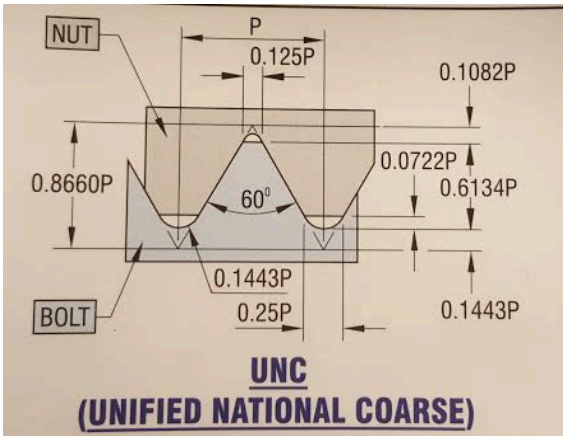
Creating Mechanical Threads



TPI = Threads Per Inch
(P)Thread Pitch = 1/TPI

The diagram above is a specific “abstraction” for every size bolt for the UNC coarse thread type.

Your first step in using the diagram above is to calculate “P”

Once you calculate “P” you multiply P against the constants listed above.

For example:

1. You need to know the dimension called out as **“0.25P”**
2. You know that the **TPI** (Threads Per Inch) is **13**
3. You **calculate 1 over the TP**I: 1 divided by 13 = **.07692** (Use 5 decimal places)
4. Use the dimension callout “0.25P” as a formula for multiplication using the variable “P”
    a. 0.25 X .07692 = **.01923**
    b. The dimension callout **“0.25P” = .01923**

UNC
(UNIFIED NATIONAL COARSE)

Nom. Dia. UNC (No./inch)	Threads per inch (t.p.i.)	Basic Major Diameter (inch)	Basic Effective Diameter (inch)	Basic Minor Dia. of Ext. Thd. (inch)	Basic Minor Dia. of Int. Thd. (inch)	Tapping Drill Size (inch)	Clearance Drill Size (inch)
No. 1	64	0.0730	0.0629	0.0538	0.0561	# 53	# 48
No. 2	56	0.0860	0.0744	0.0641	0.0667	# 50	# 43
No. 3	48	0.0990	0.0855	0.0734	0.0764	# 47	# 37
No. 4	40	0.1120	0.0958	0.0813	0.0849	# 43	# 32
No. 5	40	0.1250	0.1088	0.0943	0.0979	# 38	# 30
No. 6	32	0.1380	0.1177	0.0997	0.1042	# 36	# 27
No. 8	32	0.1640	0.1437	0.1257	0.1302	# 29	# 18
No.10	24	0.1900	0.1629	0.1389	0.1449	# 25	# 9
No.12	24	0.2160	0.1889	0.1649	0.1709	# 16	# 2
1/4	20	0.2500	0.2175	0.1887	0.1959	# 7	F
5/16	18	0.3125	0.2764	0.2443	0.2524	F	P
3/8	16	0.3750	0.3344	0.2983	0.3073	5/16”	W
7/16	14	0.4375	0.3911	0.3499	0.3602	U	29/64”
1/2	13	0.5000	0.4500	0.4056	0.4167	27/64”	33/64”
9/16	12	0.5625	0.5084	0.4603	0.4723	31/64”	37/64”
5/8	11	0.6250	0.5660	0.5135	0.5266	17/32”	41/64”
3/4	10	0.7500	0.6850	0.6273	0.6417	21/32”	49/64”
7/8	9	0.8750	0.8028	0.7387	0.7547	49/64”	57/64”
1	8	1.0000	0.9188	0.8466	0.8647	7/8”	1 1/64”
1 1/8	7	1.1250	1.0322	0.9497	0.9704	63/64”	1 5/32”
1 1/4	7	1.2500	1.1572	1.0747	1.0954	1 7/64”	1 17/64”
1 3/8	6	1.3750	1.2667	1.1705	1.1946	1 7/32”	1 13/32”
1 1/2	6	1.5000	1.3917	1.2955	1.3196	1 11/32”	1 17/32”
1 3/4	5	1.7500	1.6201	1.5046	1.5335	1 9/16”	1 25/32”
2	4 1/2	2.0000	1.8557	1.7274	1.7594	1 25/32”	2 1/32”
2 1/4	4 1/2	2.2500	2.1057	1.9774	2.0094	2 1/32”	2 5/16”

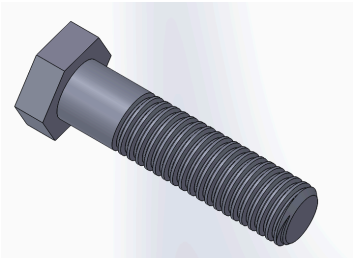
Using the chart above:
Nom. Dia UNC = Nominal Size (not actual)
Threads per inch = TPI
Major Dia = Diameter from thread tip
Minor Dia = Diameter from thread root
Ext. = External Threads
Int. = Internal Threads

You will not use:

- Basic Effective Dia
- Tapping Drill Size
- Clearance Drill SIze

Your Task:
Create a mechanical bolt with the following characteristics

1. Bolt Type: ½” Nom. Dia UNC
2. TPI = 13
3. 2” long bolt (excluding hex head)
    a. .5” non threaded shoulder
4. Hex head measures .750” across flats (parallel sides)
    a. .25” thick
5. TPI = 13



Tutorial on how to create a ½" UNC Bolt with a ¾" hex head

1. Create a new part
    a. File, New, Part

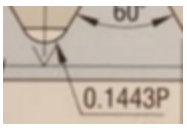
2. Create a sketch on the "Top" datum plane
    a. Select "Top"
    b. Click "Sketch"

3. Draw a circle on origin using the "Major Dia" value for a ½" Nom Dia bolt
    a. Major Dia value listed in table on page 1
    b. Extrude Boss/Base the circle to a length of 2.5" (in)

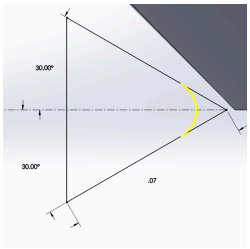
4. Create a new sketch on the "Top" datum plane
    a. Select "Top"
    b. Click "Sketch"

5. Draw a circle on origin using the Basic Minor Dia of Ext. Thd. listed in table on page 1
    a. Be sure to use the values from the row that specifies ½" Nom Dia UNC.
    b. While you are still in sketch mode after you have smart dimensioned
        i. Click "Insert"
            1. Click "Curve"
                a. Click "Helix/Spiral"
    c. Set the Helix/Spiral settings to the following
        i. Make sure the drop down under "Defined by" is set to "Height and Pitch"
        ii. Make sure "Constant pitch" is selected
        iii. Height = 2"
        iv. Pitch = 1/TPI
            1. Your TPI = 13 for this tutorial
        v. Start angle = 270° deg
        vi. Click the green check mark

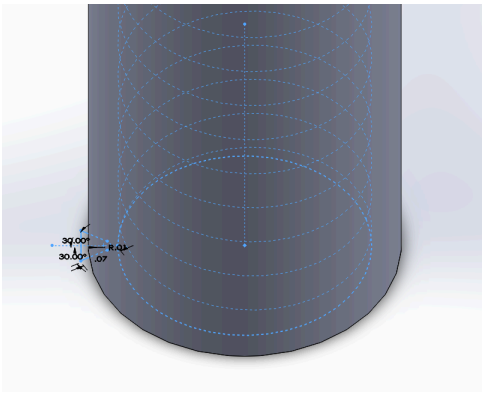
6. Create a new sketch on the "Front" plane
    a. Be sure to press the spacebar and select the front view to make "Normal To" the front
    b. Once "Normal To" you are ready to draw your cutting tool

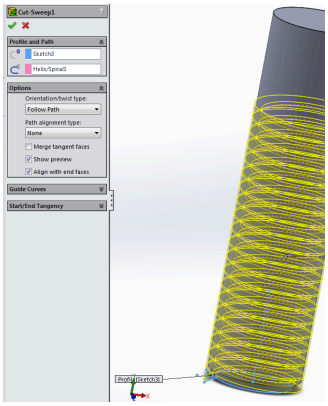
7. Draw your triangular cutting tool using the following steps
    a. Start drawing your triangle at the bottom tip of your helix you made in step 5
        i. Use the line tool
        ii. Create two solid lines and one center line
        iii. The solid lines should form a shape similar to the "greater than" symbol >
        iv. Draw a centerline horizontally across the middle of your two legs from its vertex
        v. Use smart dimension to make your solid lines 30° above and below your center line
        vi. Use smart dimension to make your legs of the triangle .07
        vii. Connect the two legs with a vertical line to complete the shape
        viii. Calculate the Radius for a Fillet that will round the tip of the triangle
            1. Using the diagram above and your pitch value (P) calculate and use the value for Fillet radius
            2. 

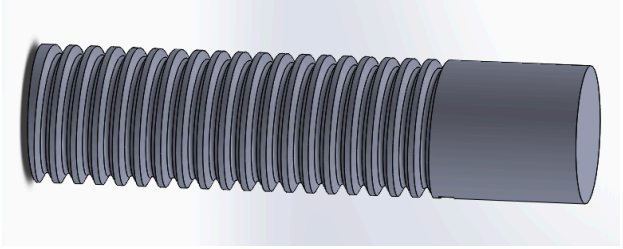
            3. 1/13 = P so do the following (1/13)*.1443
        ix. Click sketch fillet button 
            1. Select the two angled lines and enter in your calculated value
            2. It should look like this

3. 

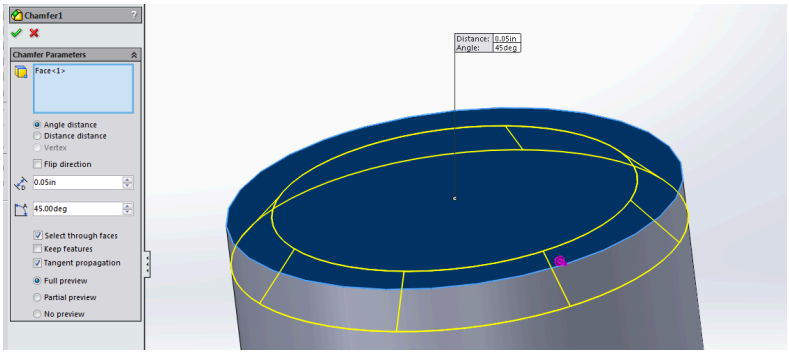
x. Exit your sketch

8. At this point you should have the following
    a. A solid cylinder
    b. A helix sketch inside your solid cylinder
    c. A filleted triangular shape attached to the bottom tip of your helix that intersects your solid cylinder
    d. 

9. Click “Swept Cut” under Features
    a. Select your triangular sketch (Cutting tool) as your profile
    b. Select your helix as the path to follow
    c. 

    d. Make sure “Show Preview” is checked
    e. Click the green check
10. Your geometry should look like this:
    a. 

11. Create the Hex Head
    a. Create a new sketch on the top of your bolt and select the polygon tool
    b. Center your polygon on the origin and draw a 6 sided polygon
    c. Smart dimension across two parallel sides
        i. Set to .75
    d. Extrude Boss/Base the sketch upwards at a length of .25”
    e. Click OK
    f. It should look like this:
    g. 

12. Chamfer the tip of your bolt
    a. Like This
        i. 

    b. 45 deg
    c. Distance: .05