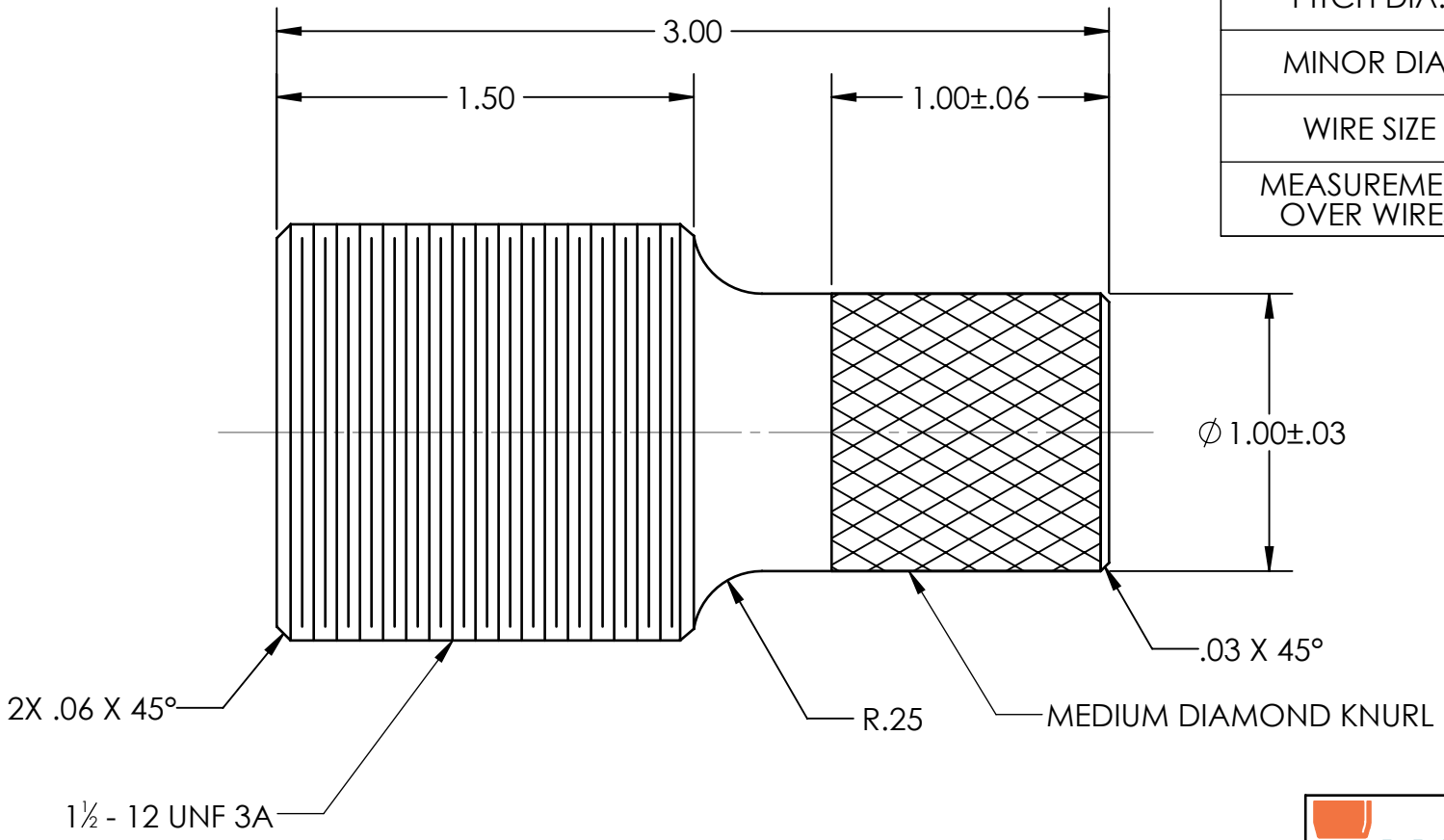
THREAD DATA	
THREAD SPEC	1½ - 12 UNF 3A
MAJOR DIA.	
PITCH DIA.	
MINOR DIA.	
WIRE SIZE	
MEASUREMENT OVER WIRES	



NOTES:

1) DEBURR ALL EDGES .015 MAX.

UNLESS OTHERWISE SPECIFIED:		NAME	DATE
DIMENSIONS ARE IN INCHES	DRAWN	A. BALOGH	4/2/2019
TOLERANCES:	CHECKED		
1/X or .X ± 1/64 (.0156) .XX ± .010 .XXX ± .005 X° ± 1°	APPROVED		
ALL SURFACES 125	MATERIAL: CR 1018 STEEL		
INTERPRET PER ASME Y14.5-2009	FINISH	PROJECTION	

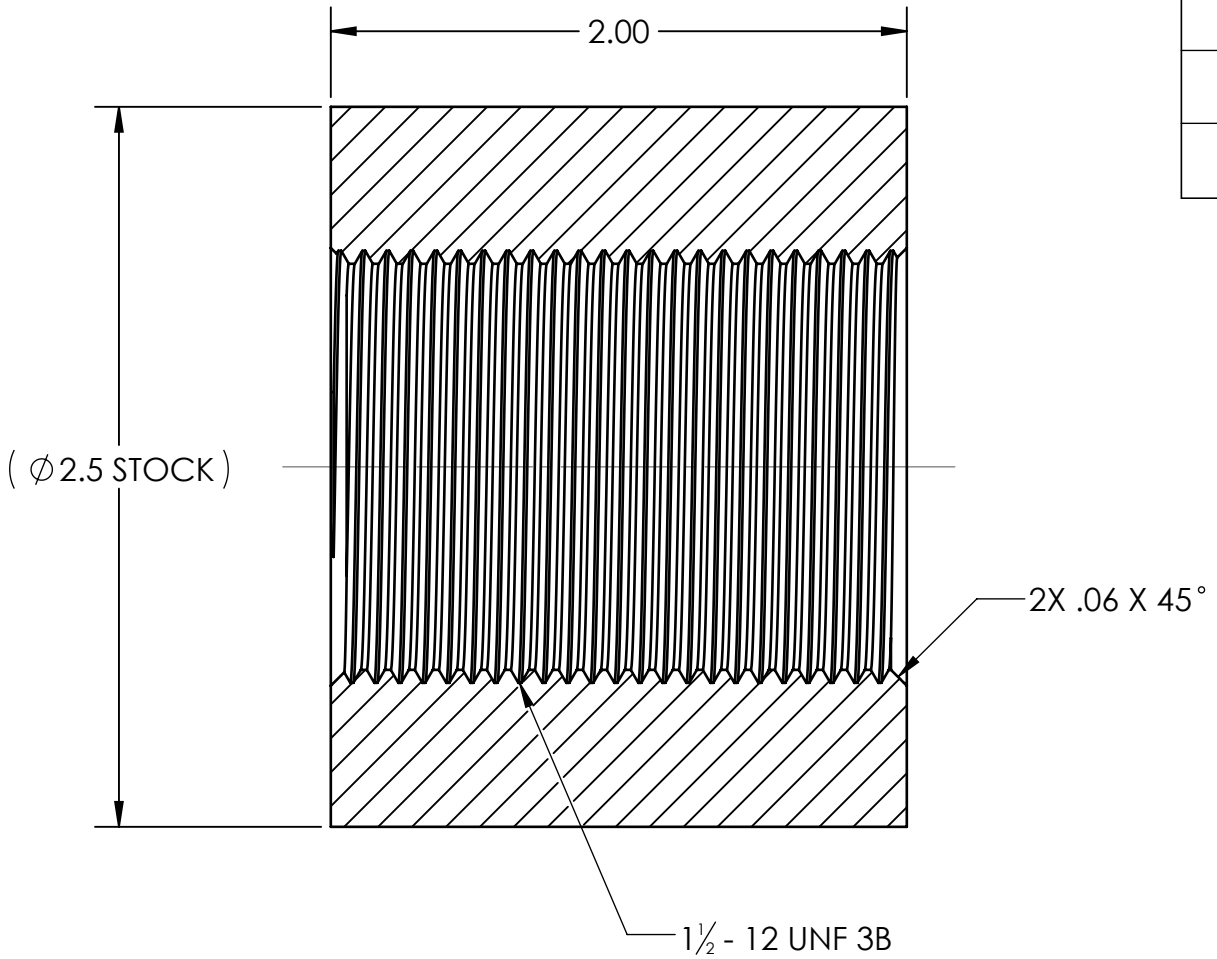
@ LANEY COLLEGE MACHINE TECH

TITLE: PLUG GAGE

SIZE	DWG. NO.	REV
A	M220-3	-

SCALE: 1.5:1	WEIGHT: 1.10	SHEET 1 OF 3

THREAD DATA	
THREAD SPEC	1½ - 12 UNF 3B
MAJOR DIA.	
PITCH DIA.	
MINOR DIA.	



NOTES:

1) DEBURR ALL EDGES .015 MAX.

UNLESS OTHERWISE SPECIFIED:		NAME	DATE
DIMENSIONS ARE IN INCHES	DRAWN	A. BALOGH	4/2/2019
TOLERANCES:	CHECKED		
1/X or .X ± 1/64 (.0156) .XX ± .010 .XXX ± .005 X° ± 1°	APPROVED		
ALL SURFACES 125	MATERIAL: CR 1018 STEEL		
INTERPRET PER ASME Y14.5-2009	FINISH: -	PROJECTION	

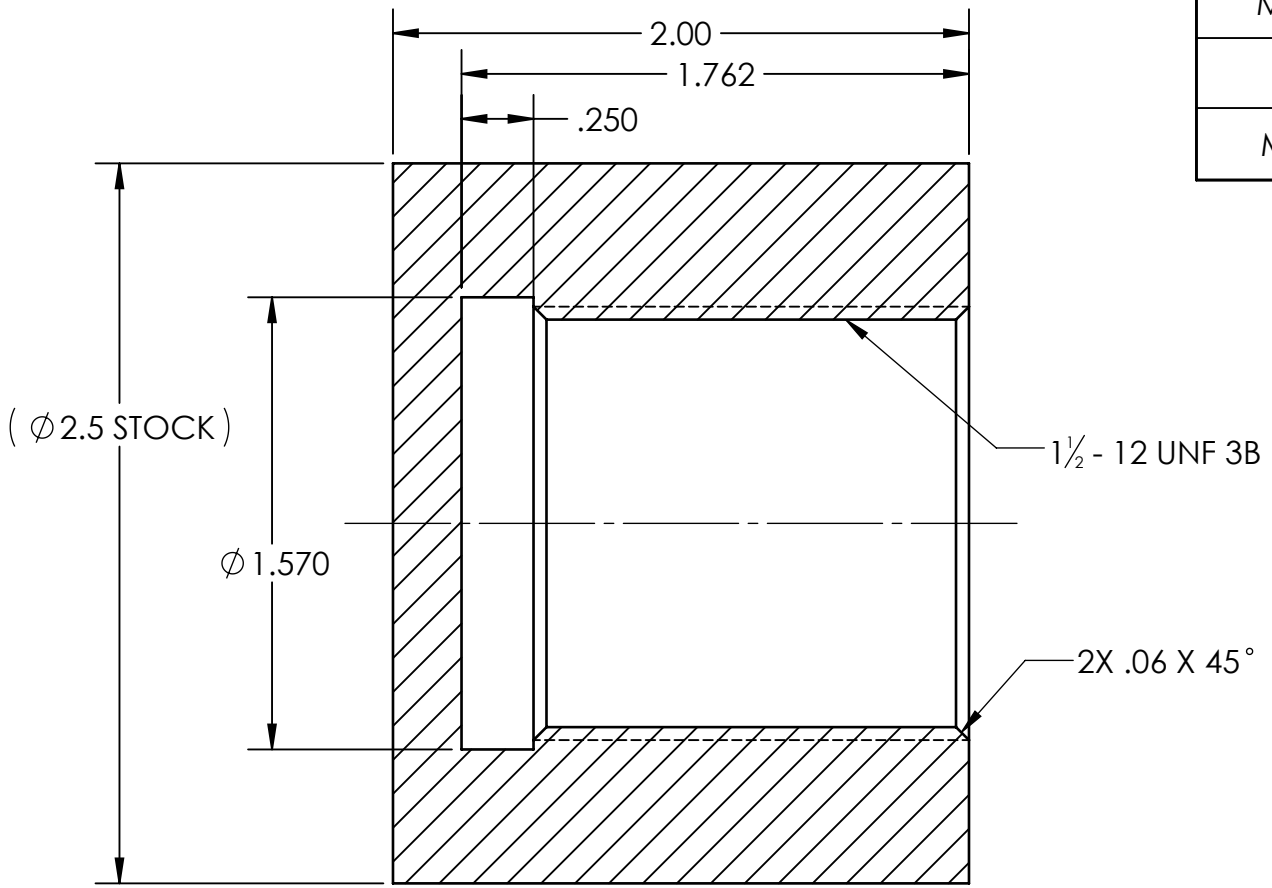
@ LANEY COLLEGE MACHINE TECH

TITLE: ROUND NUT

SIZE	DWG. NO.	REV
A	M220-3	-

SCALE: 1.5:1	WEIGHT: 1.85	SHEET 2 OF 3

THREAD DATA	
THREAD SPEC	1½ - 12 UNF 3B
MAJOR DIA.	
PITCH DIA.	
MINOR DIA.	



NOTES:

1) DEBURR ALL EDGES .015 MAX.

UNLESS OTHERWISE SPECIFIED:		NAME	DATE
DIMENSIONS ARE IN INCHES TOLERANCES: 1/X or .X ± 1/64 (.0156) .XX ± .010 .XXX ± .005 X° ± 1° ALL SURFACES 125	DRAWN	A. BALOGH	4/2/2019
	CHECKED		
	APPROVED		
	MATERIAL: CR 1018 STEEL		
	FINISH: -	PROJECTION	
INTERPRET PER ASME Y14.5-2009			

@ LANEY COLLEGE MACHINE TECH

TITLE: ROUND CAP NUT

SIZE	DWG. NO.	REV
A	M220-3	-

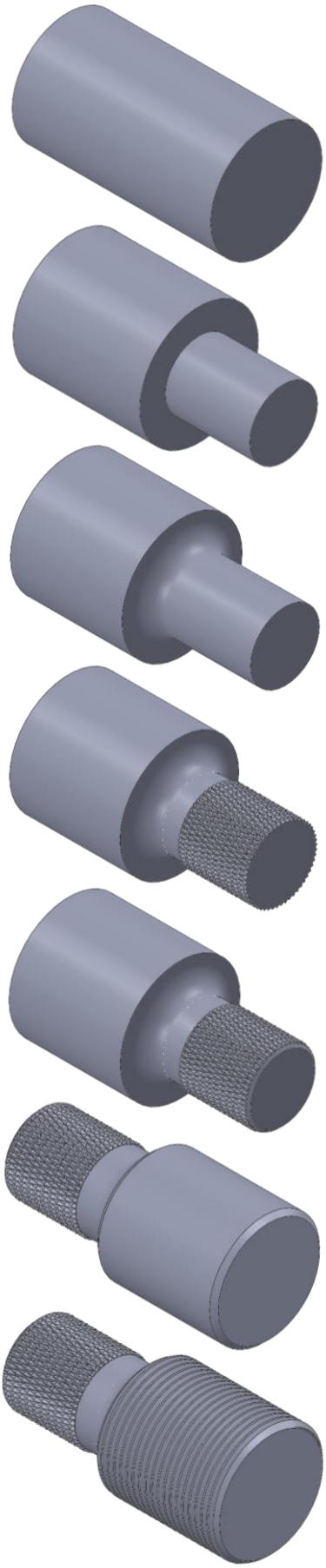
SCALE: 1.5:1	WEIGHT: 1.98	SHEET 3 OF 3

Plug Gage General Procedure

1) **Cut a piece of ⌀1.75” mild steel stock to a length of 3.125” on the bandsaw.**
   Tools used: Combination square
2) **Indicate the stock in a 4-jaw chuck on the lathe to within .001” total indicator runout.**
   Tools used: 4-jaw chuck, .001”-reading dial indicator, indicator holder with magnetic base
3) **Face and turn one side to ⌀1.0 X 1.25”, leaving sufficient material for the radius.**
   Tools used: DCLNR toolholder with CNMG-432 carbide insert, .001”-reading dial indicator with magnetic back, 1-2” outside micrometer, dial caliper
4) **Cut and blend the radius.**
   Tools used: Indexable carbide radius cutting tool, .001”-reading dial indicator with magnetic back
5) **Generate the medium diamond knurls.**
   Tools used: Clamp-style knurling tool with size 220 knurling rollers, 6” rule, sharpie, LOTS of cutting oil
6) **Cut the .030” X 45° chamfer.**
   Tools used: Chamfering tool, .001”-reading dial indicator with magnetic back

> Once you cut the major diameter of the threads, you have passed the point of no return. If you need to break down your setup, this is the last chance to do it.

7) **Face and turn the other side to major diameter of threads and final overall length.**
   Tools used: Collet chuck, 5C collet (best fit to knurled surface), DCLNR toolholder with CNMG-432 carbide insert, .001”-reading dial indicator with magnetic back, 1-2” outside micrometer, dial caliper
8) **Cut the .060” X 45° chamfers.**
   Tools used: Chamfering tool, .001”-reading dial indicator with magnetic back
9) **Cut the 1 ½ - 12 threads.**
   Tools used: Indexable carbide threading tool for coarse threads, center gage, layout dye, thread pitch gage, thread measuring wires (selected according to TPI of threads), 1-2” outside micrometer, go/no go gage

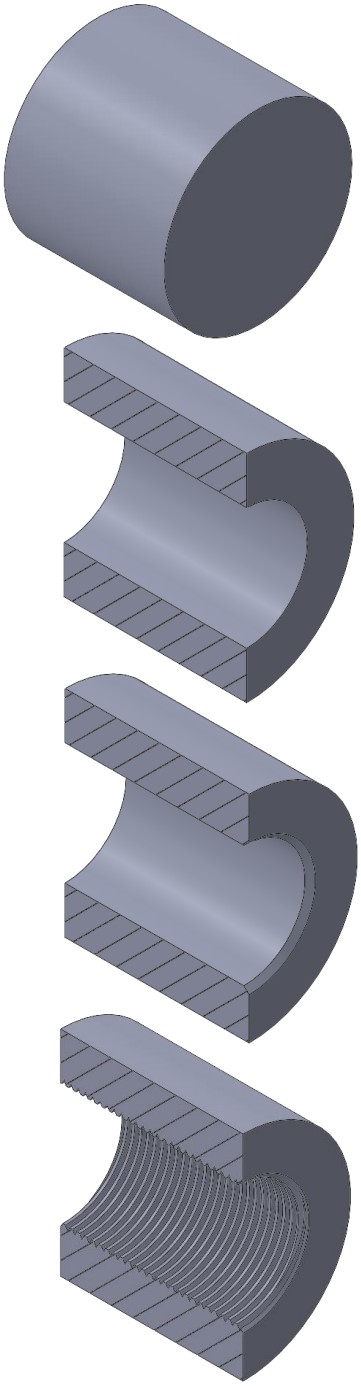


Round Nut General Procedure

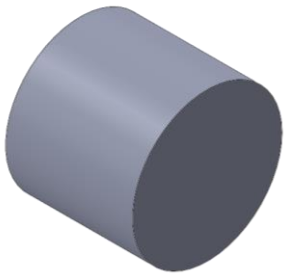
1) **Cut a piece of ⌀2.5” mild steel stock to a length of 2.125” on the bandsaw.**
   Tools used: Combination square
2) **Indicate the stock in a 4-jaw chuck on the lathe to within .001” total indicator runout.**
   Tools used: 4-jaw chuck, .001”-reading dial indicator, indicator holder with magnetic base
3) **Face one side.**
   Tools used: DCLNR toolholder with CNMG-432 carbide insert, .001”-reading dial indicator with magnetic back
4) **Pre-drill through-hole.**
   Tools used: Drill chuck, #3 center drill, 5/16” drill, 1 5/16” drill

Once you cut the minor diameter of the threads, you have passed the point of no return. If you need to break down your setup, this is the last chance to do it.

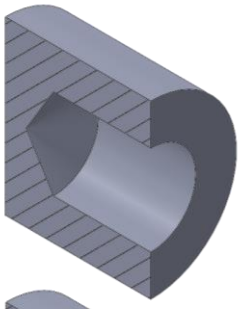
5) **Bore through-hole to minor diameter of threads.**
   Tools used: 1” boring bar with CNMG-432 carbide insert, telescoping gage, 1-2” outside micrometer
6) **Cut the .060” X 45° chamfer.**
   Tools used: 1” boring bar with CNMG-432 carbide insert, .001”-reading dial indicator with magnetic back
7) **Cut the 1 ½ - 12 threads.**
   Tools used: 1” Top Notch-style bar with carbide threading insert for coarse threads, center gage, layout dye, thread pitch gage, go/no go gage
8) **Flip the part around and indicate it to within .001” total indicator runout.**
   Tools used: 4-jaw chuck, .001”-reading dial indicator, indicator holder with magnetic base
9) **Face the other side to final overall length.**
   Tools used: DCLNR toolholder with CNMG-432 carbide insert, .001”-reading dial indicator with magnetic back, dial caliper
10) **Cut the other .060” X 45° chamfer.**
    Tools used: 1” boring bar with CNMG-432 carbide insert, .001”-reading dial indicator with magnetic back



Round Cap Nut General Procedure

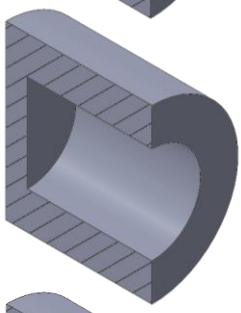


1) **Cut a piece of ⌀2.5” mild steel stock to a length of 2.25” on the bandsaw.**
   Tools used: Combination square
2) **Indicate the stock in a 4-jaw chuck on the lathe to within .001” total indicator runout.**
   Tools used: 4-jaw chuck, .001”-reading dial indicator, indicator holder with magnetic base
3) **Face one side.**
   Tools used: DCLNR toolholder with CNMG-432 carbide insert, .001”-reading dial indicator with magnetic back
4) **Pre-drill blind hole to 1 13/16” depth.**
   Tools used: Drill chuck, #3 center drill, 5/16” drill, 1 5/16” drill, 1 5/16” flat bottom drill

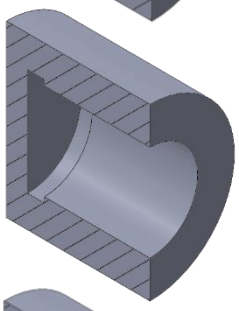


Once you cut the minor diameter of the threads, you have passed the point of no return. If you need to break down your setup, this is the last chance to do it.

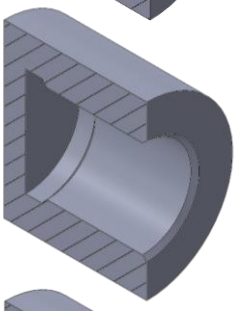
5) **Bore blind hole to minor diameter of threads. (Facing bottom of hole with small boring bar is optional.)**
   Tools used: 1” boring bar with CNMG-432 carbide insert, .001”-reading dial indicator with magnetic back, telescoping gage, 1-2” outside micrometer



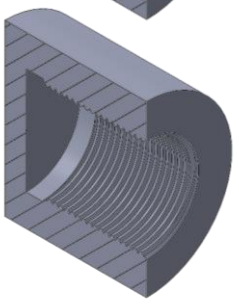
6) **Cut the groove.**
   Tools used: 1” Top Notch-style bar with .189” wide carbide grooving insert, .001”-reading dial indicator with magnetic back, groove micrometer, inside dial caliper
7) **Cut the inside .060” X 45° chamfer.**
   Tools used: 1” Top Notch-style bar with .189” wide carbide grooving insert, .001”-reading dial indicator with magnetic back
8) **Face to 1.762” depth of blind hole.**
   Tools used: DCLNR toolholder with CNMG-432 carbide insert, .001”-reading dial indicator with magnetic back, depth micrometer



9) **Cut the outside .060” X 45° chamfer.**
   Tools used: 1” boring bar with CNMG-432 carbide insert, .001”-reading dial indicator with magnetic back
10) **Cut the 1 ½ - 12 threads.**
    Tools used: 1” Top Notch-style bar with carbide threading insert for coarse threads, center gage, layout dye, thread pitch gage, .001”-reading dial indicator with magnetic back, go/no go gage
11) **Flip the part around and indicate it to within .001” total indicator runout.**
    Tools used: 4-jaw chuck, .001”-reading dial indicator, indicator holder with magnetic base



12) **Face the other side to final overall length.**
    Tools used: DCLNR toolholder with CNMG-432 carbide insert, .001”-reading dial indicator with magnetic back, dial caliper



PROJECT PLANNING WORKSHEET

OPERATION	TOOLS	CS/RPM
.		

Points Earned	
Total Points Possible	19

PLUG GAGE AND ROUND NUTS INSPECTION REPORT

Student Name _____

Plug Gage

1) Overall Length 3.00 +/- .010 _____
2) Thread Length 1.50 +/- .010 _____
3) Corner Radius R.25 ☐
4) Knurl Size, Form: ⌀1.00 +/- .03, medium diamond _____
5) Knurl Length 1.00 +/- .06 _____

For 1 1/2-12 UNF 3A threads:

6) Major Diameter ⌀1.4886 – ⌀1.5000 _____
7) Pitch Diameter ⌀1.4411 – ⌀1.4459 _____

Round Nut

1) ⌀2.5 STOCK ☐
2) Overall Length 2.00 +/- .010 _____

For 1 1/2-12 UNF 3B thru threads:

3) Minor Diameter ⌀1.4100 – ⌀1.4198 _____
4) Size, form and pitch verification: Go/No Go Gages ☐

Round Cap Nut

1) ⌀2.5 STOCK ☐
2) Overall Length 2.00 +/- .010 _____
3) Hole Depth 1.762 +/- .005 _____
4) Groove Diameter 1.570 +/- .005 _____
5) Groove Width .250 +/- .005 _____

For 1 1/2-12 UNF 3B blind threads:

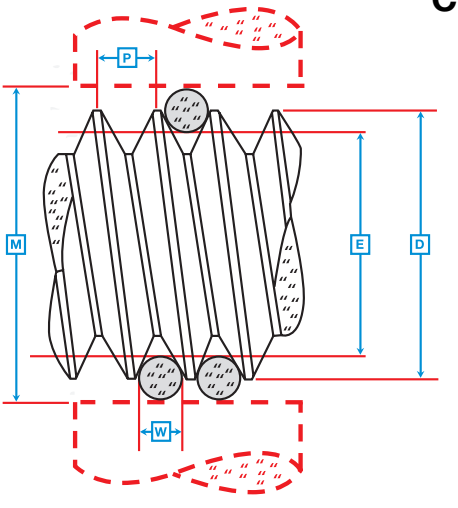
6) Minor Diameter ⌀1.4100 – ⌀1.4198 _____
7) Size, form and pitch verification: Go/No Go Gages ☐

Overall appearance (clean, deburred, free of chips) ☐

Table 3. *(Continued)* Standard Series and Selected Combinations — Unified Screw Threads

Nominal Size, Threads per Inch, and Series Designation[a]	External[b]								Internal[b]					
			Major Diameter			Pitch Diameter		UNR Minor Dia.,[c] Max (Ref.)		Minor Diameter		Pitch Diameter		Major Diameter
	Class	Allowance	Max[d]	Min	Min[e]	Max[d]	Min		Class	Min	Max	Min	Max	Min
1 7/16–28 UN	**2A**	**0.0013**	**1.4362**	**1.4297**	—	**1.4130**	**1.4088**	**1.3936**	**2B**	**1.399**	**1.407**	**1.4143**	**1.4198**	**1.4375**
	3A	**0.0000**	**1.4375**	**1.4310**	—	**1.4143**	**1.4112**	**1.3949**	**3B**	**1.3990**	**1.4051**	**1.4143**	**1.4184**	**1.4375**
1 1/2–6	**1A**	**0.0024**	**1.4976**	**1.4703**	—	**1.3893**	**1.3772**	**1.2992**	**1B**	**1.320**	**1.350**	**1.3917**	**1.4075**	**1.5000**
	2A	**0.0024**	**1.4976**	**1.4794**	**1.4703**	**1.3893**	**1.3812**	**1.2992**	**2B**	**1.320**	**1.350**	**1.3917**	**1.4022**	**1.5000**
	3A	**0.0000**	**1.5000**	**1.4818**	—	**1.3917**	**1.3856**	**1.3016**	**3B**	**1.3200**	**1.3396**	**1.3917**	**1.3996**	**1.5000**
1 1/2–8 UN	**2A**	**0.0022**	**1.4978**	**1.4828**	**1.4753**	**1.4166**	**1.4093**	**1.3490**	**2B**	**1.365**	**1.390**	**1.4188**	**1.4283**	**1.5000**
	3A	**0.0000**	**1.5000**	**1.4850**	—	**1.4188**	**1.4133**	**1.3512**	**3B**	**1.3650**	**1.3797**	**1.4188**	**1.4259**	**1.5000**
1 1/2–10 UNS	**2A**	**0.0019**	**1.4981**	**1.4852**	—	**1.4331**	**1.4267**	**1.3791**	**2B**	**1.392**	**1.413**	**1.4350**	**1.4433**	**1.5000**
1 1/2–12 UNF	**1A**	**0.0019**	**1.4981**	**1.4809**	—	**1.4440**	**1.4344**	**1.3989**	**1B**	**1.410**	**1.428**	**1.4459**	**1.4584**	**1.5000**
	2A	**0.0019**	**1.4981**	**1.4867**	—	**1.4440**	**1.4376**	**1.3989**	**2B**	**1.410**	**1.428**	**1.4459**	**1.4542**	**1.5000**
	3A	**0.0000**	**1.5000**	**1.4886**	—	**1.4459**	**1.4411**	**1.4008**	**3B**	**1.4100**	**1.4198**	**1.4459**	**1.4522**	**1.5000**
1 1/2–14 UNS	**2A**	**0.0017**	**1.4983**	**1.4880**	—	**1.4519**	**1.4464**	**1.4133**	**2B**	**1.423**	**1.438**	**1.4536**	**1.4608**	**1.5000**
1 1/2–16 UN	**2A**	**0.0016**	**1.4984**	**1.4890**	—	**1.4578**	**1.4526**	**1.4239**	**2B**	**1.432**	**1.446**	**1.4594**	**1.4662**	**1.5000**
	3A	**0.0000**	**1.5000**	**1.4906**	—	**1.4594**	**1.4555**	**1.4255**	**3B**	**1.4320**	**1.4408**	**1.4594**	**1.4645**	**1.5000**
1 1/2–18 UNEF	**2A**	**0.0015**	**1.4985**	**1.4898**	—	**1.4624**	**1.4574**	**1.4324**	**2B**	**1.440**	**1.452**	**1.4639**	**1.4704**	**1.5000**
	3A	**0.0000**	**1.5000**	**1.4913**	—	**1.4639**	**1.4602**	**1.4339**	**3B**	**1.4400**	**1.4480**	**1.4639**	**1.4687**	**1.5000**
1 1/2–20 UN	**2A**	**0.0014**	**1.4986**	**1.4905**	—	**1.4661**	**1.4613**	**1.4391**	**2B**	**1.446**	**1.457**	**1.4675**	**1.4737**	**1.5000**
	3A	**0.0000**	**1.5000**	**1.4919**	—	**1.4675**	**1.4639**	**1.4405**	**3B**	**1.4460**	**1.4537**	**1.4675**	**1.4721**	**1.5000**
1 1/2–24 UNS	**2A**	**0.0013**	**1.4987**	**1.4915**	—	**1.4716**	**1.4672**	**1.4491**	**2B**	**1.455**	**1.465**	**1.4729**	**1.4787**	**1.5000**
1 1/2–28 UN	**2A**	**0.0013**	**1.4987**	**1.4922**	—	**1.4755**	**1.4713**	**1.4561**	**2B**	**1.461**	**1.470**	**1.4768**	**1.4823**	**1.5000**
	3A	**0.0000**	**1.5000**	**1.4935**	—	**1.4768**	**1.4737**	**1.4574**	**3B**	**1.4610**	**1.4676**	**1.4768**	**1.4809**	**1.5000**
1 9/16–6 UN	**2A**	**0.0024**	**1.5601**	**1.5419**	—	**1.4518**	**1.4436**	**1.3617**	**2B**	**1.382**	**1.413**	**1.4542**	**1.4648**	**1.5625**
	3A	**0.0000**	**1.5625**	**1.5443**	—	**1.4542**	**1.4481**	**1.3641**	**3B**	**1.3820**	**1.4021**	**1.4542**	**1.4622**	**1.5625**
1 9/16–8 UN	**2A**	**0.0022**	**1.5603**	**1.5453**	—	**1.4791**	**1.4717**	**1.4115**	**2B**	**1.427**	**1.452**	**1.4813**	**1.4909**	**1.5625**
	3A	**0.0000**	**1.5625**	**1.5475**	—	**1.4813**	**1.4758**	**1.4137**	**3B**	**1.4270**	**1.4422**	**1.4813**	**1.4885**	**1.5625**
1 9/16–12 UN	**2A**	**0.0018**	**1.5607**	**1.5493**	—	**1.5066**	**1.5007**	**1.4615**	**2B**	**1.472**	**1.490**	**1.5084**	**1.5160**	**1.5625**
	3A	**0.0000**	**1.5625**	**1.5511**	—	**1.5084**	**1.5040**	**1.4633**	**3B**	**1.4720**	**1.4823**	**1.5084**	**1.5141**	**1.5625**

Three wire method of checking pitch diameter of screw threads



M = Measurement over wires
E = Pitch diameter of thread
D = Basic major or outside diameter
W = Wire Diameter
M = E + Const.
E = M. - Const.
Const. = 3W - .86603P (found in chart)

The maximum and minimum pitch diameter (E) for each class of thread can be found in machinerys hand book.

CONVERSION CHART FOR 60° METRIC THREADS

PITCH	WIRE SIZE		ADD		CONSTANT	
MM	MM	INCH	MM	INCH	MM	INCH
0.5	.4572	.018	.6138	.02417	.9386	.03695
0.6	.4572	.018	.4623	.01820	.8520	.03354
0.7	.4572	.018	.3107	.01223	.7654	.03013
0.75	.4572	.018	.2349	.00925	7221	.02843
0.8	.6096	.024	.6164	.02427	1.1360	.04472
1.0	.6096	.024	.3133	.01233	.9628	.03790
1.25	.7366	.029	.3154	.01242	1.1273	.04438
1.5	1.0160	.040	.7747	.03050	1.7490	.06886
1.75	1.0160	.040	.3958	.01558	1.5324	.06033
2.0	1.1430	.045	.3979	.01567	1.6969	.06681
2.5	1.3970	.055	.4021	.01583	2.0259	.07976
3.0	1.6002	.063	.2540	.01000	2.2025	.08671
3.5	2.0574	.081	.8678	.03416	3.1411	.12367
4.0	2.3368	.092	.9482	.03733	3.5463	.13962
4.5	2.7432	.108	1.4096	.05550	4.3325	.17057
5.0	2.7432	.108	.6519	.02566	3.8995	.15352
5.5	3.0480	.120	.8085	.03183	4.3808	.17247
6.0	3.2258	.127	.5841	.02300	4.1812	.17643

ONE INCH EQUALS 25.400 MILLIMETERS
.03937 INCH EQUALS ONE MILLIMETER

THREAD CHART
FOR ALL U.S. 60° THREADS

Select the proper wire size for either the number or threads per inch (US) or thread pitch (metric).
Measured pitch dia (E) equals measurement over wires (M) minus decimal in “CONST” column.
NOTE: Basic P.D. equals basic major diameter plus decimal in “ADD” column minus decimal in “CONST” column.

THREADS PER INCH	WIRE SIZE	ADD	CONST	THREADS PER IN	WIRE SIZE	ADD	CONST
48	.018	.02243	.03596	11 1/2	.055	.03321	.09869
44	.018	.01956	.03432	11	.055	.02722	.08627
40	.018	.01611	.03235	10	.055	.01345	.07840
36	.018	.01190	.02994	9	.063	.02061	.09277
32	.024	.02464	.04494	8	.072	.02656	.10775
28	.024	.01787	.04107	7 1/2	.081	.04093	.12753
27	.024	.01587	.03993	7	.081	.02649	.11928
24	.029	.02385	.05092	6	.092	.02341	.13166
20	.029	.01122	.04370	5 1/2	.108	.04845	.16654
18	.032	.01180	.04789	5	.120	.05689	.18679
16	.040	.02528	.06587	4 1/2	.127	.04421	.18855
14	.040	.01175	.05814	4	.143	.05011	.21249
13	.045	.01842	.06838	3 1/2	.185	.12199	.30756
12	.055	.03870	.09283	3	.185	.04982	.26632

DEAD CENTERS & KNURLS TECHNICAL INFORMATION

CNC Threaded Dead Centers

ROYAL PRODUCTS

With 60° Included Angle
For Use On N/C & CNC Live Tailstocks

Features:
- Designed for use in N/C turning centers with live tailstocks
- This center is required where there are **no knockout holes**
- The point is designed to provide excellent tool clearance
- ±0.00005" TIR guaranteed

Application:
- Dead center is threaded so **nut** can be used to remove it from live tailstock in an N/C lathe

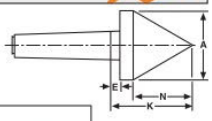
Morse Taper	Thread	HSS Order #	HSS Price Ea.	Carbide Tipped Order #	Carbide Tipped Price Ea.	Extraction Nuts Order #	Extraction Nuts Price Ea.
3MT	1-14	00100735	**$250.80**	00100834	**$341.00**	99088171	**$61.60**
4MT	1¼ - 14	00100743	**304.70**	00100842	**410.30**	98611478	**73.70**
5MT	1¾ - 12	00100750	**434.50**	00100859	**528.00**	90067430	**82.50**

Jarno, Brown & Sharpe and Straight Shank Specials Available. Contact Nationwide Sales.

Pipe Nose Dead Centers

Riten

- Accuracy guaranteed to ±0.00005"
- Through-hardened to 61-63 Rc
- Riten full service, repair and guarantee apply



Morse Taper	Head Dia. A (In.)	Point Length N (In.)	Clearance E (In.)	Point to Gauge Line K (In.)	Mfr's #	Order #	Price Ea.
2MT	2⅛	1.831	½	2.84	66102	90049552	**$259.33**
3MT	2¾	2.370	½	3.38	66103	05070578	**375.41**
4MT	2¾	2.370	½	3.38	66104	99286684	**444.57**
5MT	3½	3.017	½	4.03	66105	99402398	**523.59**

MSC

Basics of...*Knurls*

A knurling die is used to create a pattern on a cylindrical blank (metal or hard plastic). These dies have V-shaped teeth that deform, displace or push the material rather than cut it. The embossed patterns can be decorative, but more often act as hand grips and are commonly seen on handles, knobs or rollers. Diagonal, diamond and straight are the three most common patterns generated by knurling dies.

Types of Knurls


Straight Tooth


30° Diagonal R.H.


30° Diagonal L.H.


30° Diamond Male


30° Diamond Female

- Straight tooth knurls will produce the straight knurl pattern
- 30° RH diagonal knurls will produce a LH diagonal knurl pattern or a male diamond pattern if used along with a LH diagonal knurl in a double knurl holder
- 30° LH diagonal knurls will produce a RH diagonal knurl pattern or a male diamond pattern if used along with a RH diagonal knurl in a double knurl holder
- 30° male diamond will produce a female diamond knurl pattern
- 30° female diamond will produce a male diamond knurl pattern. This is only recommended if a double knurl holder is unavailable. The knurled blank should be close to the collet and large enough in diameter to prevent deflection

Traversing is not recommended when using diamond knurls (if a longer knurl pattern is required, left and right hand diagonal knurls should be used).

Determining Blank Diameter and the Number of Teeth that will be Rolled

For Circular pitch knurls:

Blank Dia. = (# Teeth [part] / # Teeth [die]) x (Knurl Dia. + C.F.*)

or

Teeth [part] = (Blank Dia. x # Teeth [die]) / (Knurl Dia. + C.F.*)

TPI	*Approximate Value of C.F. (In.)
12-19	0.010
20-29	0.007
30-39	0.005
40-49	0.003
50-80	0.002

*This value is affected by feed rates, blank hardness and diameters of knurl & blank..

For Diametral pitch knurls:

Blank Dia. = # Teeth [part] / D.P. of Knurl

or

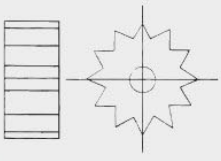
Teeth [part] = Blank Dia. x D.P. of Knurl

Diametral pitch knurls are designed to permit accurate tracking on standard fractional sized blanks. This makes choosing a blank diameter easier. Due to the Tracking Correction Factor (C.F.), choosing a blank diameter for circular pitch knurls is a bit more difficult and usually involves experimentation.

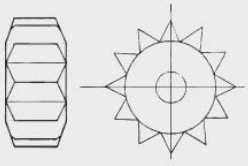
- C.F. = Tracking Correction Factor. This correction factor takes into account the fact that the tips of the knurl's teeth will penetrate below the blank's diameter by the end of the 1st revolution.

Tips on Choosing the Shape of Knurls

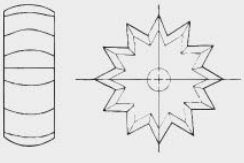
Knurling dies with a full form convex radius on each edge produce the best finishes and increase tool life when axial feeding.



GOOD: Sharp corners on leading edge of tool sees heavy loading, wear rapidly and can break off in extreme conditions.



BETTER: Beveled edge spreads out load, but now the leading edge is a blunt surface requiring higher forces on tool and holder to deform material.



BEST: Convex full form relief gives a "spread out" loading on a sharp leading edge resulting in a smoother precision finish, longer tool life and lower forces on the holder and spindle bearings.

Basic Tips

- Make sure the knurl's axis is parallel to the blank's axis
- Use lots of lubricant
- Never over roll. Try to limit the pattern to only about 90% full
- Increase the feed rate in the 1st revolution. Forming a deeper, wider impression the 1st time around helps to assure that the teeth will track into the initial grooves for all subsequent revolutions