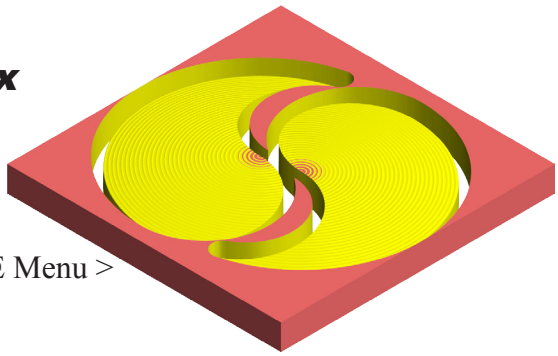
Jewelry Box
Lid



A. Sketch Lid Circle.

Step 1. If necessary start a new Mastercam file, click FILE Menu > New .

Step 2. Click CREATE Menu > Arc > Circle Center Point.

Step 3. Key-in **6.5 for diameter** in ribbon bar, **Fig. 1**.

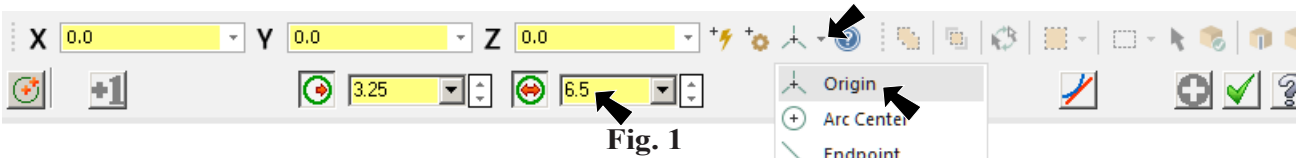


Fig. 1

Step 4. Click the down arrow in Auto Cursor ribbon bar and click Origin to place rectangle, **Fig. 1**.

Step 5. Click OK in ribbon bar to fix circle and close ribbon bar, **Fig. 1**.

Step 6. Fit (**Alt-F1**) and use **F9** to toggle Origin/Axis display on and off to confirm Origin, **Fig. 2**.

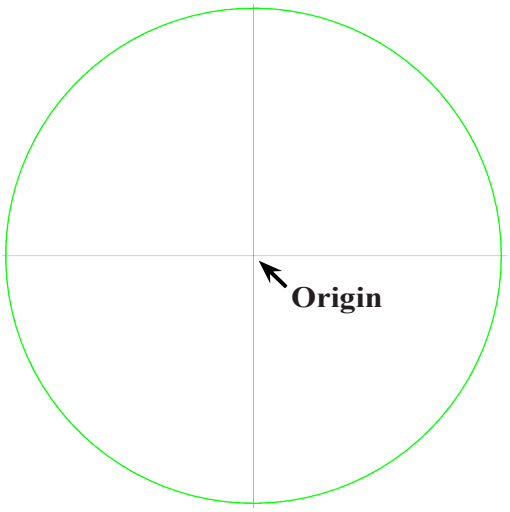


Fig. 2

B. Twin Edge Point Circles.

Step 1. Click CREATE Menu > Arc > Circle Edge Points.

Step 2. Use the **upper quadrant and Origin** as the two points to draw circle, **Fig. 3**.

Step 3. Repeat, and draw second circle using **lower quadrant and Origin**, **Fig. 4**.

Step 4. Click OK in ribbon bar to fix circle and close ribbon bar.

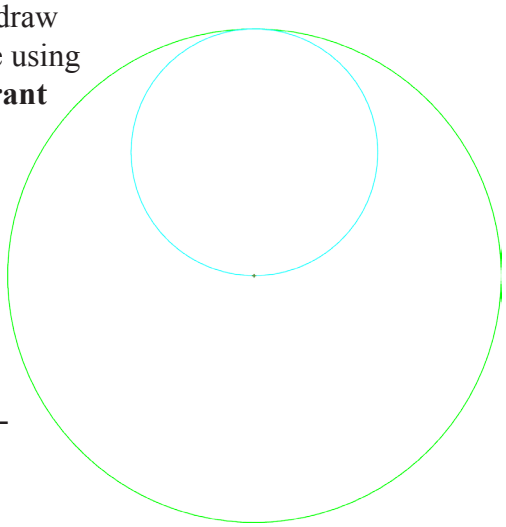


Fig. 3

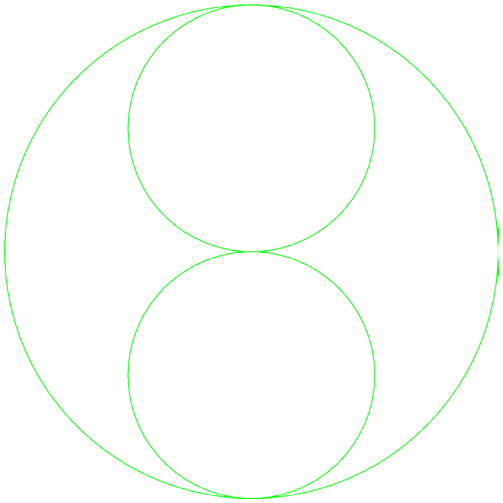


Fig. 4

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C. Save As "LID"

Step 1. Click FILE Menu > Save As.

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

D. Trim Divide.

Step 1 Click EDIT Menu > Trim/Break > Trim/ Break/Extend.

Step 2. Click **Divide** (**D**) in ribbon bar, **Fig. 6**.

Step 3. Trim arcs, **Fig. 5-8**. Click OK to close ribbon bar when done.

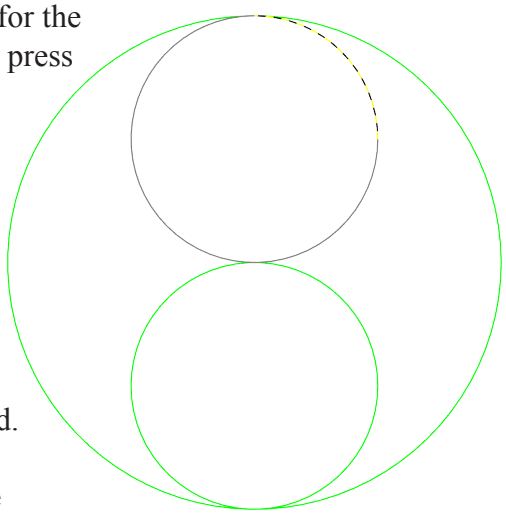


Fig. 5

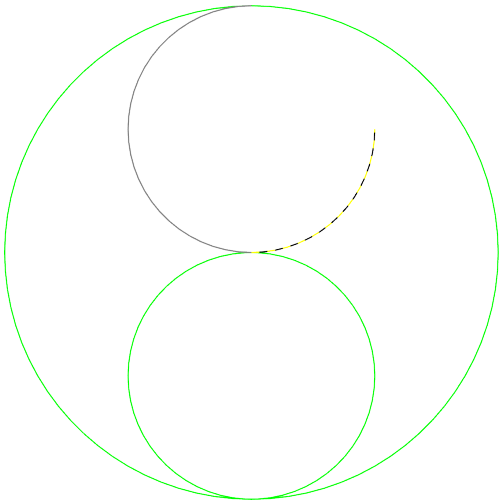


Fig. 6

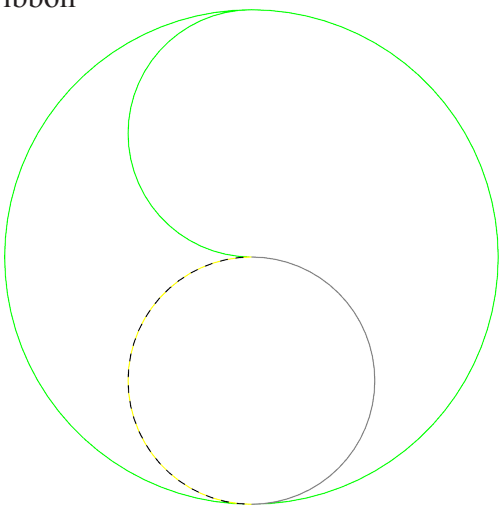


Fig. 7

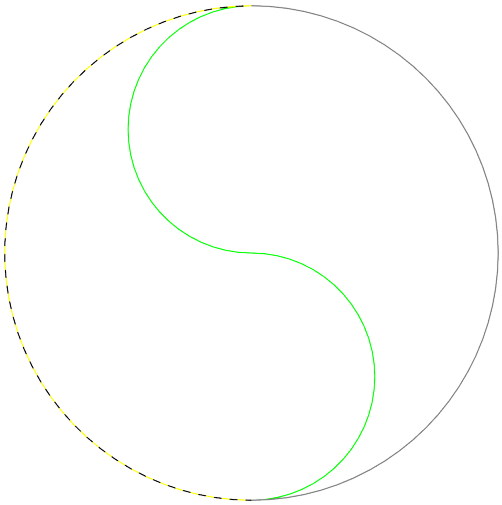


Fig. 8

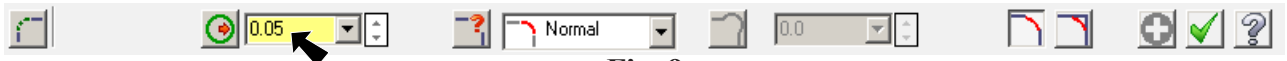


Fig. 9

E. Fillet Tip.

Step 1. Click CREATE Menu > Fillet > Entities.

Step 2. Key-in **.05 for Radius** in Fillet ribbon bar, **Fig. 9**.

Step 3. Click **both arcs at sharp tip**, **Fig. 10**.

Step 4. Click OK in ribbon bar to fix and close.

Step 5. Save (**Alt-F S**).

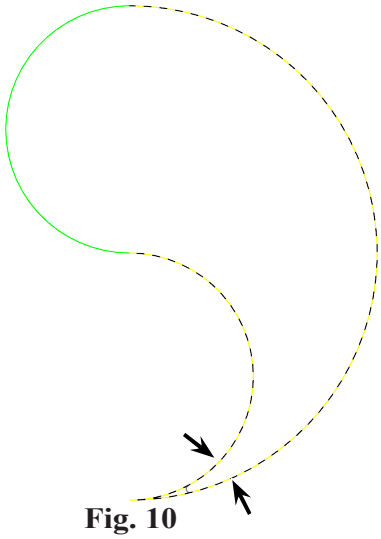


Fig. 10

F. Extrude Solid.

Step 1. Change to Isometric View (**Alt-7**).

Step 2. Click SOLIDS Menu > Extrude.

Step 3. Click Chain in Chaining dialog box.

Step 4. Click **any geometry**, **Fig. 11**.

Step 5. Click OK in Chaining dialog box.

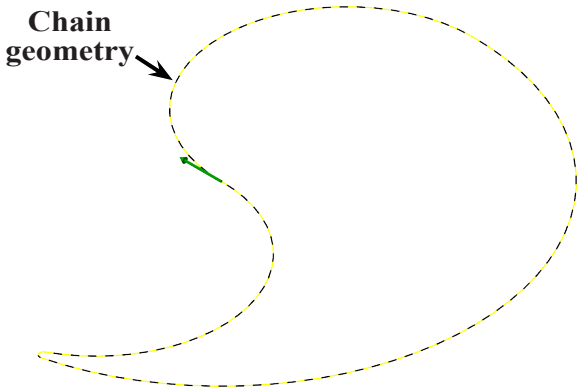


Fig. 11

Step 6. In Extrude Chain dialog box:
Select **Create Body**, **Fig. 12**
Set **Distance .75**
The direction arrow on chain points in the direction of extrude, **Fig. 13**. The direction arrow should **point down**, if arrow points in opposite direction check **Reverse direction**, **Fig. 12**.
Click OK.

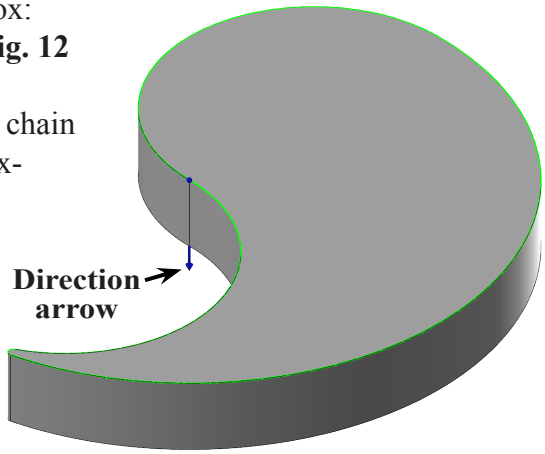


Fig. 13

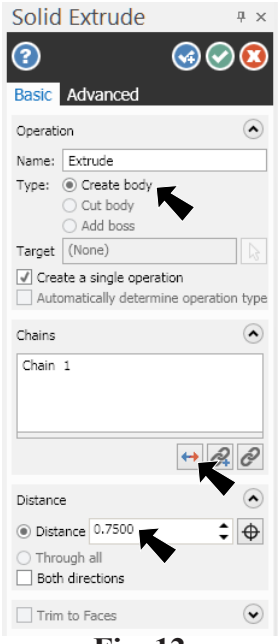


Fig. 12

G. Create Vertical Line Down from Origin.

Step 1. Change to Front View (**Alt-2**).

Step 2. Click CREATE Menu > Line > Endpoint or click Line Tool in toolbar.

Fig. 14

Step 3. Click Vertical Line in Line ribbon bar.

Step 4. Click the down arrow in Auto Cursor ribbon bar and click Origin to place first point of line, **Fig. 15**.

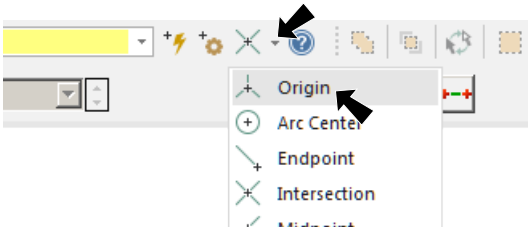


Fig. 15

Step 5. Click below **Origin** for second point, **Fig. 16**.

Step 6. Click OK in ribbon bar to fix line and close.

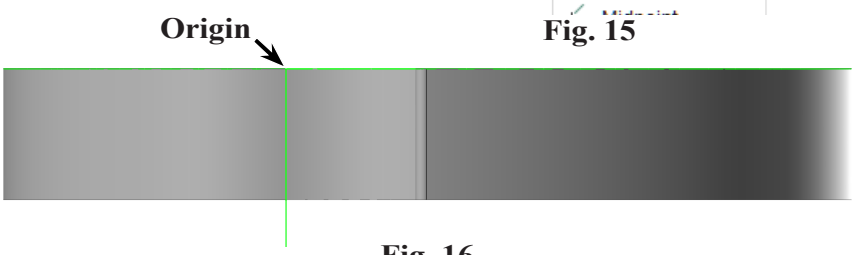


Fig. 16

H. Polar Arc.

Step 1. Turn **on** Wireframe (**Alt-S**).

Step 2. Click CREATE Menu > Arc > Arc Polar.

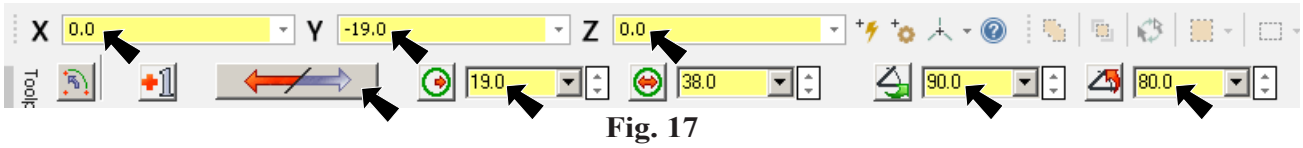


Fig. 17

Step 3. In Auto Cursor ribbon bar set:, **Fig. 17**
(the following ribbon bar entry has to be completed without moving cursor into graphics area. If that is difficult, then lock each field. To lock, click field icon and field turns red when locked)

X 0
Y -19
Z 0

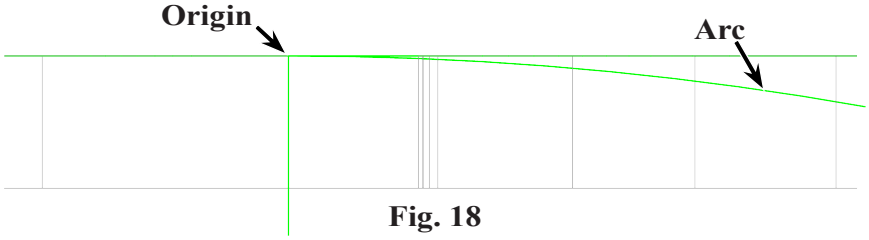


Fig. 18

Radius **19**

Start Angle **90 (origin)**

End Angle **80**

Click **Flip** until arc is on **right side of vertical line**, **Fig. 18**.

Click OK in ribbon bar to fix arc and close ribbon bar.

Step 4. Turn **on** Shading (**Alt-S**).

I. Revolved Surface.

Step 1. Click CREATE Menu > Surface > Revolved.

Step 2. Click Chain in Chaining dialog box.

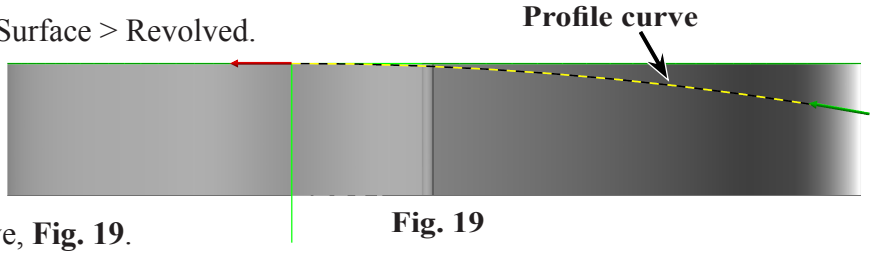


Fig. 19

Step 3. Click **arc** for profile curve, **Fig. 19**.

Step 4. Click OK in Chaining dialog box.

Step 5. Click **vertical line** for axis of rotation, **Fig. 20**.

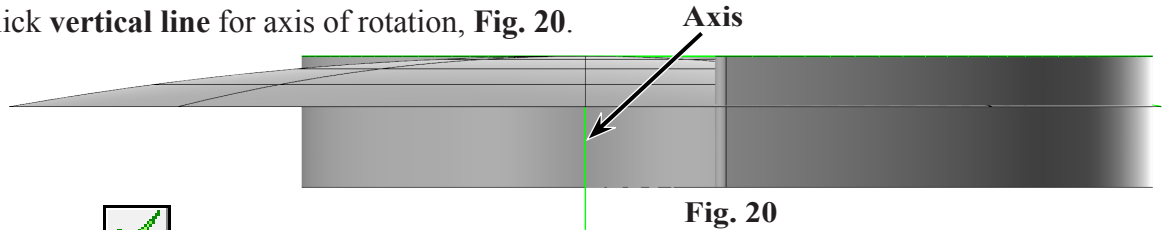


Fig. 20

Step 6. Click OK in ribbon bar to fix surface and close ribbon bar.

J. Trim Solid.

Step 1. Click SOLIDS Menu > Trim > Trim to Surface/Sheet.

Step 2. Click **solid body below the surface** as body **to trim**, **Fig. 21**.

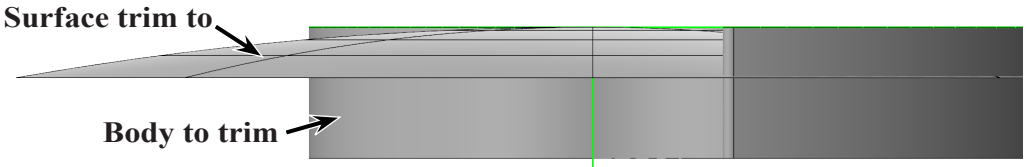


Fig. 21

Step 3. Click **surface** as surface or sheet **trim to**, **Fig. 21**.

Step 4. Click OK in Trim to Surface/Sheet dialog box, **Fig. 22**.

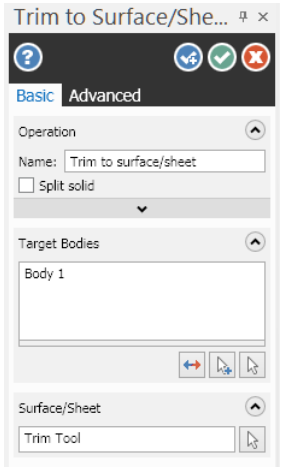


Fig. 22

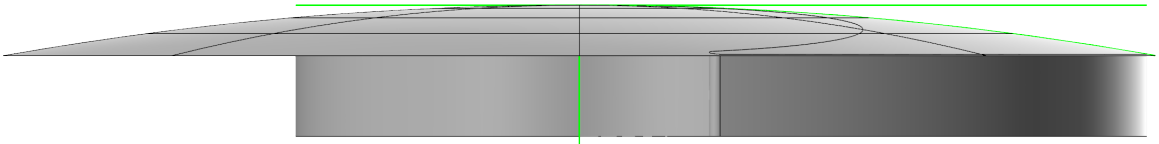


Fig. 23

K. Move Geometry to New Level.

Step 1. Click All in General Selection ribbon bar, **Fig. 24**.

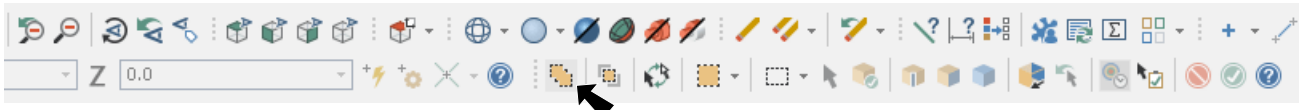


Fig. 24

Step 2. In Select All dialog box:

Check **Entities** in criteria type, **Fig. 25**.

Ctrl click to check **Wireframe** and **Surfaces** in criteria list.

Click OK.

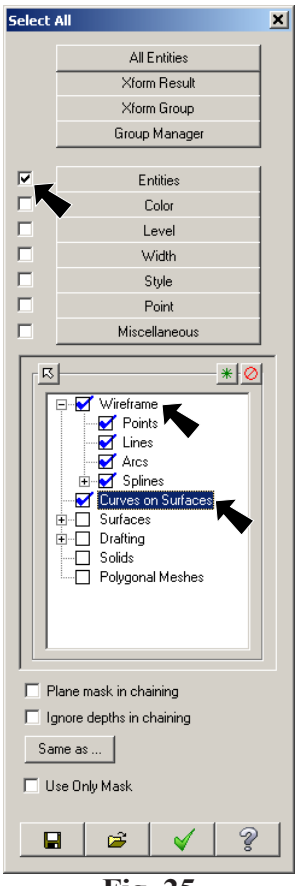


Fig. 25

Step 3. **Right click Level** in Status Bar at bottom of screen, **Fig. 26**.

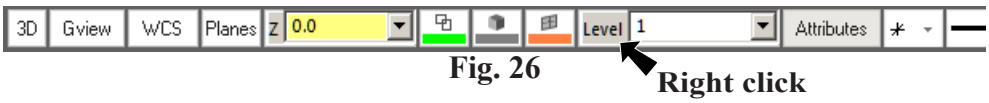


Fig. 26

Right click

Step 4. In Change Levels dialog box:

Uncheck **Use Main Level**, **Fig. 27**

Click **Select** button

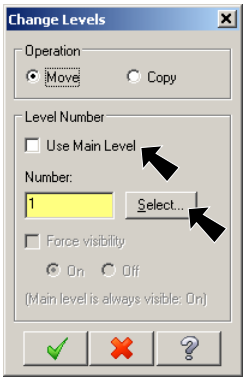


Fig. 27

Step 5. In Levels dialog box:
Key-in **2** for Number, **Fig. 28**
Key-in **GEOMETRY** for Name
Click OK .

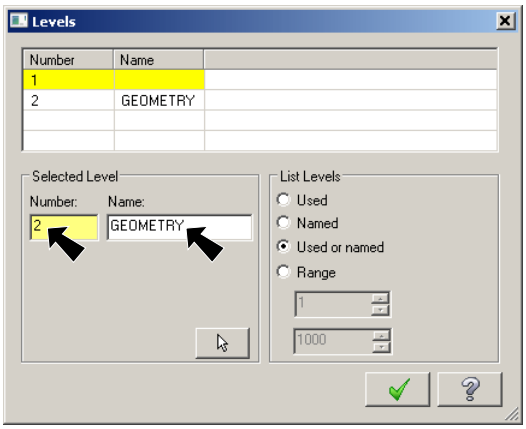


Fig. 28

Step 6. Click OK in Change Levels dialog box, **Fig. 27**.

L. Turn Off Geometry Level.

Step 1. Display Level Manager (**Alt-Z**).

Step 2. Click to remove X in Visible column of **GEOMETRY** level and click OK, **Fig. 29**.

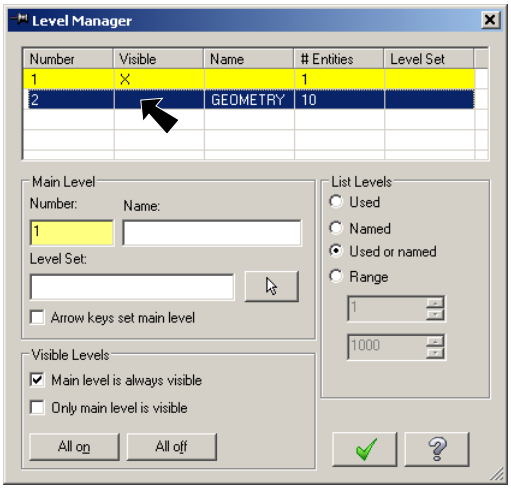


Fig. 29

M. Create BOTTOM CUT WCS.

Step 1. Change to Isometric View (**Alt-7**).

Step 2. Click **WCS** in the Status Bar at the bottom of the graphics area and **Plane Manager** from the menu, **Fig. 30**.

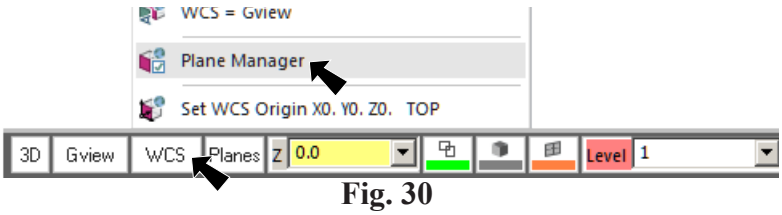


Fig. 30

Step 1. Click **Bottom plane** in the list of names and click **Copy** button in the Plane Manager dialog, **Fig. 31**.

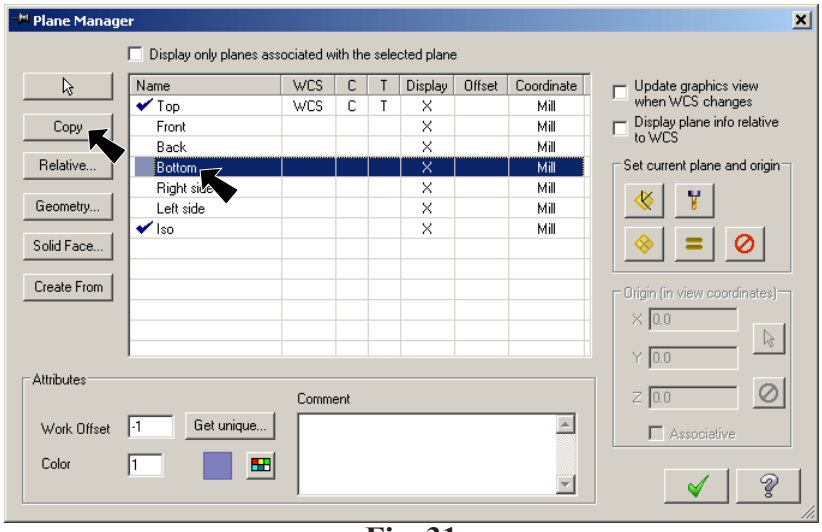


Fig. 31

Step 2. Rename Bottom-1 to **BOTTOM CUT**. To rename, double click the plane name and key-in the new name, **Fig. 32**.

Step 3. Set:
Origin X 0
Origin Y 0
Origin Z .75
Fig. 33.

Step 4. Click **Set All** button , **Fig. 33**.

Step 5. Click OK .

Step 6. Change to Isometric View (**Alt-7**).

Step 7. Use **F9** to toggle Origin/ Axis display to confirm the BOTTOM CUT origin, **Fig. 34**.

Step 8. Save . Use **Alt-F S**.

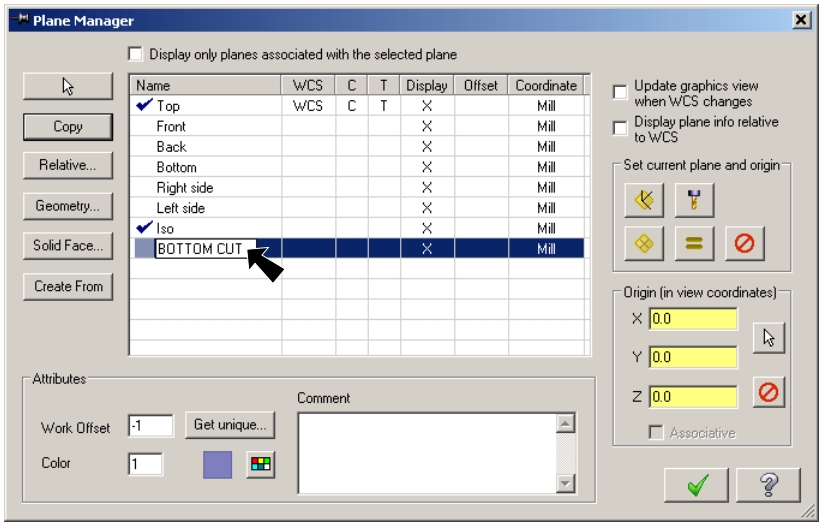


Fig. 32

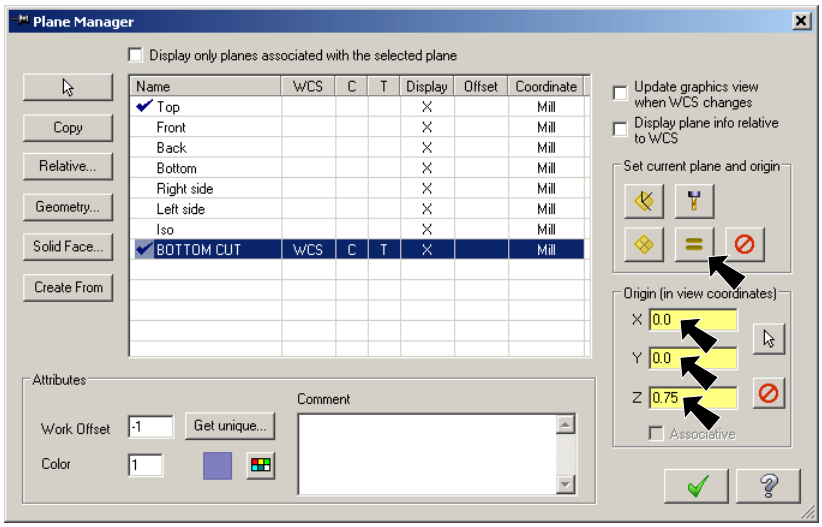


Fig. 33

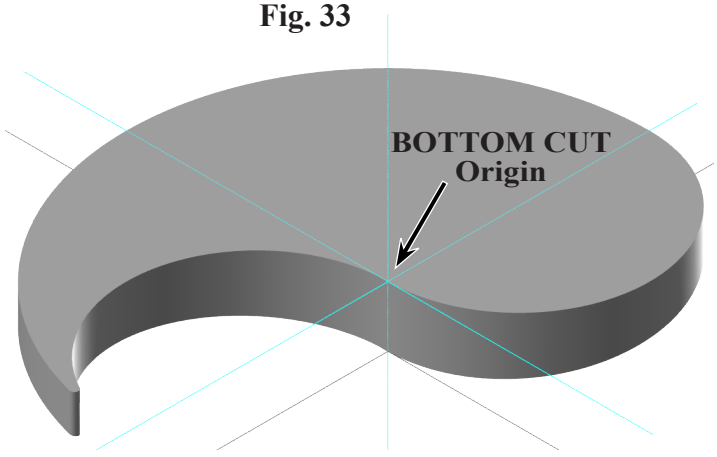


Fig. 34

N. Pin Hole Circle.

Step 1. Change to Top View (**Alt-1**).

Step 2. Click Wireframe color in Status Bar. Key-in **13 for magenta** color number and press ENTER.

Step 3. Click CREATE Menu > Arc > Circle Center Point.

Step 4. Key-in **.125 for diameter** and click Diameter to **lock**, **Fig. 35**. The field turns red when locked.

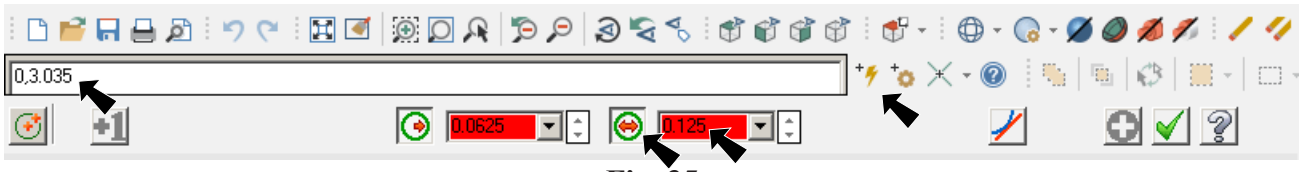


Fig. 35

Step 5. Click Fast Point (**spacebar**) to the right of the X, Y, and Z fields in Auto Cursor ribbon bar set, **Fig. 35**.

Step 6. Key-in the X, Y coordinates into the Fast Point
Pin Hole, **Fig. 36**
0, 3.035
Click OK in ribbon bar to fix circle and close ribbon bar.

Step 7. Save (**Alt-F S**).

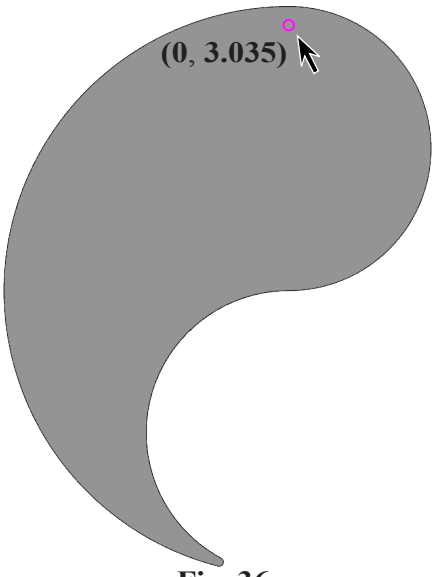


Fig. 36

O. Cut Hole.

Step 1. Change to Isometric View (**Alt-7**).

Step 2. Click SOLIDS Menu > Extrude.

Step 3. Click Chain in Chaining dialog box.

Step 4. Click **Pin hole circle** (magenta), **Fig. 37**.

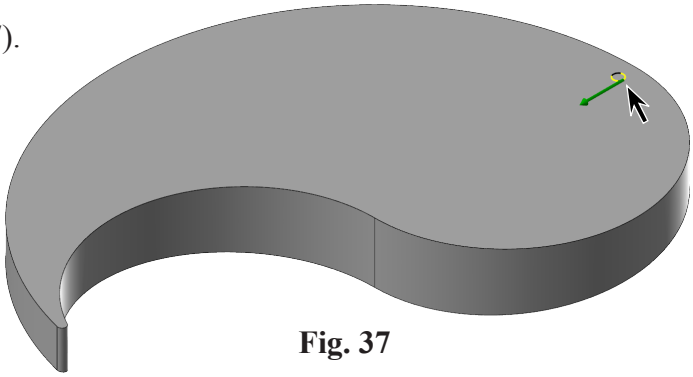


Fig. 37

Step 5. Click OK in Chaining dialog box.

Step 6. In Extrude dialog box, **Fig. 38**
Select **Cut Body**
Select **Distance**
Set **Distance .35**

The direction arrow on Extrude cut chain should point down, **Fig. 39**.

Click OK .

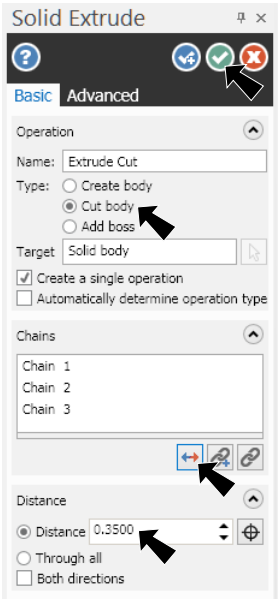


Fig. 38

Step 7. Use **Alt-S** toggle Shading to confirm the hole depth, **Fig. 40**.

Step 8. Save (**Alt-F S**).

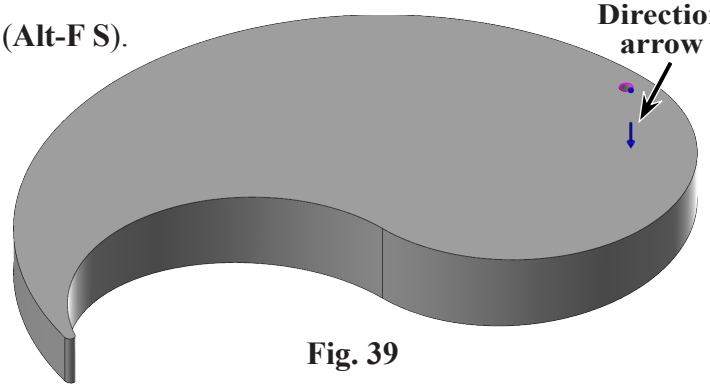


Fig. 39

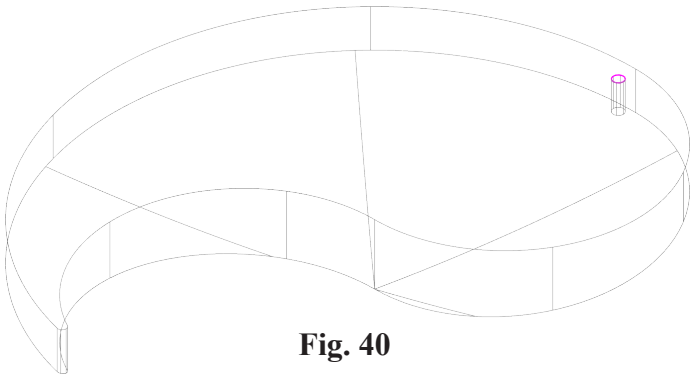


Fig. 40

P. Switch to TOP CUT WCS.

Step 1. Click **WCS** in the Status Bar at the bottom of the graphics area and **Plane Manager** from the menu.

Step 2. Click **Top** in the Plane Manager dialog, **Fig. 41**.

Step 3. Click **Set All** button , **Fig. 41**.

Step 4. Click OK .

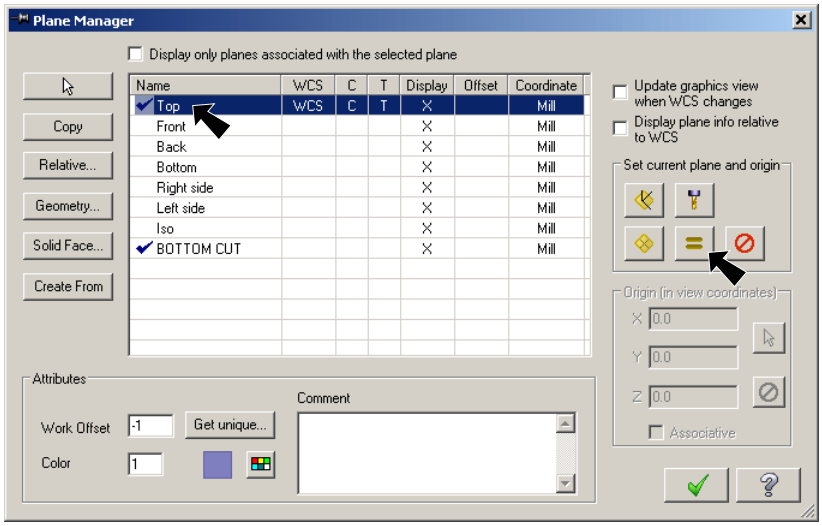


Fig. 41

Q. Translate Solid.

Step 1. Change to Top View (**Alt-1**).

Step 2. Use **F9** to toggle Origin/Axis display on.

Step 3. Click XFORM Menu > Translate.

Step 4. Click the **solid body** to select it and click **End Selection** (**ENTER**) in ribbon bar, **Fig. 42**.

Step 5. In Translate dialog box set:

Select **Move** **Fig. 43**

ΔX **.5**

ΔY **.1**

Click OK .

Click Yes to move defining wire-frame entities, **Fig. 45**.

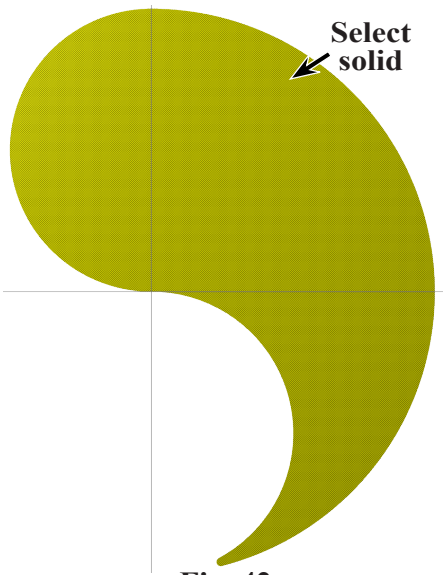


Fig. 42

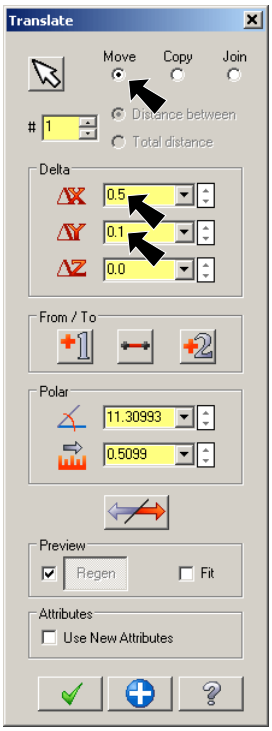


Fig. 43

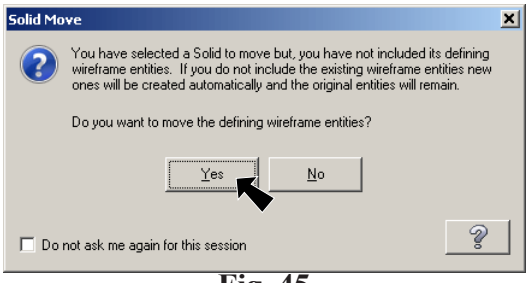


Fig. 45

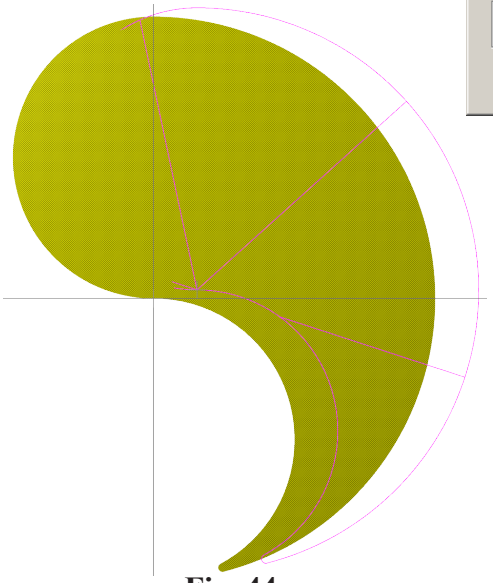


Fig. 44

R. Rotate Solid.

Step 1. Click XFORM Menu > Rotate.

Step 2. Click the **solid body** to select it and click **End Selection** (**ENTER**) in ribbon bar, **Fig. 46**.

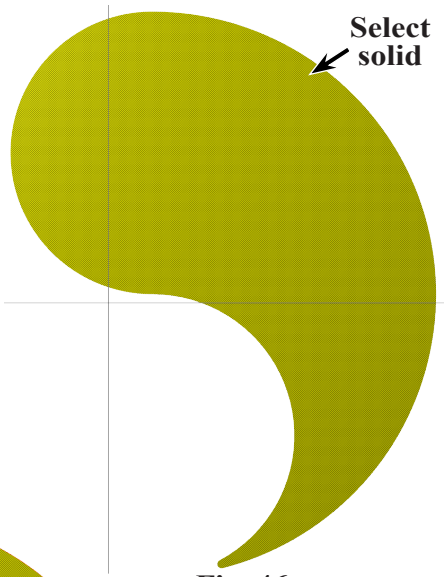


Fig. 46

Step 3. In Rotate dialog box set:

Copy **Fig. 47**

Number of Steps **1**

Rotation Angle **180**

Click OK.

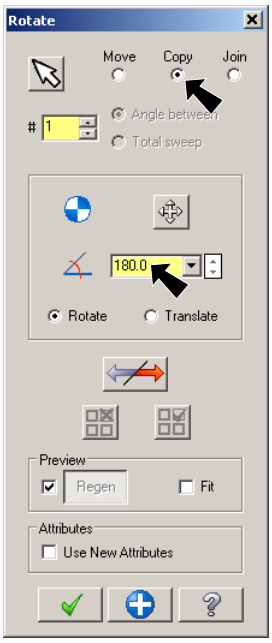


Fig. 47

Step 4. Save (**Alt-F S**).

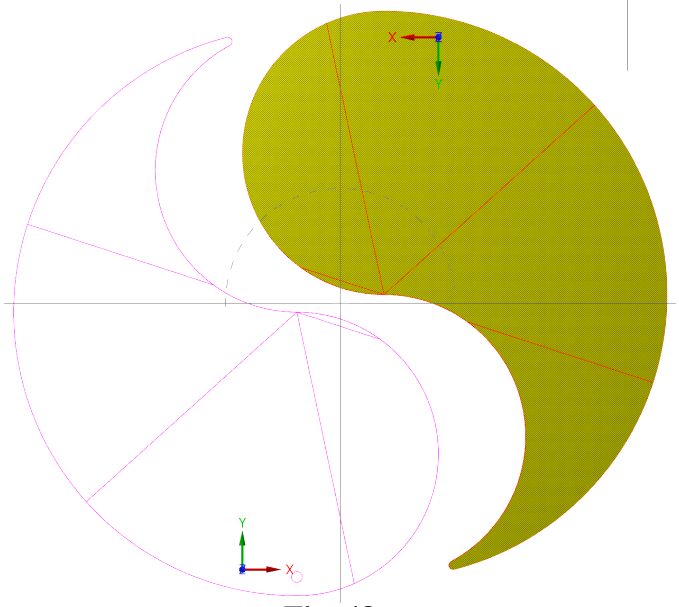


Fig. 48

Fig. 49

S. Machine Type and Stock Setup.

Step 1. Change to Isometric View (**Alt-7**).

Step 2. If necessary, display Toolpaths Manager. Use **Alt-O**.

Step 3. If Machine Group is **not** displayed in the Operations Manager, **Fig. 50**, click MACHINE TYPE Menu > Mill > Default.

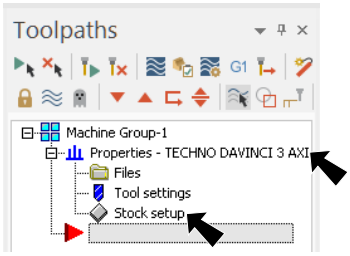


Fig. 50

Step 4. Expand **Properties** in the Toolpaths Manager and click **Stock Setup**, **Fig. 51**.

Step 5. Confirm Stock Plane is **Top**, **Fig. 51**.

Step 6. Confirm **Display** is checked.

Step 7. Key-in for X, Y and Z stock dimensions:
X 8
Y 8
Z .75

Step 8. Confirm Stock Origin coordinates:
X 0
Y 0
Z 0

Step 9. Click OK in the Machine Group Properties.

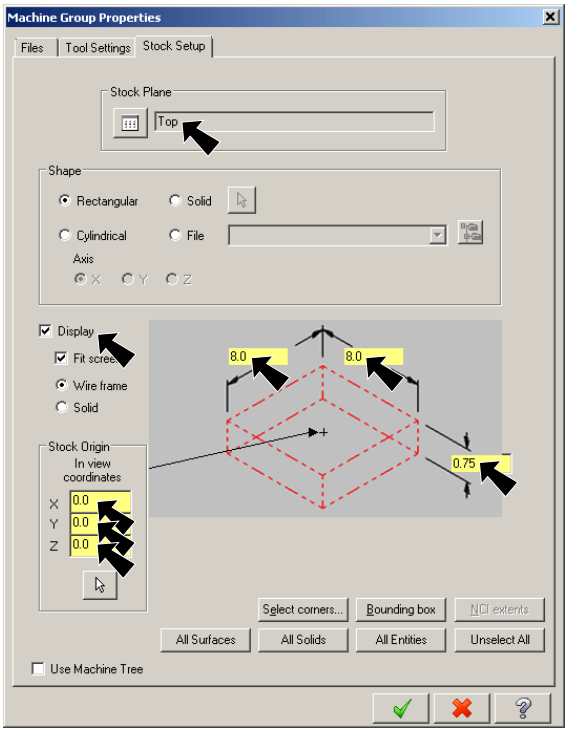


Fig. 51

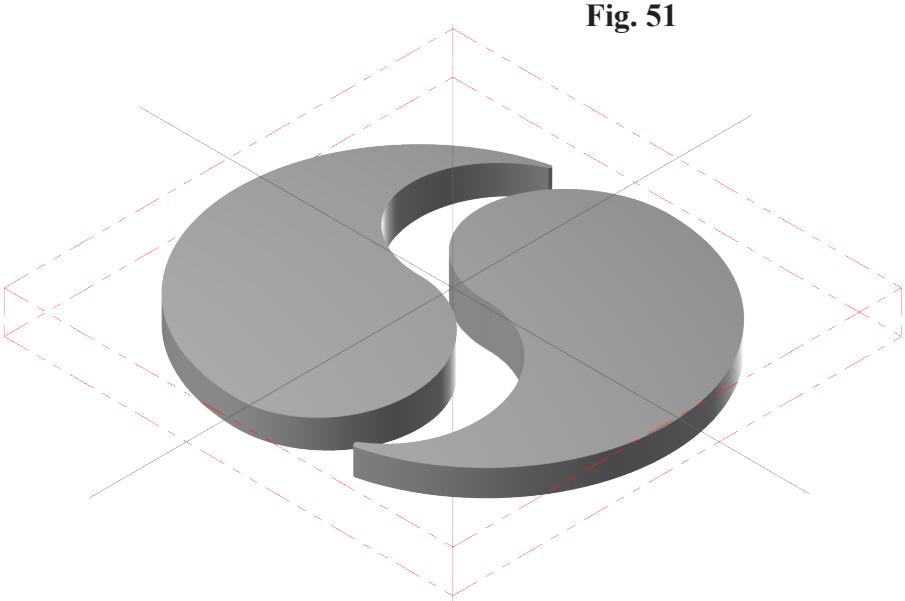


Fig. 52

T. Spiral Toolpath.

Step 1. Click TOOLPATHS Menu > Surface High Speed > **Spiral**.

Step 2. Click OK in the NC name dialog, **Fig. 53**.

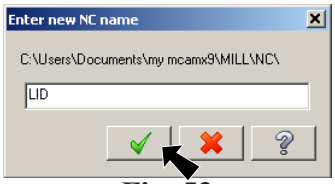


Fig. 53

Step 3. Click the **right solid body** to select as Drive Surfaces, **Fig. 54**. The solid will highlight when selected.

Step 4. Click **End Selection** (**ENTER**) in ribbon bar to accept solid as drive surfaces.

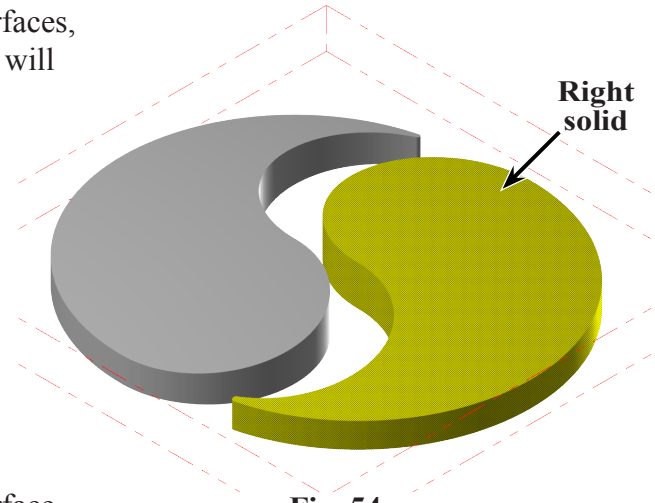


Fig. 54

Step 5. Click OK in the Toolpath/surface selection dialog box, **Fig. 55**.

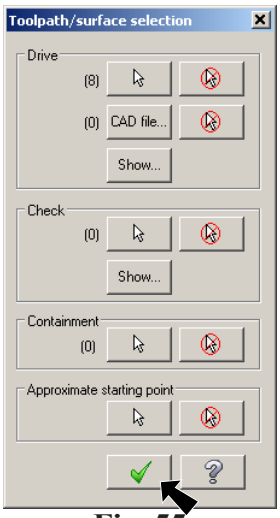


Fig. 55

Step 6. Select **Toolpath Type** from the tree control and confirm: **Spiral toolpath** **Drive surfaces** **Fig. 56**.

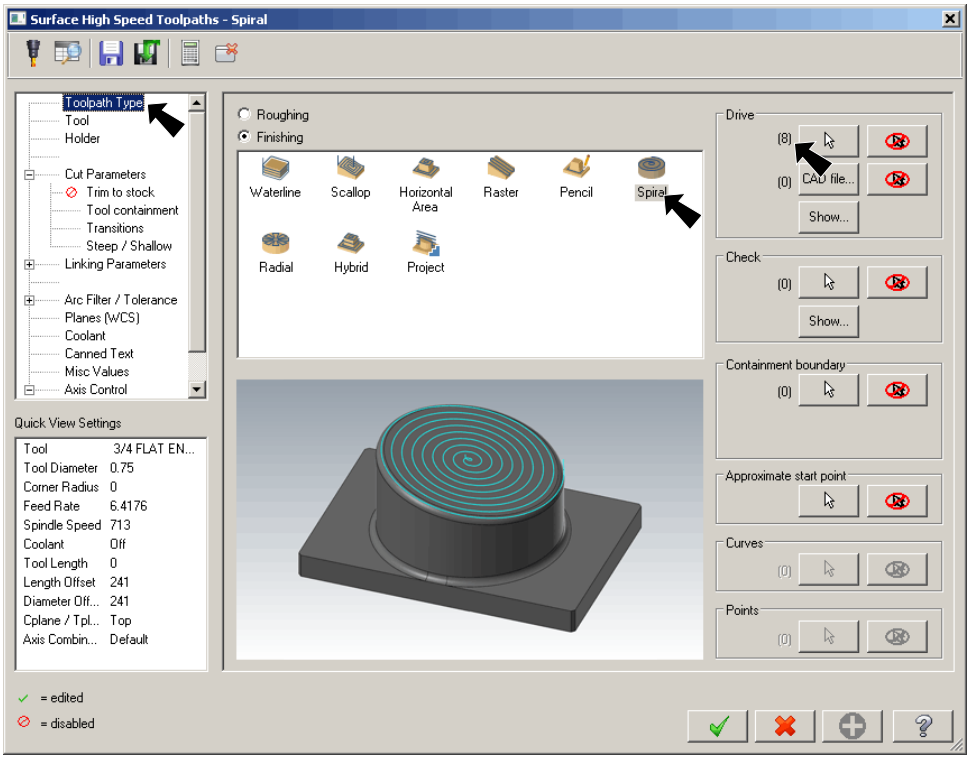


Fig. 56

Step 7. Select **Tool** from the tree control and:

click **Select library tool** button **Fig. 57**.

Step 8. Click **Filter** button **Fig. 58**.

Step 9. Click **None** button under **Tool Types** **Fig. 59**.

Step 10. Click **End-mill2 Sphere** button (second button top row) and click OK, **Fig. 59**.

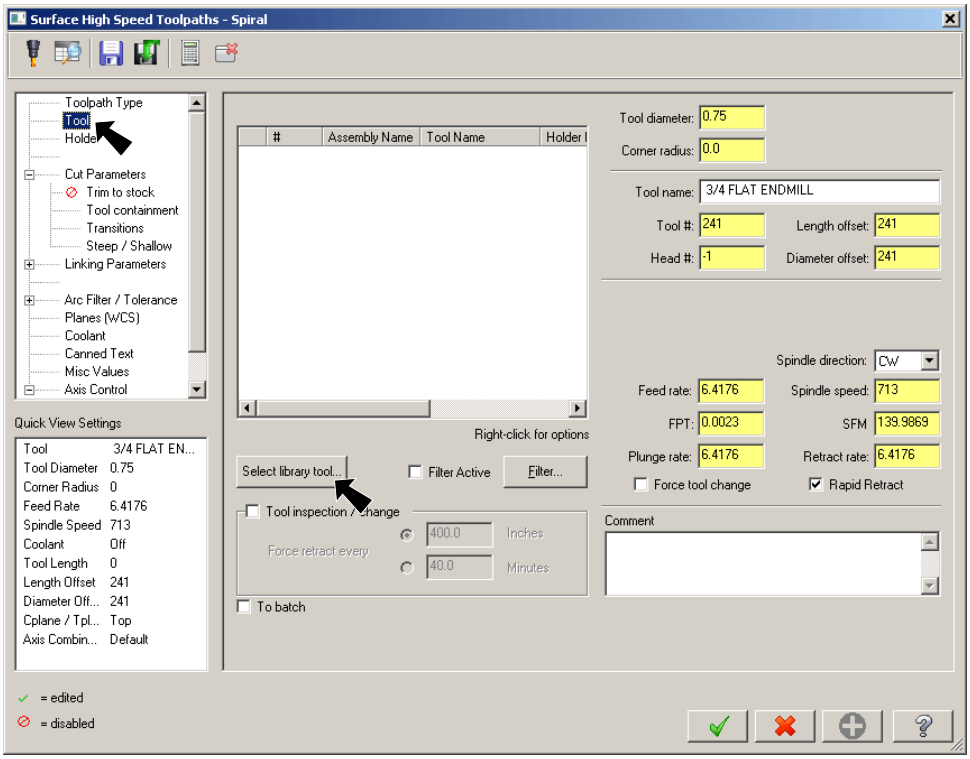


Fig. 57

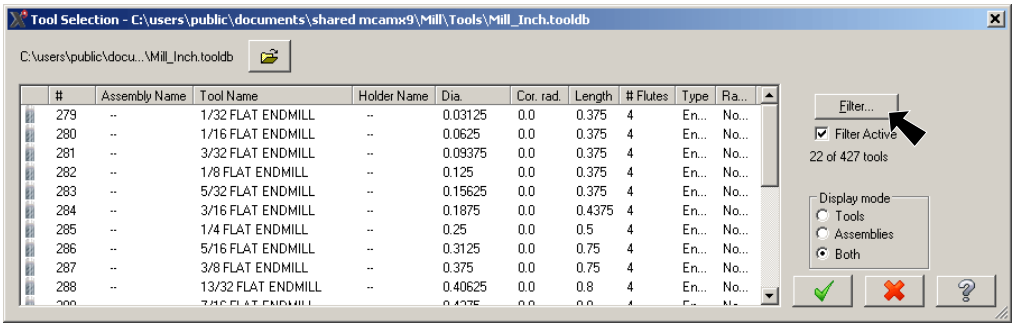


Fig. 58

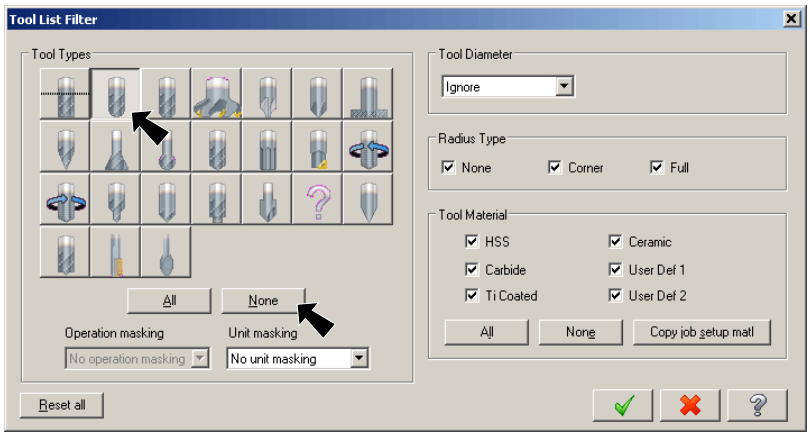


Fig. 59

Step 11. Click **307 1/4 BALL ENDMILL** and click OK **Fig. 60**.

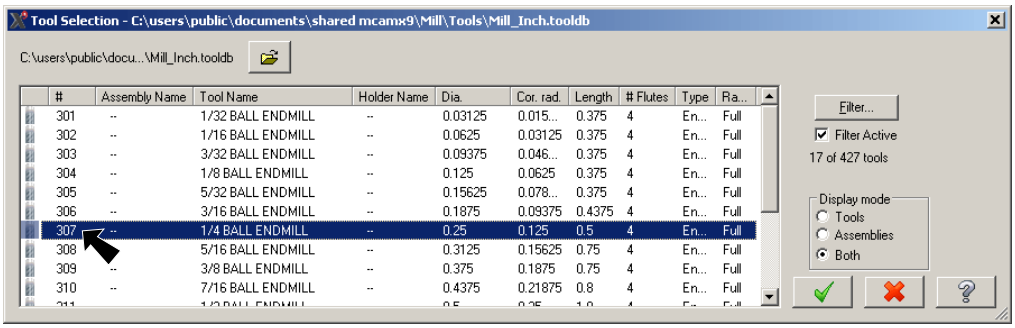


Fig. 60

Step 12. Back in **Tool** page set:
Feed rate 40

Plunge rate 20
Fig. 61.

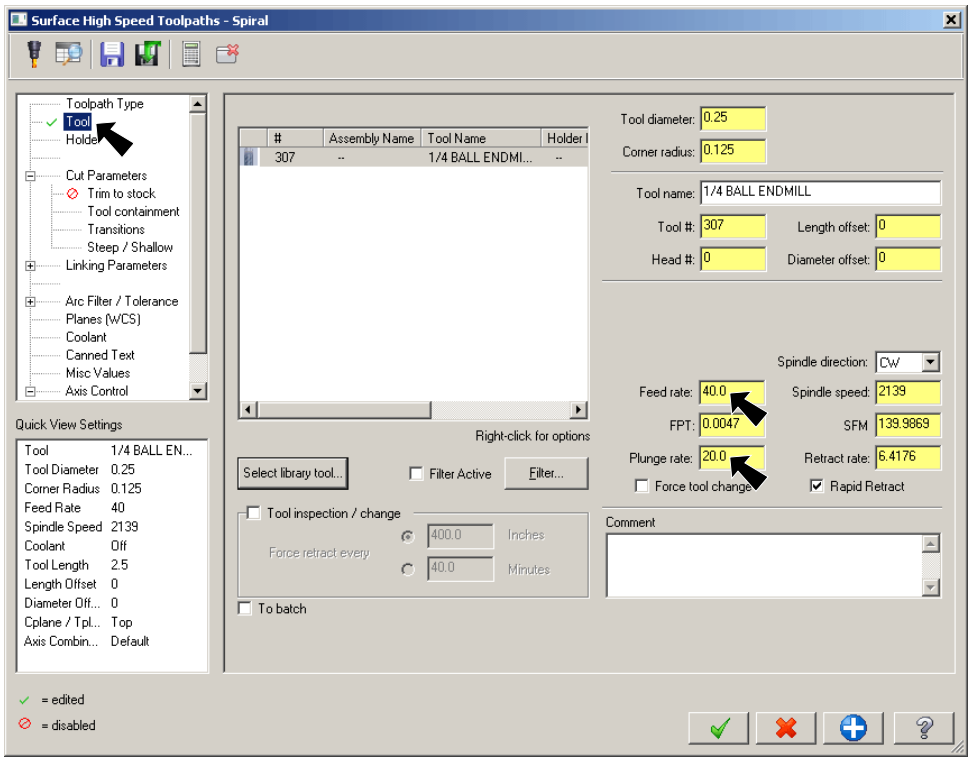


Fig. 61

Step 13. Select **Cut Parameters** from tree control and set:

Cut method One Way

Stepover .09

Click **Define Center Point** Button **Fig. 62**

Click **geometry original Origin (intersection of the two circles) in right Lid**, **Fig. 63**.

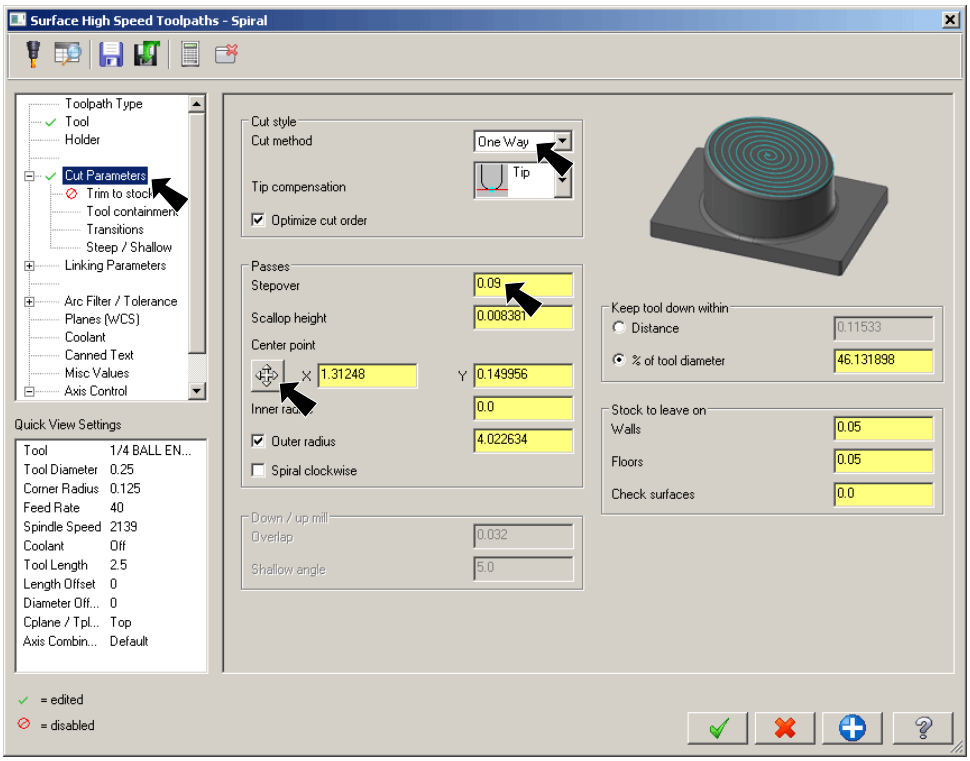


Fig. 62

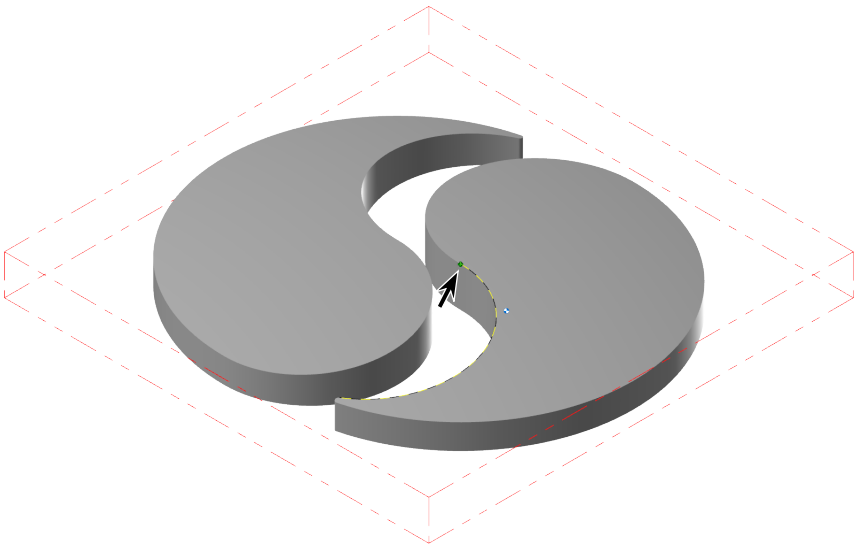


Fig. 63

Step 13. Back in **Cut Parameters** set:

Confirm **X .5 Y .1**

Keep tool down within 80%

Stock to leave on Walls and Floors 0
Fig. 64.

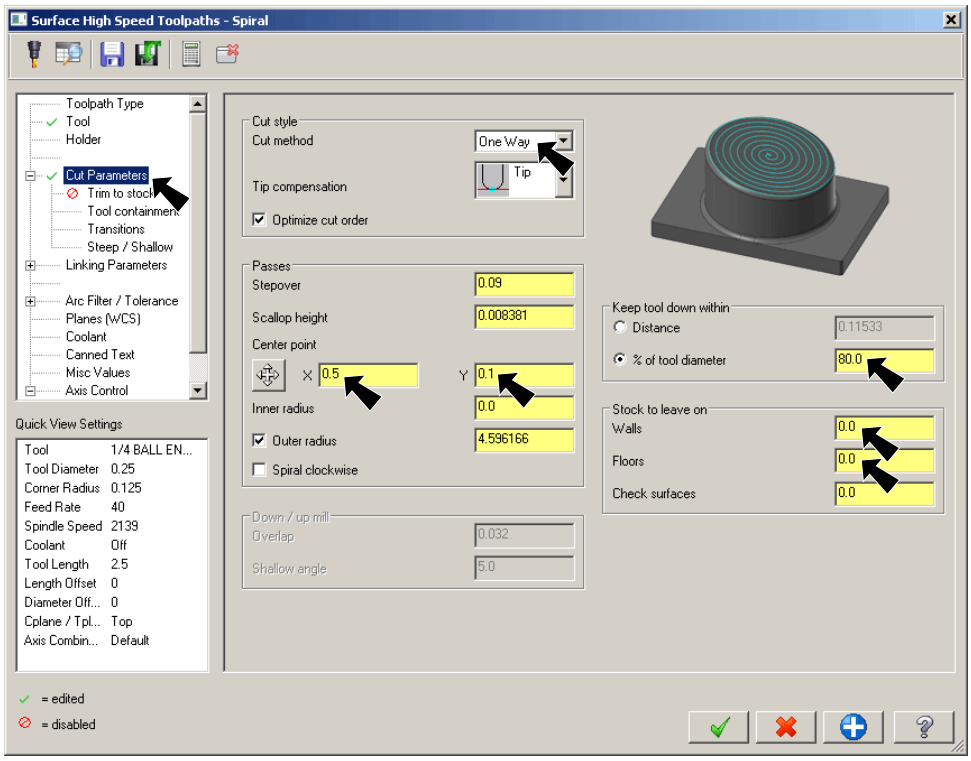


Fig. 64

Step 14. Select **Steep/ Shallow** from tree control and set:

Check **Use Z depths**
Minimum 0
Maximum -.3

Click **Apply**

Fig. 65.

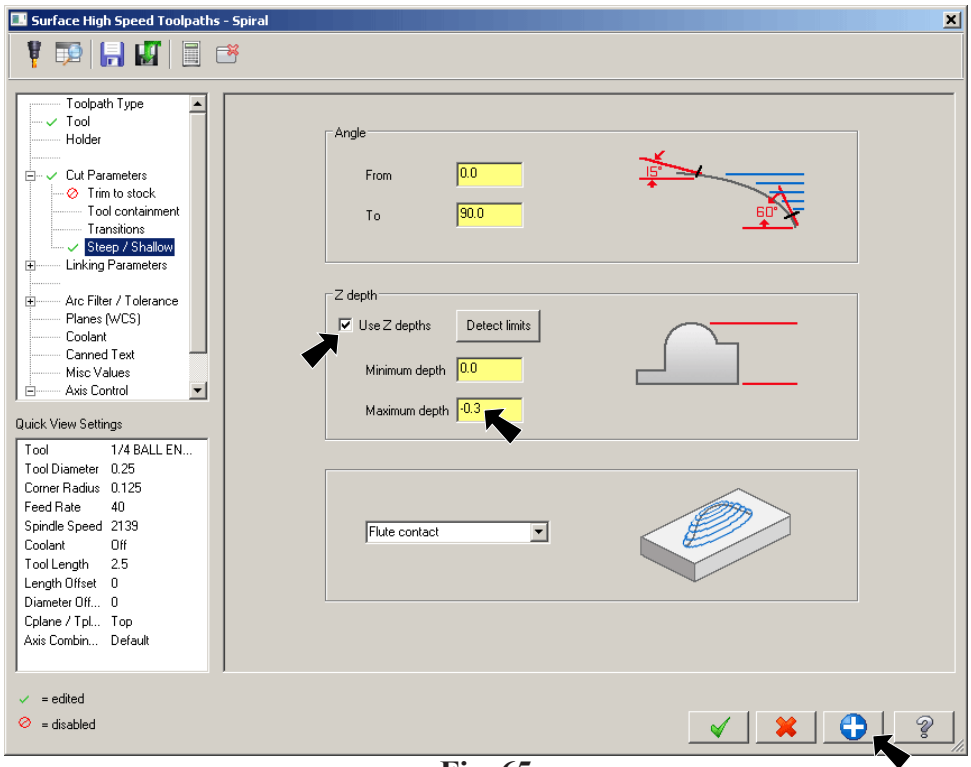


Fig. 65

Step 15. Select **Linking Parameters** from tree control and set:

Clearance plane .5

All Leads 0
Fig. 66.

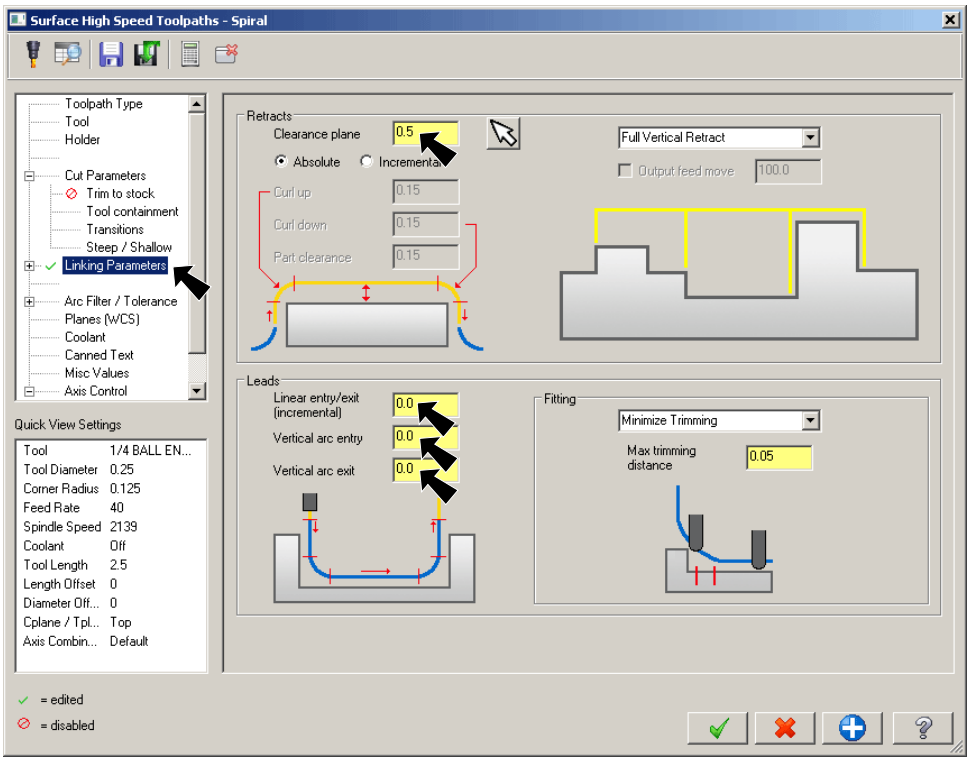


Fig. 66

Step 16. Click OK in Surface High Speed Toolpaths - Spiral dialog box.

Step 17. Allow Mastercam to calculate toolpath.

Step 18. Save (**Alt-F S**).

U. Verify Toolpath.

Step 1. Click **Verify** in the Toolpaths Manager.

Step 2. Click **Play** (**R**) in VCR bar.

Step 3. Switch back to Mastercam (**Alt-Tab**).

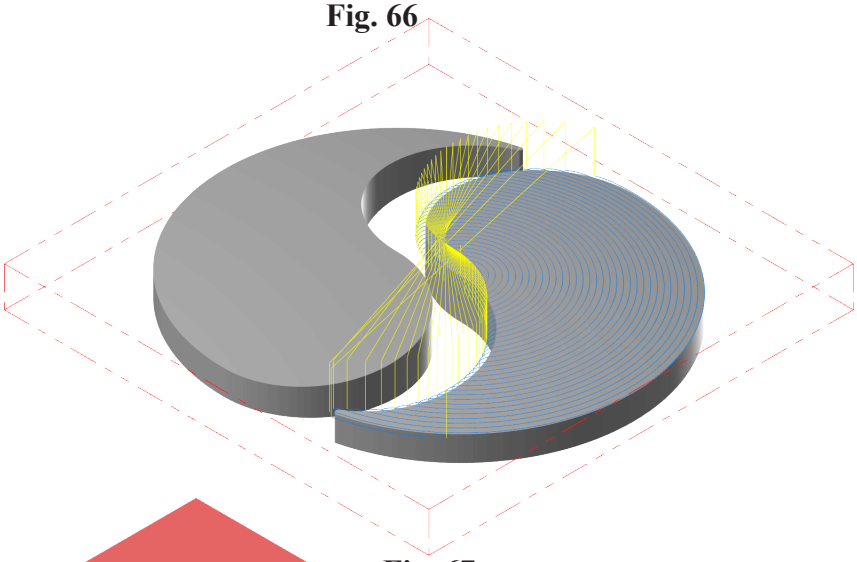


Fig. 67

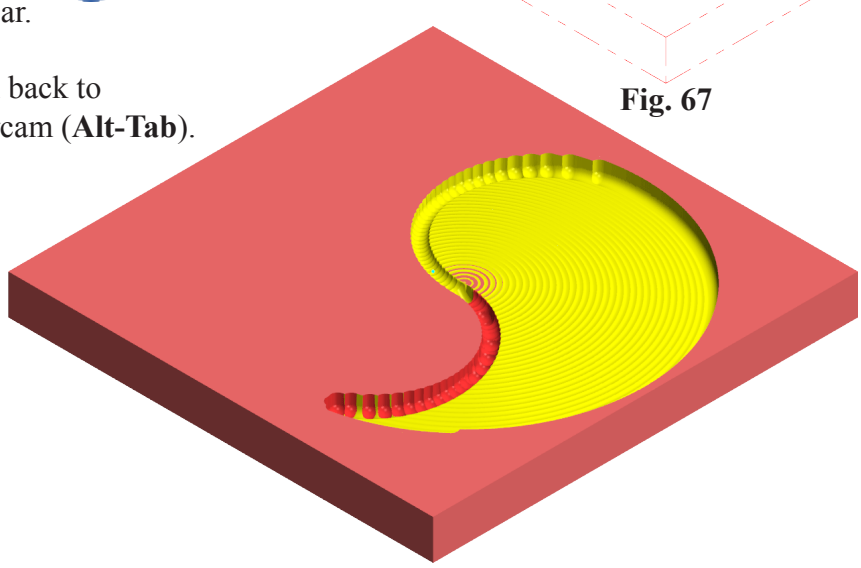


Fig. 68

V. Copy Spiral Toolpath.

Step 1. Copy Spiral toolpath in the Toolpaths Manager. To copy, click to select toolpath, **Fig. 69**.
Then, use **Ctrl-C** and **Ctrl-V**, **Fig. 70**.

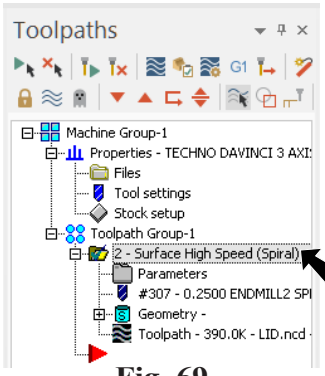


Fig. 69

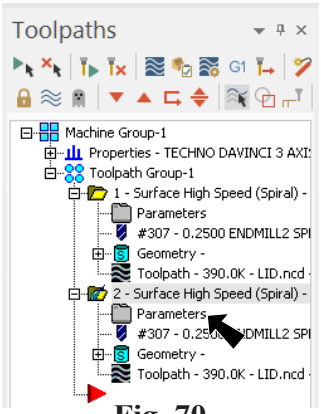
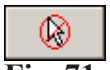


Fig. 70

Step 2. Expand copied Surface High Speed Spiral toolpath and click **Parameters**, **Fig. 70**.

Step 3. Select **Toolpath type** from the tree control and:

Click **Remove selected drive surfaces**  **Fig. 71**.

Click **Drive surfaces** **Fig. 71**.

Click the **left Lid**, **Fig. 72**.

Click **End Selection** **(ENTER)** in ribbon bar to accept solid as drive surfaces.

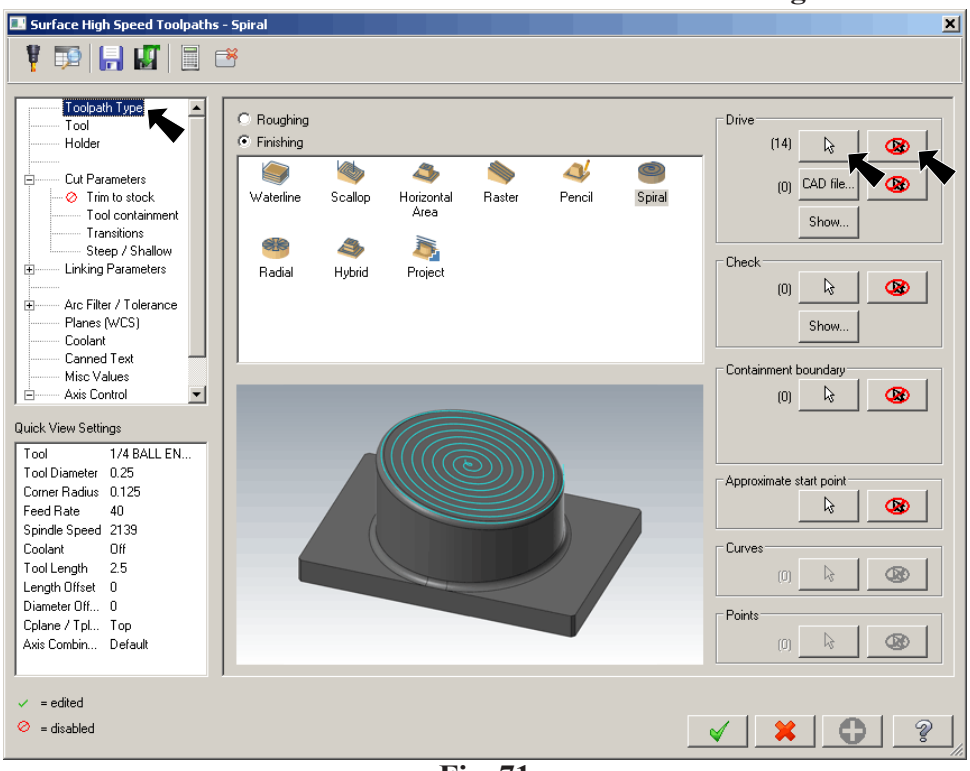


Fig. 71

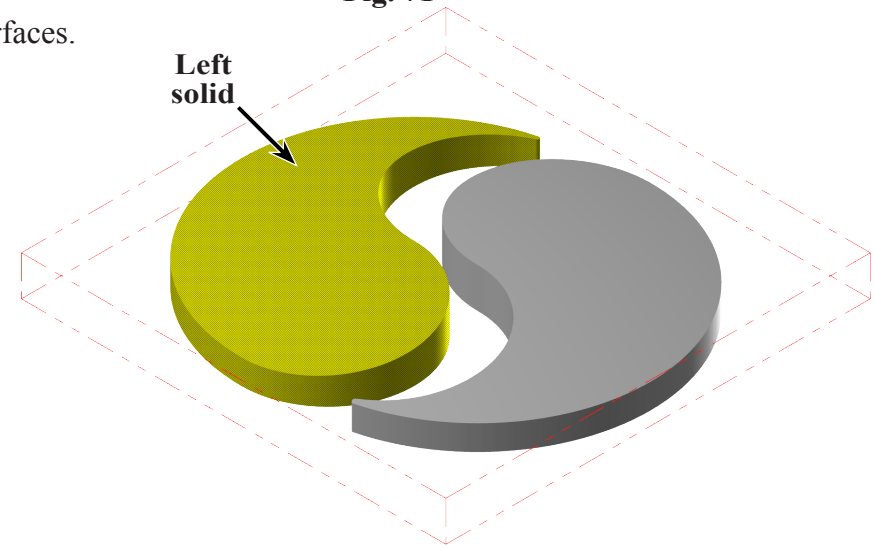


Fig. 72

Step 4. Select **Cut Parameters** from tree control and set:

Click **Define Center Point** Button **Fig. 73**.

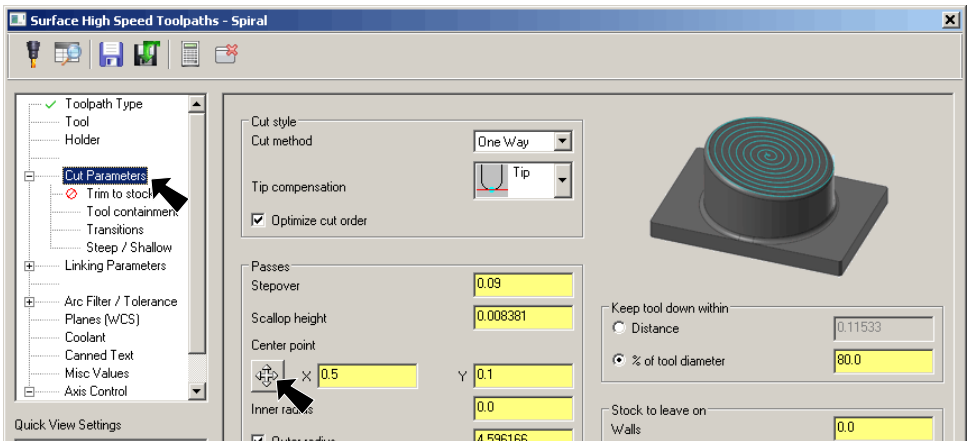


Fig. 73

Click **geometry Origin (intersection of the two circles) in left Lid Fig. 74**.

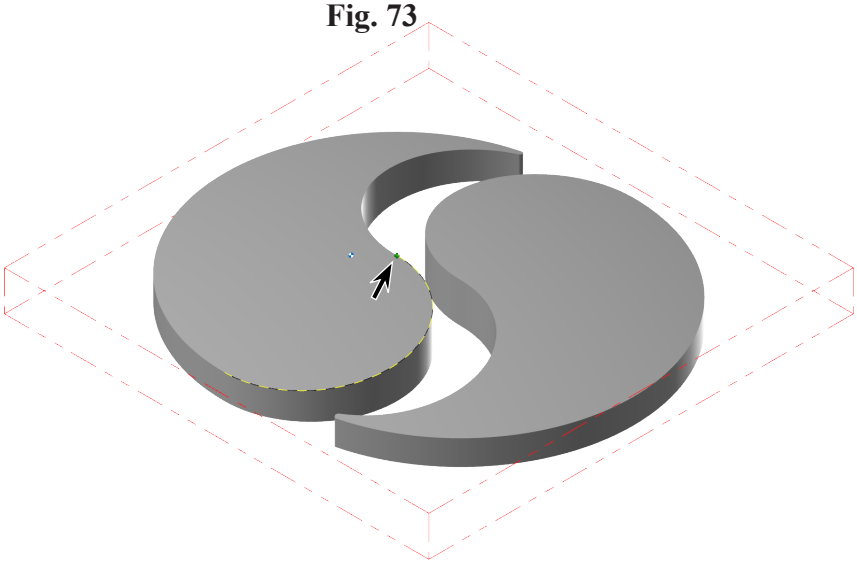


Fig. 74

Confirm **X -.5 Y -.1 Fig. 75**.

Step 5. Click OK in Surface High Speed Toolpaths - Spiral dialog box.

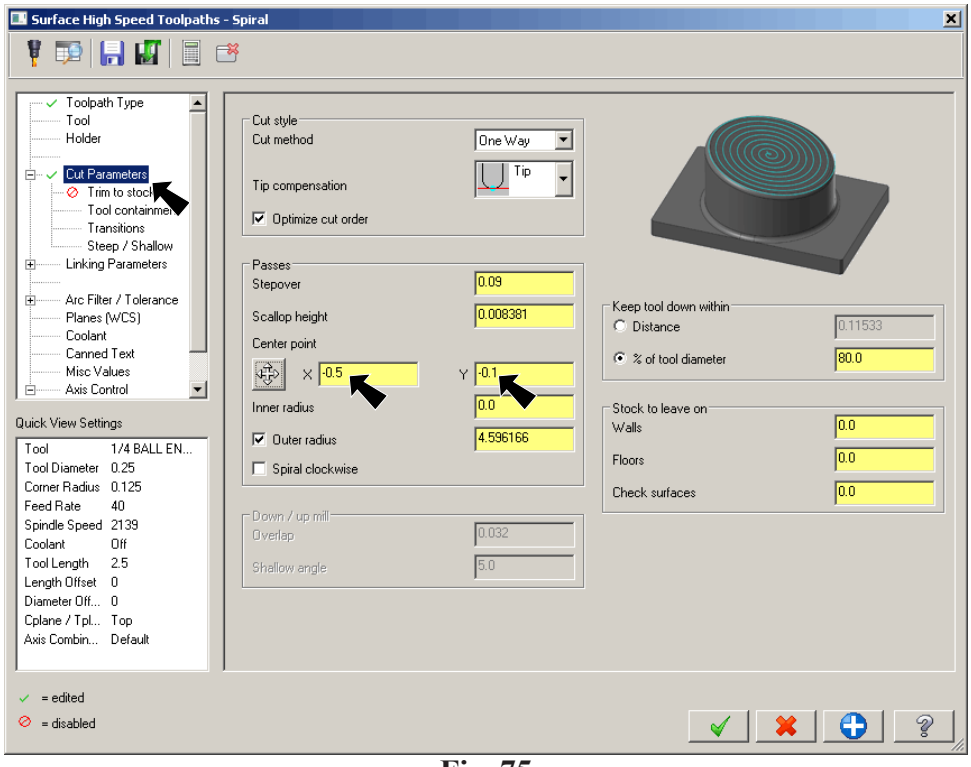


Fig. 75

Step 6. In the Toolpaths Manager, click **Regenerate all selected operations** , **Fig. 76**.

Step 7. Save **(Alt-F S)**.

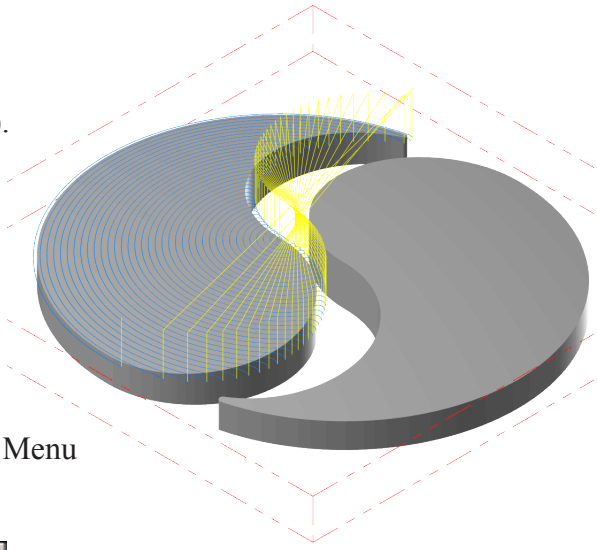


Fig. 77

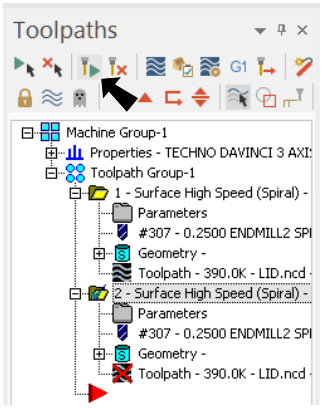


Fig. 76

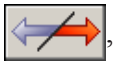
W. Contour Toolpath.

Step 1. Use **Alt-T** to turn off toolpath display.

Step 2. Click TOOLPATHS Menu > **Contour**.

Step 3. Click **Solids** in Chaining dialog box and select **Loop** , **Fig. 78**.

Step 4. Click **bottom edge of right Lid solid**, **Fig. 79**. If the wrong edge is selected, click **Other face** in Pick Reference Face dialog box, **Fig. 80**. Click OK in Pick Reference Face dialog box.

Step 5. The chain arrow should point **clockwise** around the chain, **Fig. 81**. If chaining directions arrow is pointing in the opposite direction - click Reverse  , **Fig. 78**.

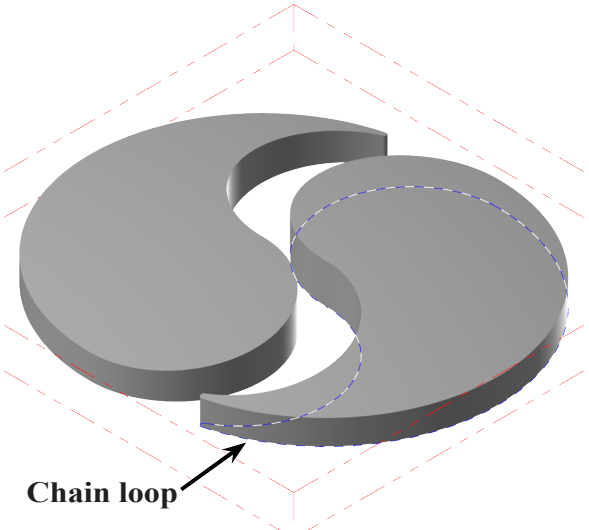


Fig. 79

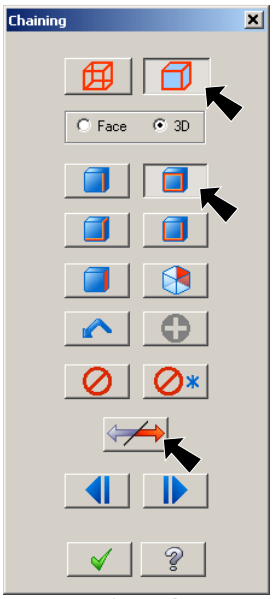


Fig. 78

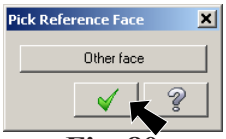


Fig. 80

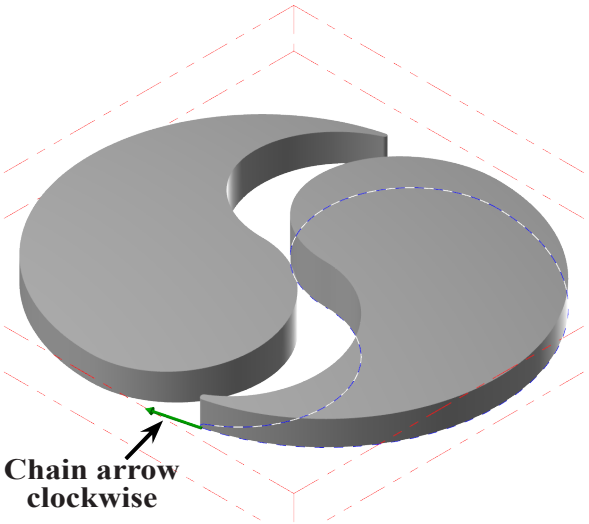


Fig. 81

Step 6. Click **bottom edge of left Lid solid**, **Fig. 82**. If the wrong edge is selected, click **Other face** in Pick Reference Face dialog box, **Fig. 83**. Click OK in Pick Reference Face dialog box.

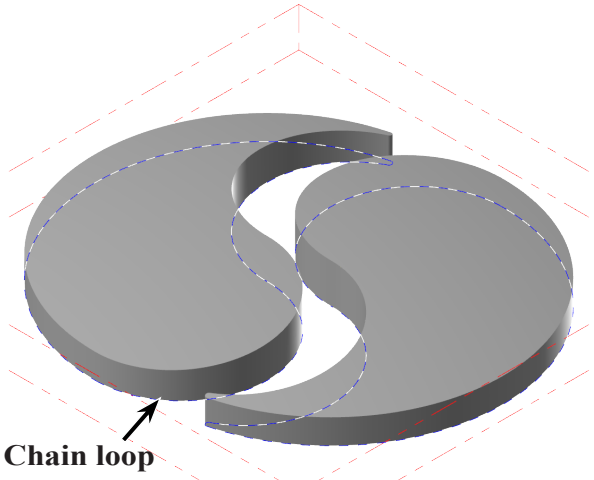


Fig. 82

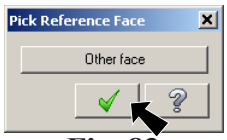


Fig. 83

Step 7. The chain arrow should point **clockwise** around the chain, **Fig. 84**. If chaining directions arrow is pointing in the opposite direction - click Reverse , **Fig. 85**.

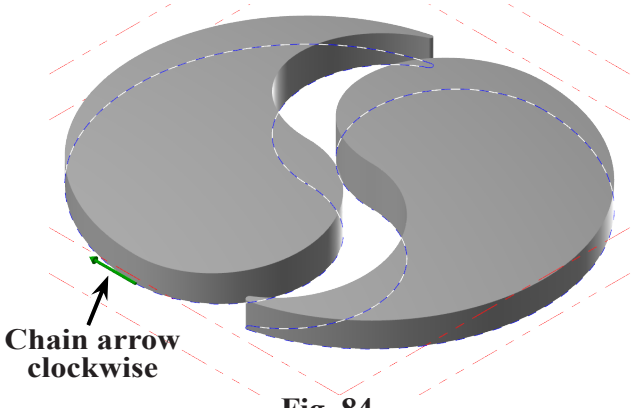


Fig. 84

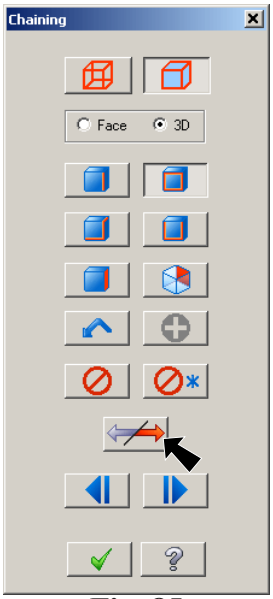


Fig. 85

Step 8. Click OK in Chaining dialog box, **Fig. 85**.

Step 9. In the 2D Toolpaths Contour dialog box confirm **2 Chains** are selected, **Fig. 86**.

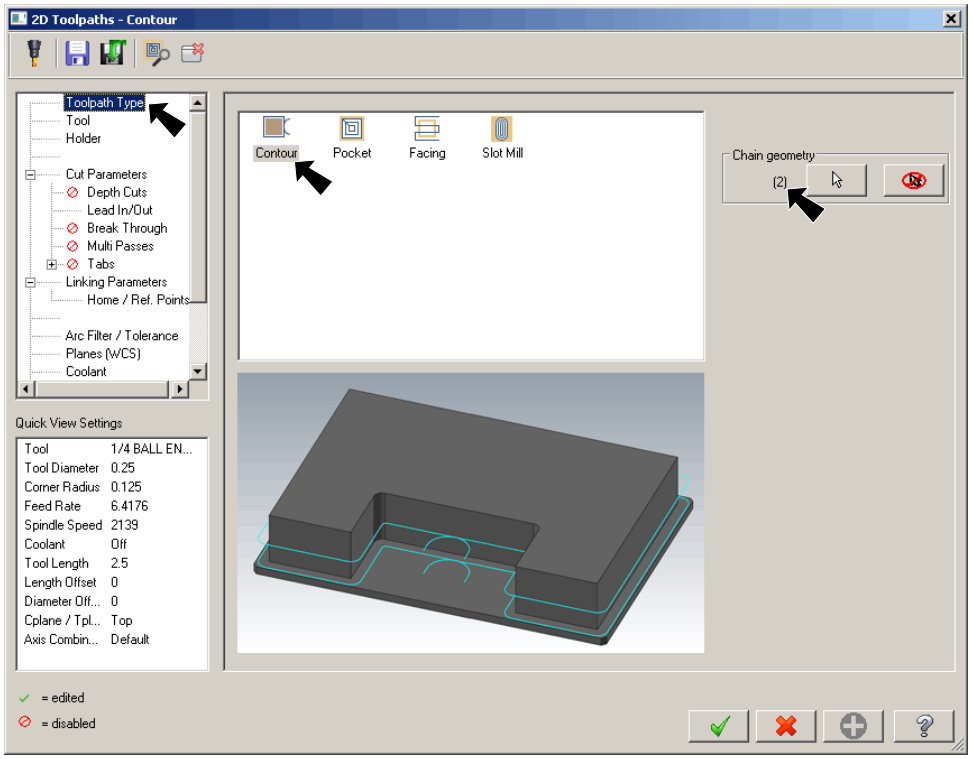


Fig. 86

Step 10. Select **Tool** from the tree control and:

click **Select library tool** button, **Fig. 87**.

Step 11. Use the Filter button to filter EndMill Flat and select **285 1/4 FLAT ENDMILL** and click OK, **Fig. 88**.

Step 12. Select **Tool** from the tree control and set: **Feed rate 40**

Plunge rate 20 **Fig. 89**.

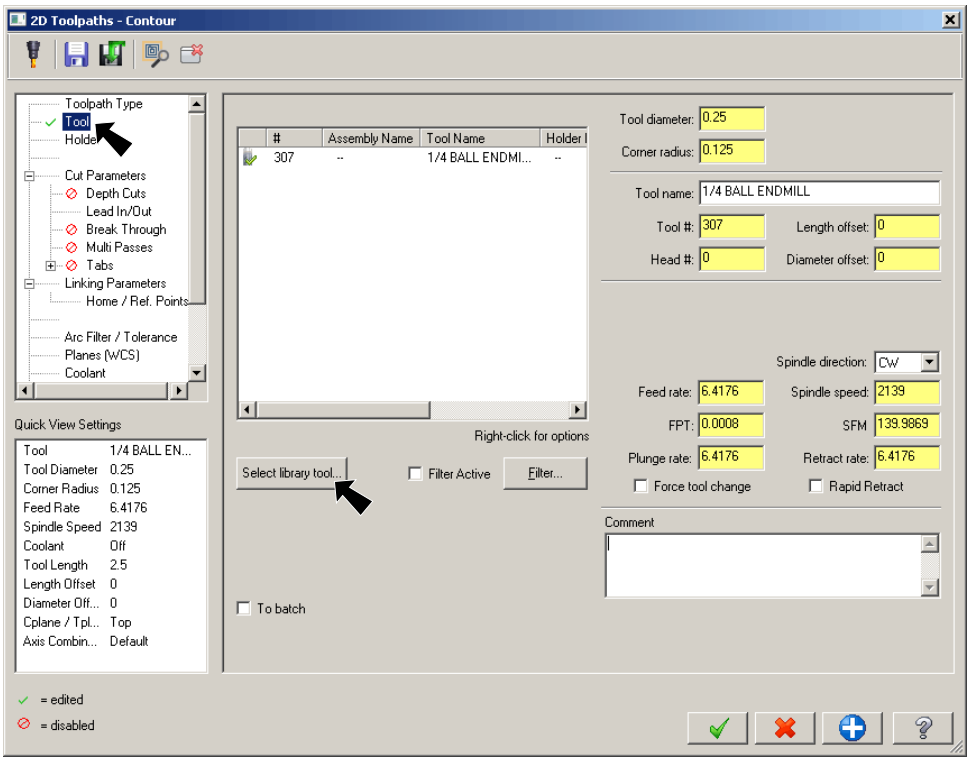


Fig. 87

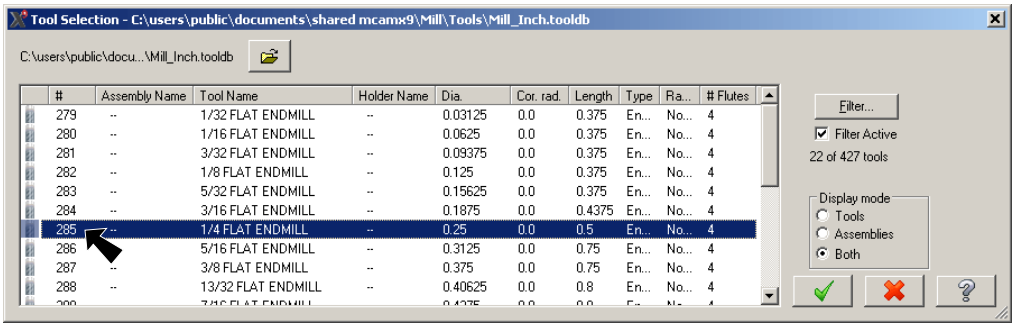


Fig. 88

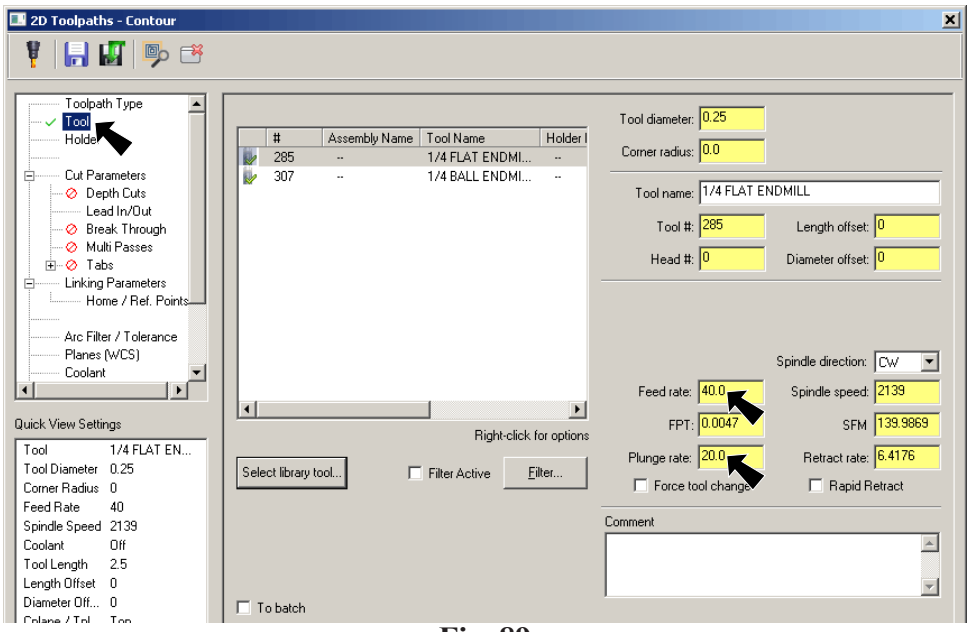


Fig. 89

Step 13. Select **Cut Parameters** from tree control and set:

Compensation type Wear

Compensation direction Left

Tip comp: Tip

Stock to leave on Walls and Floors 0
Fig. 90.

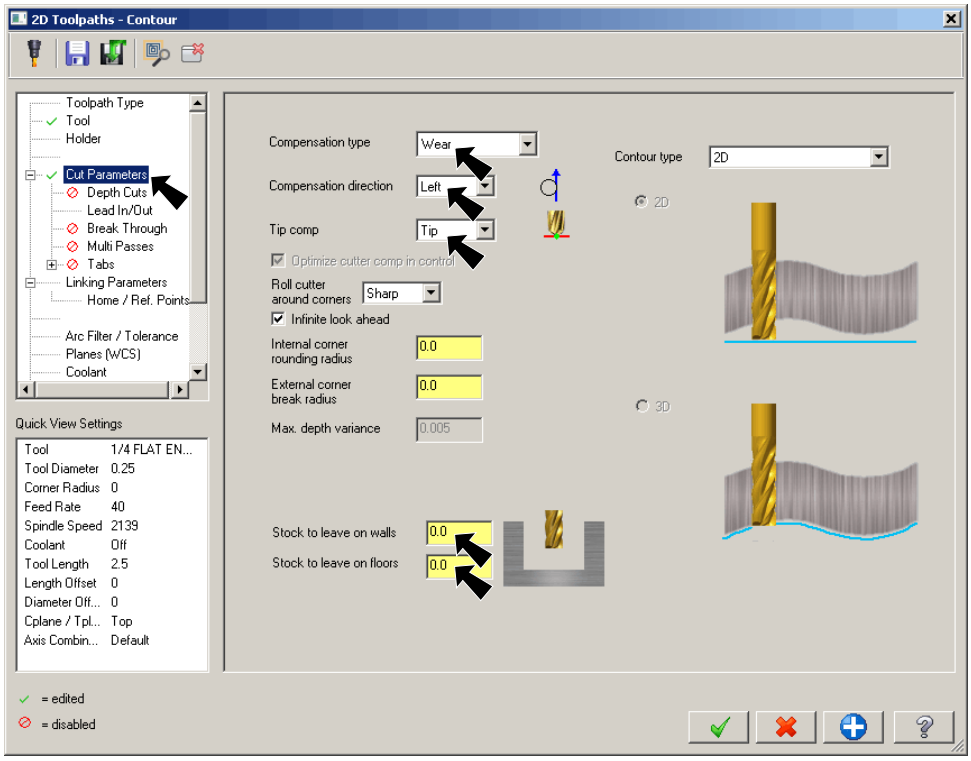


Fig. 90

Step 14. Select **Depth Cuts** from tree control and set:

Check **Depth cuts**

Max rough step .2

Check **Keep tool down**
Fig. 91.

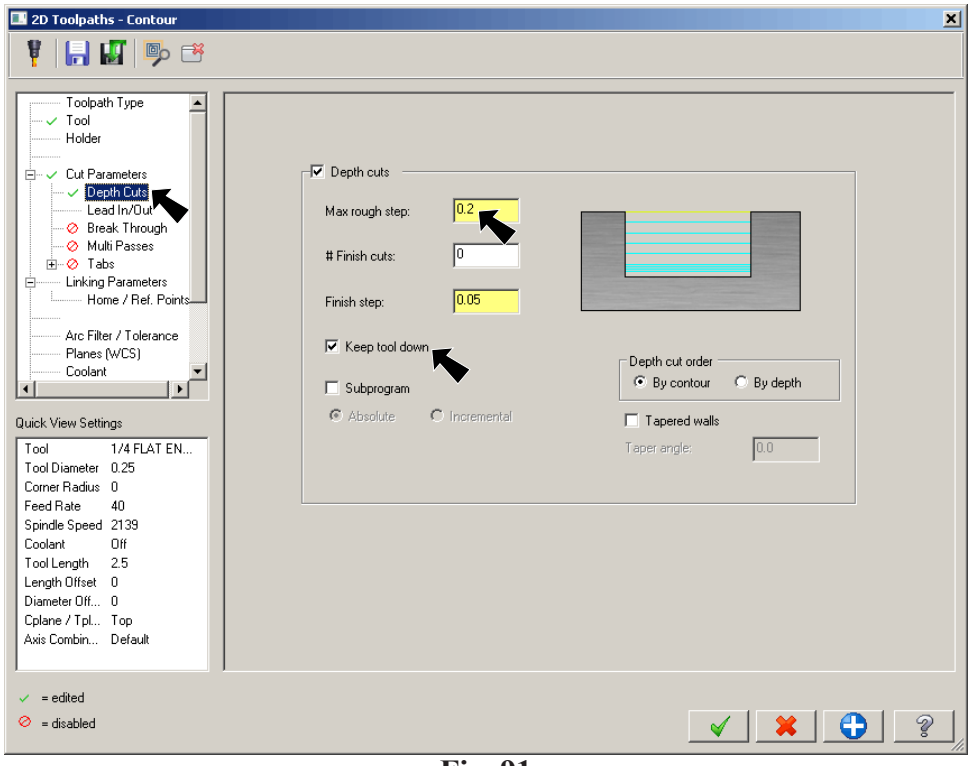


Fig. 91

Step 15. Select **Lead In/Out** from tree control and set:

Uncheck **Lead In/Out** **Fig. 92**.

Step 16. Select **Break Through** from tree control and set:

Check **Break through**

Break through amount .01 **Fig. 93**.

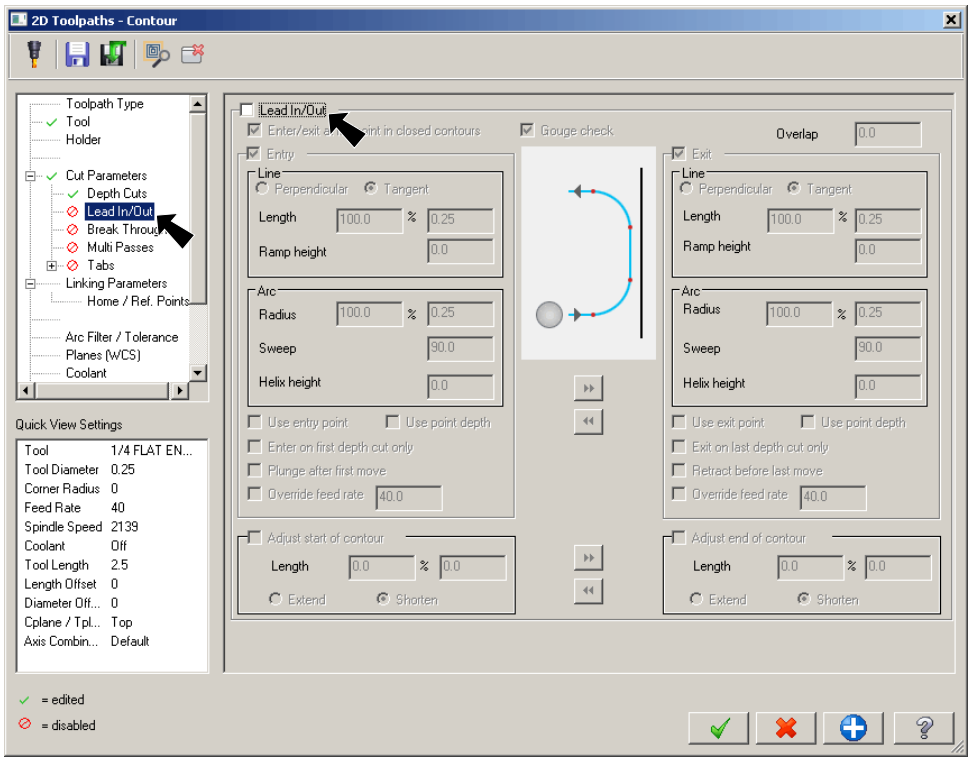


Fig. 92

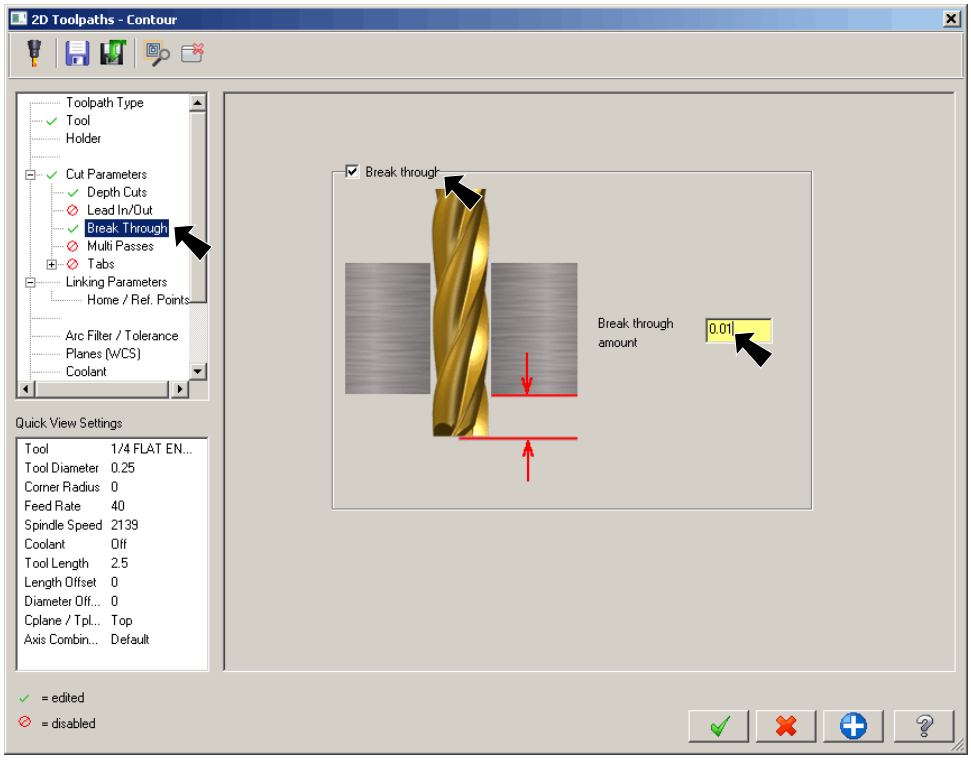


Fig. 93

Step 17. Select **Linking Parameters** from tree control and set:

Depth 0
Fig. 94.

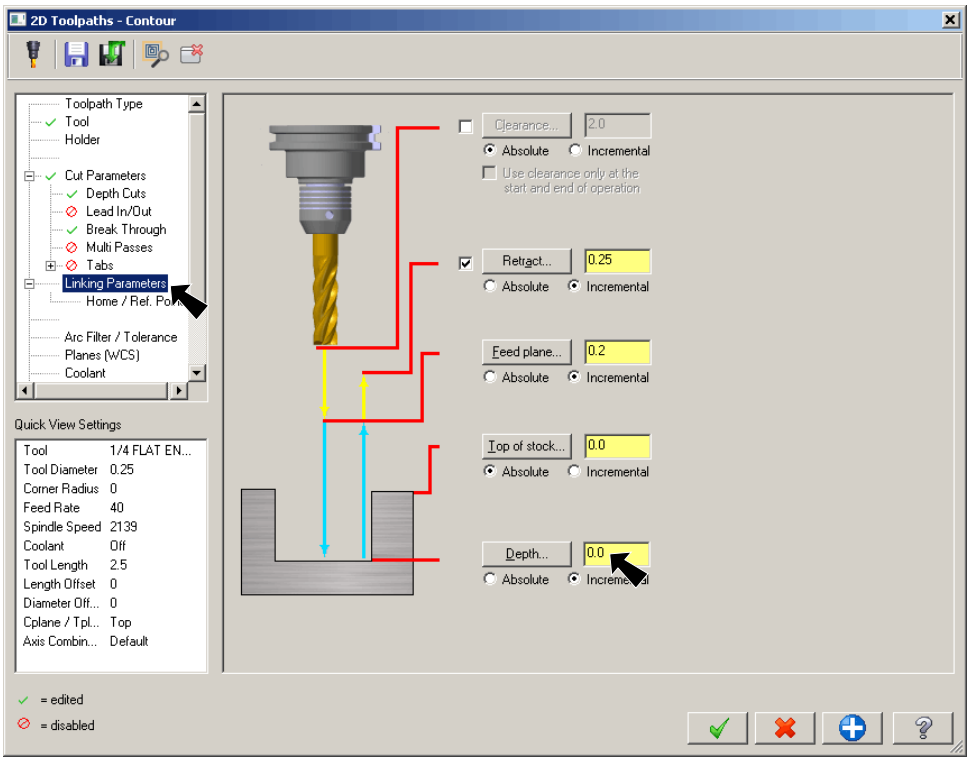


Fig. 94

Step 18. Click OK .

Step 19. Save (**Alt-F S**).

X. Verify Toolpath.

Step 1. Click **Toolpath Group-1** in the Toolpaths Manager to select **all three toolpaths**, **Fig. 95**.

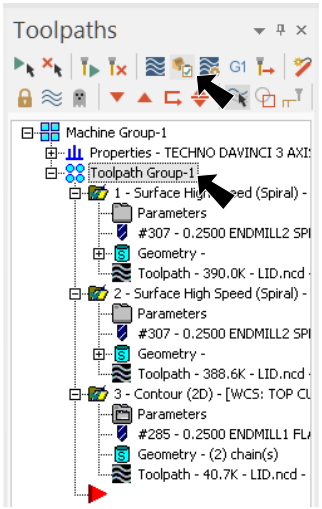


Fig. 95

Step 2. Click **Verify** in the Toolpaths Manager, **Fig. 95**.

Step 4. Click **Play** (**R**) in VCR bar along bottom of the window.

Step 5. Note **Total Time** to run program under Toolpath Info in the Move List panel (**roughly 14.5 minutes**), **Fig. 96**.

Step 6. Switch back to Mastercam (**Alt-Tab**).

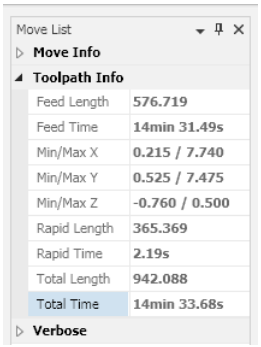


Fig. 96

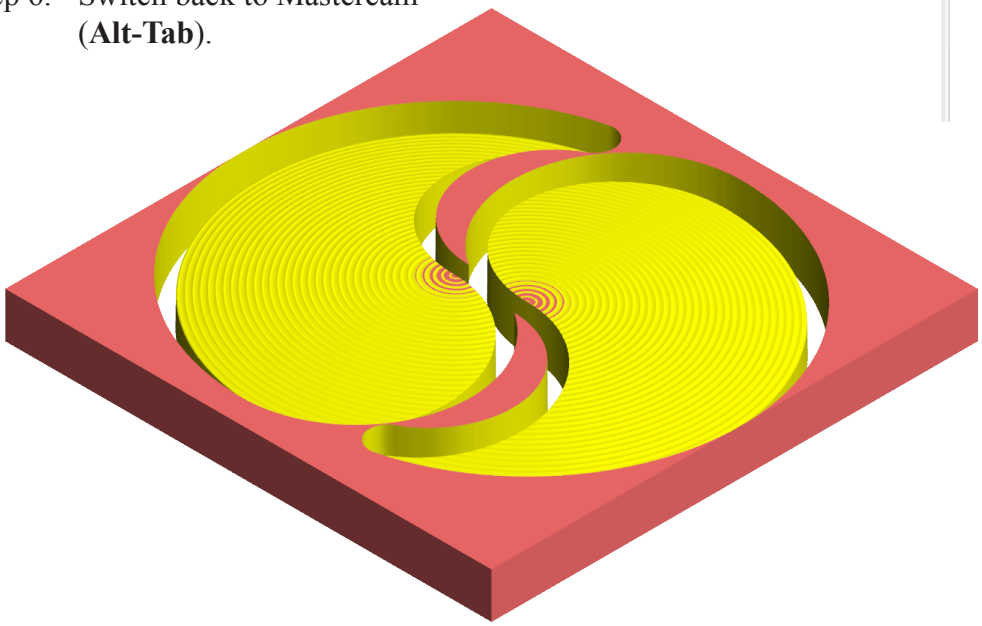


Fig. 97

Y. Switch to BOTTOM CUT WCS.

Step 1. Use **Alt-T** to turn off tool-path display.

Step 2. Click **WCS** in the Status Bar at the bottom of the graphics area and **Plane Manager** from the menu.

Step 3. Click **BOTTOM CUT** in the Plane Manager dialog, **Fig. 98**.

Step 4. Click **Set All** button , **Fig. 98**.

Step 5. Click OK .

Step 6. Change to Isometric View (**Alt-7**).

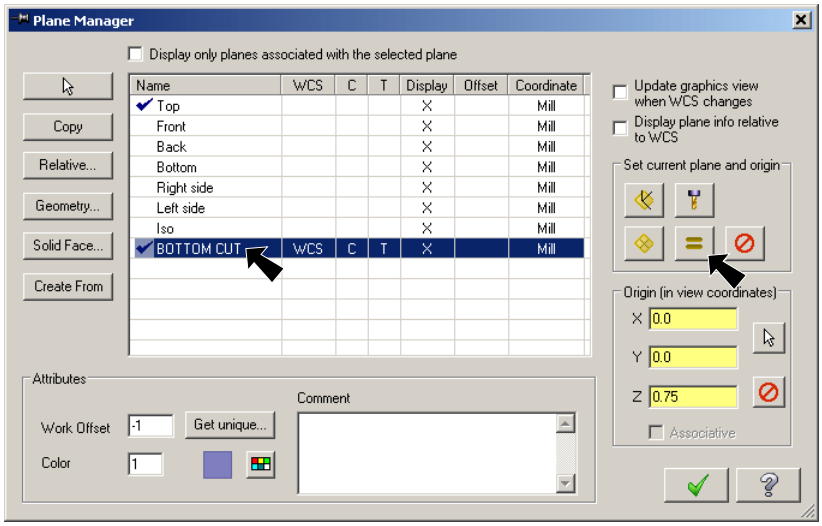


Fig. 98

Z. FBM Drill Toolpath Right Lid.

Step 1. Click TOOLPATHS Menu > **FBM Drill**.

Step 2. Click the **right Lid solid**, **Fig. 99**.

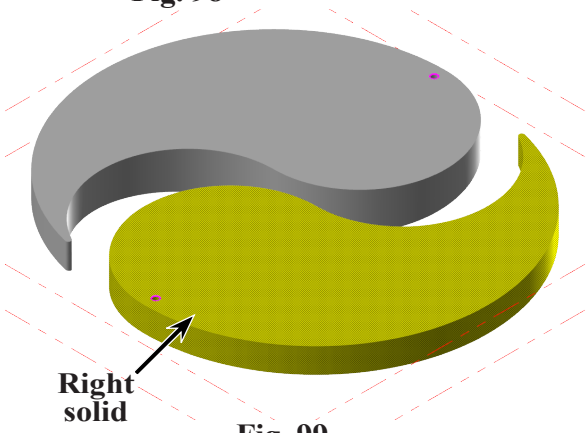


Fig. 99

Step 3. Select **Hole Detection** from the tree control and set:

Uncheck **Limit search to plane** **Fig. 100**.

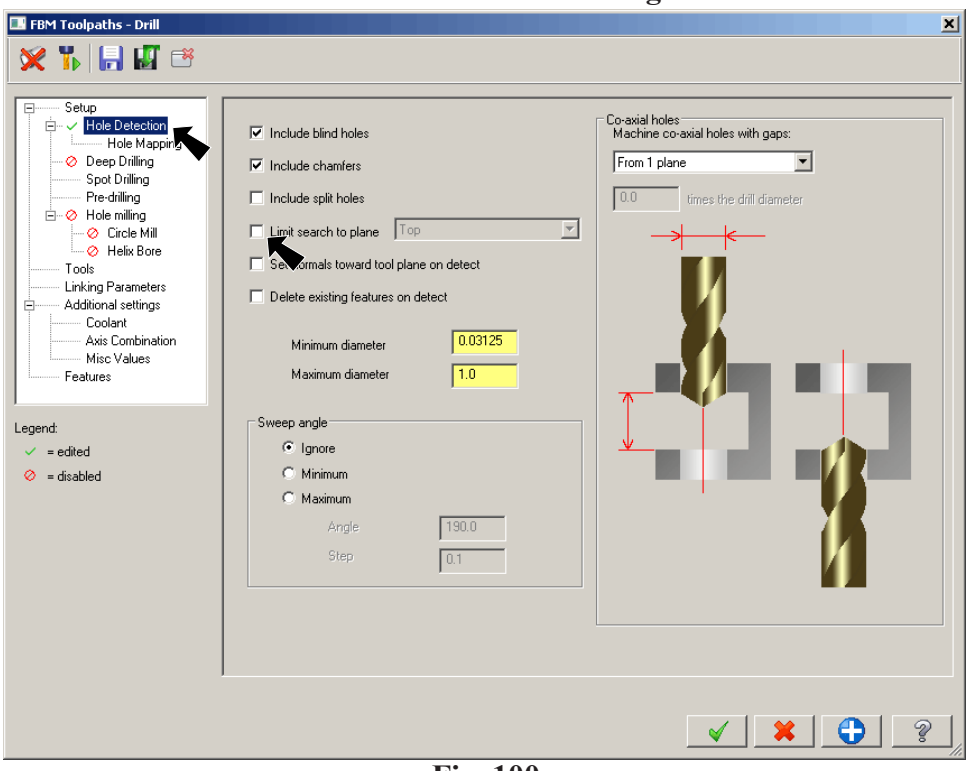


Fig. 100

Step 4. Select **Spot Drilling** from the tree control and uncheck **Spot Drilling** check box, **Fig. 101**.

Step 5. Select **Pre-drilling** from the tree control and uncheck **Pre-drilling** check box, **Fig. 102**.

Step 6. Click **Detect** button at the top of the dialog box to find the holes, **Fig. 102**.

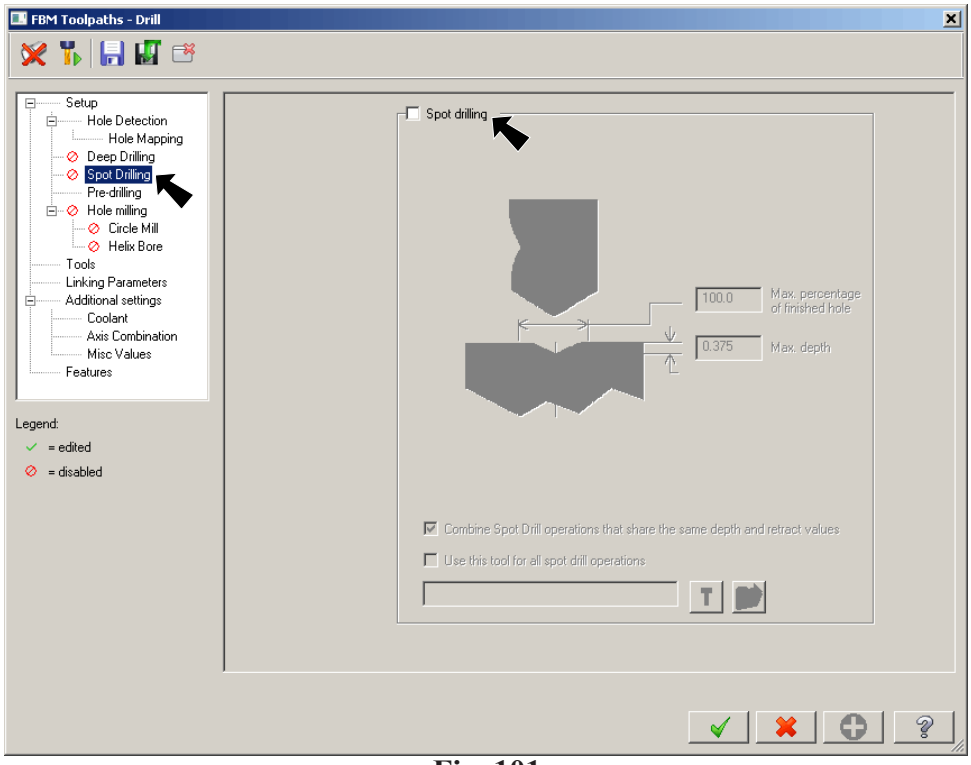


Fig. 101

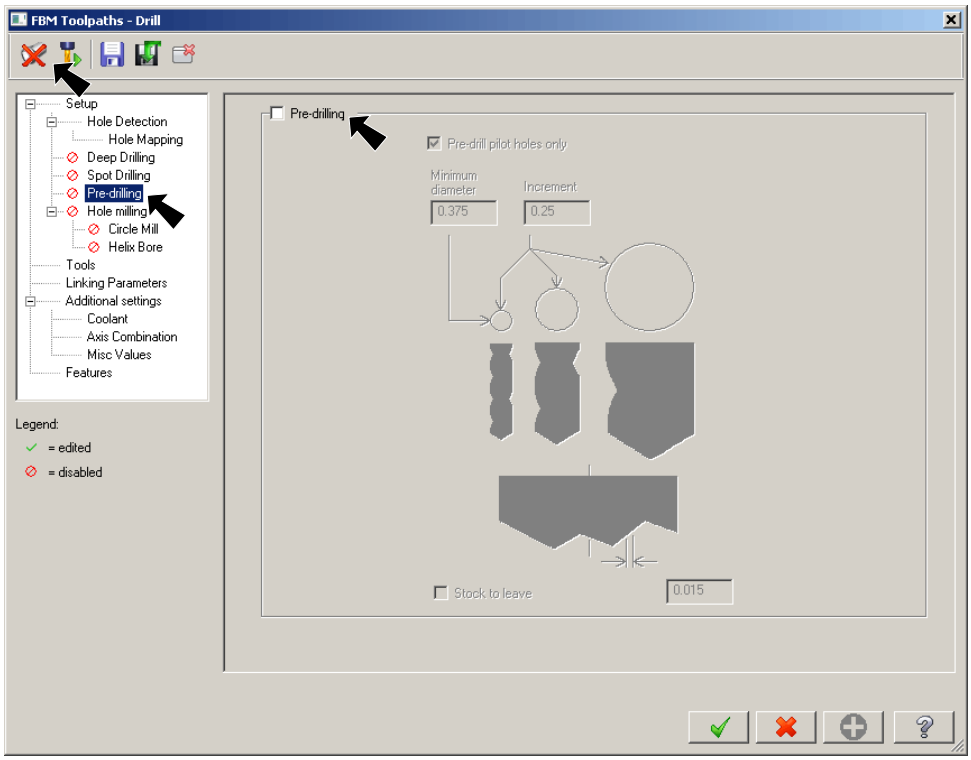


Fig. 102

Step 7. Confirm **1** hole with **depth of .35** is listed and click OK , **Fig. 103**.

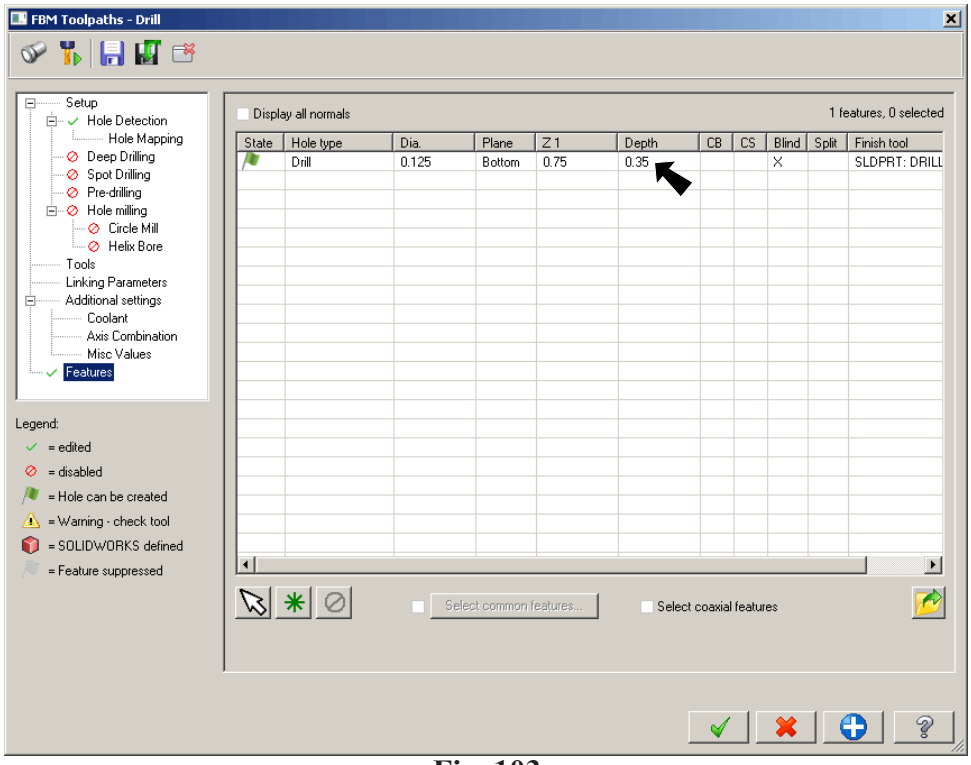


Fig. 103

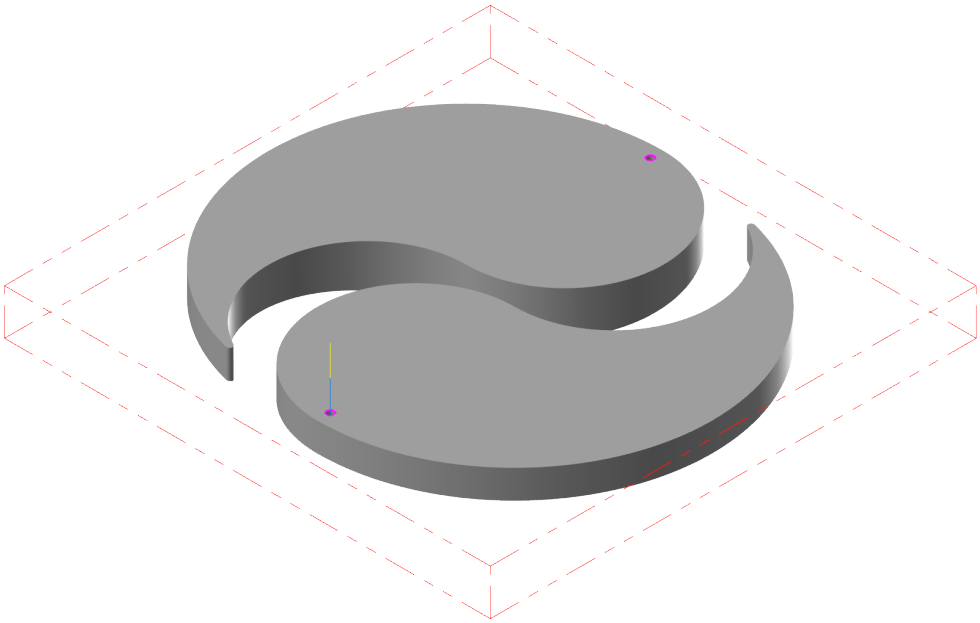


Fig. 104

AA. FBM Drill Toolpath Left Lid.

Step 1. Click TOOLPATHS Menu > **FBM Drill**.

Step 2. Click the **left Lid solid** and params are all set so just click **Detect** button , **Fig. 105**.

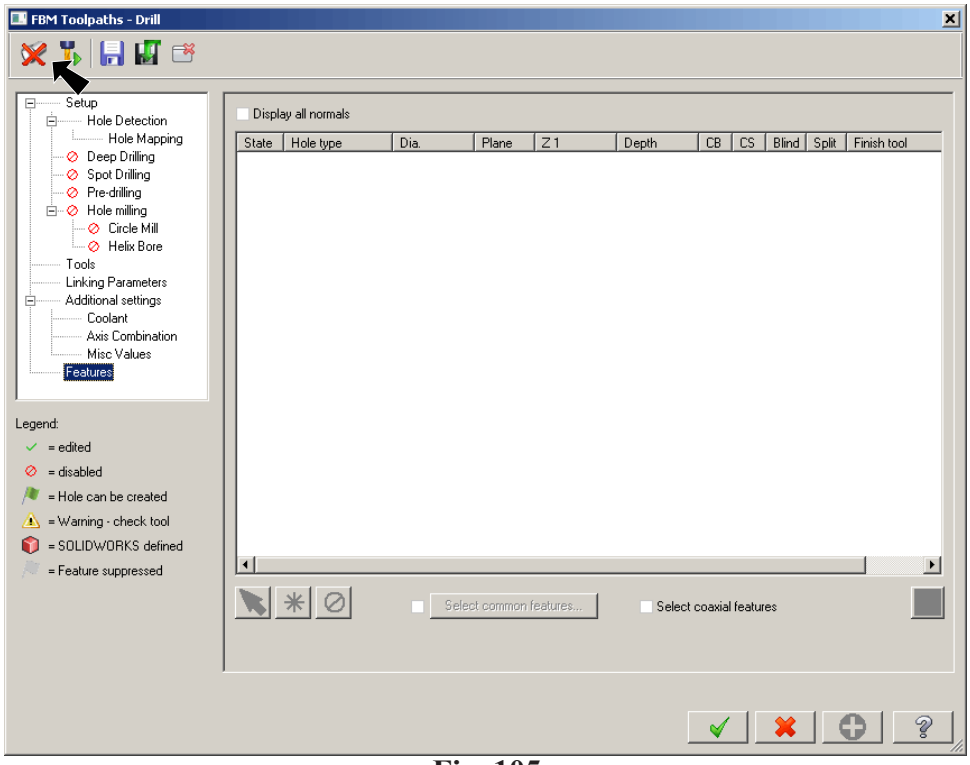


Fig. 105

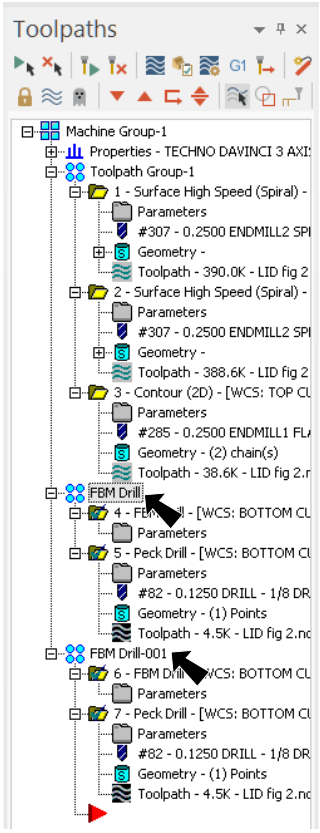


Fig. 106

Step 3. In the Toolpaths Manager **Ctrl click both FBM Drill Toolpath Groups** to select both Toolpath groups, **Fig. 106**.

Step 4. Save **(Alt-F S)**.

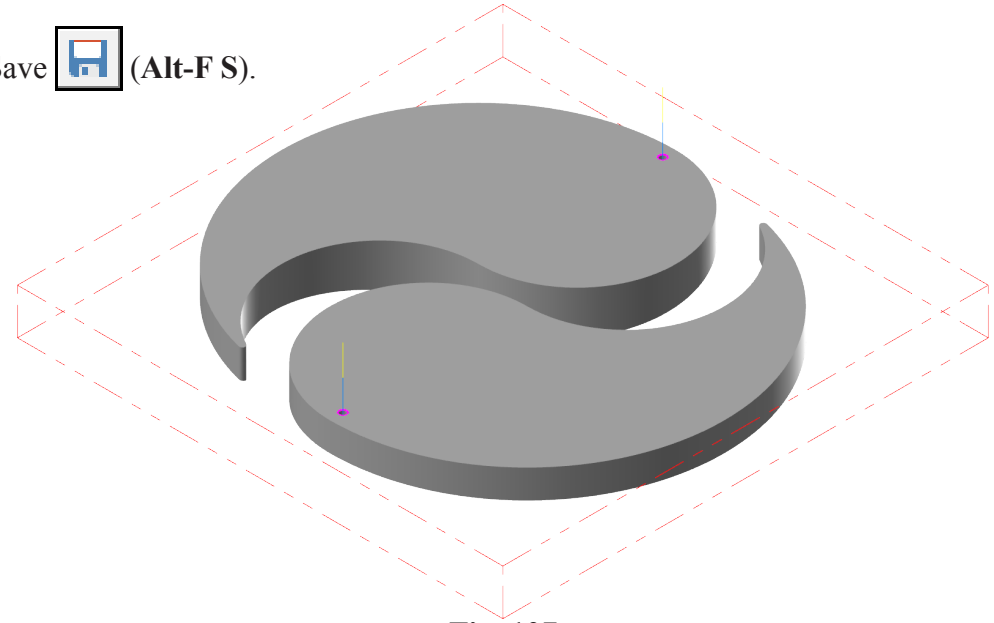


Fig. 107