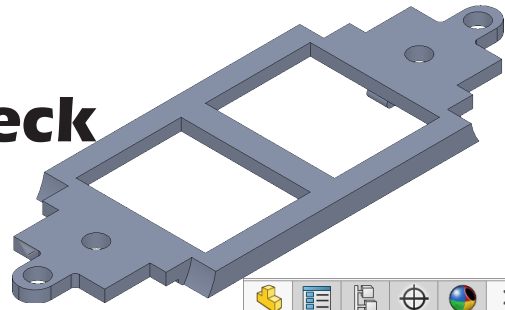


Solar Train Flat Car Deck



A. Extrude1 Sketch1.

Step 1. Click **New**  on the Standard toolbar, click **Part**  and OK.

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

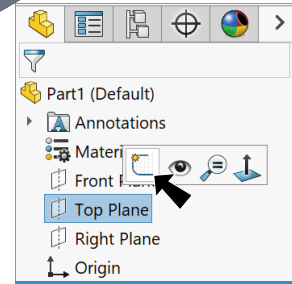


Fig. 1

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

Step 4. Sketch lines starting from **Origin** , **Fig. 2**.

Step 5. **Unselect Line tool**. To unselect, right click graphics area and click **Select**  from menu.

Step 6. Drag a selection to left to select line at **Origin**  and click **Construction Geometry**  on the context toolbar, **Fig. 3**.



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

Step 8. Add dimensions, **Fig. 4**.

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

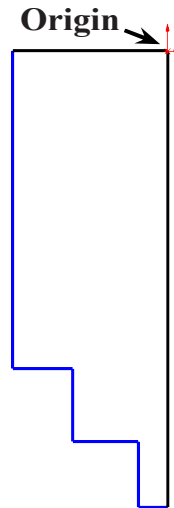


Fig. 2

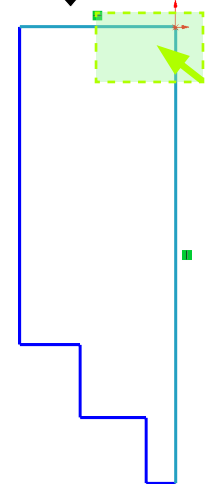


Fig. 3

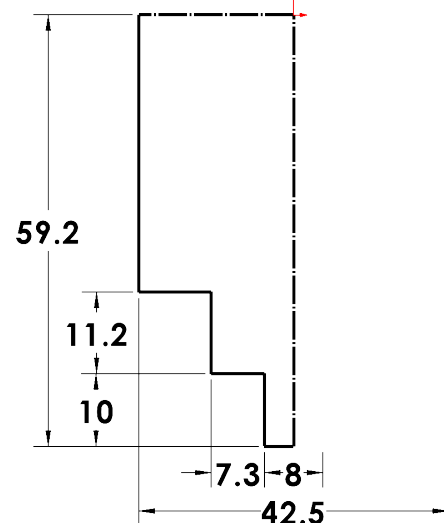


Fig. 4

Step 10. Mirror Vertically.
Drag left to select across to all geometry **except horizontal centerline**, Fig. 5.

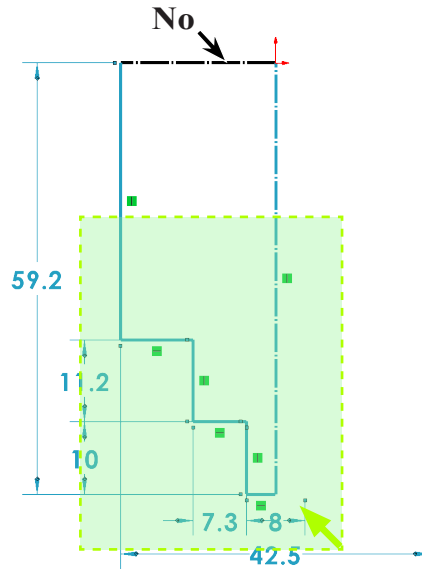


Fig. 5

Step 11. Click **Mirror Entities**  **Mirror Entities** on the Sketch toolbar.

Step 12. Mirror Horizontally.
Drag left to select across all to right of horizontal centerline, Fig. 6.

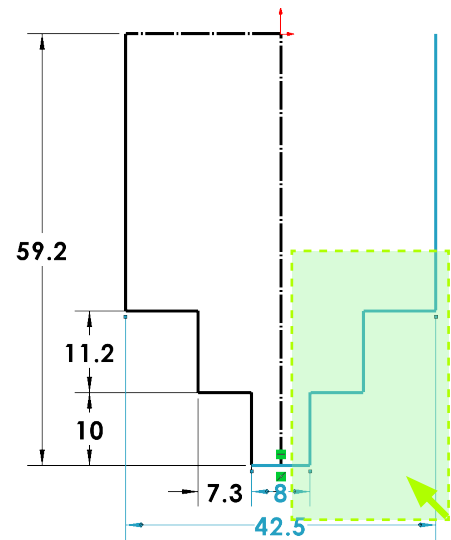


Fig. 6

Step 13. **Ctrl drag to left** to select all left of horizontal centerline to select all except horizontal centerline, Fig. 7.

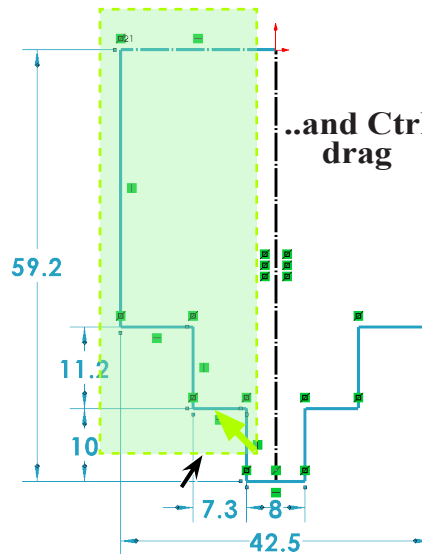


Fig. 7

Step 14. Click **Mirror Entities**  **Mirror Entities** on the Sketch toolbar, Fig. 8.

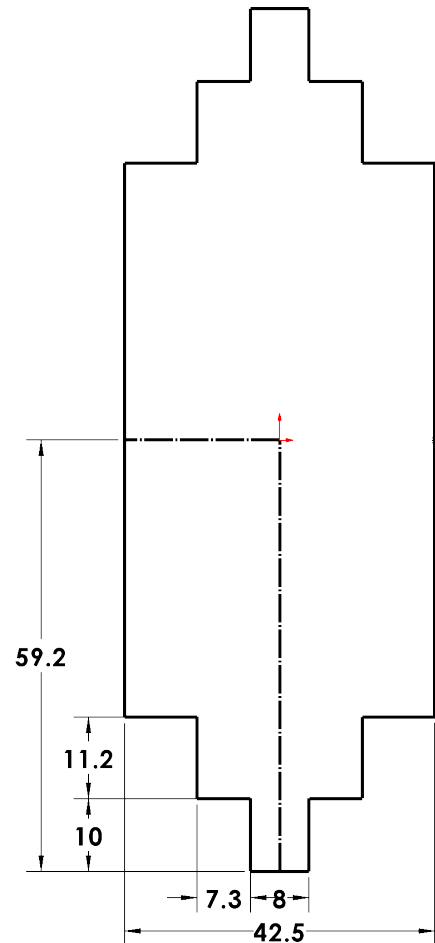
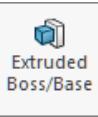


Fig. 8

Step 15. Click **Features**  on the Command Manager toolbar.

Step 16. Click **Extruded Boss/Base**  on the Features toolbar.

Step 17. In the Boss-Extrude Property Manager set:
under Direction 1, **Fig. 9**

End Condition **Blind**

Reverse Direction 

Depth  **3**

click OK 

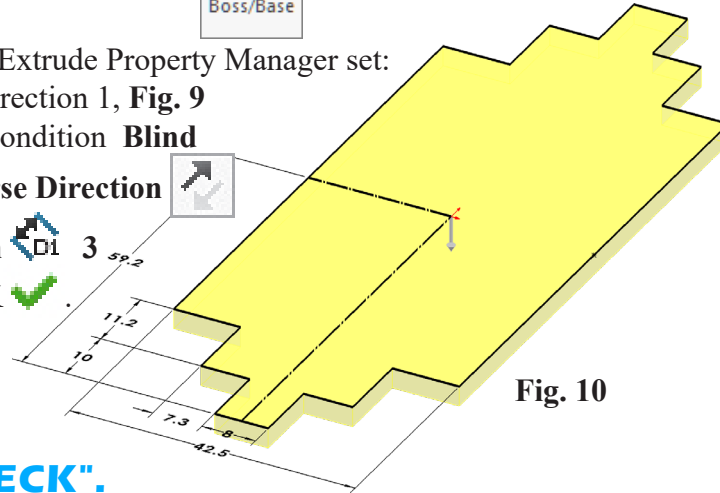


Fig. 10

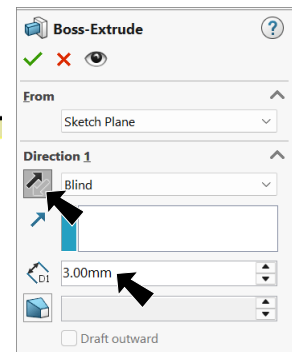


Fig. 9

B. Save as "DECK".

Step 1. Click File Menu > Save As.

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

C. Cut-Extrude1 Sketch2 Pin Holes.

Step 1. Click the **top face** and click **Sketch**

 on the context toolbar,
Fig. 11.

Step 2. Click **Normal To**

 on the Standard Views toolbar.
(Ctrl-8)

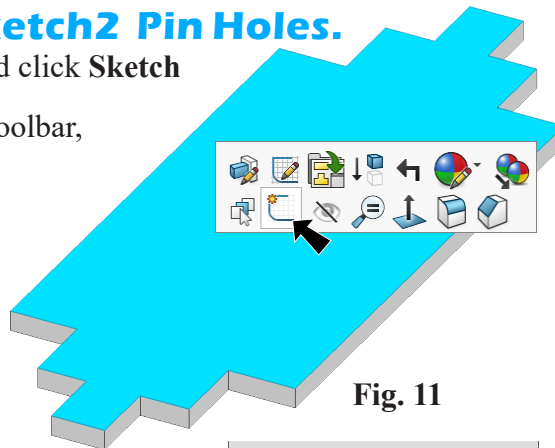


Fig. 11

Step 3. Click **Circle**  (S) on the Sketch toolbar.

Step 4. Sketch **two circles**, **Fig. 12.**

Step 5. **Unselect Circle tool.** To unselect, right click graphics area and click **Select**  from menu.

Step 6. **Ctrl click both circles** to select both. Release Ctrl key and click **Make**

Equal  on the context toolbar,
Fig. 13.

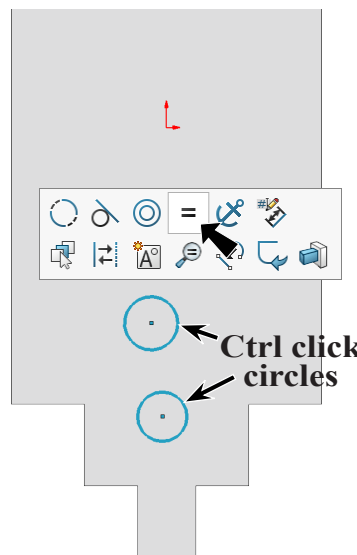


Fig. 13

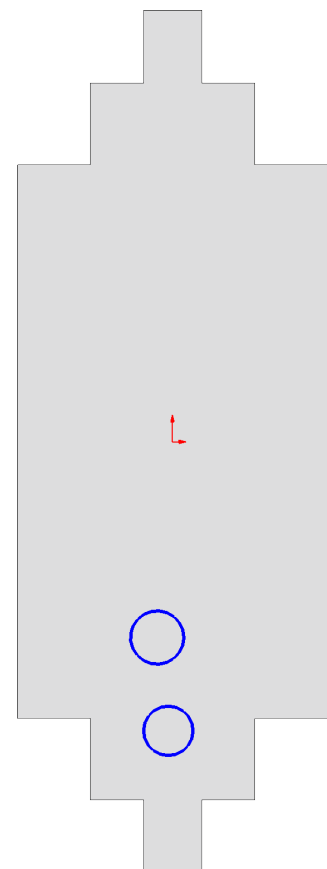
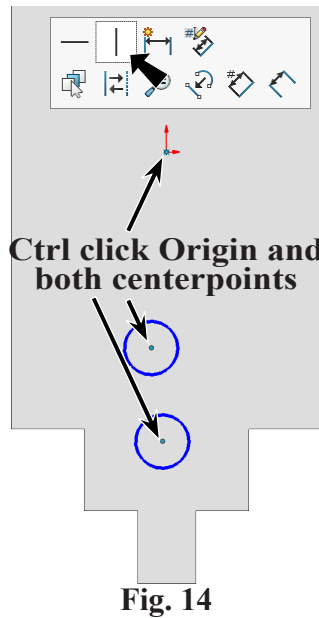
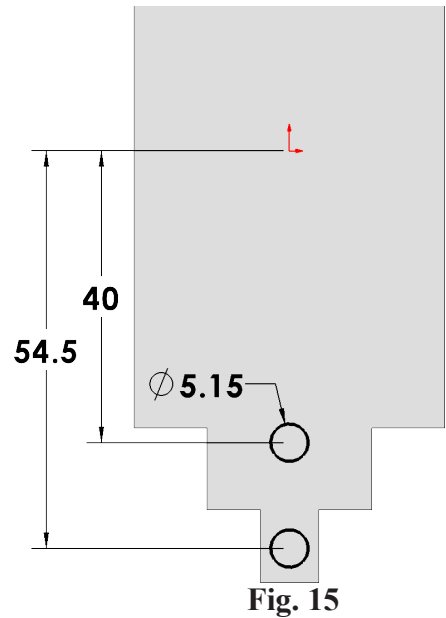


Fig. 12

Step 7. **Ctrl click centerpoint of both circles and Origin** to select all three. Release Ctrl key and click **Make Vertical** on the context toolbar, **Fig. 14**.



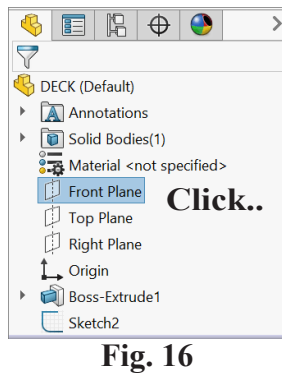
Step 8. Click **Smart Dimension** (S) on the Sketch toolbar.



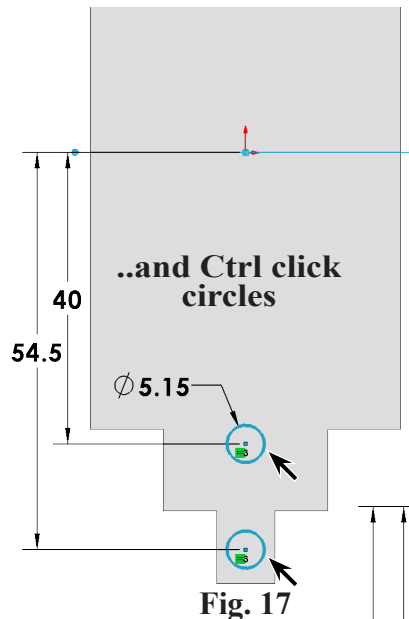
Step 9. Add dimensions, **Fig. 15**.

Step 10. **Unselect Smart Dimension.** To unselect, right click graphics area and click **Select** from menu.

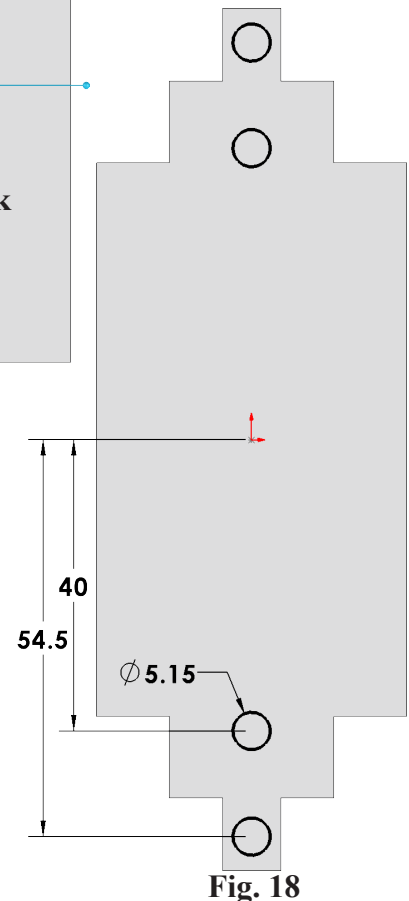
Step 11. Click **Front Plane** in the Feature Manager to select plane, **Fig. 16**.



Step 12. **Ctrl click both circles**, **Fig. 17**.

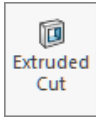


Step 13. Click **Mirror Entities** on the Sketch toolbar, **Fig. 18**.



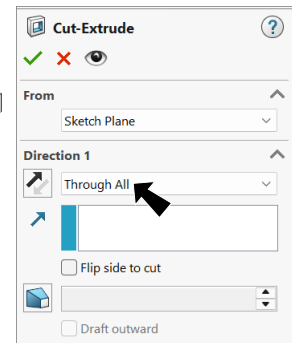
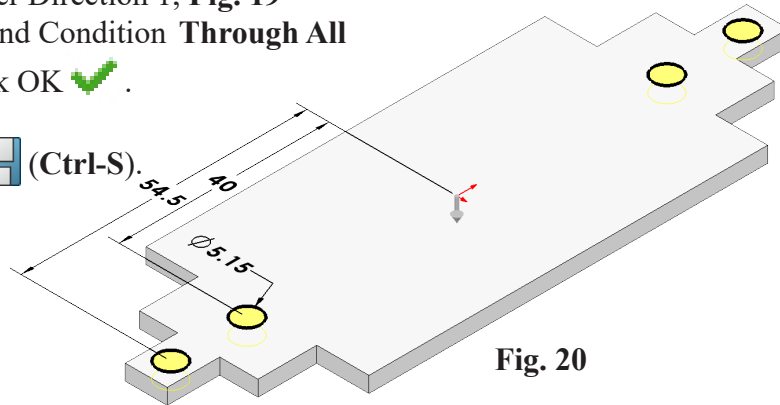
Step 14. Click **Isometric**  on the Standard Views toolbar. (**Ctrl-7**)

Step 15. Click **Features**  on the Command Manager toolbar.

Step 16. Click **Extruded Cut**  on the Features toolbar.

Step 17. In the Cut-Extrude Property Manager set:
under Direction 1, **Fig. 19**
End Condition **Through All**
click OK .

Step 18. Save  (**Ctrl-S**).



D. Cut-Extrude2 Sketch3 Solar Panel Cut.

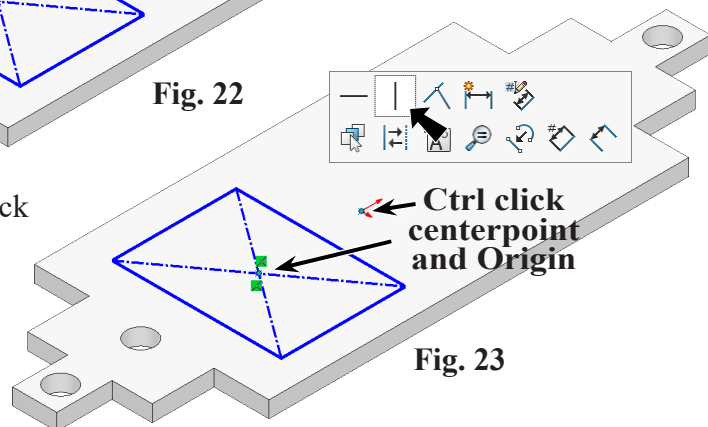
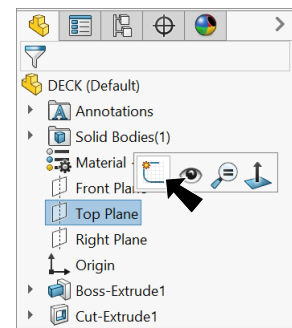
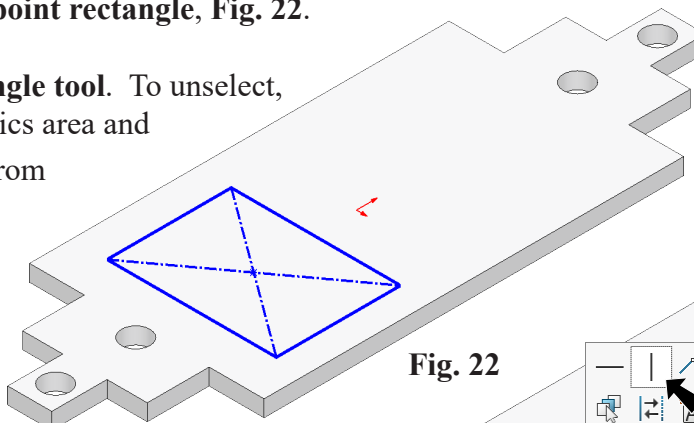
Step 1. Click **Top Plane**  in the Feature Manager and click **Sketch**  on the context toolbar, **Fig. 21**.

Step 2. Click **Center Rectangle**  in the **Rectangle** flyout  on the Sketch toolbar.

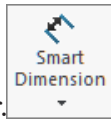
Step 3. Sketch a **centerpoint rectangle**, **Fig. 22**.

Step 4. **Unselect Rectangle tool**. To unselect, right click graphics area and click **Select**  from menu.

Step 5. **Ctrl click centerpoint of rectangle** and **Origin**  to select both. Release Ctrl key and click **Make Vertical**  on the context toolbar, **Fig. 23**.



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



Step 7. Add dimensions, **Fig. 24**.

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

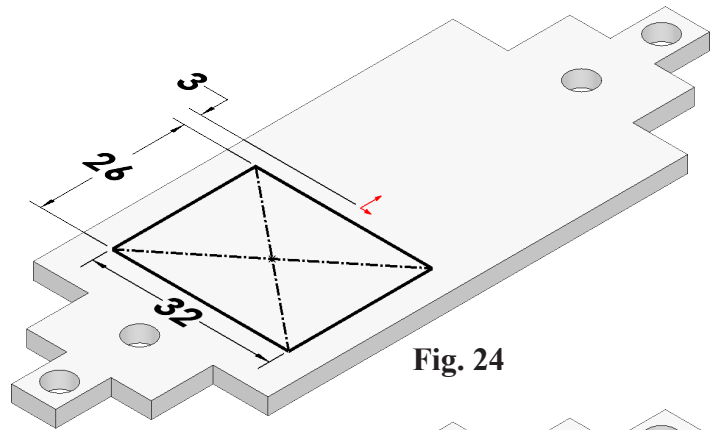


Fig. 24

Step 10. Click **Front Plane** in the Feature Manager to select plane, **Fig. 25**.

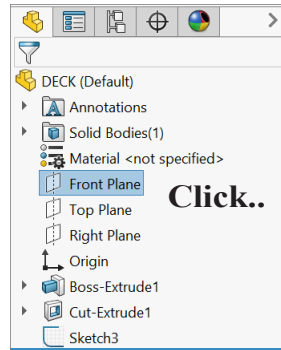


Fig. 25

Step 11. **Ctrl drag** a selection to add rectangle to selection, **Fig. 26**.

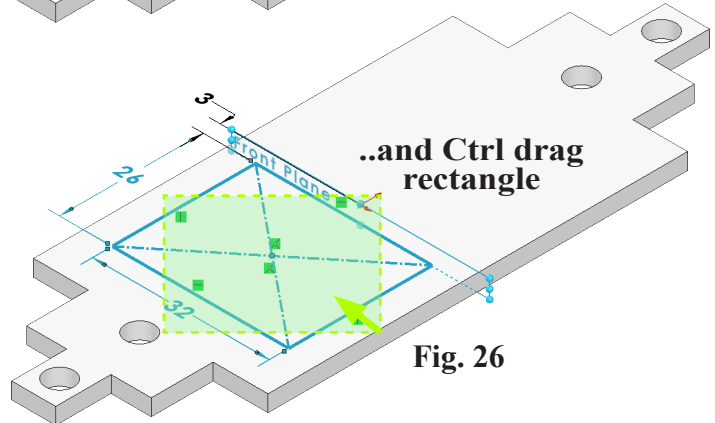
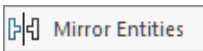


Fig. 26

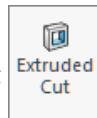
Step 12. Click **Mirror Entities** on the Sketch toolbar.



Step 13. Click **Features** on the Command Manager toolbar.



Step 14. Click **Extruded Cut** on the Features toolbar.



Step 15. In the Cut-Extrude Property Manager set:
under Direction 1, **Fig. 27**
End Condition **Through All**
click OK.

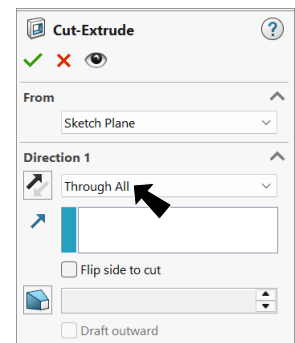


Fig. 27

Step 16. Save (Ctrl-S).

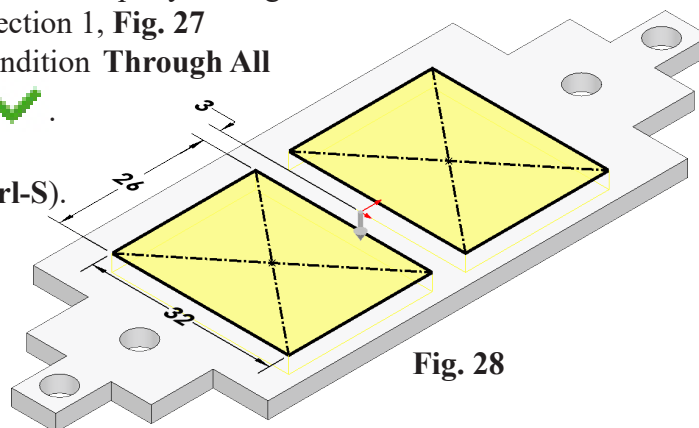


Fig. 28

E. Extrude Thin Sketch4 Spacer for Pin.

Step 1. Rotate view to Isometric 180° to view bottom,

Fig. 29. To rotate view, Shift click the Z

axis of the Reference Triad

two times.

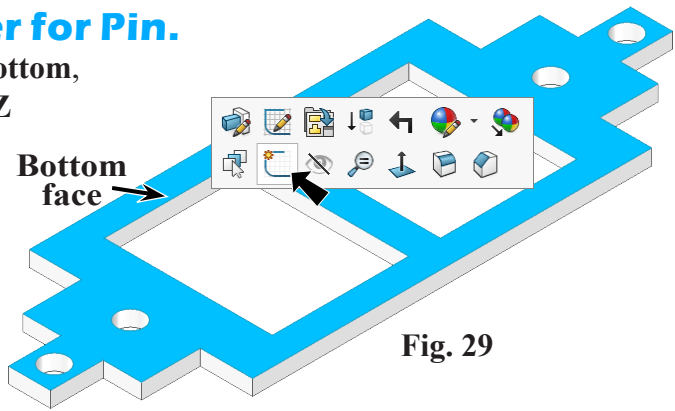


Fig. 29

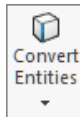
Step 2. Click the **bottom face** and click

Sketch on the context toolbar,



Fig. 29.

Step 3. Unselect face and click **Convert Entities** on the Sketch toolbar.



Step 4. In the Convert Entities Property Manager:

under Entities to Convert, **Fig. 30**

click **edge of both Bogie Pin holes,**

Fig. 31

click OK.

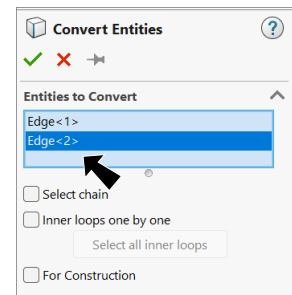


Fig. 30

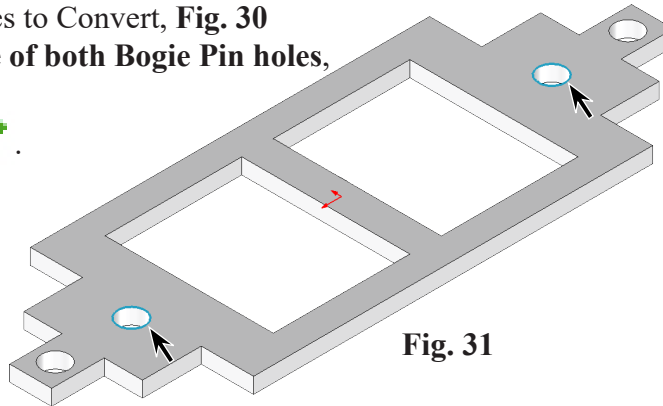
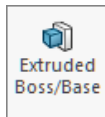


Fig. 31

Step 5. Click **Features** on the Command Manager toolbar.



Step 6. Click **Extruded Boss/Base** on the Features toolbar.



Step 7. In the Boss-Extrude Property Manager set:

under Direction 1, **Fig. 32**

End Condition **Blind**

Depth .3

check **Thin Feature**

Thickness 1

click OK.

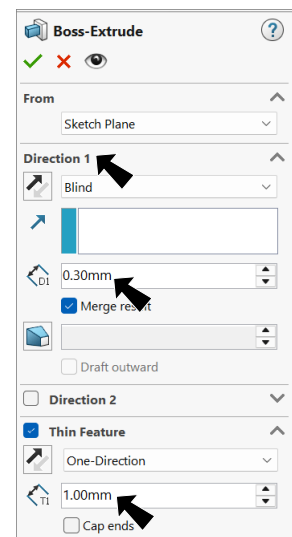


Fig. 32

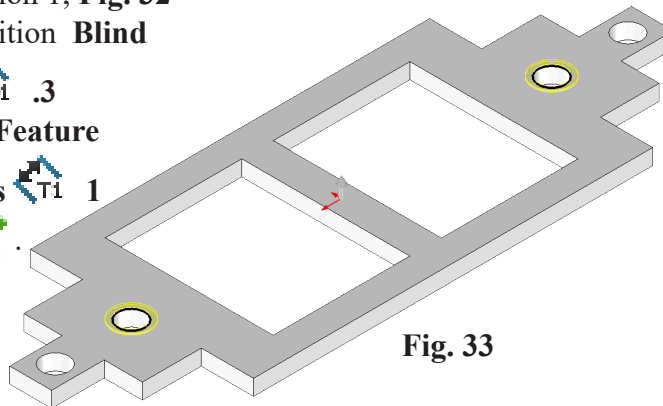


Fig. 33

Step 8. Save (Ctrl-S).



F. Extrude3 Sketch5 Bottom Support.

Step 1. Click **Bottom**  on the Standard Views toolbar. (**Ctrl-6**)

Step 2. Click the **bottom face** and click **Sketch**  on the context toolbar, **Fig. 34**.

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

Step 4. Sketch **horizontal centerline** from Origin  , **Fig. 35**.

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

Step 6. Sketch **5 lines**, **Fig. 36**.

Step 7. **Unselect Line tool**. To unselect, right click graphics area and click **Select** from menu.

Step 8. Drag a selection to **right to select all geometry**, **Fig. 37**.

Step 9. Click **Mirror Entities**  **Mirror Entities** on the Sketch toolbar.

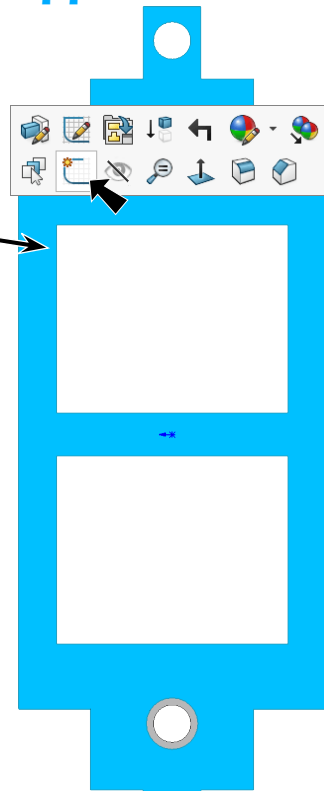


Fig. 34

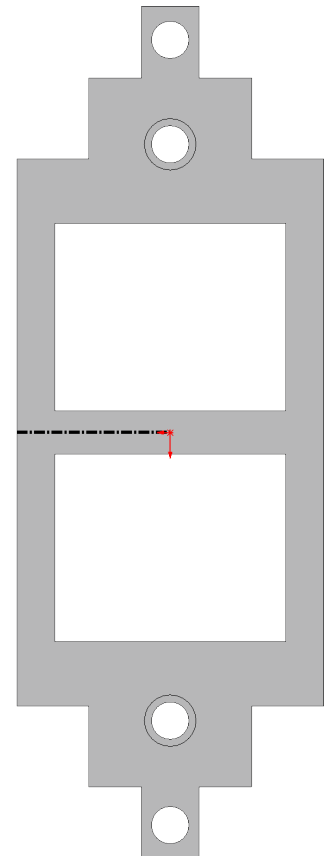


Fig. 35

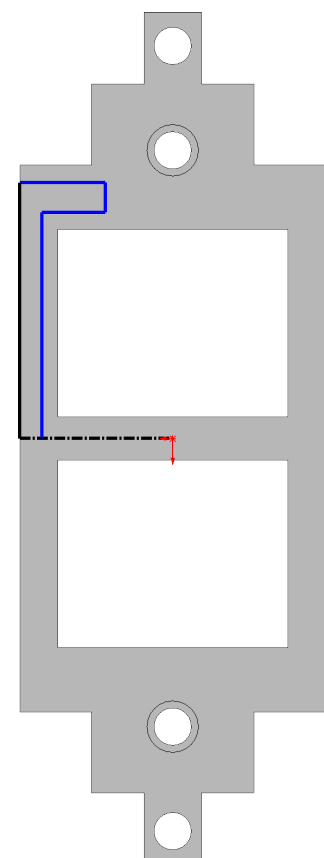


Fig. 36

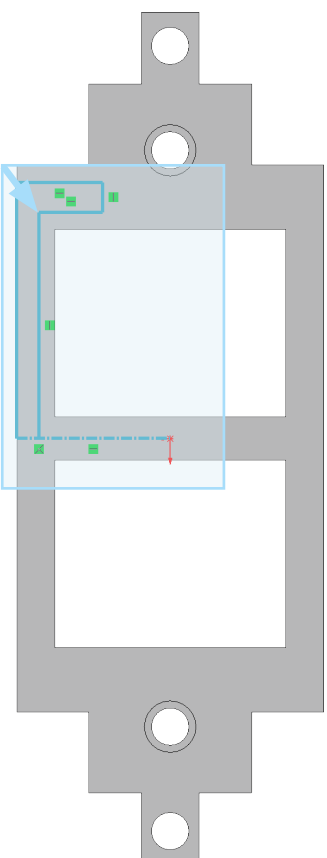


Fig. 37

Step 10. Click **Right Plane**  in the Feature Manager to select plane, **Fig. 38**.

Step 11. **Ctrl drag** a selection to **select all geometry**, **Fig. 39**.

Step 12. Click **Mirror Entities**  **Mirror Entities** on the Sketch toolbar.

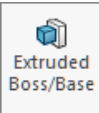
Step 13. Click **Smart Dimension**  (S) on the Sketch toolbar.

Step 14. Add dimensions, **Fig. 40**.

Step 15. Rotate view to Isometric 180° to view bottom, **Fig. 42**. To rotate view, click **Isometric**  then, **Shift click the Z axis of the Reference**

Triad  **two times.**

Step 16. Click **Features**  on the Command Manager toolbar.

Step 17. Click **Extruded Boss/Base**  on the Features toolbar.

Step 18. In the Boss-Extrude Property Manager set:
under Direction 1, **Fig. 41**
End Condition **Blind**

Depth  **1.8**
click OK .

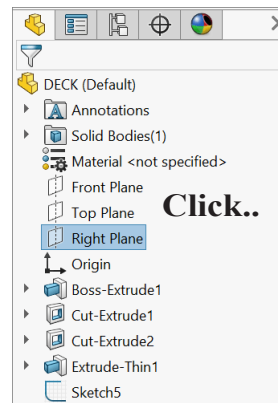


Fig. 38

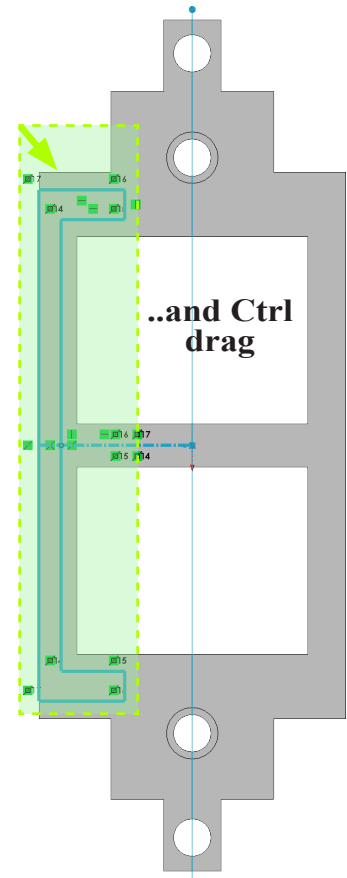


Fig. 39

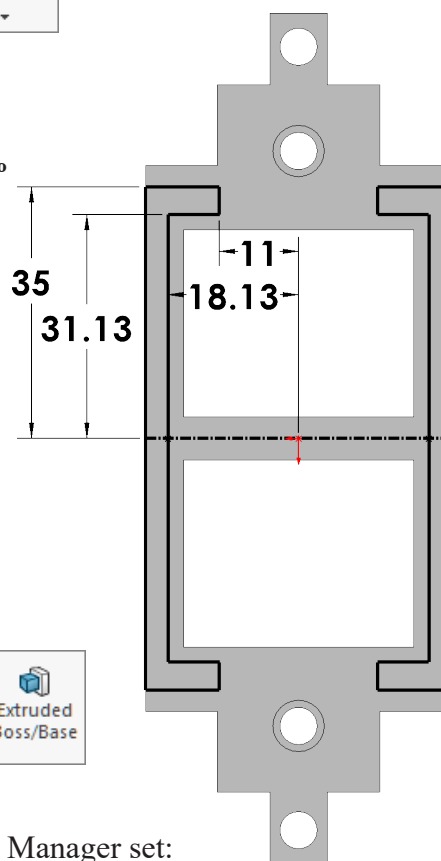


Fig. 40

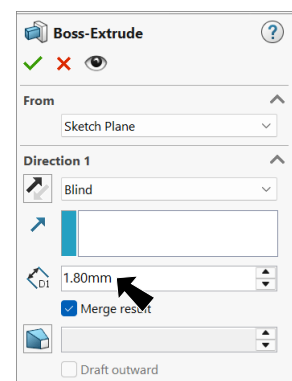


Fig. 41

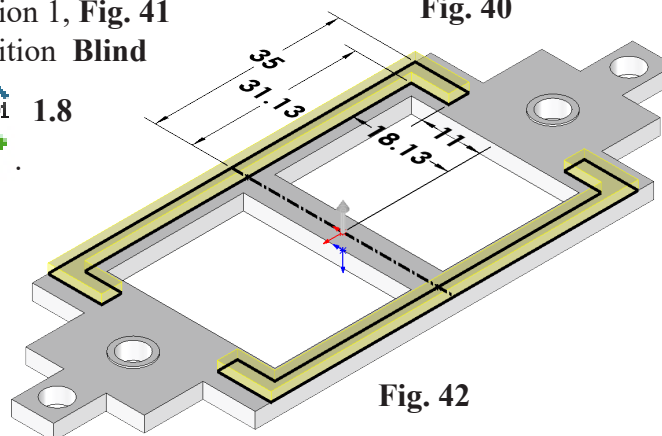
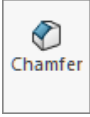


Fig. 42

G. Chamfers.

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

Step 2. In the Chamfer Property Manager set:
under Chamfer Type, **Fig. 43**

select **Angle Distance** 

click **inside, rear and front edge support (8)**, **Fig. 44**

under Chamfer Parameters

Distance  1

Angle  45°

click OK .

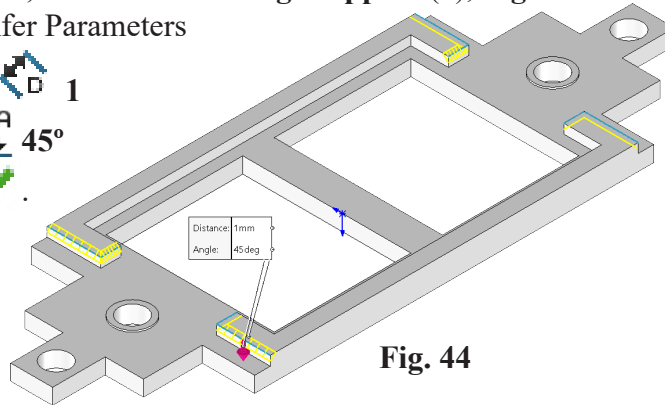


Fig. 44

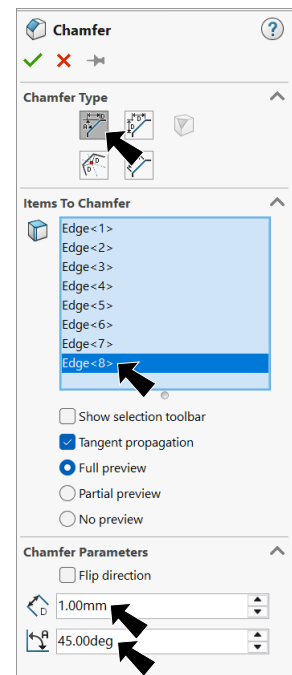


Fig. 43

H. Cut-Extrude3 Sketch6 Wheel Wells.

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

Step 2. Click the **side face** and click **Sketch**  on the context toolbar, **Fig. 45**.

Step 3. Click **Circle**  (S) on the Sketch toolbar.

Step 4. Sketch circle above and left of
Origin , **Fig. 46**.

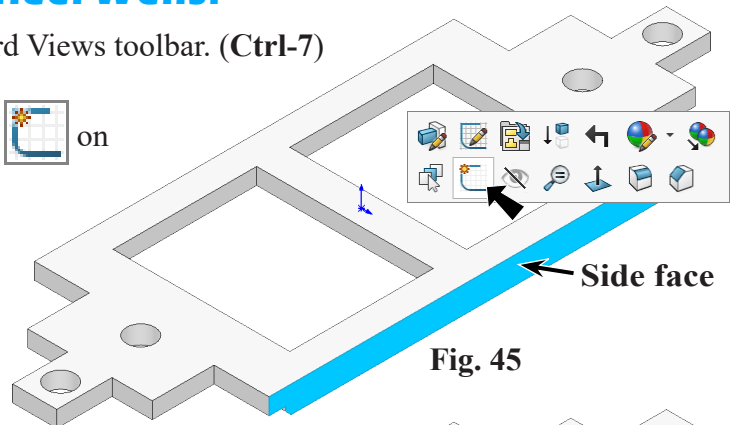


Fig. 45

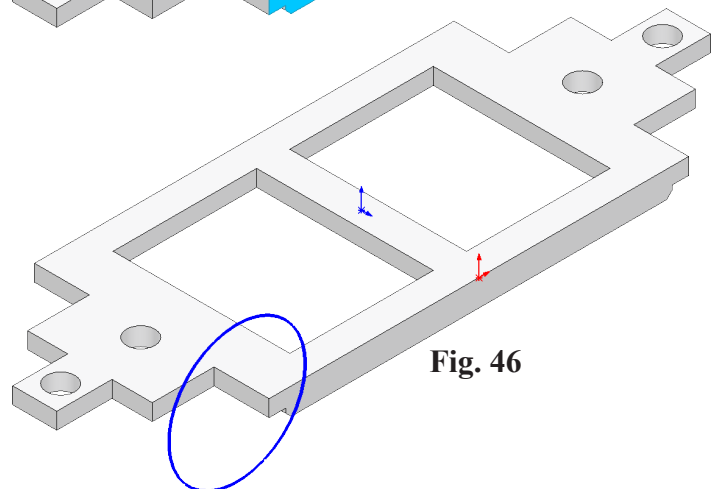


Fig. 46

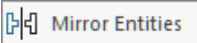
Step 5. Click **Smart Dimension**  (S) on the Sketch toolbar.

Step 6. Add dimensions, **Fig. 47**.

Step 7. **Unselect Smart Dimension**. To unselect, right click graphics area and click Select  from menu.

Step 8. Click **Front Plane**  in the Feature Manager to select plane, **Fig. 48**.

Step 9. **Ctrl click circle**, **Fig. 49**.

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

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

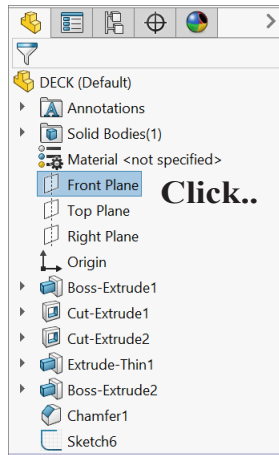


Fig. 48

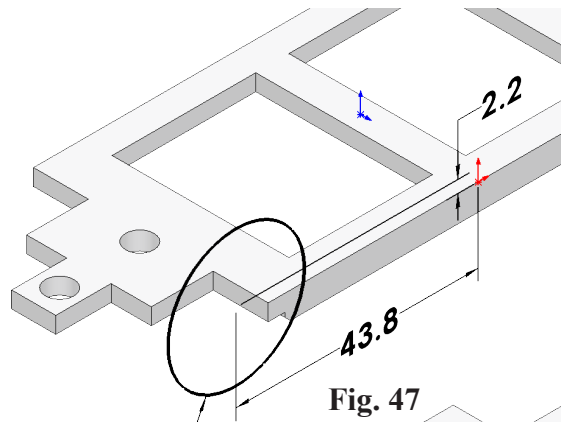


Fig. 47

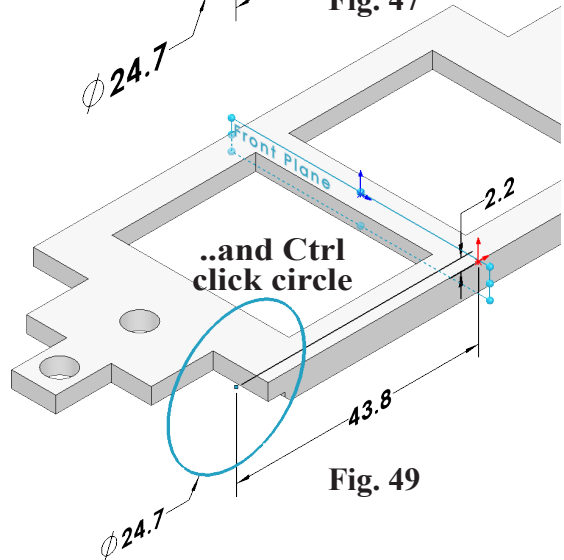
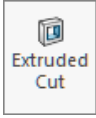


Fig. 49

Step 11. Click **Extruded Cut**  on the Features toolbar.

Step 12. In the Cut-Extrude Property Manager set:
under Direction 1, **Fig. 50**
End Condition **Blind**
Depth  **5.95**
click OK .

Step 13. Save  (Ctrl-S).

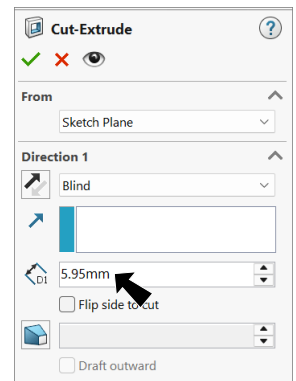


Fig. 50

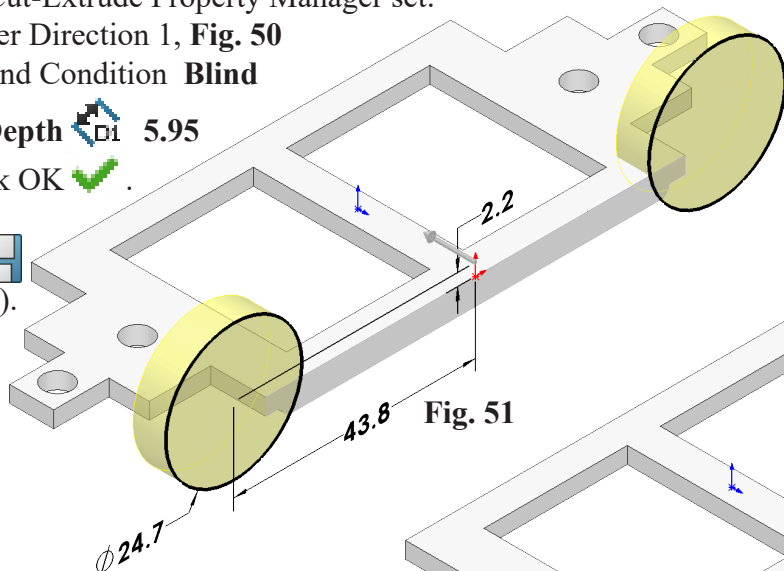


Fig. 51

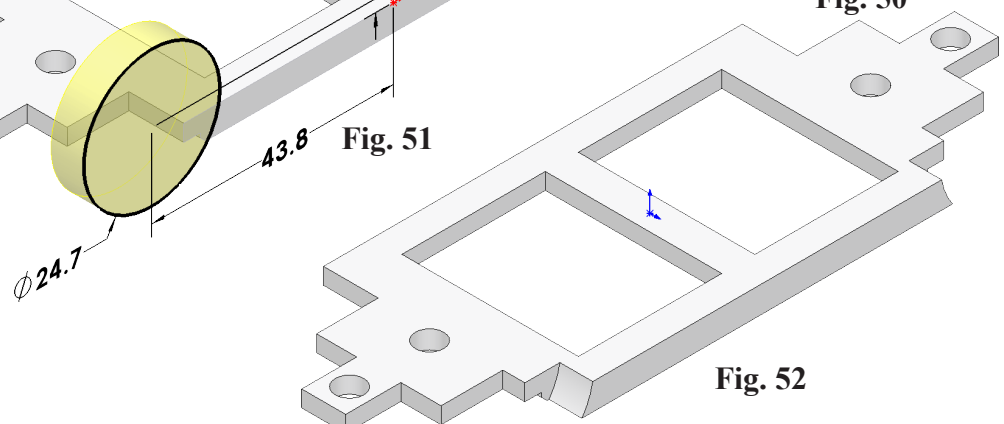


Fig. 52

I. Mirror1 Wheel Wells.

- Step 1. **Ctrl** click **Right Plane**  and **Cut-Extrude3**  feature to select plane and feature, **Fig. 53**.
- Step 2. Click **Mirror**  on the Features toolbar.
- Step 3. In the Mirror Property Manager click OK  , **Fig. 54**.
- Step 4. Save  (**Ctrl-S**).

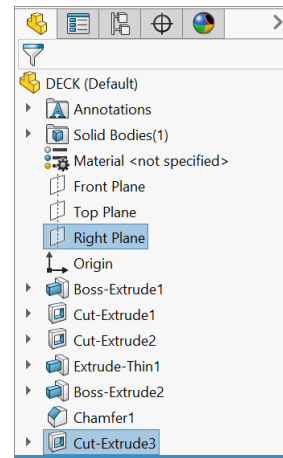


Fig. 53

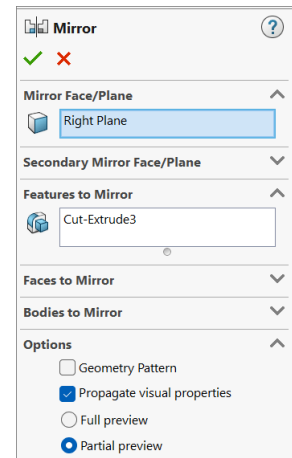


Fig. 54

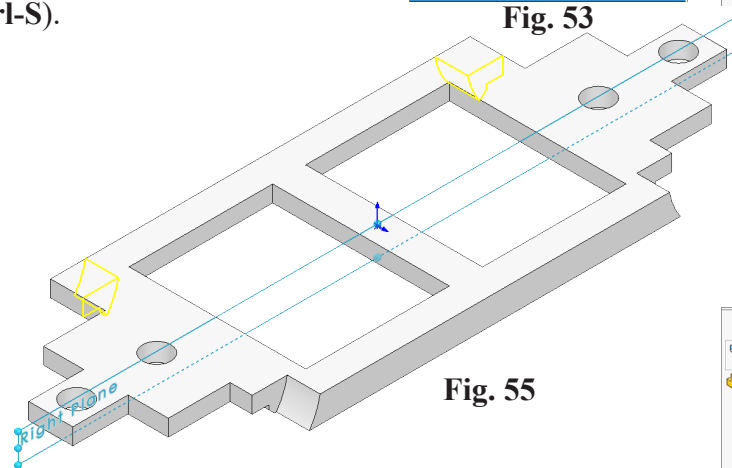


Fig. 55

J. Extrude3 Sketch7 Center Solar Panel Mount.

- Step 1. Click **Right Plane**  in the Feature Manager and click **Sketch**  on the context toolbar, **Fig. 56**.
- Step 2. Click **Normal To**  on the Standard Views toolbar. (**Ctrl-8**)
- Step 3. Zoom in on center, **Fig. 57**.

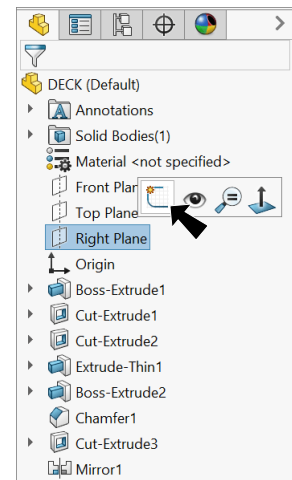


Fig. 56

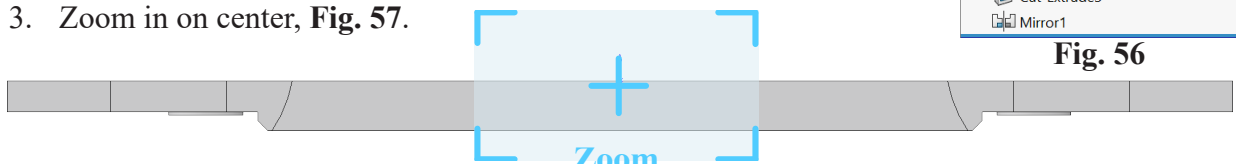


Fig. 57

- Step 4. Click **Wireframe**  on the View toolbar.
- Step 5. Sketch **6 lines starting from Origin**  , **Fig. 58**.
- Step 6. **Unselect Line tool**. To unselect, right click graphics area and click **Select**  from menu.

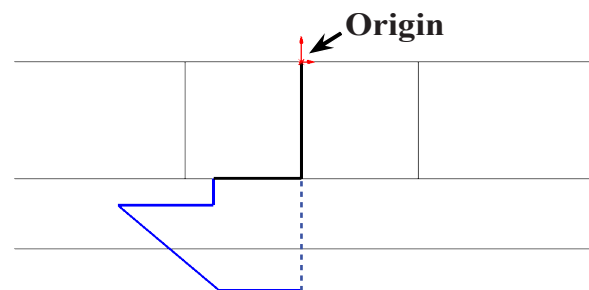
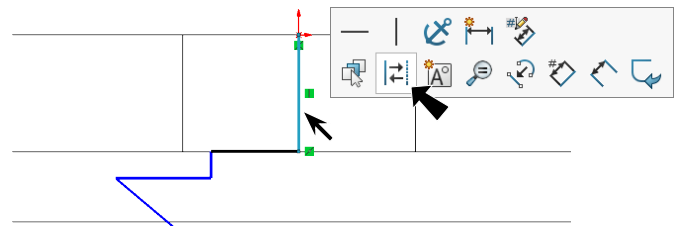


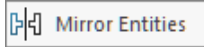
Fig. 58

Step 7. Click **vertical line at Origin** and click **Construction Geometry** on the context toolbar, Fig. 59.

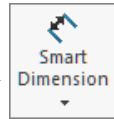


Step 8. Drag a selection to **select all**, Fig. 60.

Step 9. Click **Mirror Entities** on the Sketch toolbar.



Step 10. Click **Smart Dimension** (S) on the Sketch toolbar.



Step 11. Add dimensions, Fig. 61.

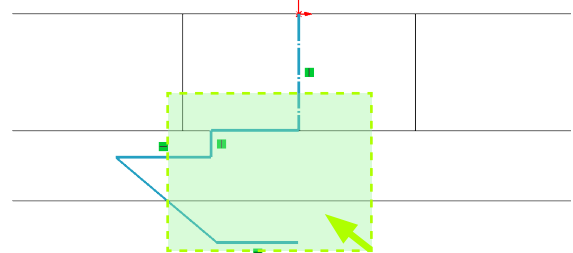


Fig. 60

Step 12. Click **Shaded With Edges** on the View toolbar.



Step 13. Rotate view to Isometric 180°, Fig. 63. To rotate view, click **Isometric** on the Standard Views toolbar (Ctrl-7), then **Shift click** the **Z** axis of the Reference Triad two times.

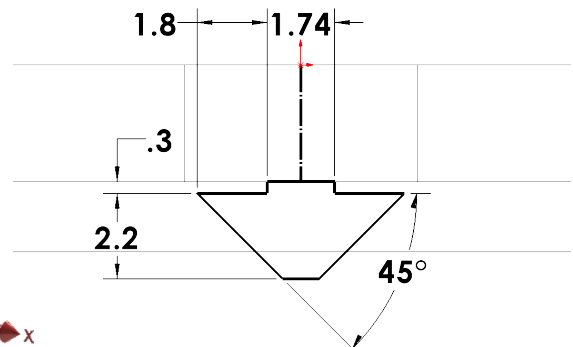
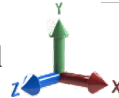
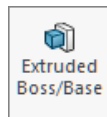


Fig. 61

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. 62

Start Condition **Offset**

Offset Value **15**

under Direction 1

Depth **5**

Reverse Direction

click OK.

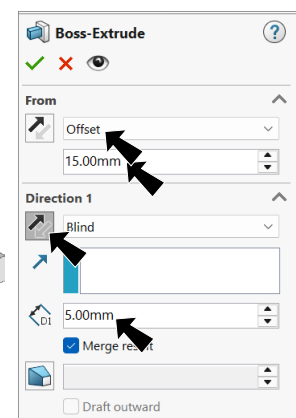


Fig. 62

Step 17. Save (Ctrl-S).

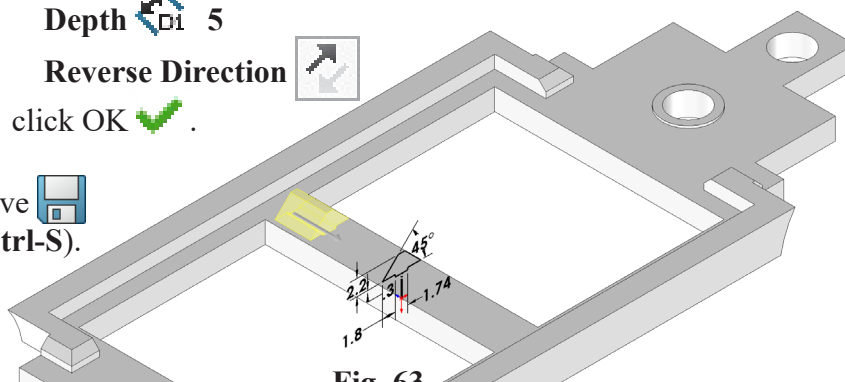


Fig. 63

K. Mirror2 Center Solar Panel Mount.

- Step 1. Ctrl click **Right Plane** and **Boss-Extrude3** feature to select Plane and feature, Fig. 64.
- Step 2. Click **Mirror** on the Features toolbar.
- Step 3. In the Mirror Property Manager click OK , Fig. 65.
- Step 4. Save  (Ctrl-S).

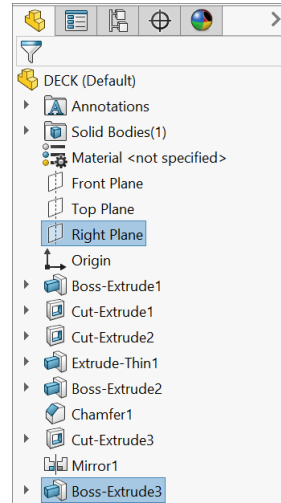


Fig. 64

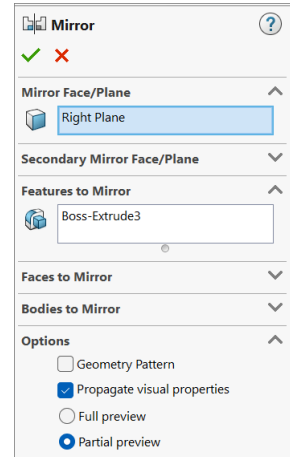


Fig. 65

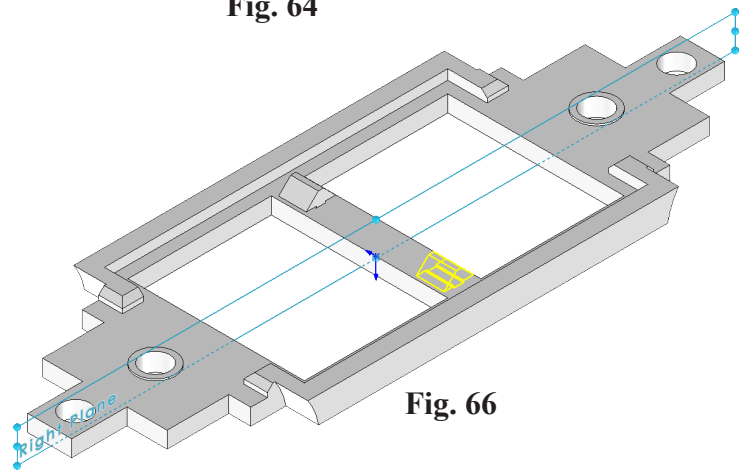


Fig. 66

L. Extrude4 Sketch8 Front Solar Panel Catch.

Step 1. Click **Right Plane**  in the Feature Manager and click **Sketch**



on the context toolbar, **Fig. 67**.

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

Step 3. Zoom in on front, **Fig. 68**.

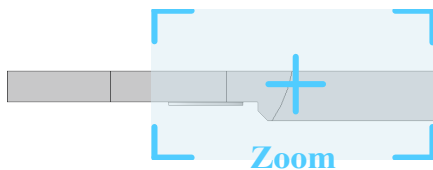


Fig. 68

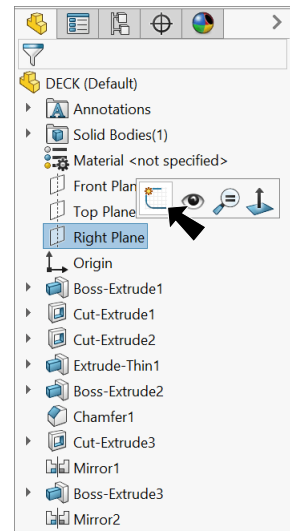


Fig. 67

Step 4. Click **Line**  (**L**) on the Sketch toolbar.

Step 5. Sketch a line across bottom, up at angle to edge and across, a vertical line down and a horizontal line across to aligned with starting point, **Fig. 69**.

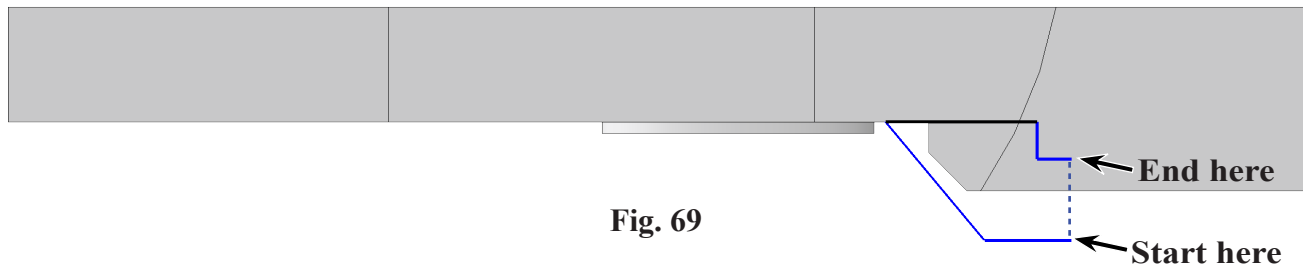


Fig. 69

Autotransition to Tangent Arc tool and sketch arc, Fig. 70. To autotransition to arc, after sketching endpoint of line, move cursor away and back. The preview shows a tangent arc. Click to place the arc.

Tip: Toggle between line and arc without returning to the endpoint, use **A** key.

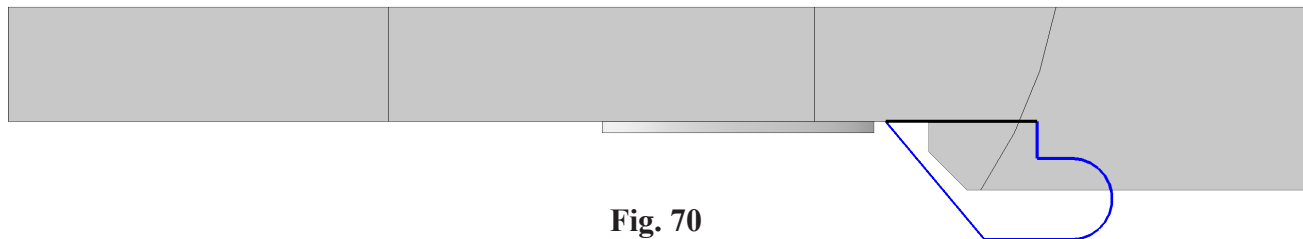
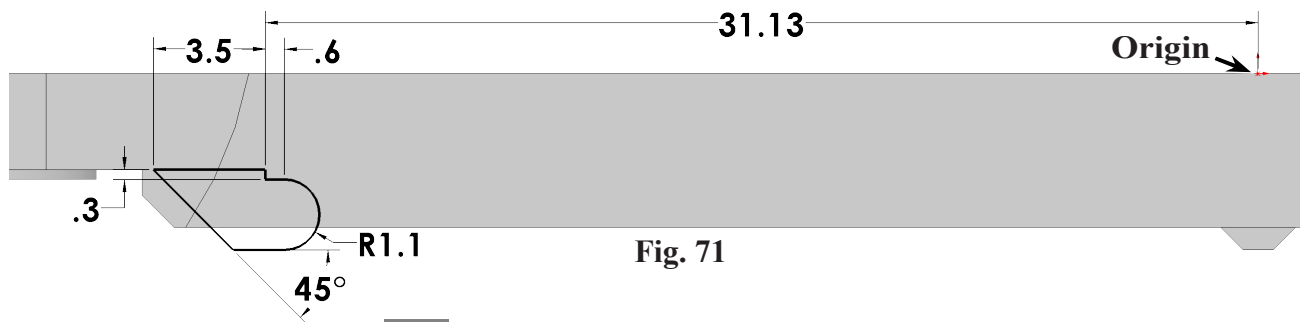


Fig. 70

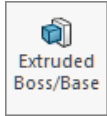
Step 6. Click **Smart Dimension**  (S) on the Sketch toolbar.

Step 7. Add dimensions, **Fig. 71**.



Step 8. Use **Previous View**  on the Standard Views toolbar. (**Ctrl-Shift-Z**) to return to previous Isometric 180°, **Fig. 73**. Or click **Isometric** , then **Shift** click the **Z**  axis of the Reference Triad  two times.

Step 9. Click **Features**  on the Command Manager toolbar.

Step 10. Click **Extruded Boss/Base**  on the Features toolbar.

Step 11. In the Boss-Extrude Property Manager set:
under Direction 1, **Fig. 72**

End Condition **Mid Plane**

Depth  **5**

click **OK** .

Step 12. Save  (**Ctrl-S**).

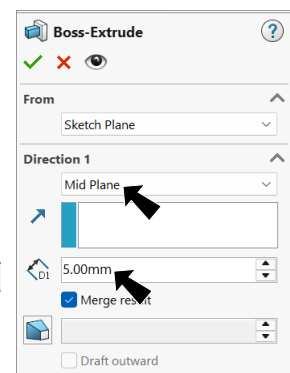


Fig. 72

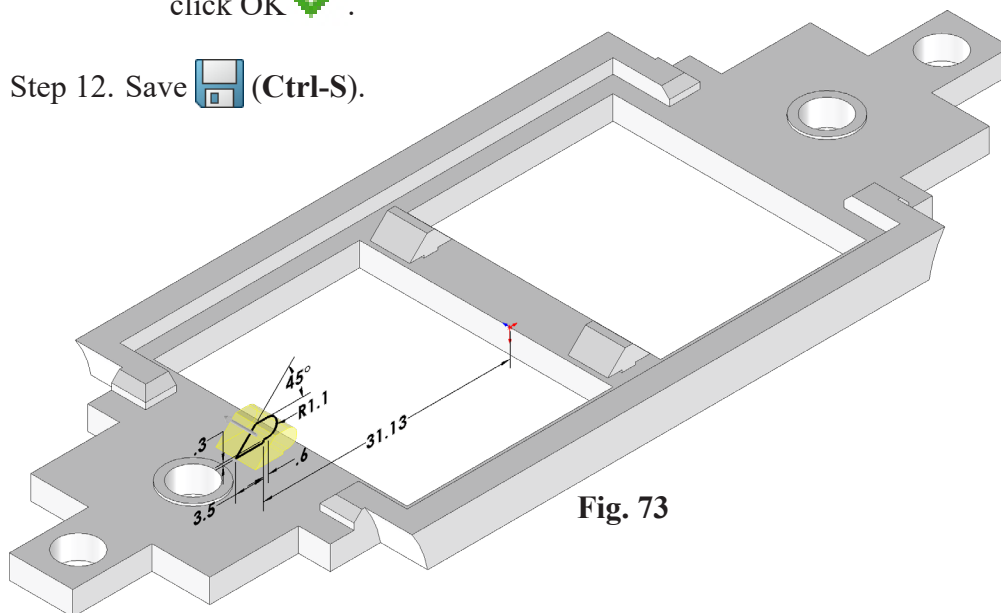


Fig. 73

M. Mirror3 Front Solar Panel Catch.

Step 1. Ctrl click **Front Plane** and **Boss-Extrude4** feature to select plane and feature, **Fig. 74**.

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

Step 3. In the Mirror Property Manager click OK , **Fig. 75**.

Step 4. Save  (Ctrl-S).

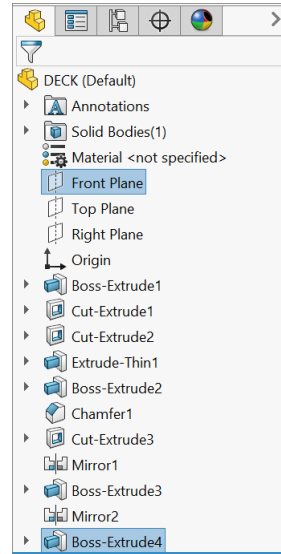


Fig. 74

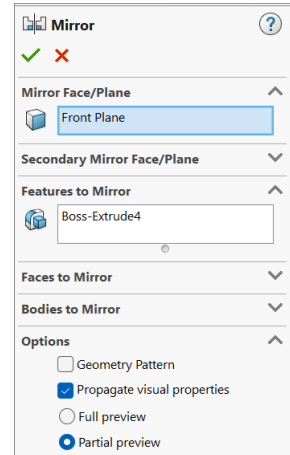


Fig. 75

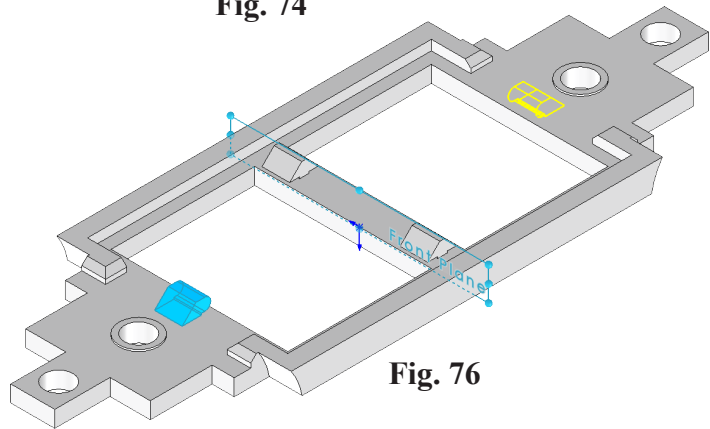


Fig. 76

N. Sweep Profile Sketch9 Wire Run.

Step 1. Click the **front face** and click **Sketch**  on the context toolbar, **Fig. 77**.

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

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

Step 4. Sketch a trapezoid, **Fig. 78**.

Step 5. **Unselect Line tool.** To unselect, right click graphics area and click **Select**  from menu.

Step 6. **Drag a selection to left to select both legs** and click **Make Equal**  on the context toolbar, **Fig. 79**.

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

Step 8. Add dimensions, **Fig. 80**.

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

Step 10. Save  (**Ctrl-S**).

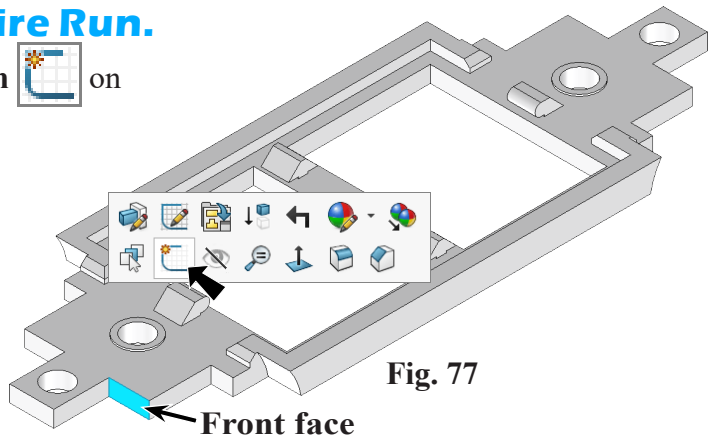


Fig. 77

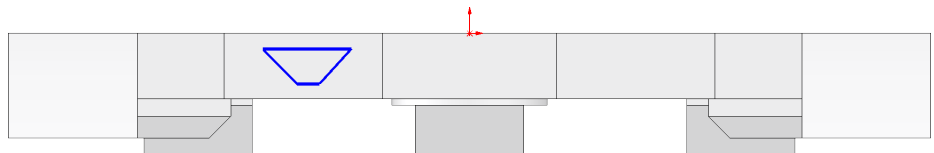


Fig. 78

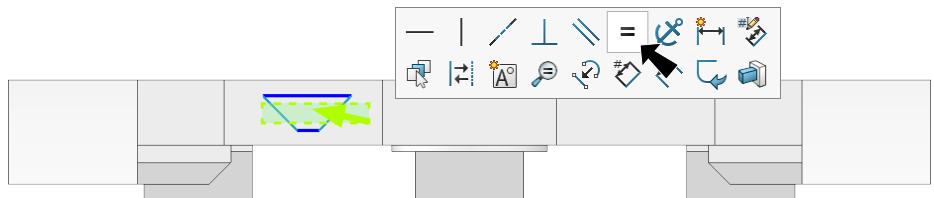


Fig. 79

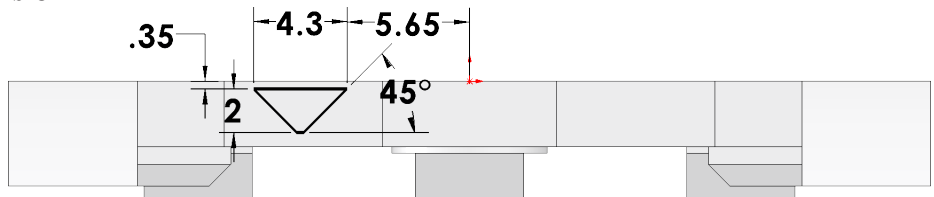


Fig. 80

O. Create Plane1.

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

Step 2. Click **Right Plane**  in the Feature Manager to display plane in graphics area, **Fig. 81**.

Step 3. In graphics area **Ctrl drag Right plane** to right hand side of the deck (passenger's side) and release, **Fig. 82**.

Step 4. In the Plane Property Manager set:
under First Reference, **Fig. 83**
Right Plane was preselected
under Second Reference
click **far right vertex** of Sketch9, **Fig. 82**.
click OK .

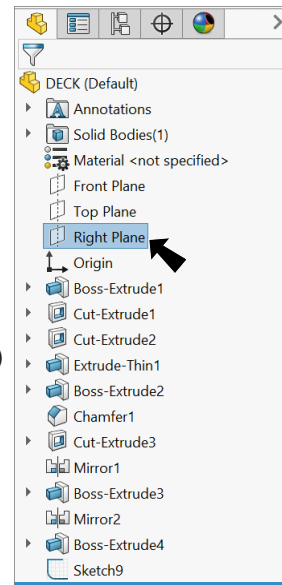


Fig. 81

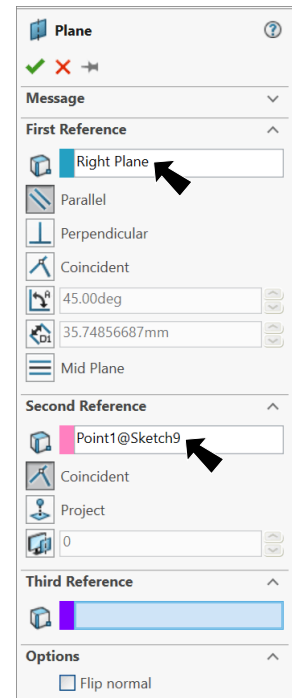


Fig. 83

Step 5. Save  (Ctrl-S).

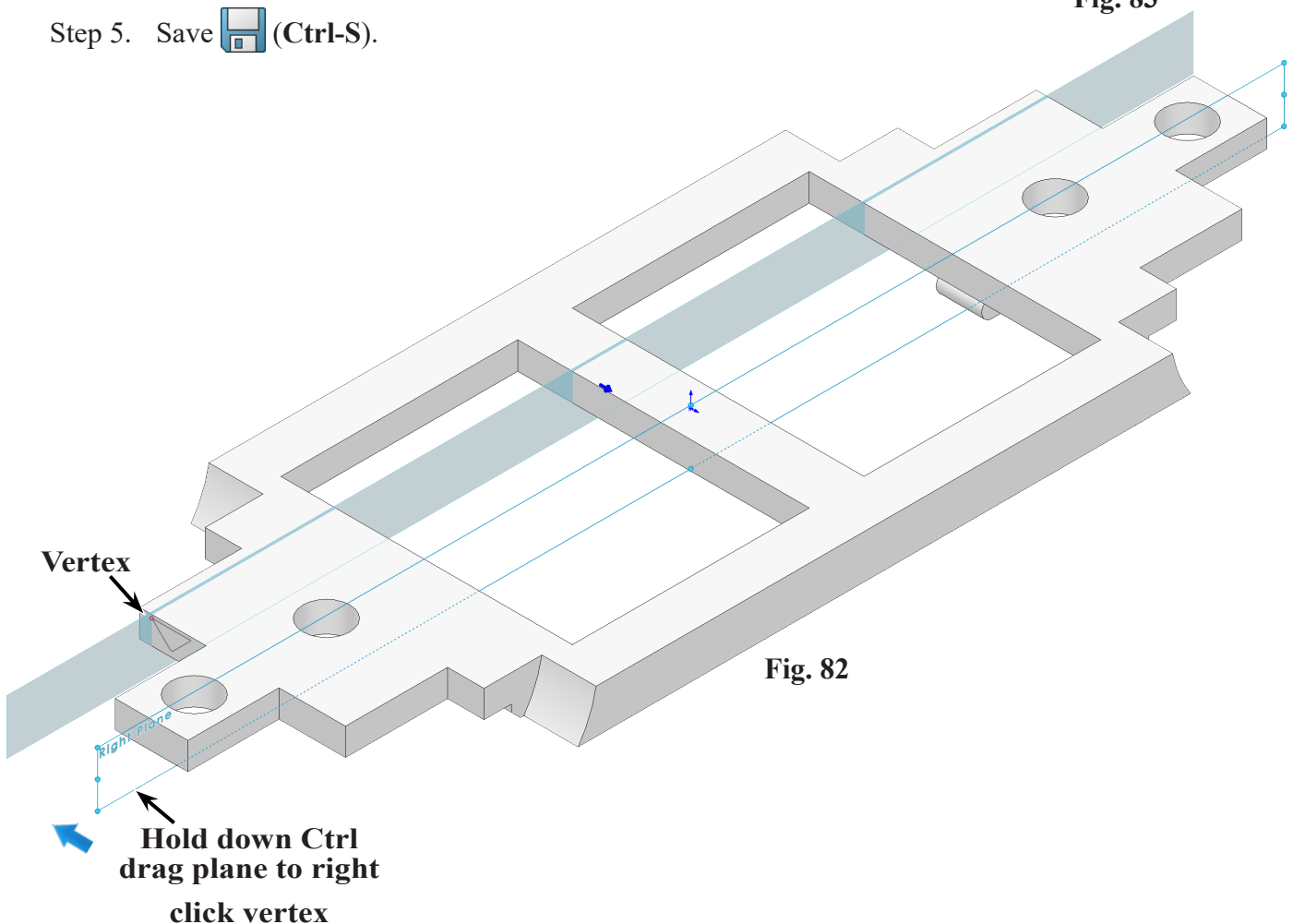


Fig. 82

P. Sweep Path Sketch 10 Wire Run.

Step 1. **Hide Plane1** . To hide, click **Plane1**  in the graphics area and **Hide**  on the context toolbar, **Fig. 84**.

Step 2. Click **Plane1**  in the Feature Manager and click **Sketch**  on the context toolbar, **Fig. 85**.

Step 3. Click **Normal To**  on the Standard Views toolbar. (**Ctrl-8**)

Step 4. Zoom in on front, **Fig. 86**.

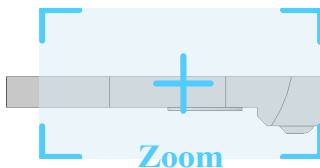


Fig. 86

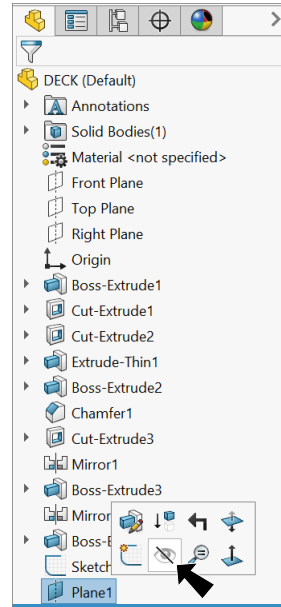


Fig. 84

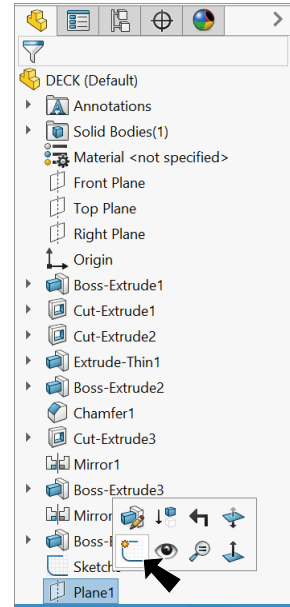


Fig. 85

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

Step 6. Sketch a horizontal line from Sketch 9 down at an angle to bottom edge of Extrude1, **Fig. 87**.

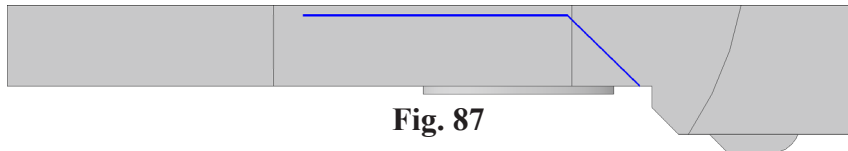


Fig. 87

Step 7. **Unselect Line tool**. To unselect, right click graphics area and click **Select**  from menu.

Step 8. **Ctrl click Sketch9 and left endpoint of horizontal line** to select both.

Release Ctrl key and click Make Pierce  on the context toolbar, **Fig. 88**. Make Pierce adds a Pierce relation between sketches.

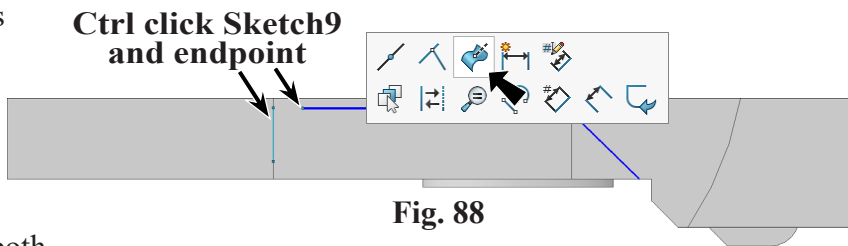


Fig. 88

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

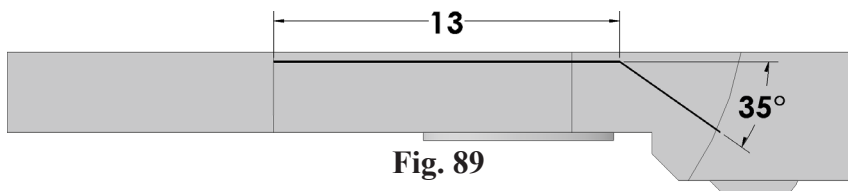


Fig. 89

Step 10. Add dimensions, **Fig. 89**.

Step 11. Click **Sketch Fillet**  on the Sketch toolbar.

Step 12. In the Sketch Fillet Property Manager set:
under Fillet Parameters, **Fig. 90**

Radius  **5**

click endpoint at lines, **Fig. 91**

click OK  twice.

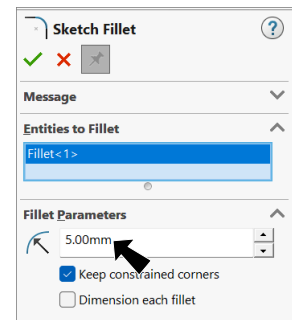


Fig. 90

Step 13. Click **Exit Sketch**



on the Sketch toolbar.

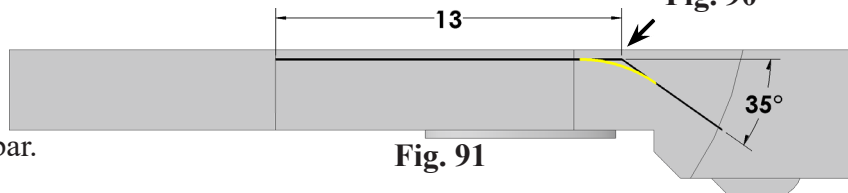


Fig. 91

Step 14. Save  (Ctrl-S).

Q. Sweep Cut Wire Run.

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

Step 2. Click **Features**  on the Command Manager toolbar.

Step 3. Click **Swept Cut**  on the Features toolbar.

Step 4. In the Cut-Sweep Property Manager set:
under Profile and Path, **Fig. 92**

select **Sketch Profile**

Profile  click **trapezoid Sketch9**, **Fig. 93**

Path  click any geometry in **Sketch10**

click OK .

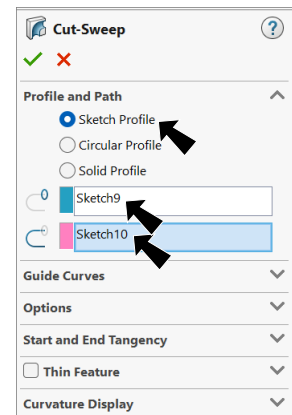


Fig. 92

Step 5. Save  (Ctrl-S).

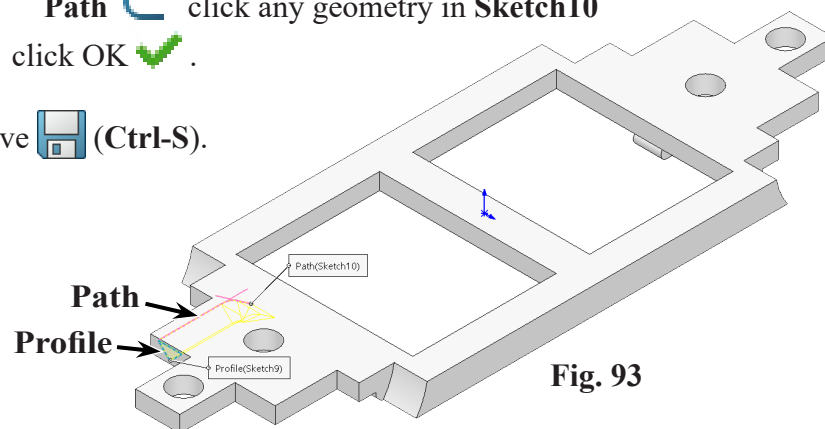


Fig. 93

R. Mirror3 Cut Sweep Wire Run.

Step 1. Ctrl click **Front Plane** and **Cut-Sweep1** feature to select Plane and feature, **Fig. 94**.

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

Step 3. In the Mirror Property Manager click OK , **Fig. 95**.

Step 4. Save  (Ctrl-S).

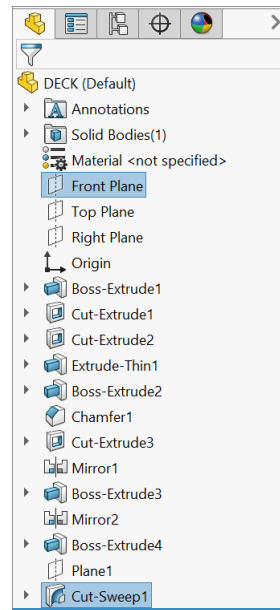


Fig. 94

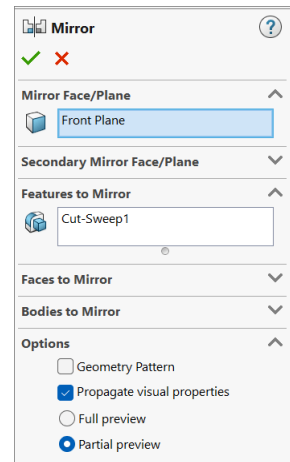


Fig. 95

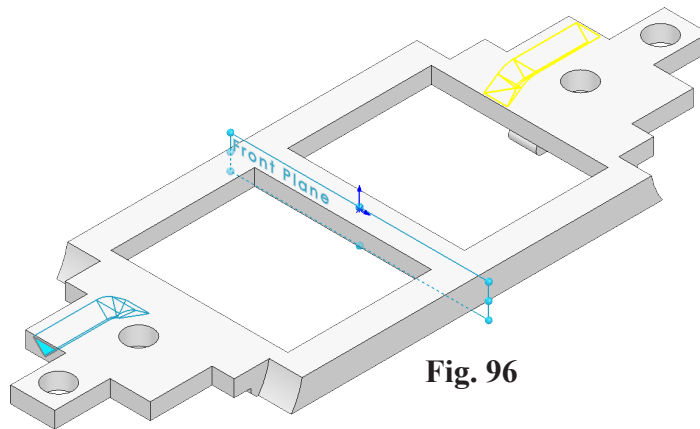
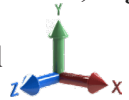


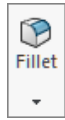
Fig. 96

S. Fillets 1-3.

Step 1. Rotate view to Isometric 180°, Fig. 98. Shift click the Z axis of the Reference Triad two times.



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



Step 3. In the Fillet Property Manager set:

① Radius .5

click front edge of both center holders (4), Fig. 98
click Apply

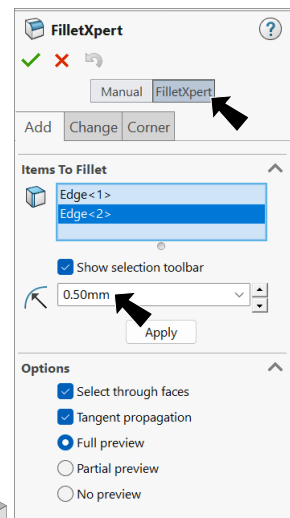


Fig. 97

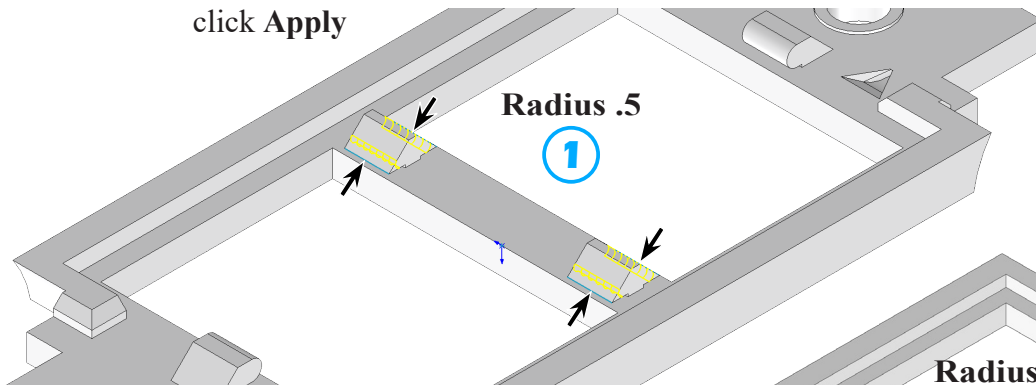


Fig. 98

② Radius 1

click both inside edges of both hitches (4), Fig. 99
click Apply

③ Radius 4

click both front edges of hitch at both ends of Deck (4), Fig. 100
click OK

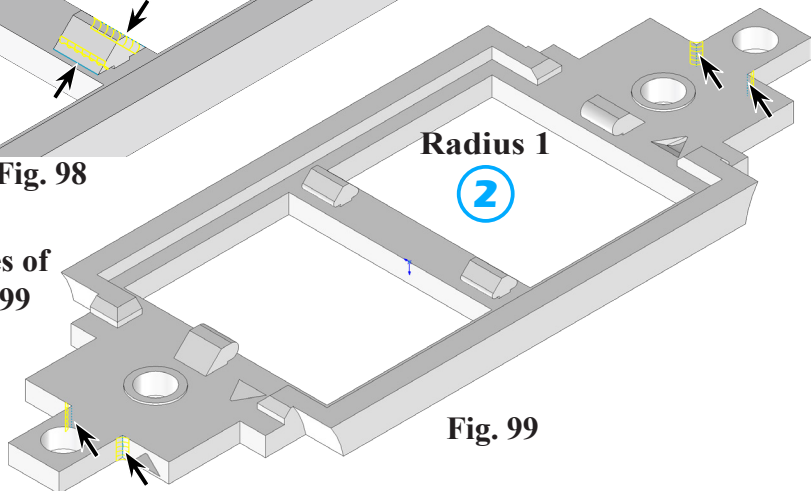


Fig. 99

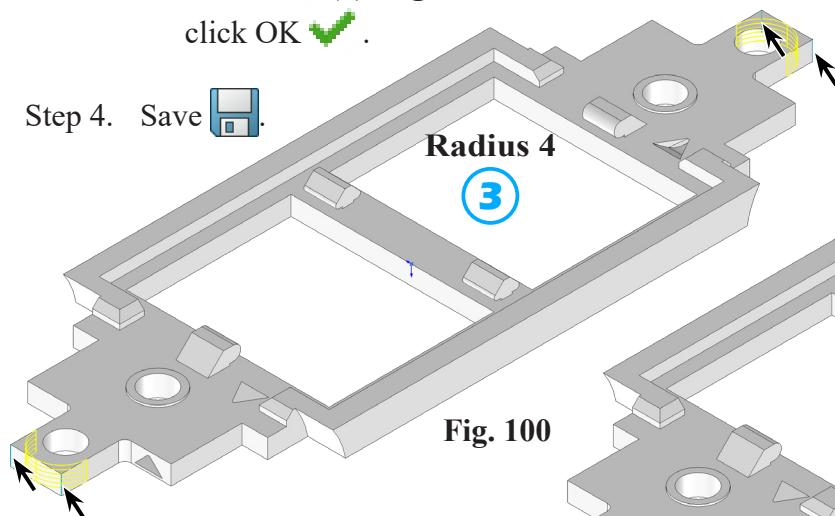


Fig. 100

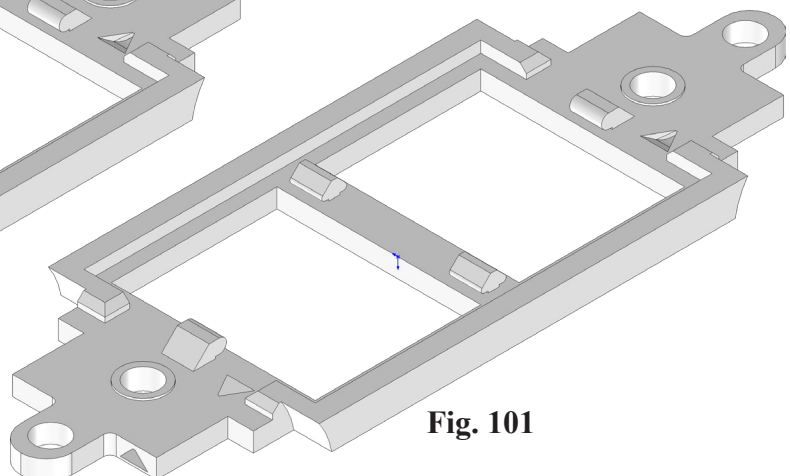


Fig. 101

Step 4. Save



T. Appearance: Blue Plastic.

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

Step 2. Click part, click **Appearance Call-out**  on the context toolbar and click **DECK** , Fig. 102.

Step 3. In the Appearances Task pane, expand **Plastic**, click **Medium Gloss** and in the lower pane select **blue medium gloss plastic**, Fig. 103.

Step 4. Over in Appearances Property Manager:
under Color, Fig. 104
set RGB values
R 132
G 142
B 165
and OK .

Step 5. Save  (Ctrl-S).

Note: The Deck part is not complete. In the Deck Assembly file, we will add Indent features using each Solar Panel. **Do not print** until after these features are added in Assembly file.

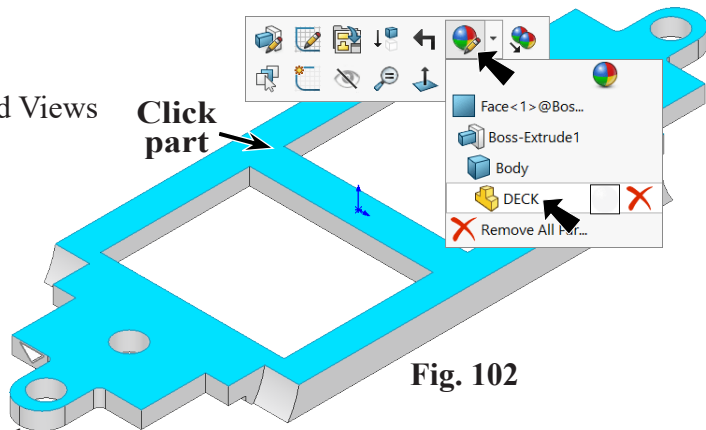


Fig. 102

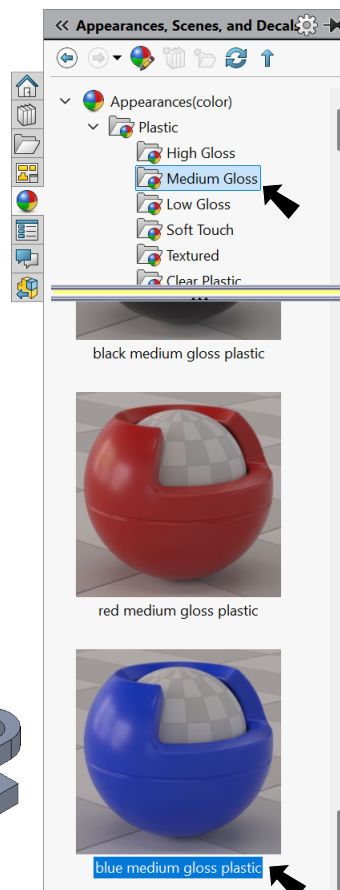


Fig. 103

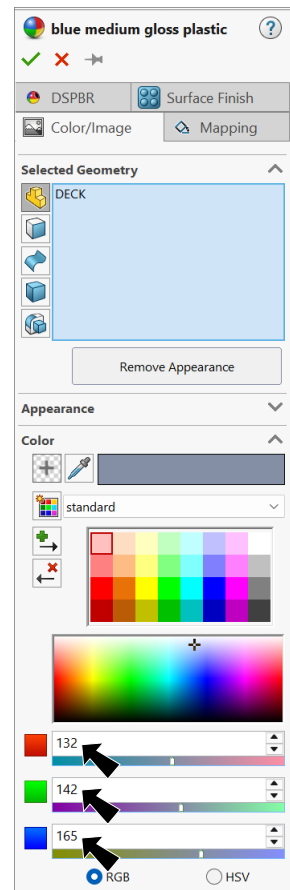


Fig. 104

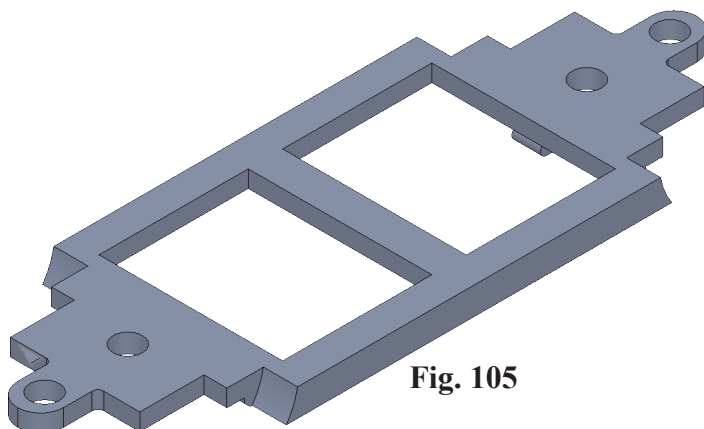


Fig. 105