# ProDrill Feature creation on Solids and Wire-frame Models ProDrill V5 - (METRIC)

In addition to feature recognition from surface or Solid models, ProDrill offers machinists a powerful, fast and easy to use tool to create and insert complex drill forms/processes.

Create drill forms using Mastercam Solids and/or using the reference 2D geometry created in Mastercam or any another CAD system (e.g. AutoCAD). Chamfers, tooltip angle, reaming, tapping, etc are all taken into consideration in this powerful design tool. The created geometry has all the associated toolpath operations as defined in the ProDrill form library tables!

On Solids, you can easily create the drill forms geometry and operations of all your drill forms with a couple of clicks for single or multiple solids (up to 8 solids supported).

On wireframe/2D drawings, you can create 3D surface forms of the desired drill forms. Surfaces are created for visualization of the forms/features that have been inserted.

THIS IS TRUE FEATURE BASED CAD/CAM! All the features (including reaming and tapping) are inserted into the file for fast and perfect processing by ProDrill.

# Creating Solid Drill Forms using ProDrill Creating Surface Drill Forms using ProDrill

## **Drilling on Solids**

To try the drill form design tool, load the **PART7\_DESIGN.MCAM** file. This is a Solid form created using Mastercam Solids. Several points of varying colors are also created to assist you in creating the different drill forms. You can also use the Auto Cursor function of Mastercam to select points based on reference geometry.



We will create a few different drill forms on this part including some inclined plane drills.

1 1 🖓 👘 🚺	s 🔲 🚹
	Drilling Surfaces
	Drilling Solids
	Exit

Click on **Drilling Solids**. The ProDrill Automatic Process Forms library is presented:

Automatic Process Forms	: Default (mm)				? <mark>x</mark>
		Local data			Colored Features Setings
	Reaming Created				
A_Drill	B_Flat Drill	C_2 Diameters	CA_2 Diameters	D_2 Diameters	DA_2 Diameters
DB_2_Diameters	E_3 Diameters	EA_3 Diameters	EB_3 Diameters	EC_3_Diameters-in	ED_3 Diameters
EE_3_Diameters	EF_3_Diameters	EG_3_Diameters	EH_3_Diameters	F_Screw Top	G_Screw Top_1
	Prev Page	Next	Page	Exit	

You will be presented with the table list. Select the **18mm** form by *clicking* on it once to highlight it. Right click to get the menu and select **Drill Solid**.

Process Co	nfiguration. Tal	ble: A_Drill (	mm)		
			L	ocal Data	
D	Finish Stoc	Max Dept	Safety Ream	Process	A_Drill
0.5 2 4 10 14 18 22 26 40 50 70	0.02 0.03 0.05 0.125 0.125 0.125 0.15 Drill solid Rename pro Copy proce Paste proce 0.4 a line	10 12 40 60 100 140 160 160 160 160 160 160 160 16	0.1 0.3 0.6 0.9 1.5 2.1 2.7 3.3 3.9 5 7.5 10	UpTo3 UpTo3 UpTo8 UpTo10 UpTo13 UpTo17 UpTo25 UpTo39 UpTo39 UpTo50 UpTo100	
	Delete the s	selected lines			Form Parameters Current process

Select the **A\_Drill** Form.



Selecting **Drill Solid** will now present the following dialog:

Change the values to the above settings and click on

You will be presented with the following menu. Since there is only 1 Solid, it is automatically selected. You need to select the points at this stage. The Mastercam selection toolbar is presented:

Since you can use existing points to select geometry and the AutoCursor function of Mastercam, the following message is displayed:

Select the point/s to drill. To toggle selection: Pick again over a point Can use R-Click Autocursor option. Click on [Return] when done We will first select the plane on which the drill form will be created. Click on **Planes**, **Planes by solid face** and select the **Front** face on which the point will be created. Select the blue point and click on the **Enter** key to create the drill form. ProDrill will create the drill form on the Solid as shown below.



Notice that the form created has a 0.5mm chamfer at the start of the drill form and has a 118 drill tip form.

Within a few seconds, you have created the drill form with the required drilling operations to machine it!

We will create some more forms on this part. Click on **Create Forms – Solids**, select the same form and measurement. The drill form parameters will be the same as the previous settings.

In this case, all you need to do is to set the new **Plane** first by selecting the **Solid Face** on which the form will be created and then to select the blue point and click on the **Enter** key. The same form type is created on the **Side** plane.



You can then proceed to create the same forms on the other 2 planes that are opposite the Front and Side using the same method described as above (not essential to complete exercise). After you have inserted the forms on the other sides we will proceed to insert other forms on the Top plane.

We will now create some forms on the **Top** plane.

# Click on **Create Forms - Solids**, select the **C2\_Diameters** and then select the **Guide\_42** form.

ocess Config	guration.	Table: C_2 Di	ameters (mn	1)			
				Local Data			_
Name	D	L	d	Process	<u>^</u>	C_2 Diameters	_
55×10	55	10	8.5	2			-
6.35×12.7	6.35	12.7	5.105	1			
7.525×6.88	7.525	6.886	6.145	1			
Allen_10	17.5	11	11.5	1			
Allen_12	19	18	13	1			
Allen_14	24	15	16	2		- d-	
14×9	14	9	9	1			
Allen_16	26	17.5	18	2			
Allen_20	33	21.5	23	3			
Allen_4	8	4.6	4.8	1			
Allen_5	10	5.7	5.8	1			
Allen_6	11	6.8	7	1			
Allen_8	14.5	9	9.5	1			
CounterBor	2.185	3.302	1.78	1		Form Parameters	
CounterBor	2.845	3.81	2.26	1			
CounterBor	2.845	5.588	2.26	1		Current process	
CounterBor	2.185	5.588	1./8	1		Process: 4 cm	-
CounterBor	50	13.5	21	2		Applied to definite size (diams:±5%, len:±15%)	
Guide_10	13	3	10	1			
Guide_12	16	4	12	1		Change the process used	
Guide_14	18	4	14	1			_
Guide_16	20	5	16	2		Ceptering (30.00) -	_
Guide_17	17	100	16.3	1		Ne Delline (10.00)	N
Guide_18	23	6	18	2		Drilling (12.00) -	
Guide_20	25	5	20	Guide		Drilling (20.00) -	_
Guide_25	31	1	25	Guide		Drilling (30.00) -	me
Guide_23d Cuida 20	26	0	20	Guide		🛅 Drilling ( d) -	
Guide_30 Guide 30a	30	6	30	Guide		💼 Circle milling D -	
Guide_30a Cuida 30b	37	0	30	Guide		💼 Reaming (d) -	nha
Guide_300 Guide_42	48	6	42	4 cm			ares
Guide 42a	Drill colid		42	4		Tiewi	ame
Guide 42b	Dial Solid		42	4			
Guide B13	kename pro	cess	12	1			
Guide G(35	Copy proces	SS	35	Guide cm		Dele	.ce
**14×6	Paste proce	SS	10	1 cm		proce	sses
- 169	Add a line		10	1_cm	~		
	Delete the c	elected lines				Simulation	
	Examples of the s	sciected in ies	ok		Canad	Sindidion	
	EXIC		UK		Cancel		



Click on **Drill Solid**. You will be presented with this dialog:

Since this will be a through hole for the Guide pins, we need we need to

check the box d=42 V VV- to indicate that the hole will be reamed. Click on

Click on **Plane**, **Solid Face** and select the **Top** face.

Click on **the 4 yellow points**. Click on **Enter**. The forms will be created and the following will be the result.



Taking a closer look at the drill form, you will notice that at the top of the smaller cylinder / through hole, a yellow arc is created. This represents the cylinder that will be reamed.



We shall now create some Allen 16 screws for the red points on the top plane.

The Allen screws are also located in the same C2\_Diameters table. Click on Create Forms - Solids. Select the C2\_Diameters, Allen\_16 diameter, right click and select Drill Solid.





The dialog will appear as follows upon selecting the form.

Change the settings as shown above. Disable the reaming of this drill form for the cylinders. Click on OK. Click on the **8 red** points (Mastercam color 12). Click on **Enter**. The following will be the result.



We will now create some tapped holes on the **Top** plane. Click on **Create Forms - Solids**, *K\_Metric Tap*, select the **M14X2.0**, right click and select **Drill Solid**.

Process Co	nfiguration	. Table: K_	Metric Ta	р (mm) - Су	lindrical -	×
				Loca	Data	
Name	D	р	Int. d	Safety	Process	K_Metric Tap
M1.6X0.35	1.6	0.350	1.25	1.05	1	
M2X0.4	2.0	0.400	1.6	1.20	1	
M2.5X0.45	2.5	0.450	2.05	1.35	1	
M3×0.5	3.0	0.500	2.5	1.5	1	<u>ş-uxp-</u> ş S ≥
M3.5×0.6	3.5	0.600	2.9	1.8	1	
M4×0.7	4.0	0.700	3.3	2.1	1	
M5X0.8	5.0	0.800	4.2	2.4	1	
M6X1.0	6.0	1.000	5.0	3.0	1	
M8X1.25	8.0	1.250	6.8	3.75	1	
M10x1.25	10.0	1.250	8.75	4.75	1	
M10X1.5	10.0	1.500	8.5	4.5	1	
M14X1.5	14.0	1.500	12.5	5.0	2	
M18×1.5	18.0	1.500	16.5	4.5	2	
M45x1.5	45.0	1.500	43.5	4.5	4	Form Parameters
M60x1.5	60.0	1.500	58.5	4.5	5	
M12X1.75	12.0	1.750	10.2	4.25	1	Current process
M14X2.0	14.0	2.000	12.	6.0	2	Discussion 0
M16X2.(	Drill solid		14.0	6.0	2	Process: 2
M33x2.(	Rename proc	ess	31.0	6.0	3	Applied to definite size (diams:±1%, len:±5%)
M39x2.0	Copy process		37.0	6.0	4	Change the process used
M20X2.5	Copy process		17.5	7.5	2	in selected line 🛛 🞽
M22x2.5	Paste process	5	19.5	7.5	2	
M24x3.0	Add a line		21.0	9.0	3	Centering (30.00) -
M27x3.(	Delete the se	lected lines	24.0	9.0	3	Drilling (Int. d) -
M30x3.5	Exit		26.5	10.5	3	Counter Sink (30.00) -
M36x4.ú			82.0	12.0	3	Tapping RH (Int. d) -
M42x4.5	42.0	4.500	37.5	13.5	4	Rename Rename

The following dialog will be presented.



Use the identical above settings then click on **OK**. Select the 4 purple points (color 5 of Mastercam). Click on **Enter**. The tapped forms will be created.



Zooming in to a form will show that there is a red arc that is 270 degrees that represents the tapped hole.



We will now create some forms on non-standard planes. Click on **Create Forms - Solids**, *B\_Flat\_Drill* **and select the <b>Flat\_Drill\_12mm** form, right click and select **Drill Solid**.

Process Config	uration. Table: B_Flat I	Drill (mm)			×
		Local Dat	a		
Name	D	Process		B_Flat Drill	
Flat_Drill_1.525	1.525	1			
Flat_Drill_05	5	1			
Flat_Drill_06	6	1			
Flat_Drill_6.35	6.35	1		-D	
Flat_Drill_12	12	2			
Flat_Drill_12.7	Drill solid	2			
Flat_Drill_16	Rename process	3			
Flat_Drill_20	Copy process	4			
Flat_Drill_25	Deste process	4			
Flat_Drill_35	Paste process	4			
Flat_Drill_38.1	Add a line	4			
Flat_Drill_55	Delete the selected lines	4			
	Exit			Form Pa	arameters
				Currents	
				Current	process

Set the total depth to **30 mm** for this form in the following dialog.



Click on **Plane**, **Plane by solid face** and select the angled plane in the front as shown below. Select the 3 brown points Mastercam color 6). Click on **Enter**. The Flat Drill forms are created on this plane.



A closer look at the form in Isometric view and then Side View.



We have one more form to create on another plane. Another flat drill of diameter 16mm.

		Local Data			
Name	D	Process		B_Flat Drill	
lat_Drill_1.525	1.525	1			
lat_Drill_05	5	1			
lat_Drill_06	6	1			
lat_Drill_6.35	6.35	1		D_	
lat_Drill_12	12	2			
lat_Drill_12.7	12.7	2			
lat_Drill_16 📻	140	3			
lat_Drill_20	Drill solid	4			
lat_Drill_25	Rename process	4			
lat_Drill_35	Copy process	4			
lat_Drill_38.1	Paste process	4			
lat_Drill_55	Add - K	4			
	Add a line				
	Delete the selected lines			For	m Parameters
	Exit				
		-	5	Curr	ent process

Set the dialog settings as shown with total depth set to 40mm



We can also add this depth to the Depth List. To add the new depth of 40mm

to the list so that it is presented to us the next time, click on Depth List The following options are presented:



Highlight and click on the "*Add current value to List*". The 40mm will be added to the depth list. The result will be as follows:

40	-
Through_Hole 12 25	
40 50 100	

Click on **OK**. Click on **Planes** and select the following **Solid Face** as shown below.



Once the new plane is set, select the brown point on the face as the **point** for drilling. Click on **Enter**.

The following form will be created.



You will notice that this form depth is too long and will cut with the other Guide 42 form.



We are done creating Solid Drill Forms.

In a fraction of the time normally involved, we have created the forms we need and assigned the appropriate drilling operations to them!

Think about the time and money you save doing this simple part. ProDrill's ROI on investment is incredibly rapid.



If you need to delete any form, go to the Mastercam Solids Manager and delete the cut and then the Solid form from the Solids Manager.

#### Solids Manager.

You will be presented with a list of all the forms created. You can highlight any of them and delete the cut first, then the Solid (which is moved to the bottom of the list). PLEASE NOTE THAT THE USER CANNOT EDIT ANY OF THE DRILL FORMS CREATED USING PRODRILL.



You can now process all the Drill Forms using ProDrill. Click on **Forms View** icon to process the part. All the Forms are recognized. When you apply drilling processes to them, the following is the result:



Notice that the holes that need to be tapped or reamed are all automatically recognized. At this point the toolpath can be generated for all the operations and you can backplot the toolpath or verify it to make sure it is exactly what you wanted.



# **Drilling on Wireframe models**

To try the drill form design tool, load the **PART\_2D\_DESIGN\_MM.MCAM** file. This is a simple 2D drawing. Several points of varying colors are created to assist you in creating the different drill forms.



We will create a few different drill forms on this drawing. ProDrill feature creation will work in all possible tool planes.



Click on **Drilling Surfaces**. The Forms Manager library is displayed:



Select the **A\_Drill** Form. You will be presented with the table list. Select the **22** mm form, right click and select **Create Surface Form**.

			L	ocal Data	
D	Finish Stoc	Max Dept	Safety Ream	Process	A_Drill
0.5	0.02	10	0.1	UpTo3	
2	0.03	12	0.3	UpTo3	
4	0.05	40	0.6	UpTo8	
6	0.125	60	0.9	UpTo10	
10	0.125	100	1.5	UpTo13	
14	0.125	140	2.1	UpTo17	
18	0.15	180	2.7	UpTo21	
22	0.15	200	33	UpTo25	
26	0.2 Crea	ite Surface Form	1	UpTo39	
40	0.25 Rena	ame process		UpTo39	
50	0.35 Conv	/ process		UpTo50	
70	.5 Deck	, process		UpTo100	
	Pasi	e process			
	Add	a line			Form Parameters
	Dele	te the selected l	ines		
	Exit				Current process
					Brocescy LipTo25
					Applied to D: > 20,000 to 24,000
					Applied to D1 > 20.000 to 21.000
					Change the process used in selected line
					New New
					Drilling (12.00) -

The following dialog is presented to enter the form parameters:



Set the values as shown above and click on \_\_\_\_\_\_. You are prompted to select the points:

Select the point/s to drill. Click on [Return] when done

With this simple part we can easily select the center points of the green arcs one by one. If you select the 4 green arcs and click on **Enter**, the following drill forms are created (displayed with Mastercam shading turned on):



We will now create the other forms mentioned in the Mastercam note in the drawing.

Click on **Create Forms - Surfaces**. Select the *B\_Flat\_Drill* form. Select the *Flat\_Drill\_12* measurement form, right click and select *Create Surface Form*.

Process Confi	iguratio	n. Table: B_Flat	Drill (mm)				
			Local Dat	a			
Name		D	Process		B_Flat Dr	ill	
Flat_Drill_1.52	25	1.525	1				
Flat_Drill_05		5	1				
Flat_Drill_06		6	1				
Flat_Drill_6.35	5	6.35	1				
Flat_Drill_12		12	2				
Flat_Drill_12.	Create	e Surface Form	2				
Flat_Drill_16	Renan	ne process	3				
Flat_Drill_20	Convi	process	4			J	
Flat_Drill_25	Dacke		4				
Flat_Drill_35	Paste	process	4				
Flat_Drill_38.	Add a	line	4				
Flat_Drill_55	Delete	the selected lines	4				
	Exit						
L L						Form Param	heters



The form parameters dialog is presented. Set the depth to **40mm**.

Set the parameters as displayed above and click on \_\_\_\_\_\_\_. The selection menu is once again presented. Select the 4 red points manually and click on **Enter** to create the forms. The following will be result of the creation of the Flat Drills. If you look at the bottom of the forms, you will see a flat surface created to indicate that it is a blind hole.



Click on **Create Forms - Surfaces**, select the tab for the **Tap** and click on *K\_Metric Tap*. Right click on the **M14X2.0** form and click on "*Create Surface Form*". The form creation parameters dialog is presented:



Set the parameters as shown above. Notice that we are creating a 1mm chamfer and creating it as a blind hole (**ThroughHole** unchecked). Click on

Select the 4 purple points. The following will be the result of the Tap forms creation (indicated by red arrows).



To indicate a Tap form, ProDrill also creates a 270 degree red arc on top of the cylinder to be tapped. Notice that the arc is created below the chamfer. The image on the right shows that the tap form ends in a tooltip (angle used in the Forms Parameters).



We will now create the final form for this drawing. Click on **Create Forms -Surfaces**, **C\_2 Diameters**, select the **Guide\_42** measurement, right click and select the "**Create Surface Form**". The following dialog is presented:



Set the parameters as shown above. Notice that the 42mm diameter is checked d=42 vov ---- – indicating that it should be reamed. Click on

OK . You are returned to the selection menu. Select **the 4 blue arcs**. Click on **Enter**. The 4 forms will be created.



If you zoom close to one of the guide forms created, you will notice that a yellow arc is created on top of the 42mm diameter. This indicates that this form will be reamed.



Within a few minutes, you have created drill forms and assigned machining features on a 2D drawing!

Save the geometry as a new file if you desire. You can process the part in the same manner as the previous part in ProDrill V4.

Once the toolpaths are created, click on **Backplot** and verify the toolpaths generated.



You have created drilling forms on a 2D drawing, processed the part and generated toolpaths for the same in a manner of minutes!

Using the surface form creation tool, you can easily convert 2D Drawings into 3D drawings with all relevant drilling forms created with all necessary drilling operations.

This concludes the Drill Form creation guide.

## **Revisions:**

ProDrill V5 – February 13, 2019 (minor edits) ProDrill V5 – February 15, 2019 (minor edits, update part names)