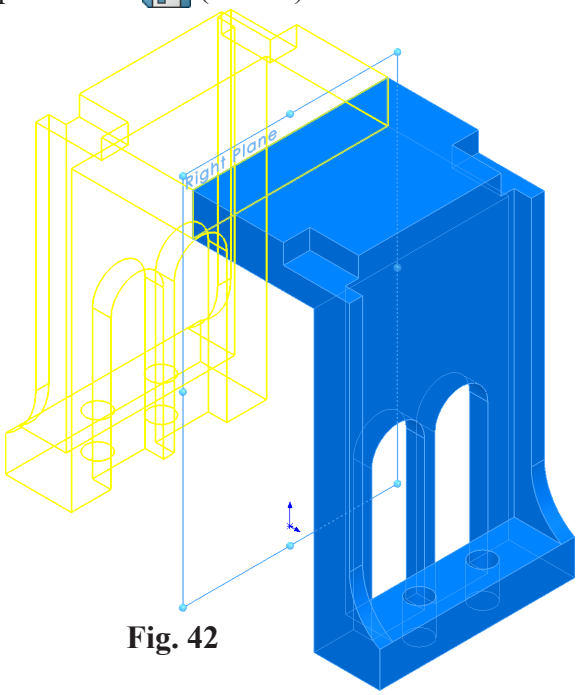


Fig. 42

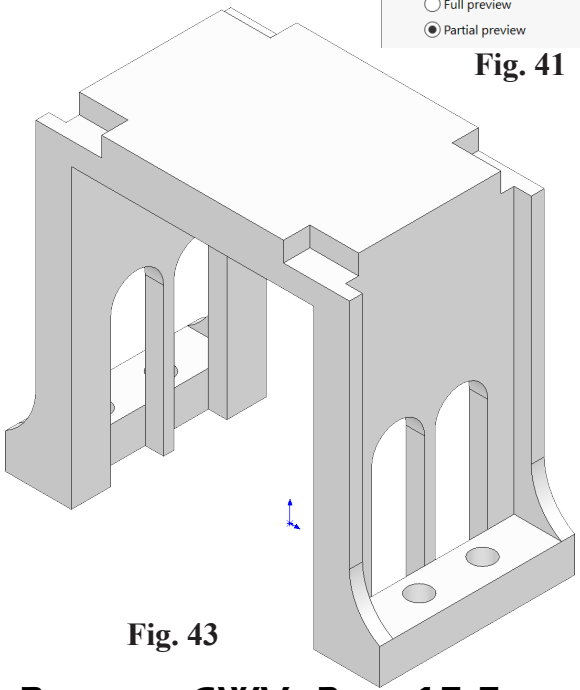


Fig. 43

I. Sketch6 Pattern for Holes.

Step 1. Click the **top face of body** and click **Sketch** on the context toolbar, **Fig. 44**.

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 through Origin**, **Fig. 45**.

Step 5. Click **Point** on the Sketch toolbar.

Step 6. Sketch point at **Origin** and **two more points on centerline**, **Fig. 46**.

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

Step 8. Dimension points **5**, **Fig. 47**.

Step 9. **Unselect Smart Dimension**. To unselect, right click graphics area and click Select from menu.

Step 10. Drag a selection to right to select **all points**, **Fig. 48**.

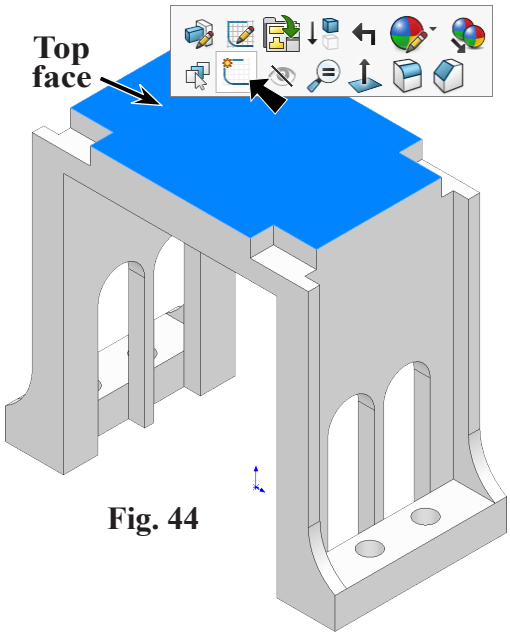


Fig. 44

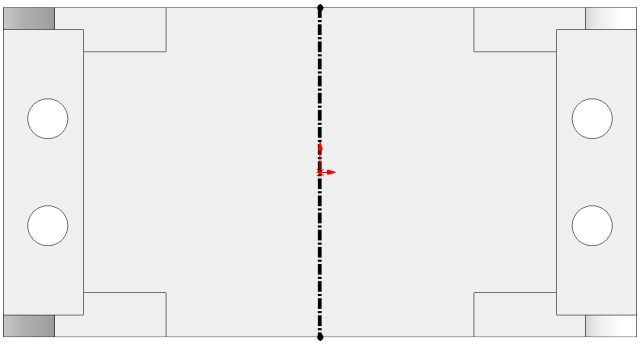


Fig. 45

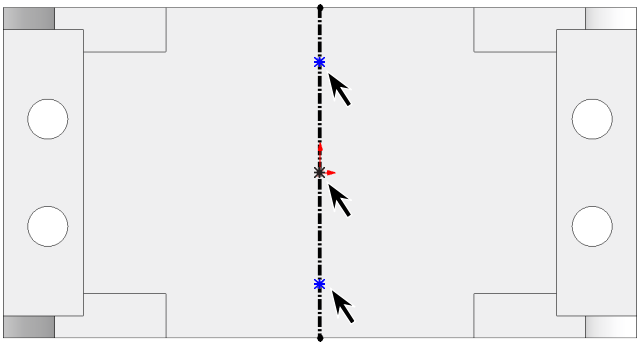


Fig. 46

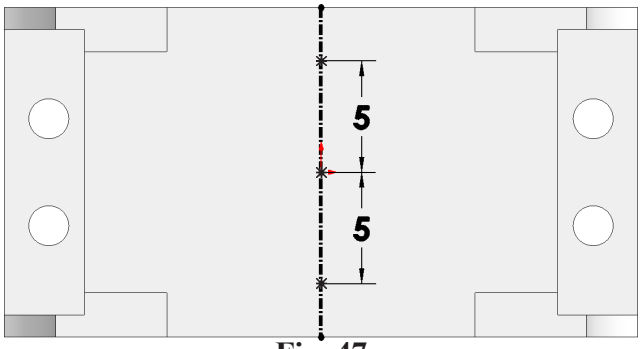


Fig. 47

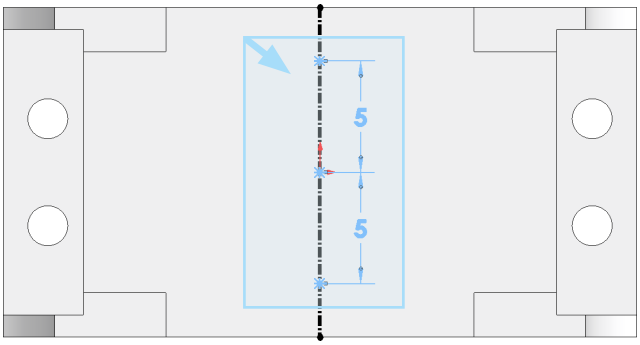


Fig. 48

Step 11. Click **Linear Sketch Pattern** 

on the Sketch toolbar.

Step 12. In the Linear Pattern Property Manager set:
under Direction 1, **Fig. 49**

Spacing **5**

Number of Instances **2**

under Direction 2

Number of Instances **2**

Spacing **5**

Angle **180**

click OK .

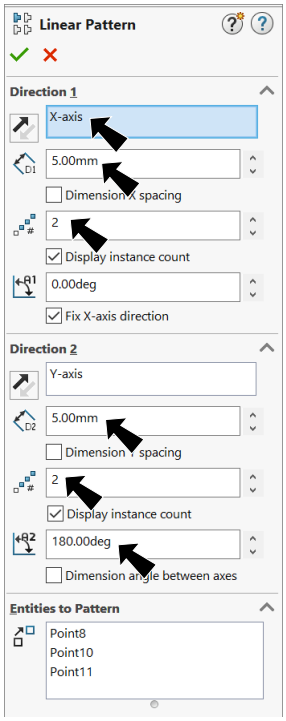


Fig. 49

Step 13. Click **Exit Sketch** 

on the Sketch toolbar.

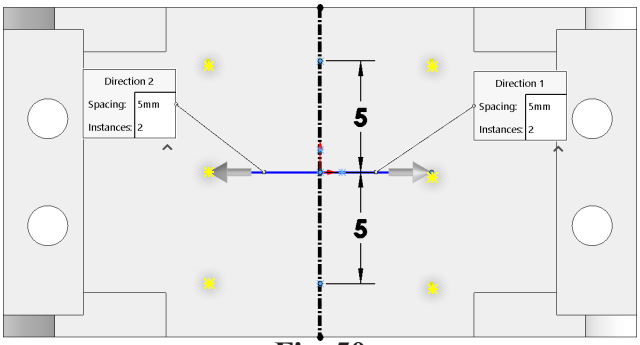


Fig. 50

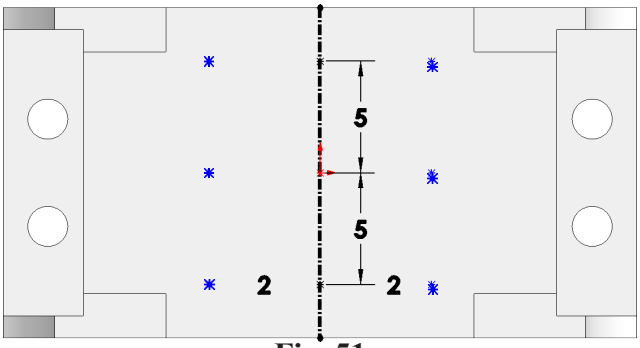


Fig. 51

J. Hole Wizard 1 Hole.

Step 1. Click **Features** Features on the Command Manager toolbar.

Step 2. Click **Hole Wizard** Hole Wizard on the Features toolbar.

Step 3. In the Property Manager on the Type tab set:
under Hole Type, **Fig. 52**
select **Hole**
under Standard:
select **ANSI Metric**
under Type:
Drill sizes
under Size:
select **1.8**
under End Condition:
Through All
click **Positions tab** Positions at top of the Property Manager.

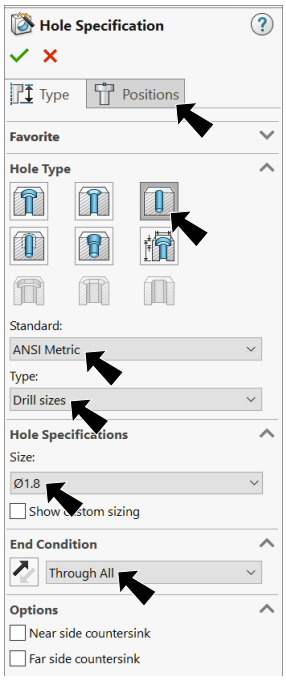


Fig. 52

Step 4. Click **top face** one time as face for holes, **Fig. 53**.

Step 5. Click a **point**, **Fig. 53**.
Yes, just one point.

Step 6. Click OK in Hole Property Manager.

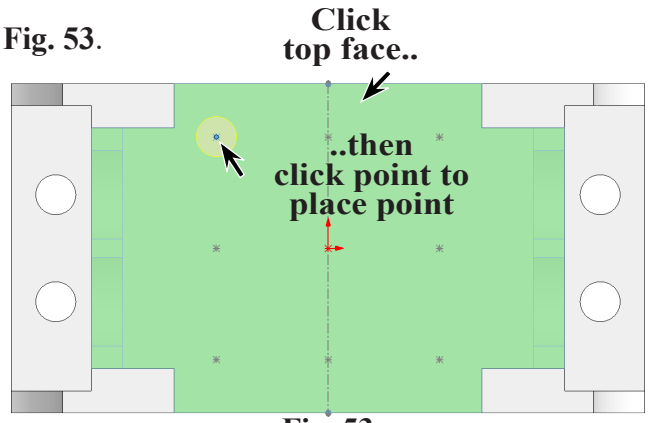


Fig. 53

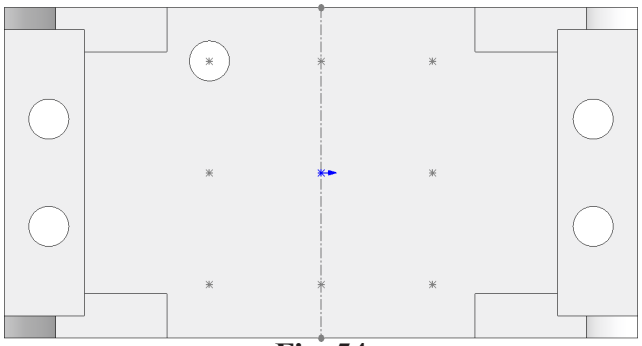


Fig. 54

K. Sketch Driven Pattern1

Step 1. **Ctrl click Sketch6** and **Hole1** **feature** in the Feature Manager to select both, **Fig. 55**.

Step 2. Click **Sketch Driven Pattern** Curve Driven Pattern in the **Linear Pattern flyout** Linear Pattern on the Features toolbar.

Step 3. In the Sketch Pattern Property Manager set:
under Direction 1, **Fig. 56**
Sketch6 was preselected
under Features and Faces
click **Hole1** was preselected
click OK .

Step 4. **Hide Sketch6** . To hide, click **Sketch6** in the graphics rear and **Hide** on the context toolbar, **Fig. 58**.

Step 5. Save (**Ctrl-S**).

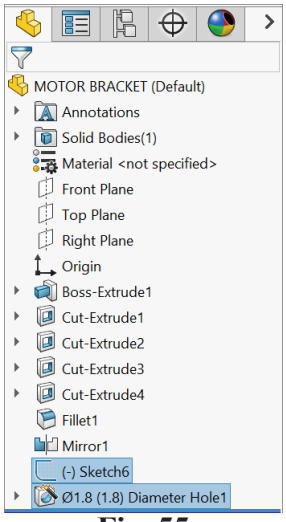


Fig. 55

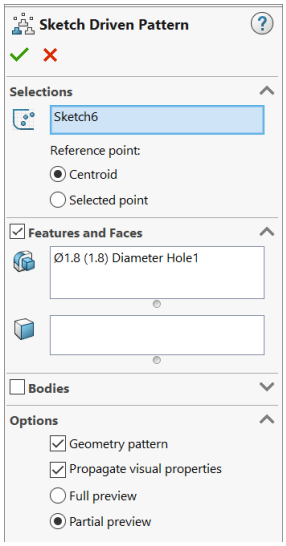


Fig. 56

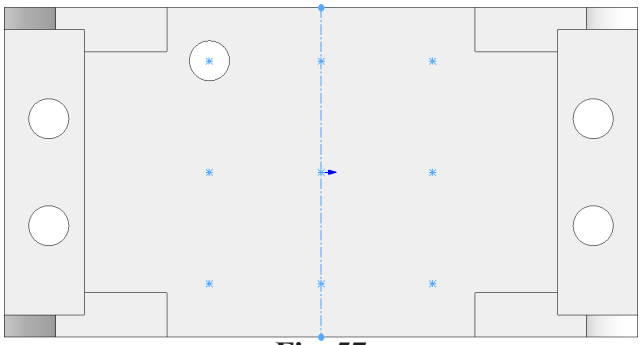


Fig. 57

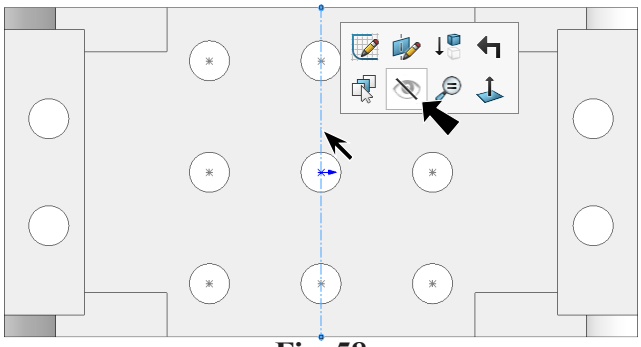


Fig. 58

L. Sketch9 Pattern for Counterbore Holes.

Step 1. Click the **top face of body** and click **Sketch** on the context toolbar, **Fig. 59**.

Step 2. Click **Centerline** in the **Line fly-out** on the Sketch toolbar.

Step 3. Sketch **horizontal and vertical centerline through Origin** and **horizontal construction line**, **Fig. 60**.

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

Step 5. Sketch **two points on construction line to left of Origin**, **Fig. 61**.

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

Step 7. Add dimensions, **Fig. 62**.

Step 8. **Unselect Smart Dimension**. To unselect, right click graphics area and click Select from menu.

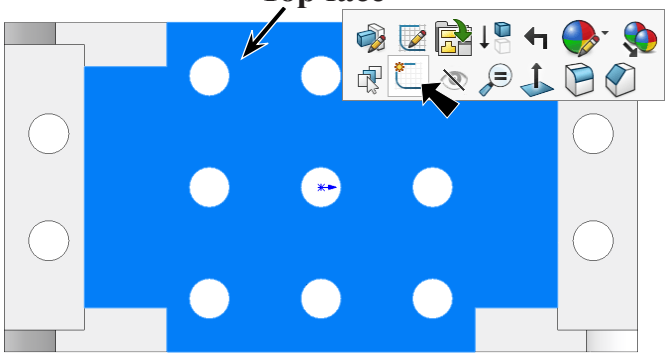


Fig. 59

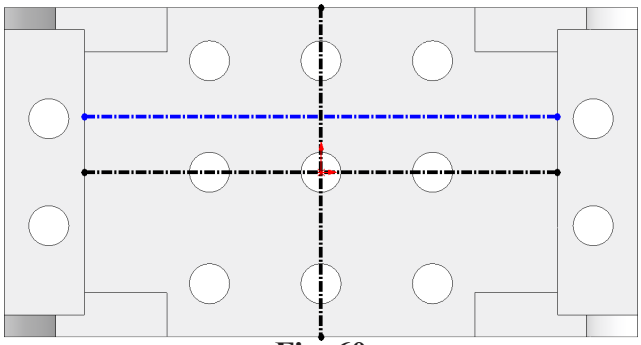


Fig. 60

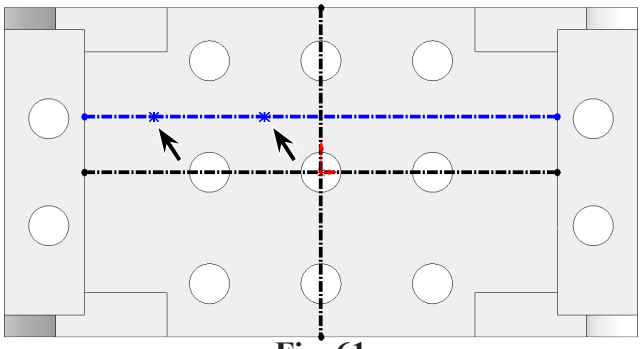


Fig. 61

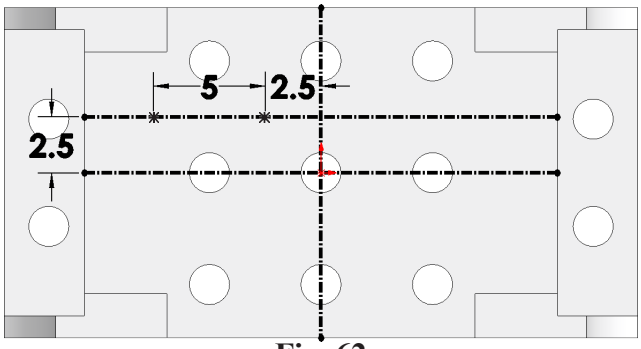
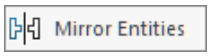


Fig. 62

Step 9. Drag a selection to **right to select both points and vertical centerline**, **Fig. 63**.

Step 10. Click **Mirror Entities** 

on the Sketch toolbar.

Step 11. Drag a selection to **right to select the 4 points** and **Ctrl click horizontal centerline**, **Fig. 64**.

Step 12. Click **Mirror Entities** 

on the Sketch toolbar, **Fig. 65**.

Step 13. Click **Exit Sketch** 

on the Sketch toolbar.

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

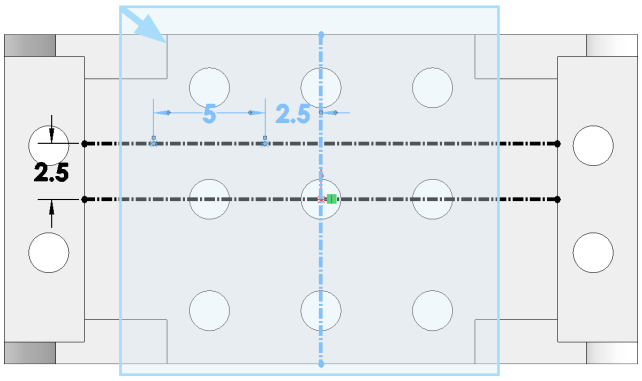


Fig. 63

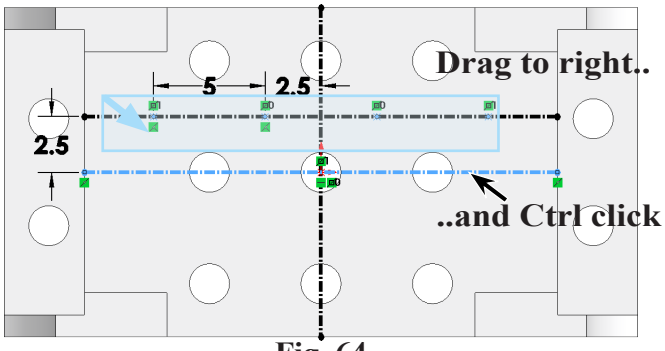


Fig. 64

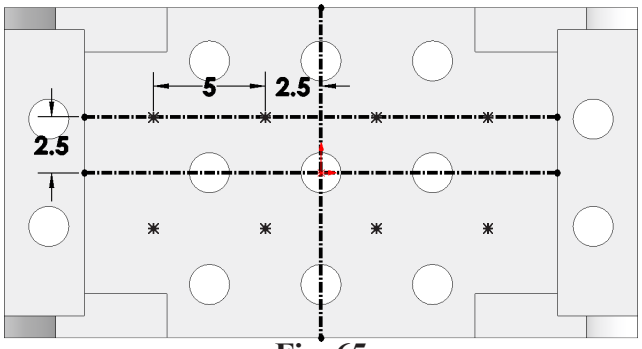


Fig. 65

M. Hole Wizard2 Counterbore Hole.

Step 1. Click **Features** Features on the Command Manager toolbar.

Step 2. Click **Hole Wizard** Hole Wizard on the Features toolbar.

Step 3. In the Property Manager on the Type tab set:
under Hole Type, **Fig. 66**
select **Counterbore**
under Standard:
select **ANSI Metric**
under Type:
Hex Screw - ANSI B818.6.7M
under Size:
select **M5**
check **Show custom sizing**
Through Hole Diameter 1.8
Counterbore Diameter 4
Counterbore Depth 1

under End Condition: **Through All**
uncheck **Near side countersink**

click **Positions tab** Positions at top of the Property Manager.

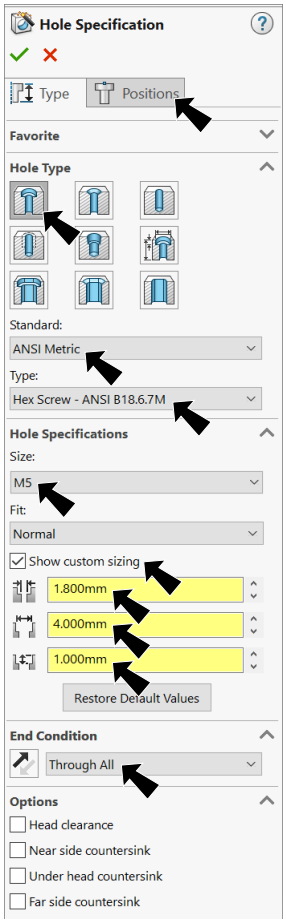


Fig. 66

Step 4. Click **top face** one time as face for holes, **Fig. 67**.

Step 5. Click the **two outside points on both sides** (4), **Fig. 67**.

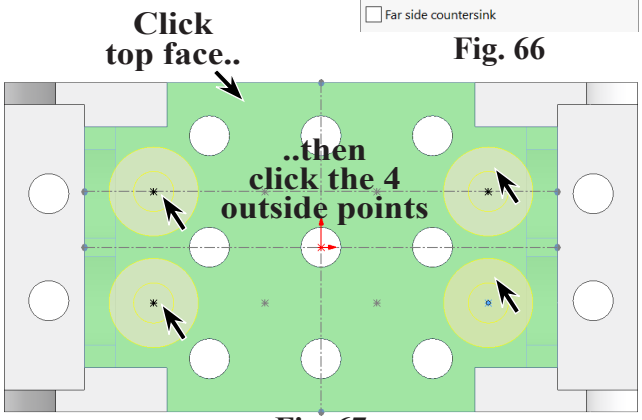


Fig. 67

Step 6. Click OK in Hole Property Manager.

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

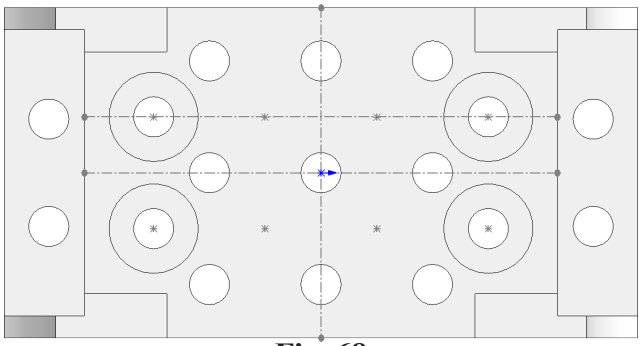


Fig. 68

N. Advanced Hole.

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

Step 2. Click **Advanced Hole** Advanced Hole in the **Hole Wizard flyout** Hole Wizard on the Features toolbar.

Step 3. In the Advanced Hole Property Manager on the Type tab set:
(**Element one**)
in Near Side flyout, **Fig. 69**
first element select **Counterbore**
under Near And Far Side Faces
click **top face of body**, **Fig. 70**
under Standard:
select **ANSI Metric**
under Type:
Hex Screw
under Size:
select **M2**
under Custom sizing
click **Diameter Override**
Diameter 4
click **End Condition Override**
Depth D **1**

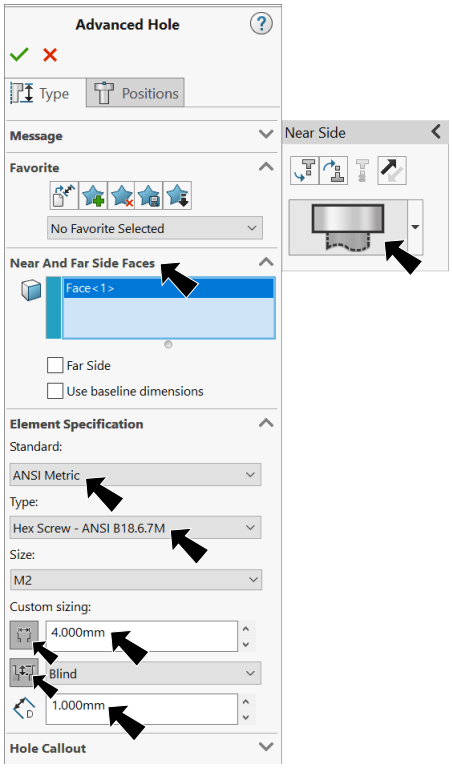


Fig. 69

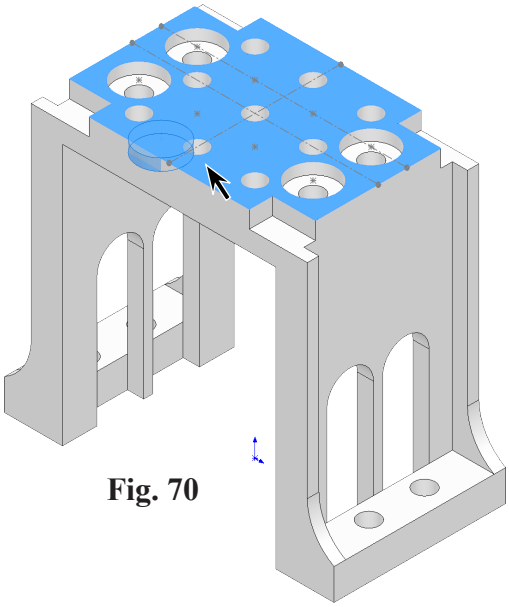


Fig. 70

Step 4. In Near Side flyout, **Fig. 71**
(Element two)

click **Insert Element Below Active Element**

For second element select **Hole**

under Element Specification
under Standard:
select **ANSI Metric**
under Type:
Drill Sizes
under Size:
select **1.8**
under Custom sizing
End Condition **Blind**
Depth **1**

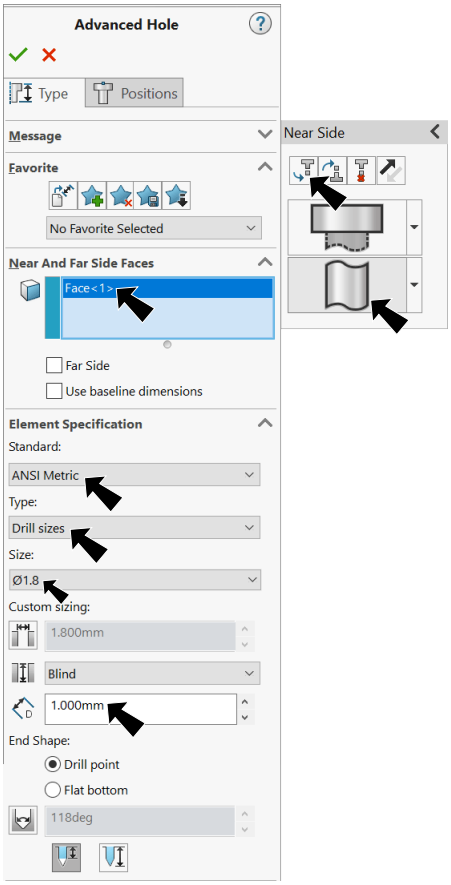


Fig. 71

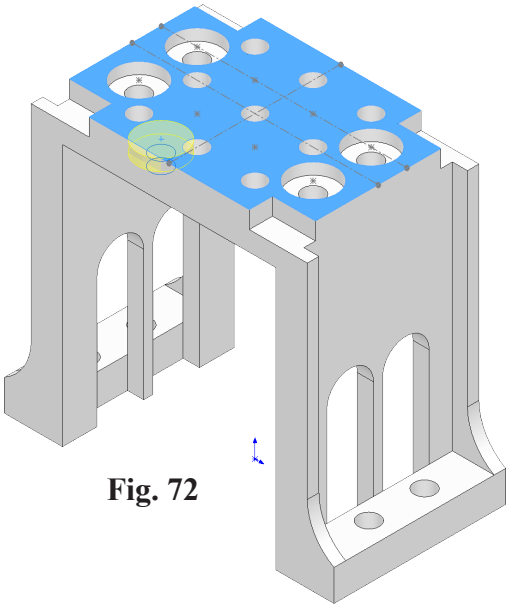


Fig. 72

Step 5. Under Near And Far Side Faces
(Element three)
check **Far Side, Fig. 73**
rotate body and
click **under side face of body, Fig. 74**
in Far Side flyout

third element select **Far Side Counterbore**
under Element Specification
under Standard:
select **ANSI Metric**
under Type:
Hex Screw
under Size:
select **M2**
under Custom sizing

click **Diameter Override**
Diameter 4

click **End Condition Override**
End Condition **Up To Next Element**

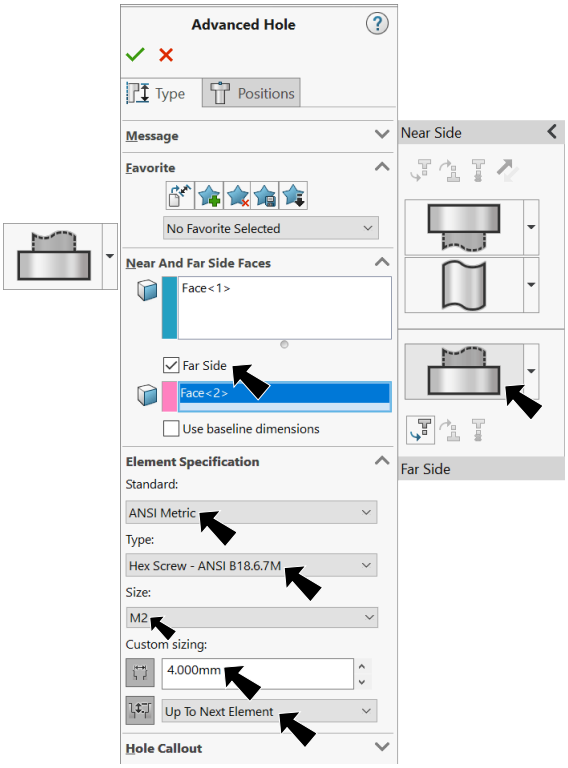


Fig. 73

click **Positions tab** Positions at top of the Property Manager.

Step 6. Click the **4 inside points (4), Fig. 75.**

Step 7. Click OK in Hole Property Manager.

Step 8. **Hide Sketch9**. To hide, click **Sketch9** in the graphics area and **Hide** on the context toolbar, **Fig. 76.**

Step 9. Save (**Ctrl-S**).

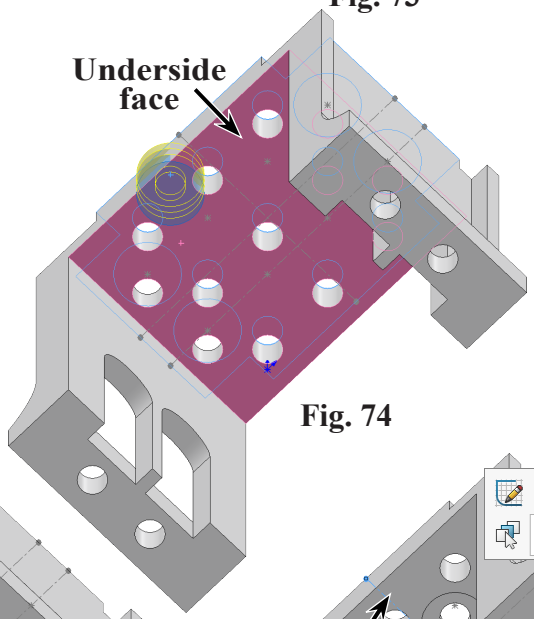


Fig. 74

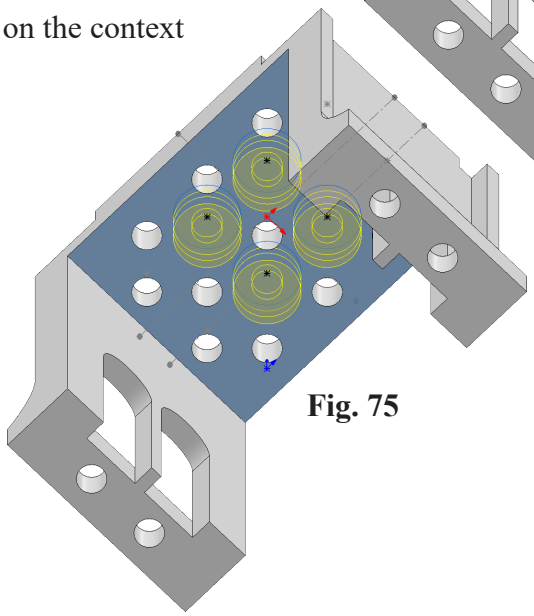


Fig. 75

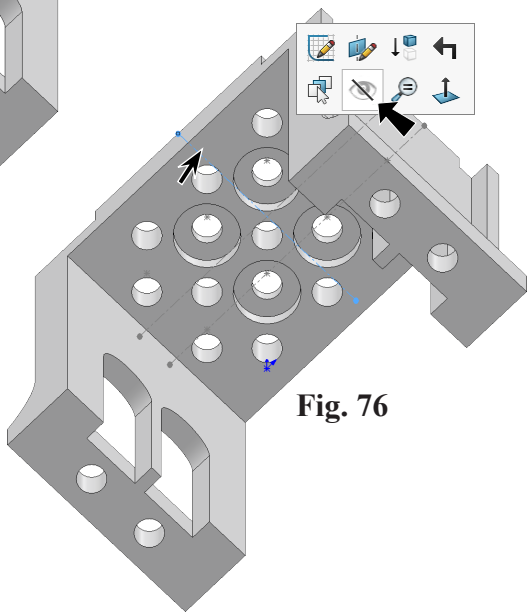


Fig. 76

O. Appearance Yellow Plastic.

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

Step 2. Click the **Motor Bracket** to select part, click **Appearances Callout** on the context toolbar and click **Motor B..**, **Fig. 77**.

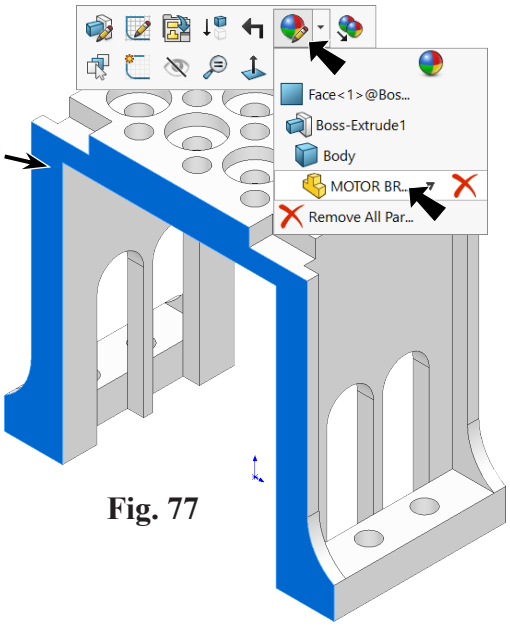


Fig. 77

Step 3. In the Appearances Task pane, expand **Plastic**, click **High Gloss** and in the lower pane select **yellow high gloss plastic**, **Fig. 78**.

Step 4. In the Appearances Property Manager:
under Color, **Fig. 79**
set **RGB values:**
R 250
G 196
B 21
click OK .

Step 5. Save (**Ctrl-S**).

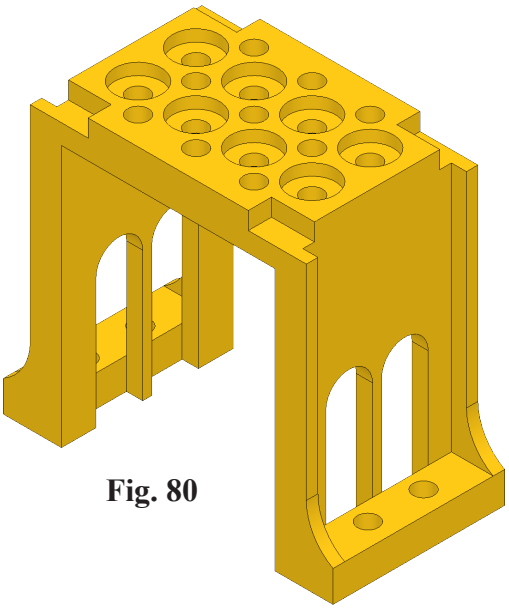


Fig. 80

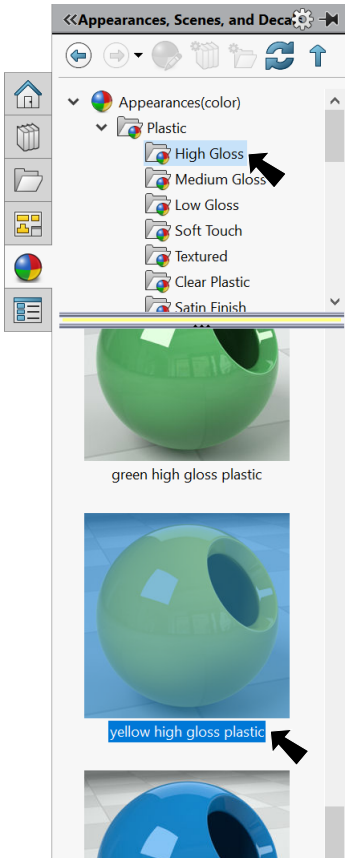


Fig. 57

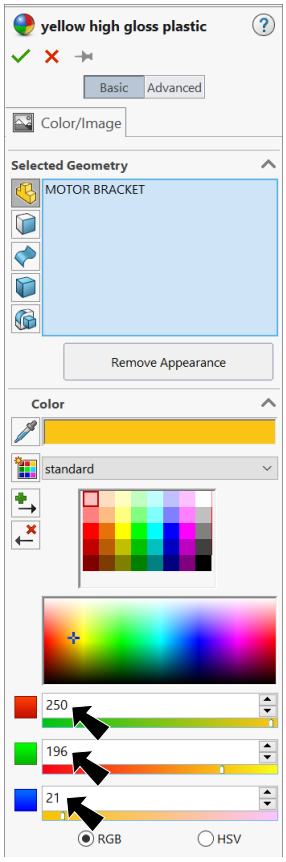


Fig. 58