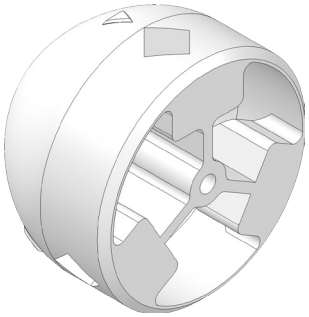
Chapter 18

HAWT
Rotor



A. Revolve.

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

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

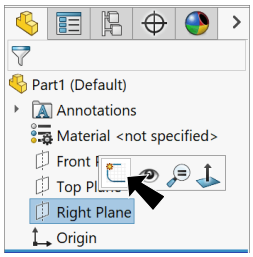


Fig. 1

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

Step 4. Sketch 3 lines. Sketch **horizontal line out to left** from Origin . Double click to terminate the chain. Sketch **vertical line up from** Origin and **horizontal line out to left** of endpoint of line, **Fig. 2**

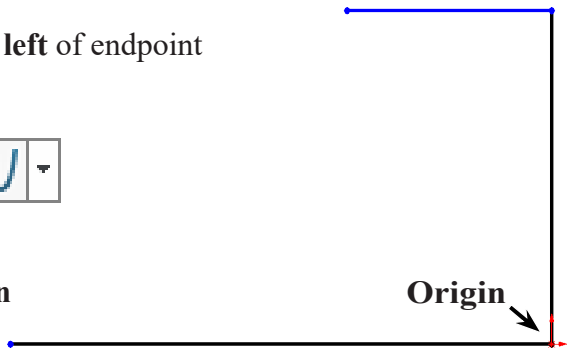


Fig. 2

Step 5. Click **Style Spline** in the **Spline flyout** on the Sketch toolbar.

Step 6. Sketch a **4 control vertex point Spline between left endpoint of horizontal line and left endpoint of horizontal line**, **Fig. 3**. Press Escape to end spline.

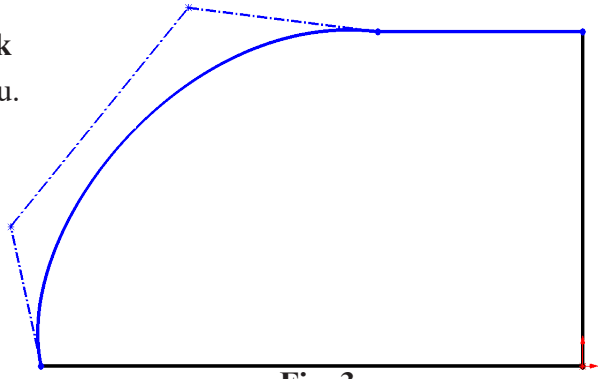


Fig. 3

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

Step 8. Click **top control polygon segment** and click **Make Horizontal** on the context toolbar, **Fig. 4.**

Step 9. Click **left control polygon segment** and click **Make Vertical** on the context toolbar, **Fig. 5.**

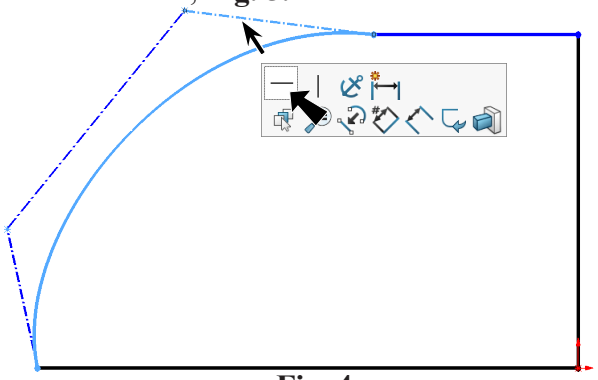


Fig. 4

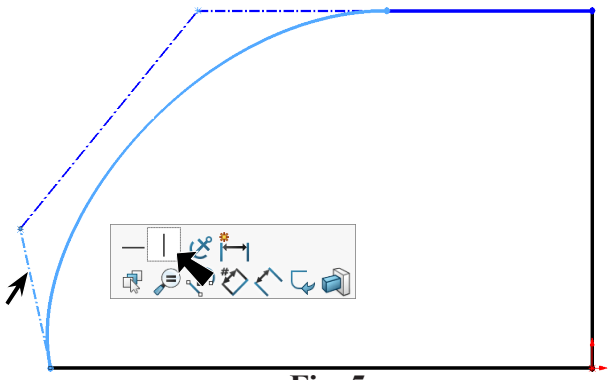


Fig. 5

Step 10. Click **Smart Dimension** 

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

Step 11. Add dimensions, **Fig. 6**.

Step 12. Click **Features** 

on the Command Manager toolbar.

Step 13. Click **Revolved Boss/Base** 

on the Features toolbar.

Step 14. In the Revolve Property Manger set:

under Axis of Revolution 
click **bottom line in sketch**, **Fig. 8**

click OK  .

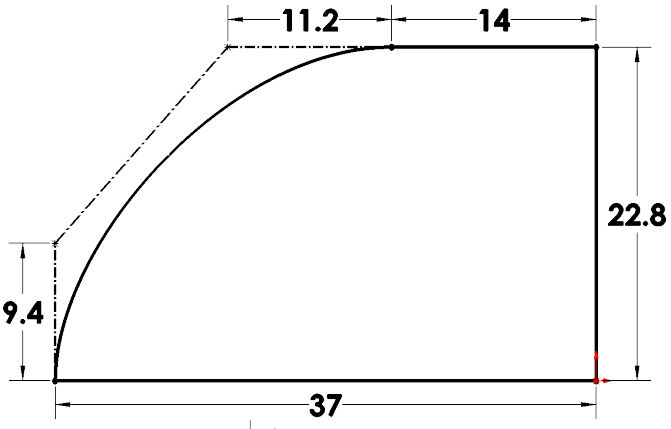


Fig. 6

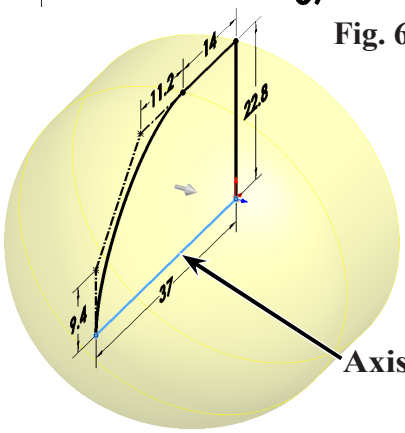


Fig. 8

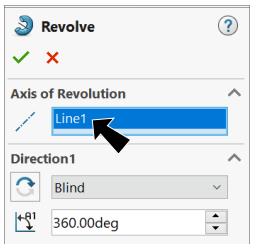


Fig. 7

B. Save as "ROTOR".

Step 1. Click File Menu > Save As.

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

C. Cut Pin Hole.

Step 1. Click **Top Plane** in the Feature Manager and click **Sketch**  on the context toolbar, **Fig. 9**.

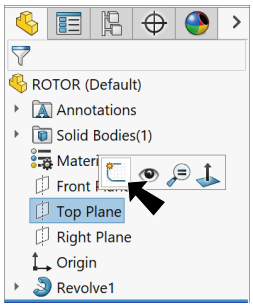


Fig. 9

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. 10**

Number of Sides  **4**

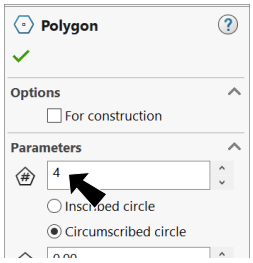


Fig. 10

Step 5. Sketch **polygon below the Origin**  , **Fig. 11**.

Step 6. **Unselect Polygon tool**. To unselect, **right click graphics area and click Select**  from menu.

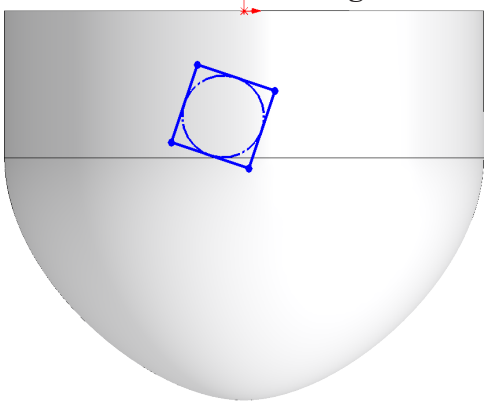


Fig. 11

Step 7. **Ctrl click centerpoint of polygon inscribed circle** and **Origin** to select both. Release Ctrl key and click **Make Vertical** on the context toolbar, **Fig. 12**.

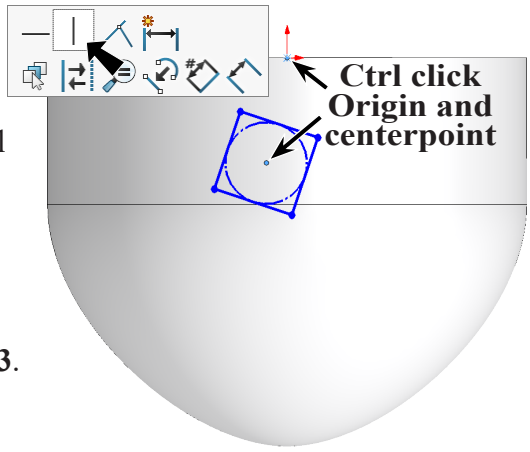


Fig. 12

Step 8. Click **two opposite vertices of polygon** and click **Make Vertical** on the context toolbar, **Fig. 13**.

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

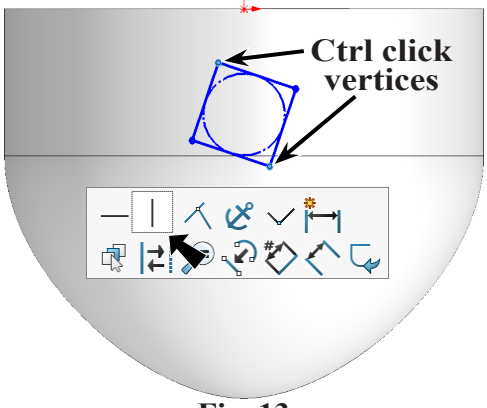


Fig. 13

Step 10. Dimension **10 across two opposite vertices and 9 from Origin to centerpoint of polygon**, **Fig. 14**.

Step 11. Rotate view to **view rear face**, **Fig. 16**. To rotate view, click **Isometric** on the Standard Views toolbar (**Ctrl-7**), then in bottom left corner of graphics area **Shift click the Y axis of the Reference Triad** .

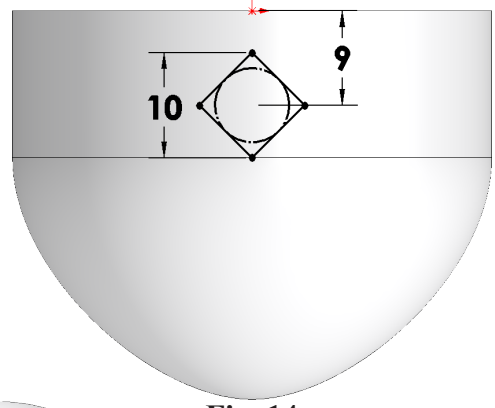


Fig. 14

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 From, **Fig. 15**
Start Condition **Offset**
Offset value **13.5**
under Direction 1, **Fig. 16**
End Condition **Through All**
Reverse Direction
click OK .

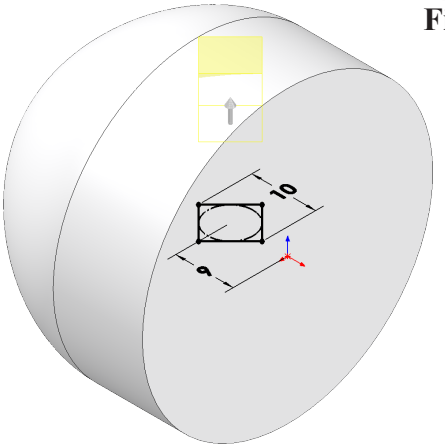


Fig. 16

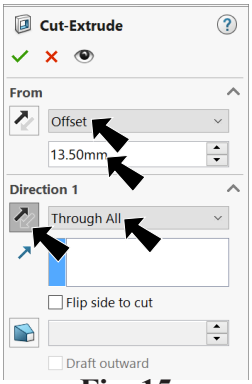
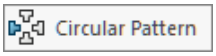


Fig. 15

Step 15. Save (**Ctrl-S**).

D. Circular Pattern1.

Step 1. Click **Circular Pattern** 

in the **Linear Pattern flyout** 

on the Features toolbar.

Step 2. In the Circular Pattern Property Manager set:
under Features and Faces, **Fig. 17**
click **Cut-Extrude1** in graphics area, **Fig. 18**
under Direction 1
click in **Pattern Axis** box
click **cylindrical face**
select **Equal spacing**
Number of Instances 3
click OK .

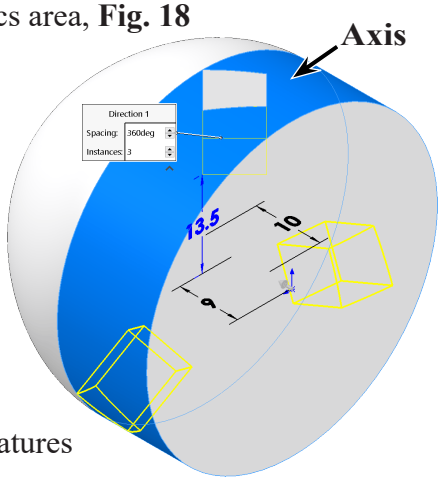


Fig. 18

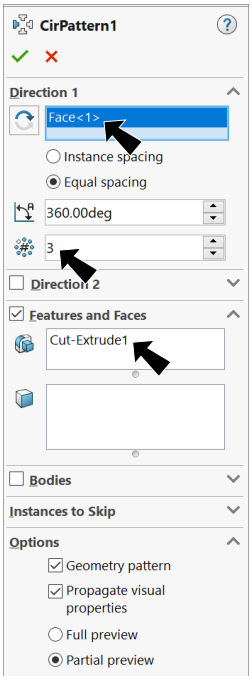
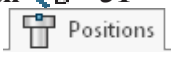


Fig. 17

E. Hole Wizard.

Step 1. Click **Hole Wizard** 

on the Features toolbar.

Step 2. In the Property Manager on the Type tab set:
under Hole Type, **Fig. 19**
select **Hole** 
under Standard:
select **ANSI Metric**
under Type:
Drill Sizes
under Size:
select **3.5**
check **Show custom sizing**
Angle at Bottom  **90**
under End Condition:
Blind Hole Depth  **31**
click **Positions tab** 

at top of the Property Manager.

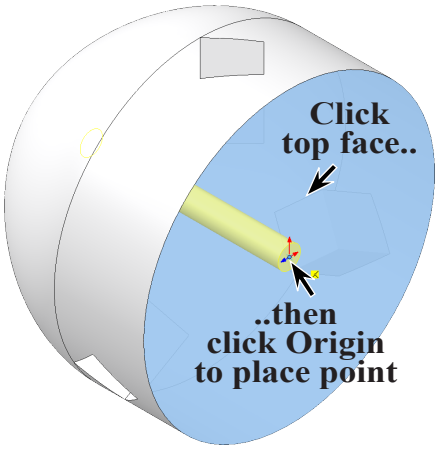


Fig. 20

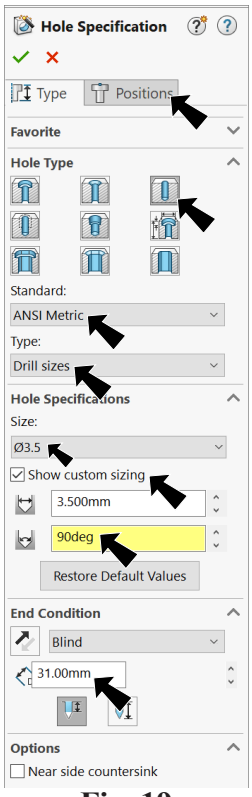


Fig. 19

Step 3. Click **rear face** one time as face for hole and click the **Origin**  to place the point, **Fig. 20**.

Step 4. Click OK in Hole Property Manager..

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

F. Split.

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

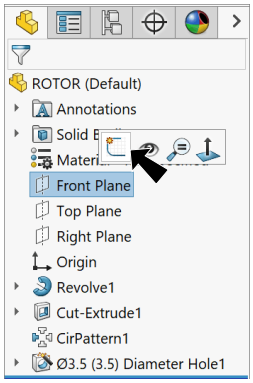


Fig. 21

Step 2. Click **Offset Entities** on the Sketch toolbar.

Step 3. In the Offset Entities Property Manager set:
under Parameters, **Fig. 22**
Distance .2
uncheck **Reverse**
click **edge of hole**, **Fig. 23**
Yellow offset should be on outside of edge
click OK .

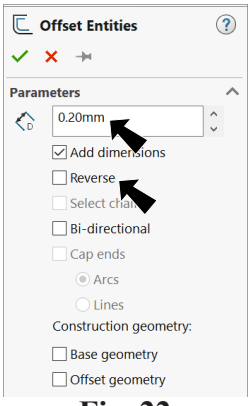


Fig. 22

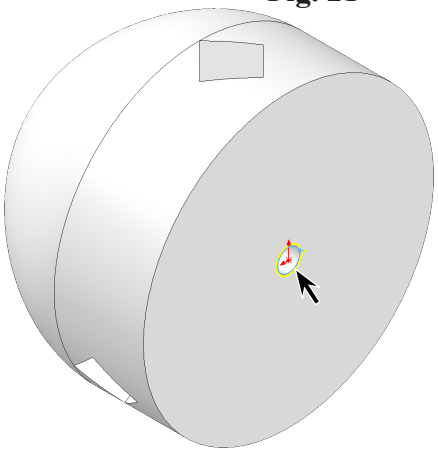


Fig. 23

Step 4. Click Insert Menu > Features > Split.

Step 5. In the Split Property Manager:
under Trim Tools, **Fig. 24**
Sketch5 was preselected
click **Cut Part** button
under Resulting Bodies
click **Select All**
uncheck **Consume cut bodies**
click OK .

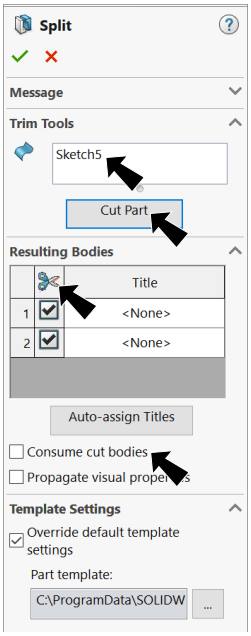


Fig. 24

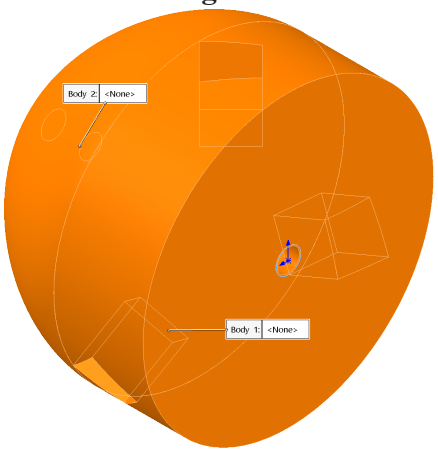


Fig. 25

Step 6. **Hide Sketch5**. To hide, click **Sketch5** in the Feature Manager and **Hide** on the context toolbar, **Fig. 26**.

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

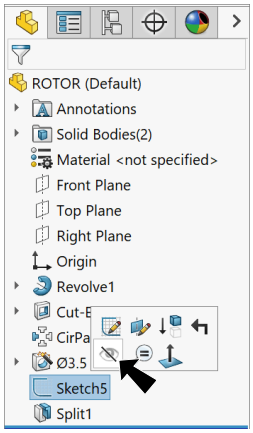


Fig. 26

G. Shell.

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

Step 2. In the Shell Property Manager set:
under Parameters, **Fig. 27**
Distance 2
under Faces to Remove
click **rear face of large body**, **Fig. 28**
click OK .

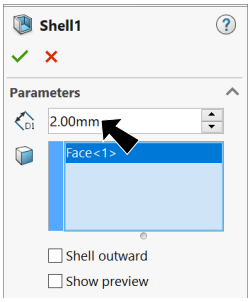


Fig. 27

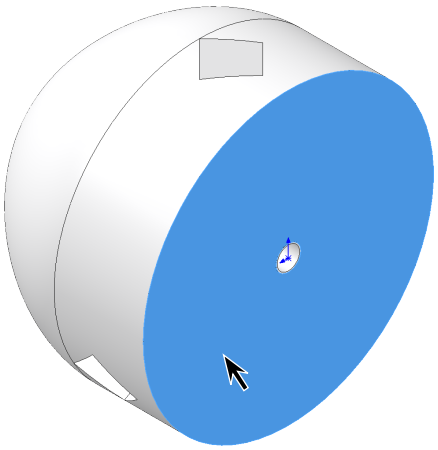


Fig. 28

H. Combine Bodies.

Step 1. Click Insert Menu > Features > Combine.

Step 2. In the Combine Property Manager:
under Operation Type, **Fig. 29**
select **Add**
drag a selection to select both bodies, Fig. 30
click OK .

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

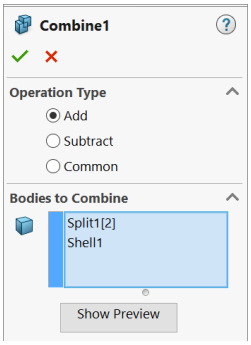


Fig. 29

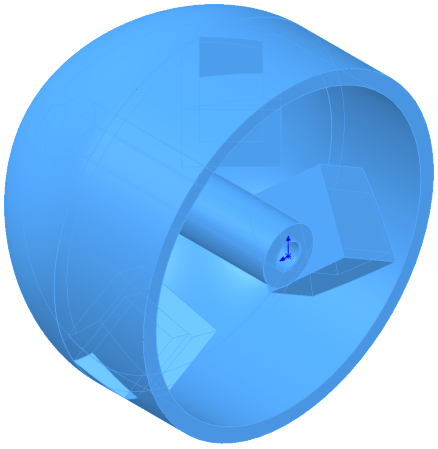


Fig. 30

I. Extrude1 Dial Pointer.

Step 1. Click **Top Plane** in the Feature Manager and click **Sketch** on the context toolbar, **Fig. 31**.

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. 32**
Number of Sides 3

Step 5. Sketch **polygon** below Cut-Extrude1, **Fig. 33**.

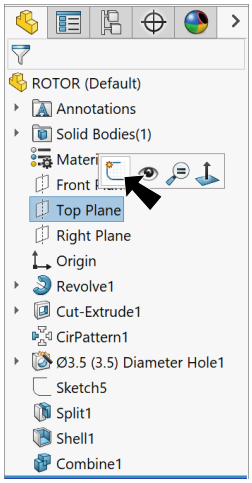


Fig. 31

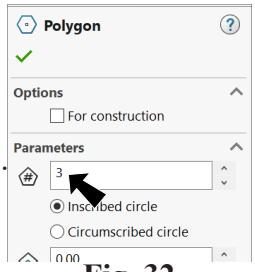


Fig. 32

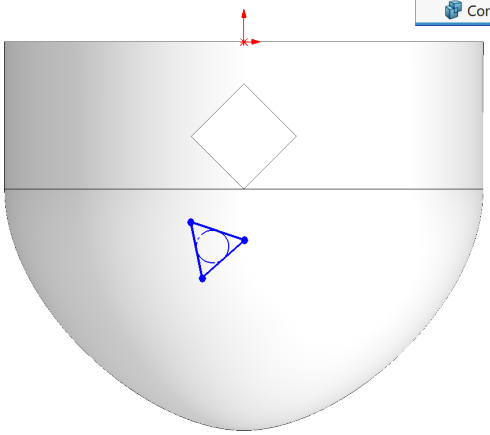


Fig. 33

Step 6. **Unselect Polygon tool**. To unselect, **right click graphics area and click Select** from menu.

Step 7. **Ctrl click centerpoint of polygon inscribed circle** and **Origin** to select both. Release Ctrl key and click **Make Vertical** on the context toolbar, **Fig. 34**.

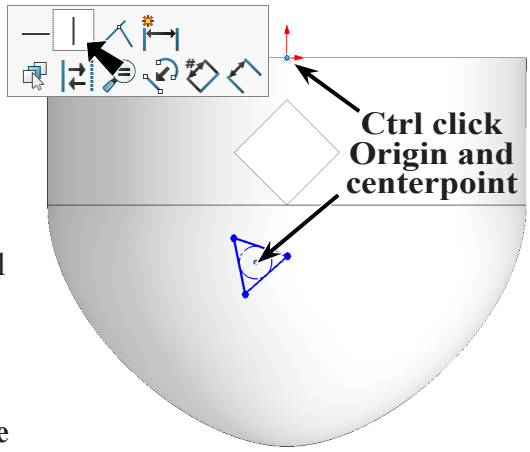


Fig. 34

Step 8. Click **bottom segment of polygon** and click **Make Horizontal** on the context toolbar, **Fig. 35**.

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

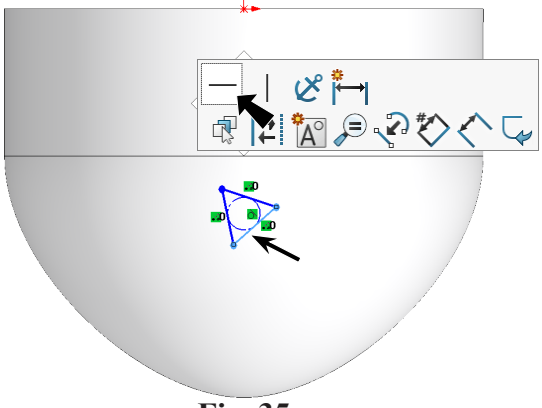


Fig. 35

Step 10. Dimension a **segment length 5** and **Origin** to **centerpoint 19.4**, **Fig. 36**.

Step 11. Click **Isometric** on the Standard Views toolbar. (**Ctrl-7**)

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

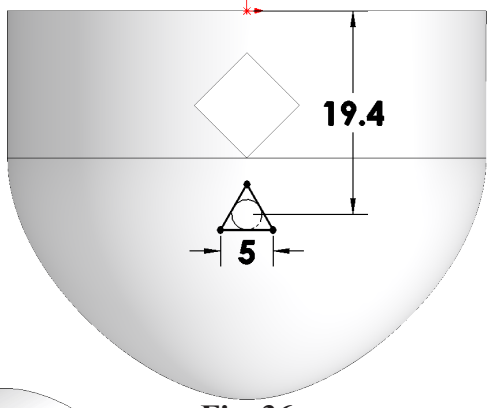


Fig. 36

Step 13. Click **Extruded Boss/Base** on the Features toolbar.

Step 14. In the Boss-Extrude Property Manager set:
under From, **Fig. 37**
Start Condition **Surface/Face/Plane**
click **spline revolved face**
under Direction 1, **Fig. 38**
End Condition **Blind**
Depth **.5**
click OK .

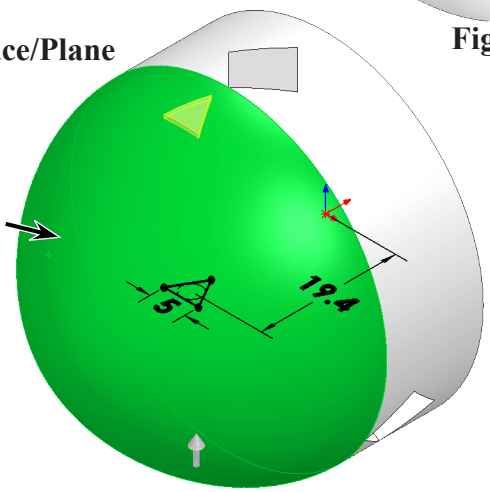


Fig. 38

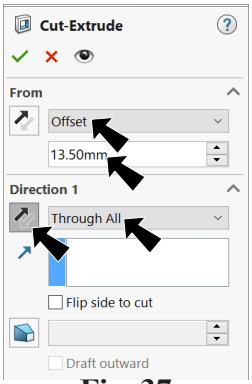
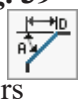


Fig. 37

J. Chamfer1 Face of Pointer.

Step 1. Click **Chamfer** 

on the Features toolbar.

Step 2. In the Chamfer Property Manager:
under Chamfer Type, **Fig. 39**
select **Angle Distance** 
under Chamfer Parameters
Distance .4
Angle 45°
under Items To Chamfer
click **top face of Extrude1**, **Fig. 40**
click OK .

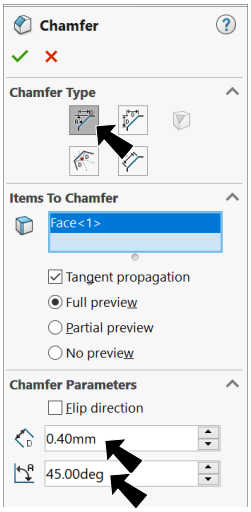


Fig. 39

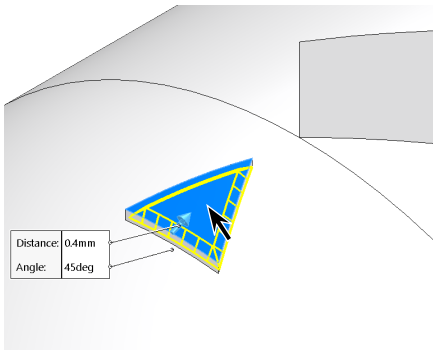


Fig. 40

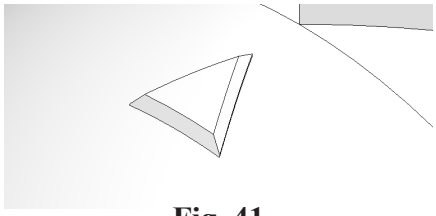
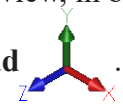


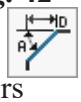
Fig. 41

K. Chamfer2 Rear Outside Edge.

Step 1. Rotate view to rear, **Fig. 43**. To rotate view, in bottom left corner of graphics area **Shift click the Y axis of the Reference Triad** 
.

Step 2. Click **Chamfer** 

on the Features toolbar.

Step 3. In the Chamfer Property Manager set:
under Chamfer Type, **Fig. 42**
select **Angle Distance** 
under Chamfer Parameters
Distance 1.5
Angle 45°
under Items To Chamfer
click **rear outside edge**, **Fig. 43**
click OK .

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

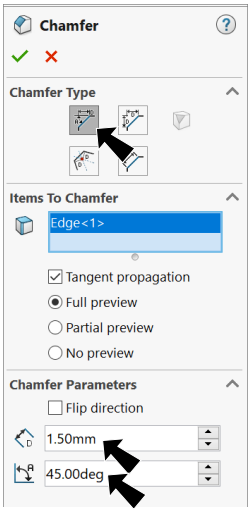


Fig. 42

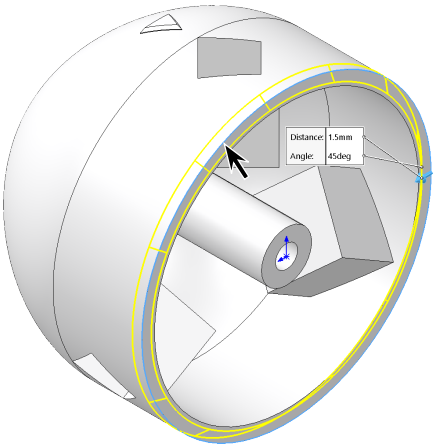


Fig. 43

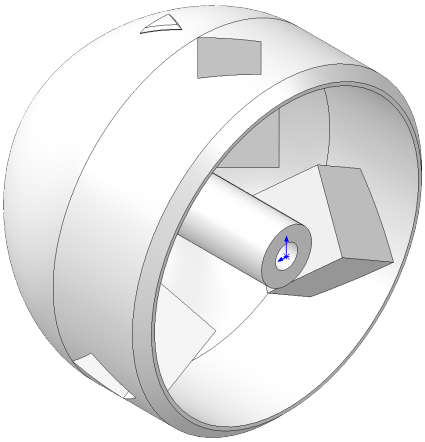


Fig. 44

L. Extrude2.

Step 1. Click **Front Plane** in the Feature Manager and click **Sketch** on the context toolbar, **Fig. 45**.

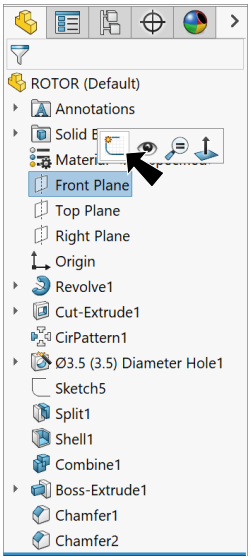


Fig. 45

Step 2. Click **Back** on the Standard Views toolbar. (**Ctrl-2**)

Step 3. Click **Convert Entities** (Convert Entities) on the Sketch toolbar.

Step 4. In the Convert Entities Property Manager:
under Entities to Convert, **Fig. 46**
click **both bottom faces of shell at pin hole**, **Fig. 47**
click OK .

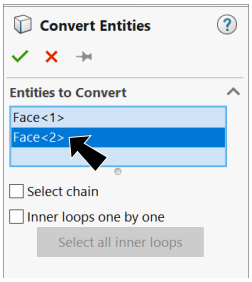


Fig. 46

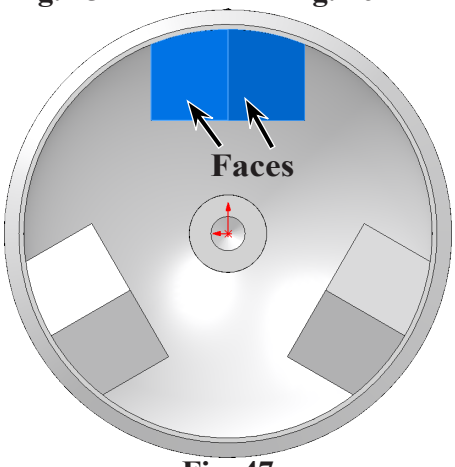


Fig. 47

Step 5. Use **Previous View** on the Standard Views toolbar. (**Ctrl-Shift-Z**) to return to previous view, then **Up Arrow key** **four times**, **Fig. 49**.

Step 6. Click **Features** (Features) on the Command Manager toolbar.

Step 7. Click **Extruded Boss/Base** (Extruded Boss/Base) on the Features toolbar.

Step 8. In the Boss-Extrude Property Manager set:
under Direction 1, **Fig. 48**
End Condition **Up To Next**
click OK .

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

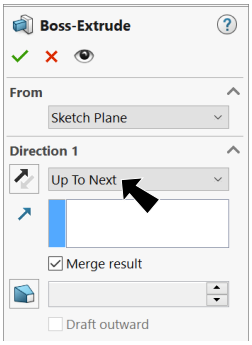


Fig. 48

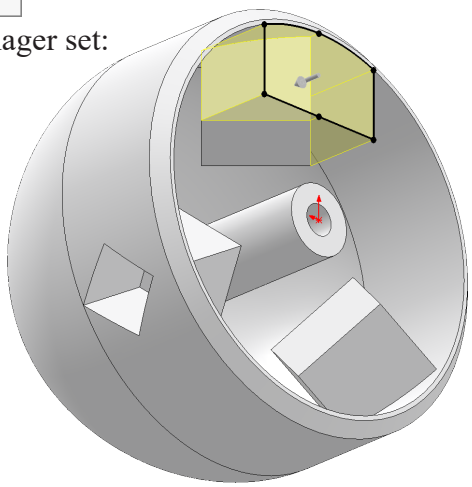


Fig. 49

M. Extrude3.

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

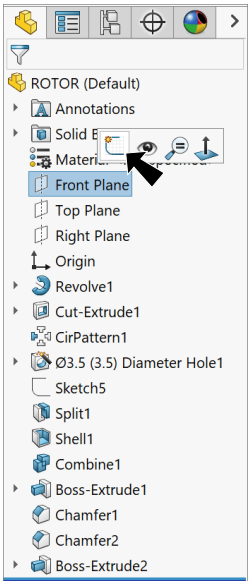


Fig. 50

Step 2. Click **Back** on the Standard Views toolbar. (**Ctrl-2**)

Step 3. Click **Convert Entities** on the Sketch toolbar.

Step 4. In the Convert Entities Property Manager:
under Entities to Convert, **Fig. 51**
click **inside bottom edges (2) of shell at pin hole and outside bottom circular edge of shell at shaft hole**, **Fig. 52**
click OK .

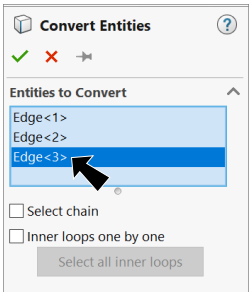


Fig. 51

Step 5. Click **Centerline** in the **Line flyout** on the Sketch toolbar.

Step 6. Sketch **vertical centerline from Origin up to converted line**, **Fig. 53**.

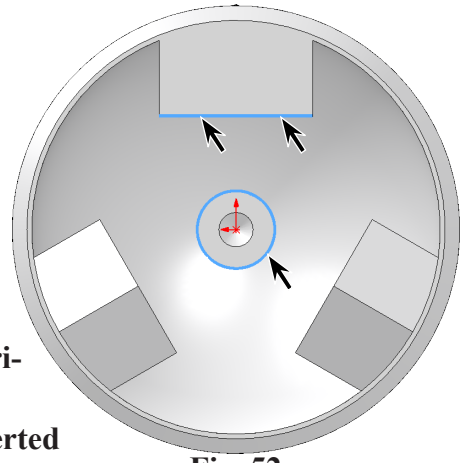


Fig. 52

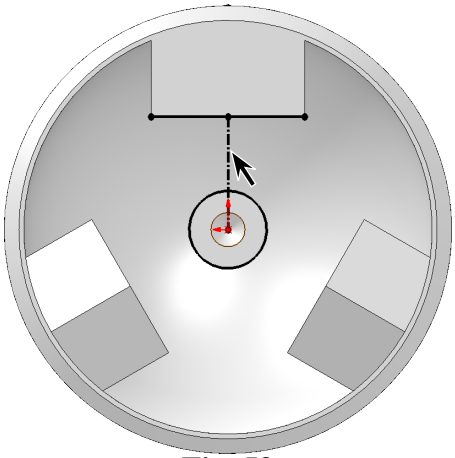


Fig. 53

Step 7. Click **Offset Entities** on the Sketch toolbar.

Step 8. In the Offset Entities Property Manager set:
under Parameters, **Fig. 54**
Distance 1
click **centerline**, **Fig. 55**
check **Bi-directional**
click OK .

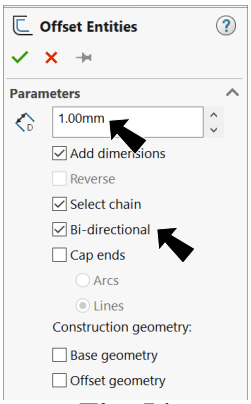


Fig. 54

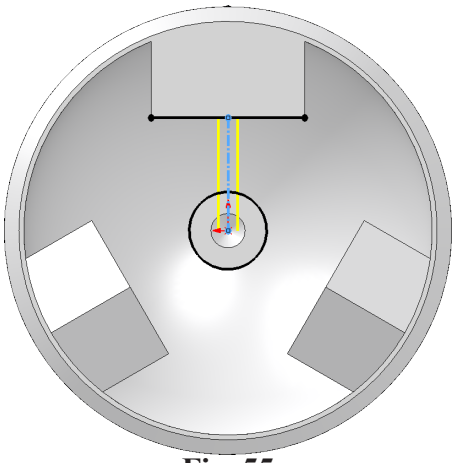


Fig. 55

Step 9. Use **Previous View** on the Standard Views toolbar. (**Ctrl-Shift-Z**) to return to previous zoomed in view.

Step 10. Click **Features** Features on the Command Manager toolbar.

Step 11. Click **Extruded Boss/Base** Extruded Boss/Base on the Features toolbar.

Step 12. In the Boss-Extrude Property Manager set:
under Direction 1, **Fig. 56**
End Condition **Up To Body**
in the Solid/Surface Body box
click the **body**
under Selected Contours
click **both regions inside offset lines**, **Fig. 57**
click OK .

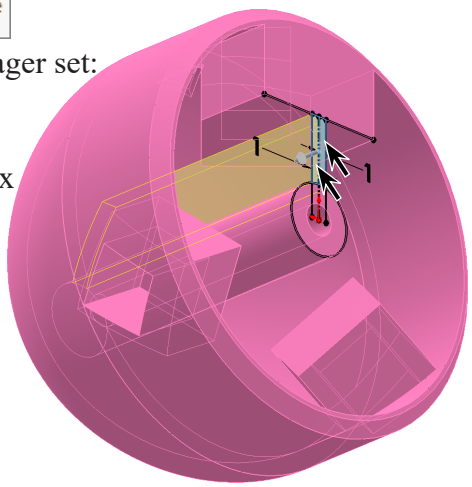


Fig. 57

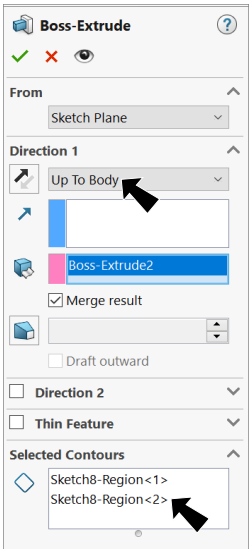


Fig. 56

N. Fillet Edges.

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

Step 2. In the Fillet Property Manager set:
select **FilletXpert**, **Fig. 58**
Radius **1.5**
click **edge of Extrude2**, **Fig. 59**
click **Connected to start loop** **7 edges** on the Fillet pop-up
click OK .

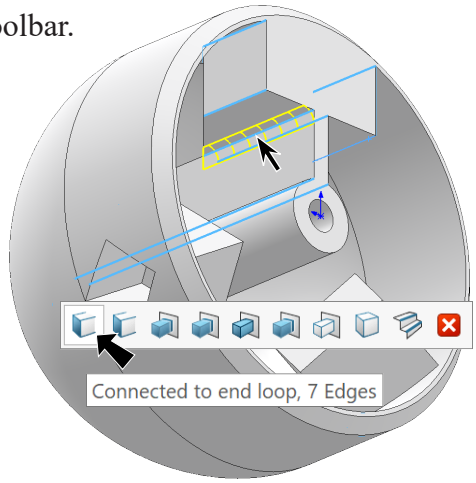


Fig. 59

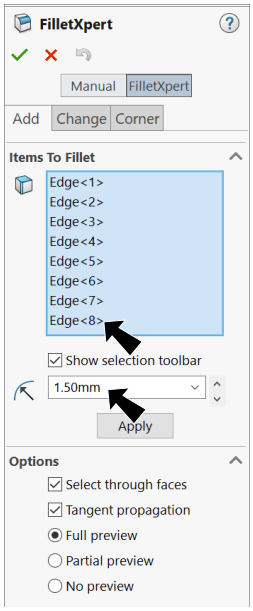


Fig. 58

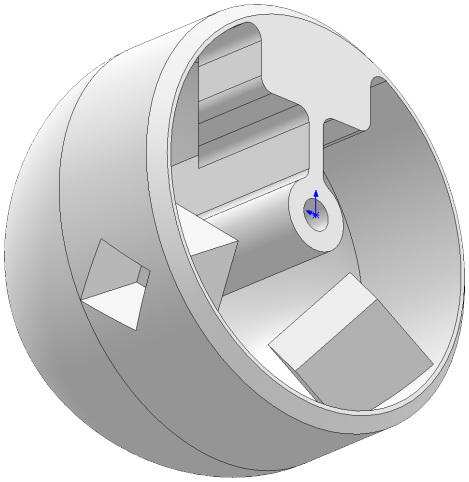


Fig. 60

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

O. Circular Pattern2.

Step 1. Click **Circular Pattern** Circular Pattern in the **Linear Pattern flyout** Linear Pattern on the Features toolbar.

Step 2. In the Circular Pattern Property Manage
under Features and Faces, **Fig. 61**
in graphics area click:
Boss-Extrude2
Boss-Extrude3
Fillet1
Fig. 62
under Direction 1
click in **Pattern Axis** box
click a **cylindrical face,**
Fig. 63
check **Equal spacing**
Number of Instances **3**
under Options
uncheck **Axis** **Geom** **ttern**

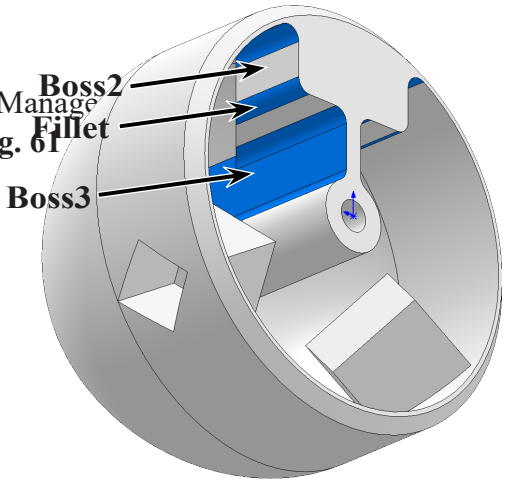


Fig. 62

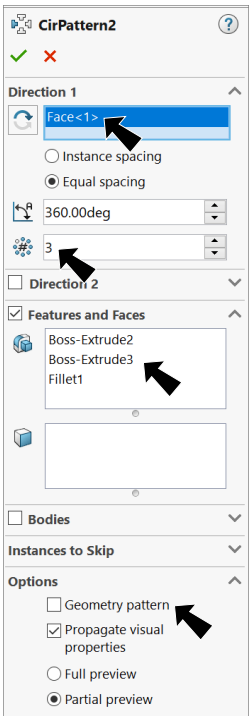


Fig. 61

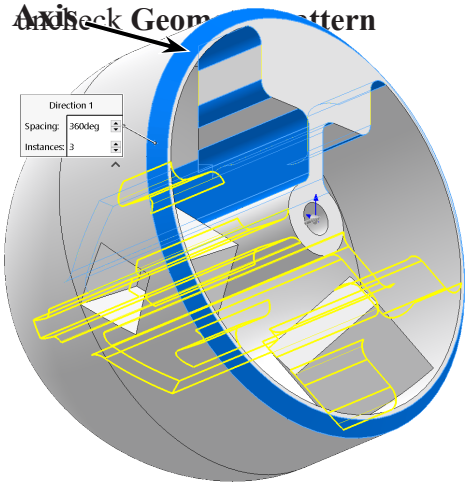


Fig. 63

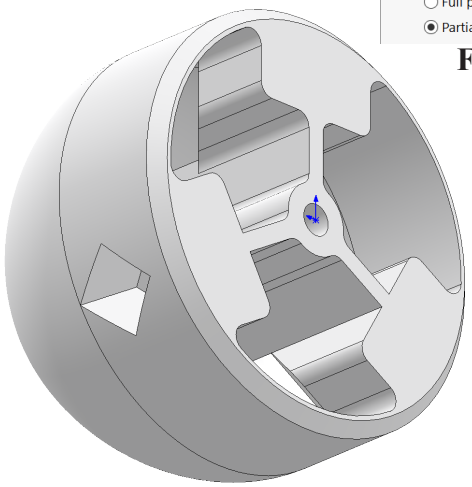


Fig. 64

click OK .

P. Circular Pattern3.

Step 1. Click **Circular Pattern** Circular Pattern in the **Linear Pattern flyout** tures toolbar.

Step 2. In the Circular Pattern Property Manager set:
under Features and Faces, **Fig. 65**
in graphics area click **Boss-Extru**
under Direction 1
click in **Pattern Axes** box
click a **cylindrical face**
check **Equal spacing**
Number of Instances **3**
click OK .

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

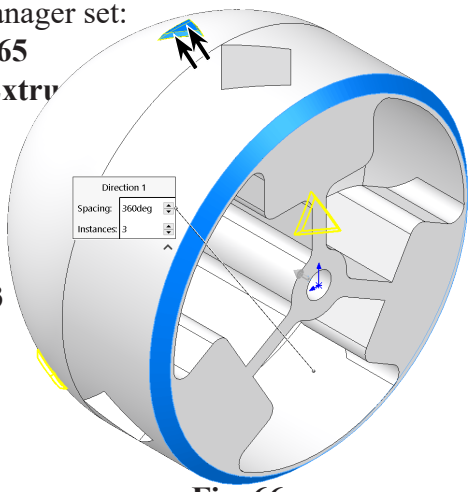


Fig. 66

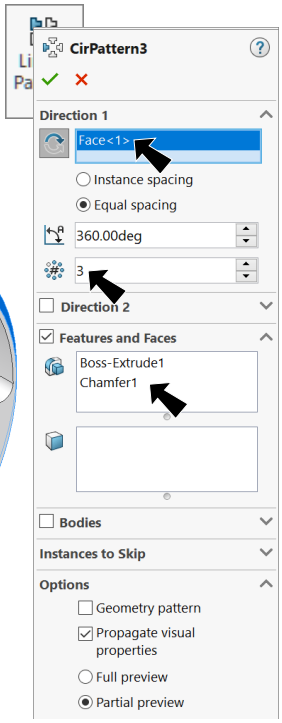


Fig. 65

Q. Appearance: White Plastic.

Step 1. Click part, click **Appearance Callout** on the context toolbar and click **ROTOR**, **Fig. 67**.

Step 2. In the Appearances Task pane, expand **Plastic**, click **High Gloss** and in the lower pane select **white high gloss plastic**, **Fig. 68**.

Step 3. Click OK In the Appearances Property Manager

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

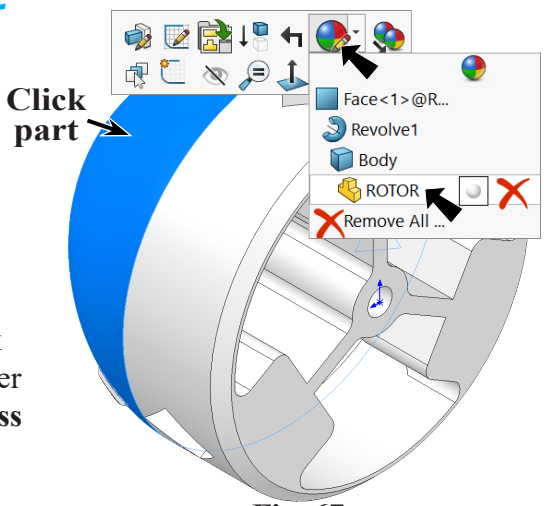


Fig. 67

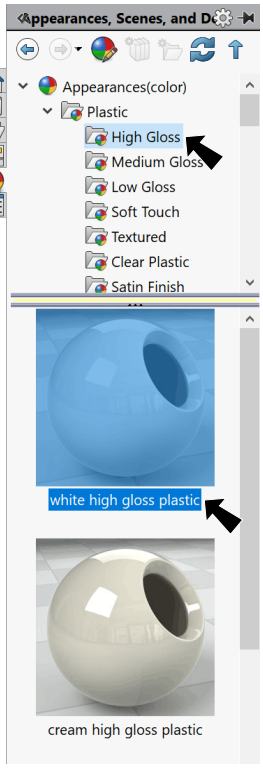


Fig. 68

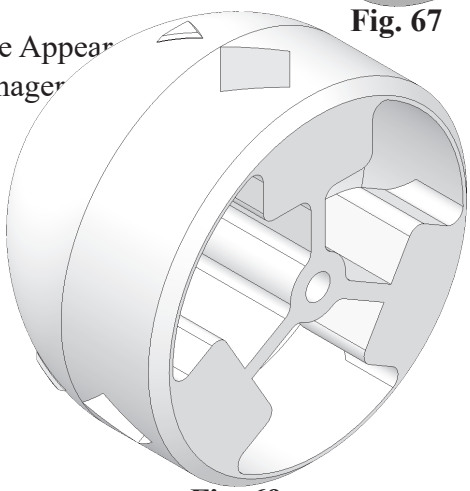


Fig. 69