

Magneto-Thermo-Mechanical Test Frame (MTM) for the characterization of multicaloric effects in metamagnetic shape memory alloys

Load frame specifications:

Sample Size: 8mm x 4mm x 4mm

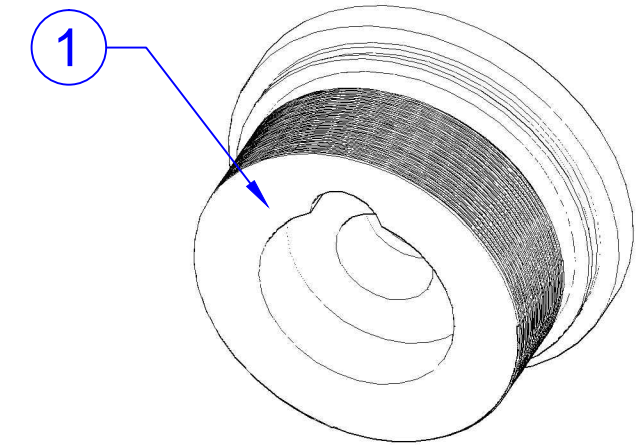
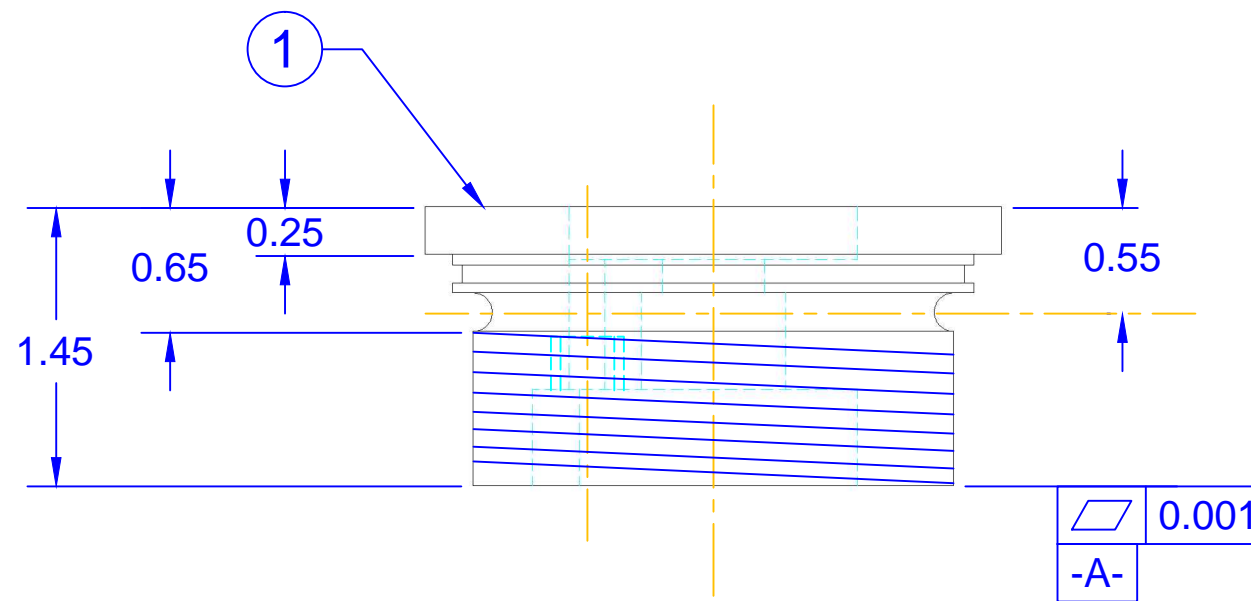
Maximum Sample Load: 200 MPa

Maximum Sample Field: 9 Tesla

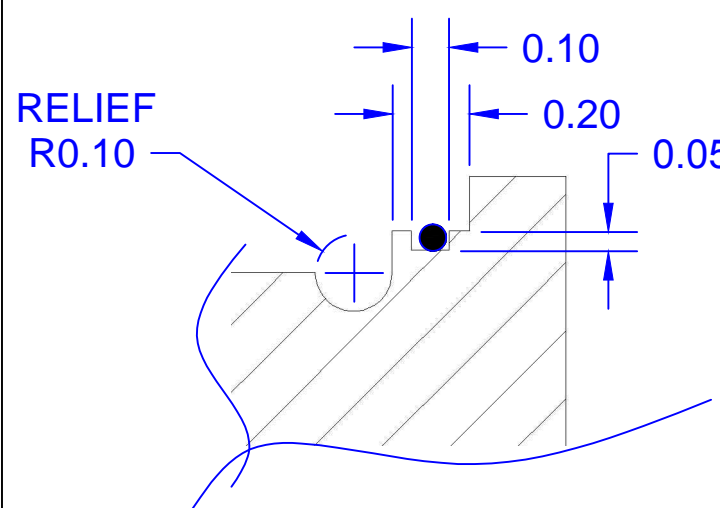
Maximum Sample Temperature: 353K

- All components are para/dia-magnetic
- Parts interacting with the sample are CuBe for thermal conductivity and hardness.
- All other parts are Ti (grade2) for thermal conductivity, machinability, and strength.



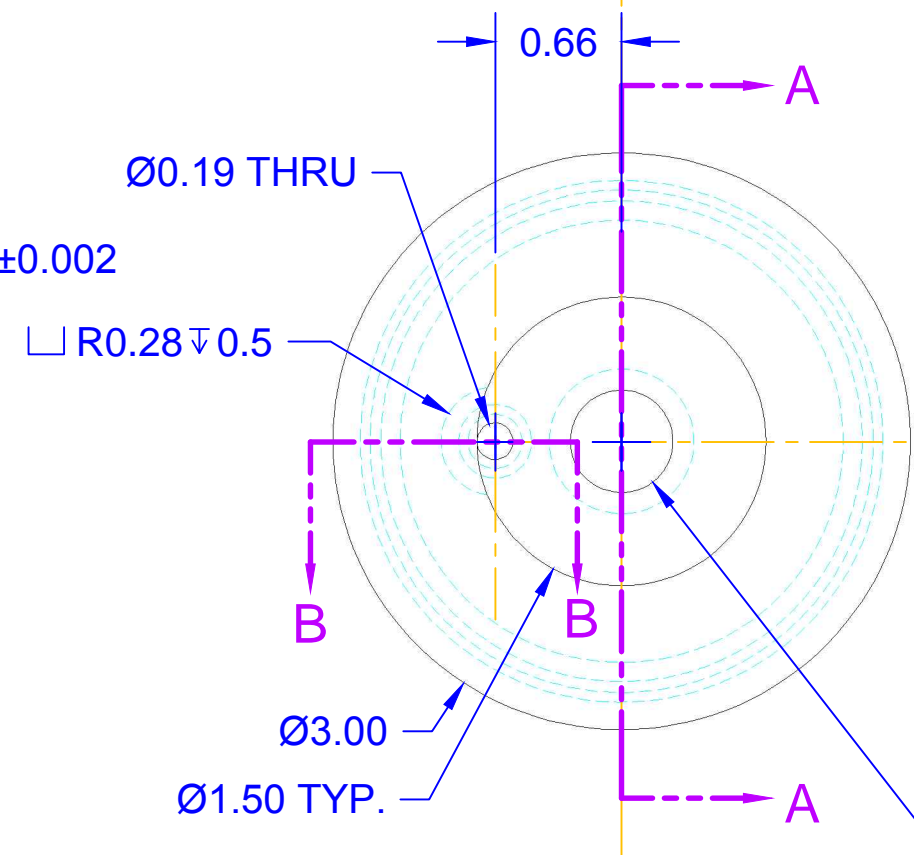


TOP CAP

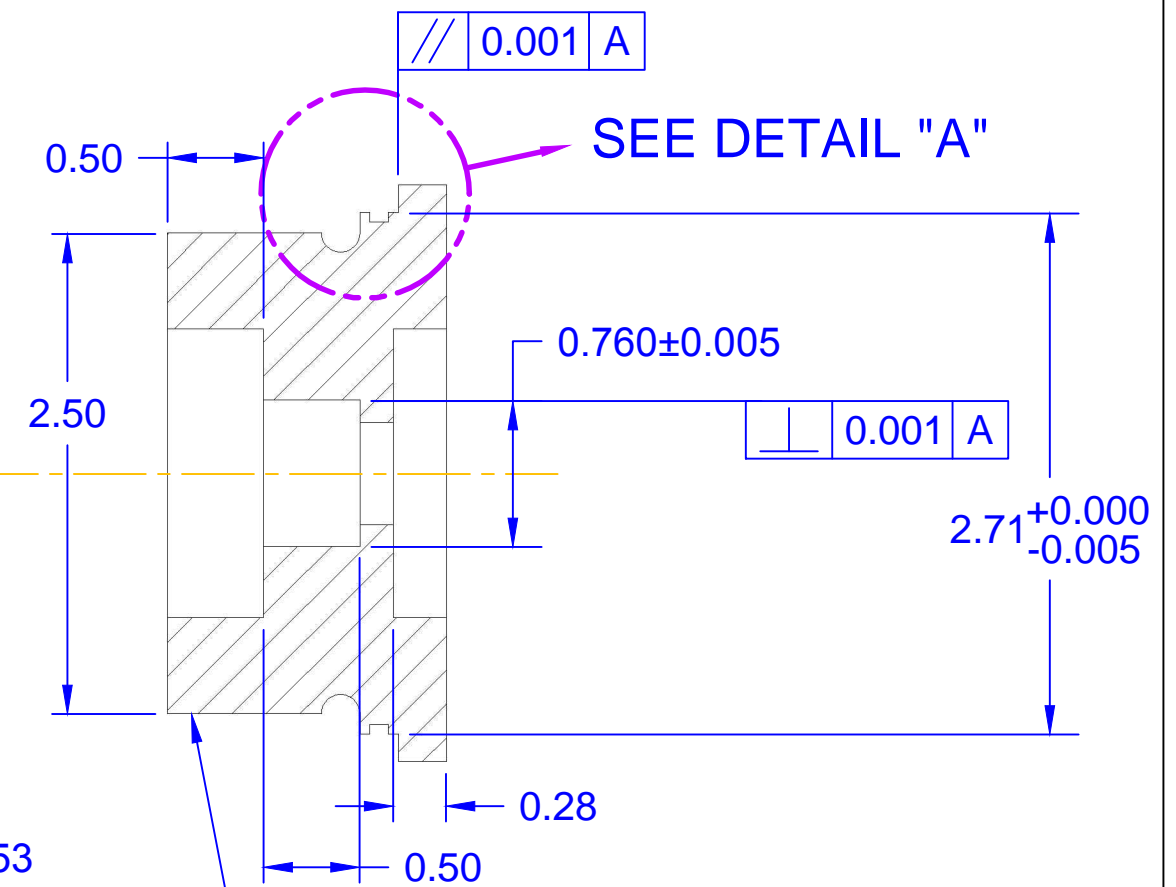


DETAIL "A"
GLAND FOR -038 ORING
SCALE 2:1

Kt = 2.35 (stress concentration)
40.2MPa Max stress predicted

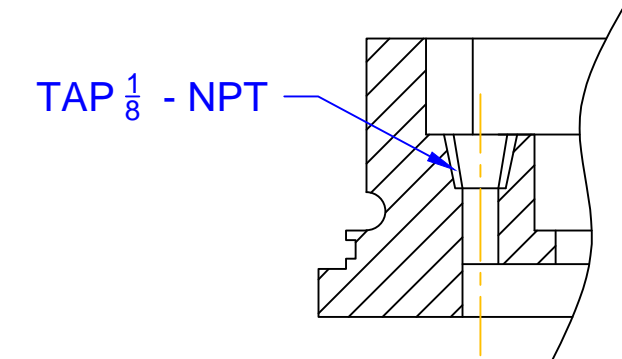


SECTION B-B



SECTION A-A

2.5 - 18 UNS 2A
THREAD FROM END TO RELIEF



TAP 1/8 - NPT

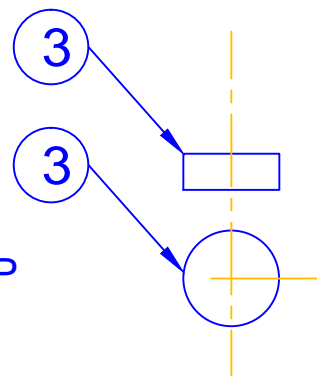
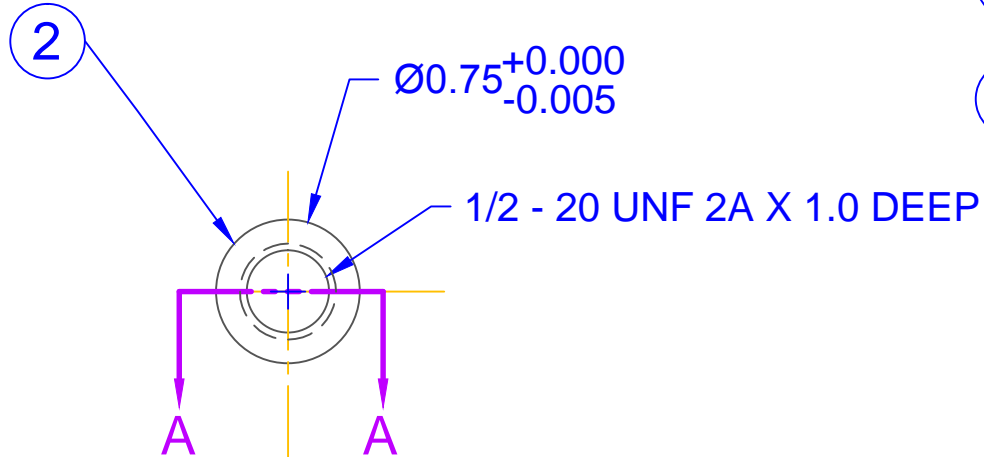


SCALE 1:1
ALL DIMENSIONS IN INCHES
ALL TOLERANCES ± 0.01
UNLESS SPECIFIED

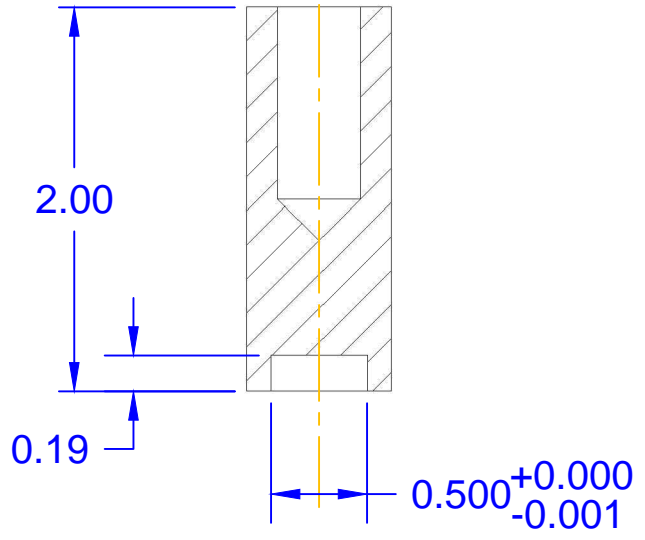
DWG BY	CHECK	CHECK
NMB		

DWG NAME	TOP CAP
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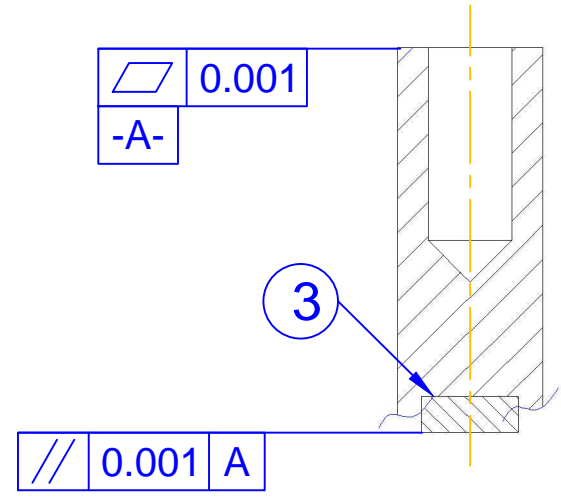
MATERIAL LIST			
No.	QTY	STOCK SIZE	MATERIAL
1	1	3" DIA. X 1.5" LG.	Titanium (Grade 2)



PRESS FIT 2 INTO 1



SECTION A-A



CHECK TOLERANCE AFTER PRESS FIT

*NOTE: 48.4MPa MAXIMUM STRESS WHILE LOADING (42MPa RADIAL AND TANGENTIAL STRESS FROM SHRINK FIT)
 -CuBe (C17510) SELECTED FOR HIGH THERMAL CONDUCTIVITY (240W/MK), HARDNESS, AND YIELD STRENGTH.

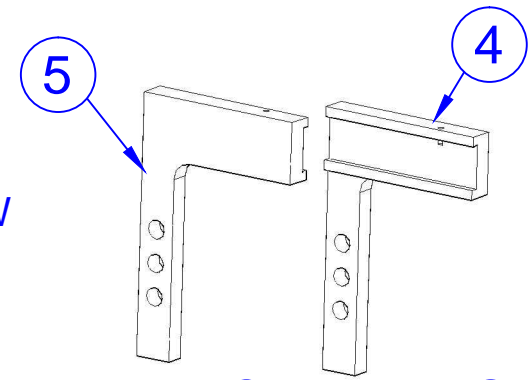


SCALE 1:1
 ALL DIMENSIONS IN INCHES
 ALL TOLERANCES ± 0.01
 UNLESS SPECIFIED

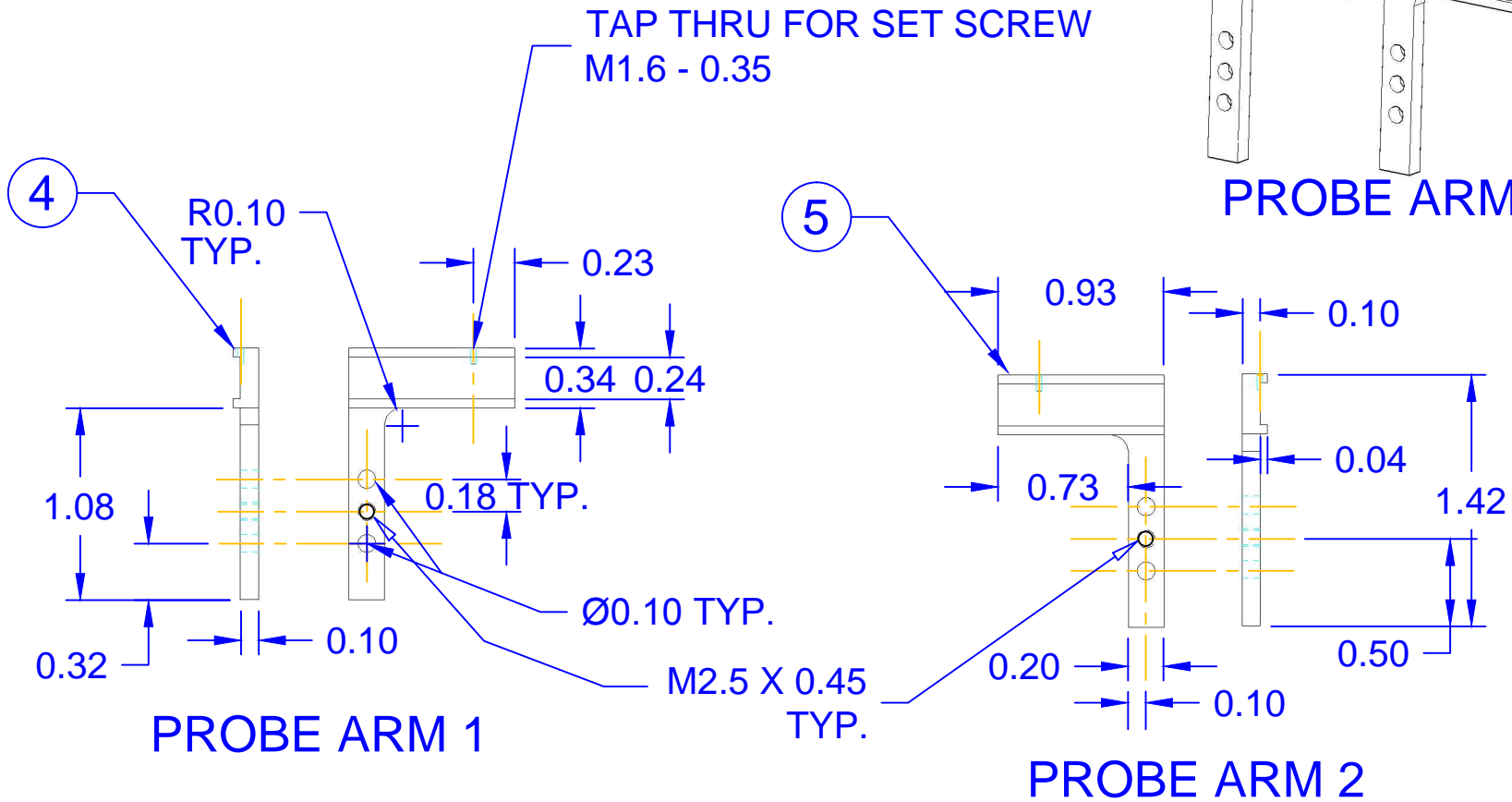
DWG BY	CHECK	CHECK
NMB		

MATERIAL LIST				
DWG NAME	No.	QTY	STOCK SIZE	MATERIAL
TOP ROD	2	1	0.75" DIA. X 2" LG.	CuBe (C17510)
	3	1	Bass Tool and Supply inc. Prod. No. RNG 43T	SX-5 Tool Ceramic

PROBE ARM 2 IS MIRROR IMAGE OF PROBE ARM 1



PROBE ARMS



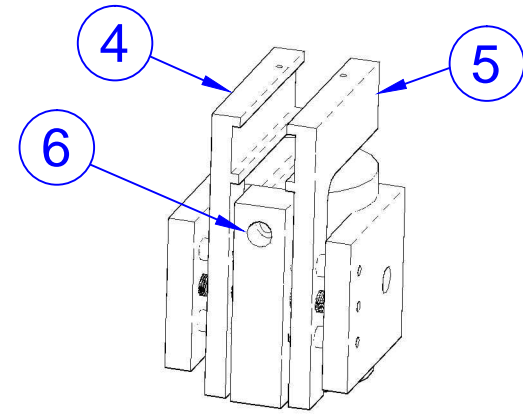
*NOTE: THREADS ARE METRIC BUT DRAWING IS INCHES
-TI (GRADE 2) SELECTED FOR LOW THERMAL CONDUCTIVITY (16W/MK)



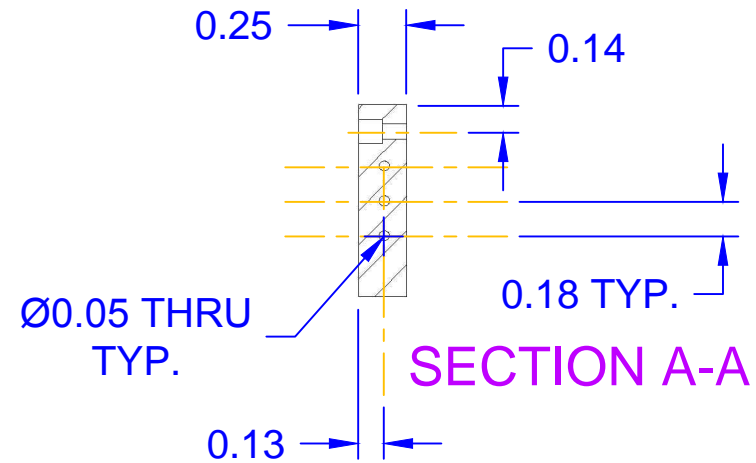
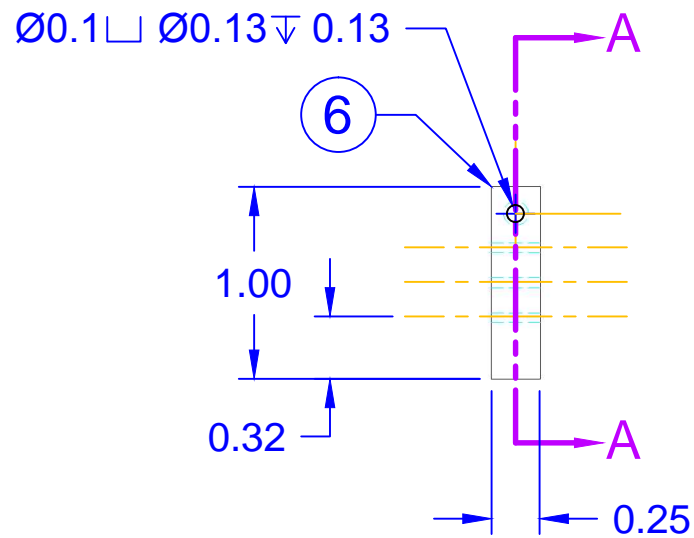
SCALE 1:1
ALL DIMENSIONS IN INCHES
ALL TOLERANCES ± 0.01
UNLESS SPECIFIED

DWG BY	CHECK	CHECK
NMB		

MATERIAL LIST				
DWG NAME	No.	QTY	STOCK SIZE	MATERIAL
PROBE ARMS	4	1	1" X 1.5" X 0.1"	Titanium (Grade 2)
	5	1	1" X 1.5" X 0.1"	Titanium (Grade 2)



SPINE



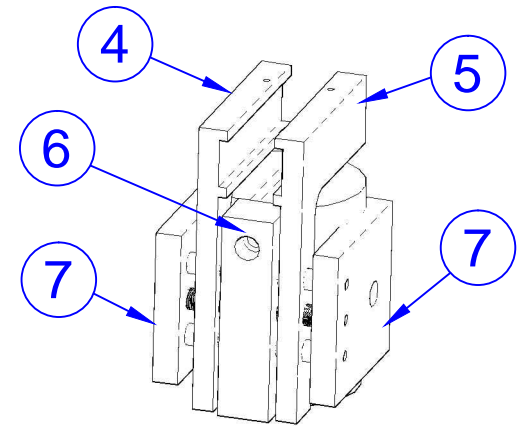
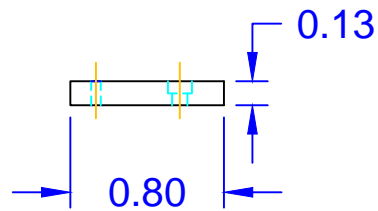
*NOTE: NON-LOAD BEARING
 TI (GRADE 2) SELECTED FOR LOW THERMAL CONDUCTIVITY (16W/MK)



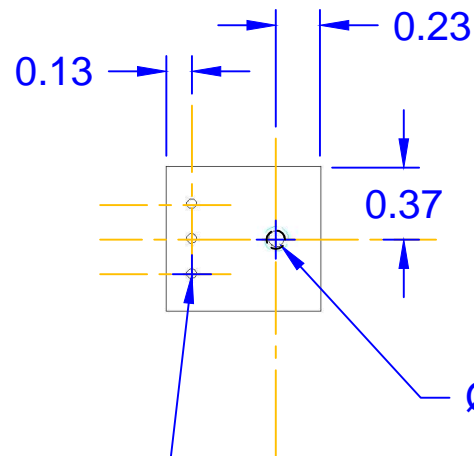
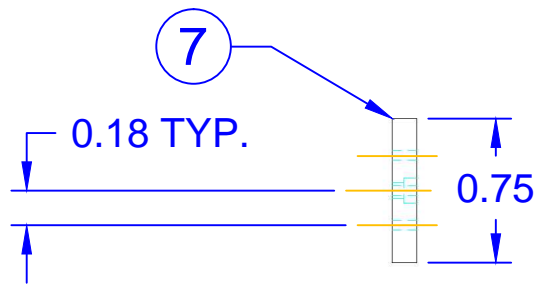
SCALE 1:1
 ALL DIMENSIONS IN INCHES
 ALL TOLERANCES ± 0.01
 UNLESS SPECIFIED

DWG BY	CHECK	CHECK
NMB		

DWG NAME	MATERIAL LIST			
	No.	QTY	STOCK SIZE	MATERIAL
SPINE	6	1	0.25" X 0.25" X 1"	Titanium (Grade 2)



ARM COMPONENT CONFIGURATION



Ø0.05 TYP.
THRU

*NOTE: THREADS ARE METRIC BUT DRAWING IS INCHES
 -TI (GRADE 2) SELECTED FOR LOW THERMAL CONDUCTIVITY (16W/MK)



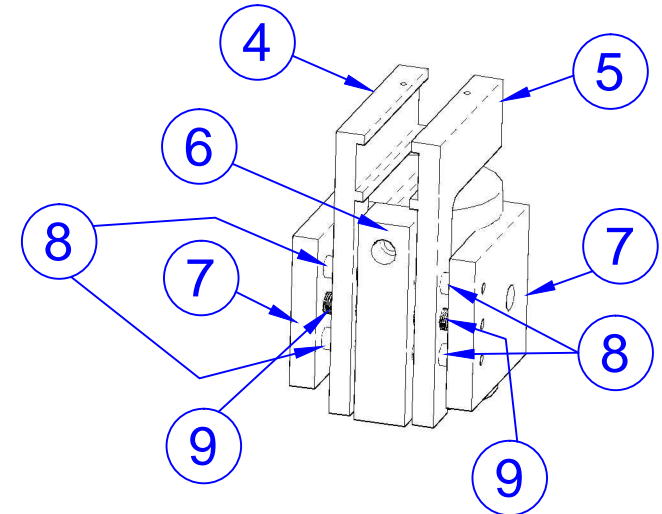
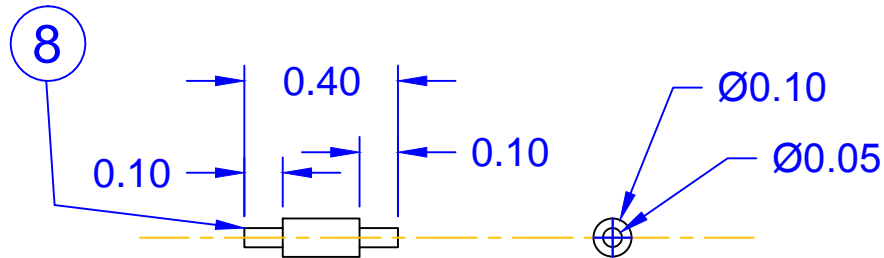
SCALE 1:1
 ALL DIMENSIONS IN INCHES
 ALL TOLERANCES ± 0.01
 UNLESS SPECIFIED

DWG BY	CHECK	CHECK
NMB		

DWG NAME
SIDES

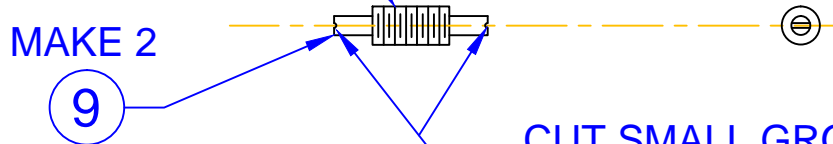
MATERIAL LIST			
No.	QTY	STOCK SIZE	MATERIAL
7	2	0.8" X 0.75" X 0.125"	Titanium (Grade 2)

MAKE 4



ARM COMPONENT CONFIGURATION

M2.5 X 0.45 THREAD
2 RODS



CUT SMALL GROVE
FOR FLAT HEAD SCREWDRIVER

*NOTE: THREADS ARE METRIC BUT DRAWING IS INCHES
-TI (GRADE 2) SELECTED FOR LOW THERMAL CONDUCTIVITY (16W/MK)

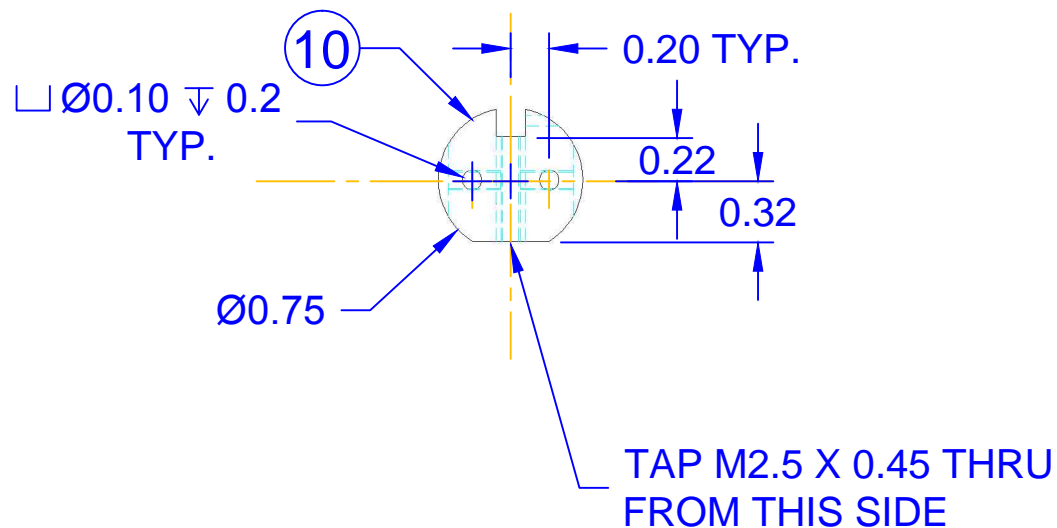
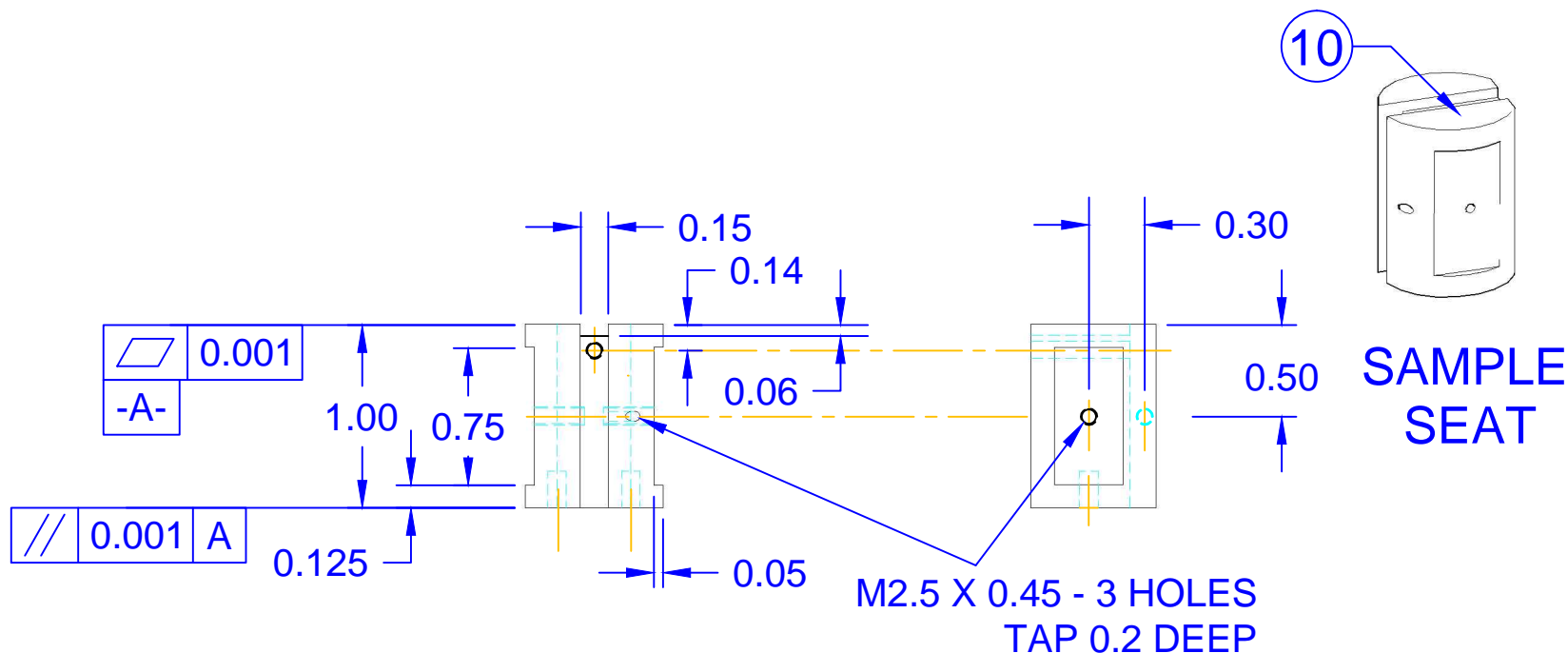


SCALE 2:1
ALL DIMENSIONS IN INCHES
ALL TOLERANCES ± 0.01
UNLESS SPECIFIED

DWG BY	CHECK	CHECK
NMB		

DWG NAME
ARM RODS

MATERIAL LIST			
No.	QTY	STOCK SIZE	MATERIAL
8	4	Ø0.2" X 0.8" LG.	Titanium (Grade 2)
9	2	M2.5 X 0.45 - 0.8 LG.	Titanium (Grade 2)



*NOTE: THREADS ARE METRIC BUT DRAWING IS INCHES
 -CuBe SELECTED FOR HIGH THERMAL CONDUCTIVITY (240W/MK)

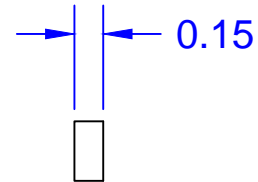
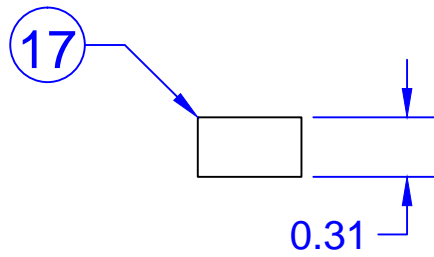
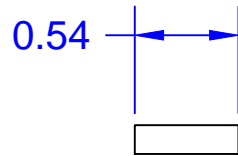
SCALE 1:1
 ALL DIMENSIONS IN INCHES
 ALL TOLERANCES ± 0.01
 UNLESS SPECIFIED

DWG BY	CHECK	CHECK
NMB		

DWG NAME
SEAT

MATERIAL LIST			
No.	QTY	STOCK SIZE	MATERIAL
10	1	Ø0.75 X 1.0 LG.	CuBe (C17510)





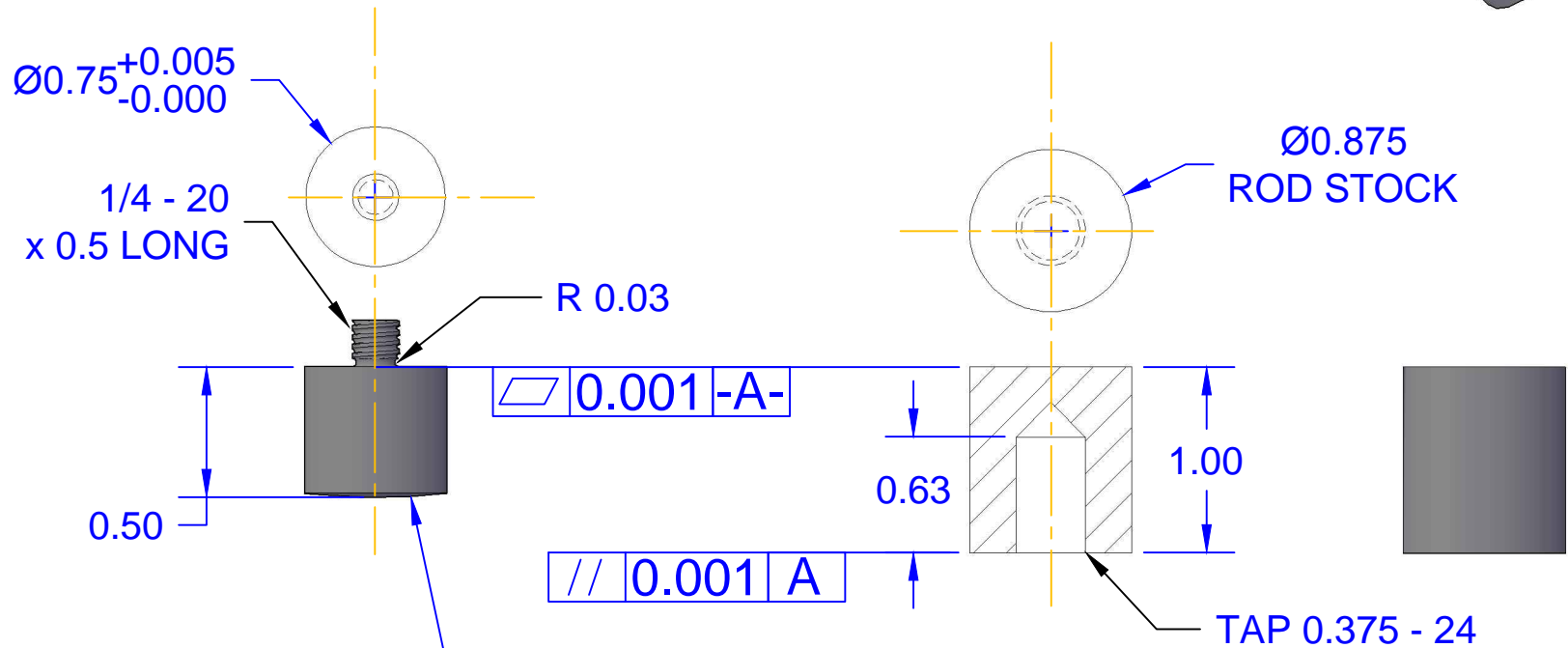
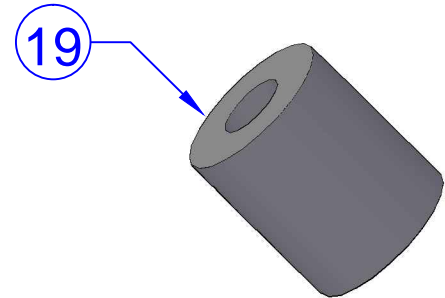
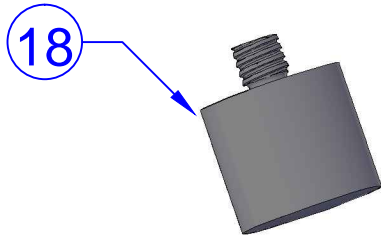
**NOTE: RECTANGULAR ALUMINA SEAT MUST BE CUT FROM HIGH TEMPERATURE, NONPOROUS, HIGH DENSITY, ALUMINA CERAMIC WITH A MINIMUM COMPRESSIVE STRENGTH OF 210KSI



SCALE 1:1
 ALL DIMENSIONS IN INCHES
 ALL TOLERANCES ± 0.005
 UNLESS SPECIFIED

DWG BY	CHECK	CHECK
NMB		

DWG NAME	MATERIAL LIST			
	No.	QTY	STOCK SIZE	MATERIAL
AL203 SEAT	17	3		HIGH DENSITY AL2O3 SEE NOTE**



R3.23
SPHERICAL

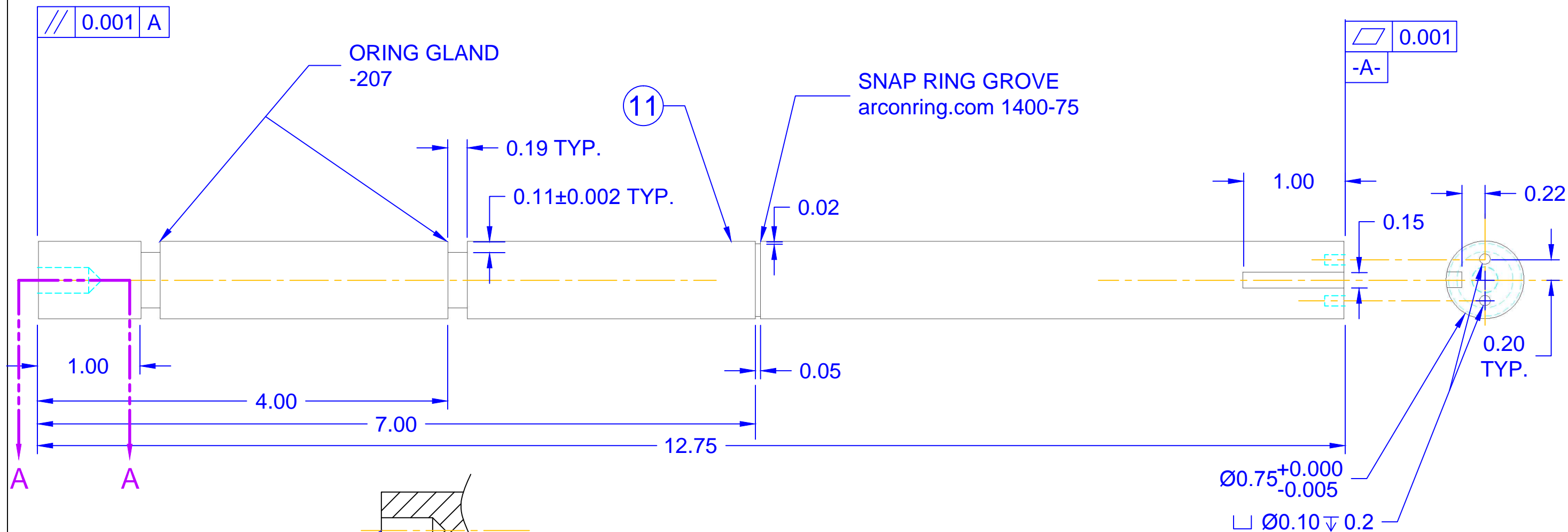


SCALE 1:1
ALL DIMENSIONS IN INCHES
ALL TOLERANCES ± 0.005
UNLESS SPECIFIED

DWG BY	CHECK	CHECK
NMB		

DWG NAME
PLATENS

MATERIAL LIST			
No.	QTY	STOCK SIZE	MATERIAL
18	1	0.875 X 6	TI-6-4
19	1	0.875 X 6	TI-6-4



BOTTOM COMPRESSION ROD



SCALE 1:1
 ALL DIMENSIONS IN INCHES
 ALL TOLERANCES ± 0.01
 UNLESS SPECIFIED

DWG BY	CHECK	CHECK
NMB		

DWG NAME	
BTM. ROD	

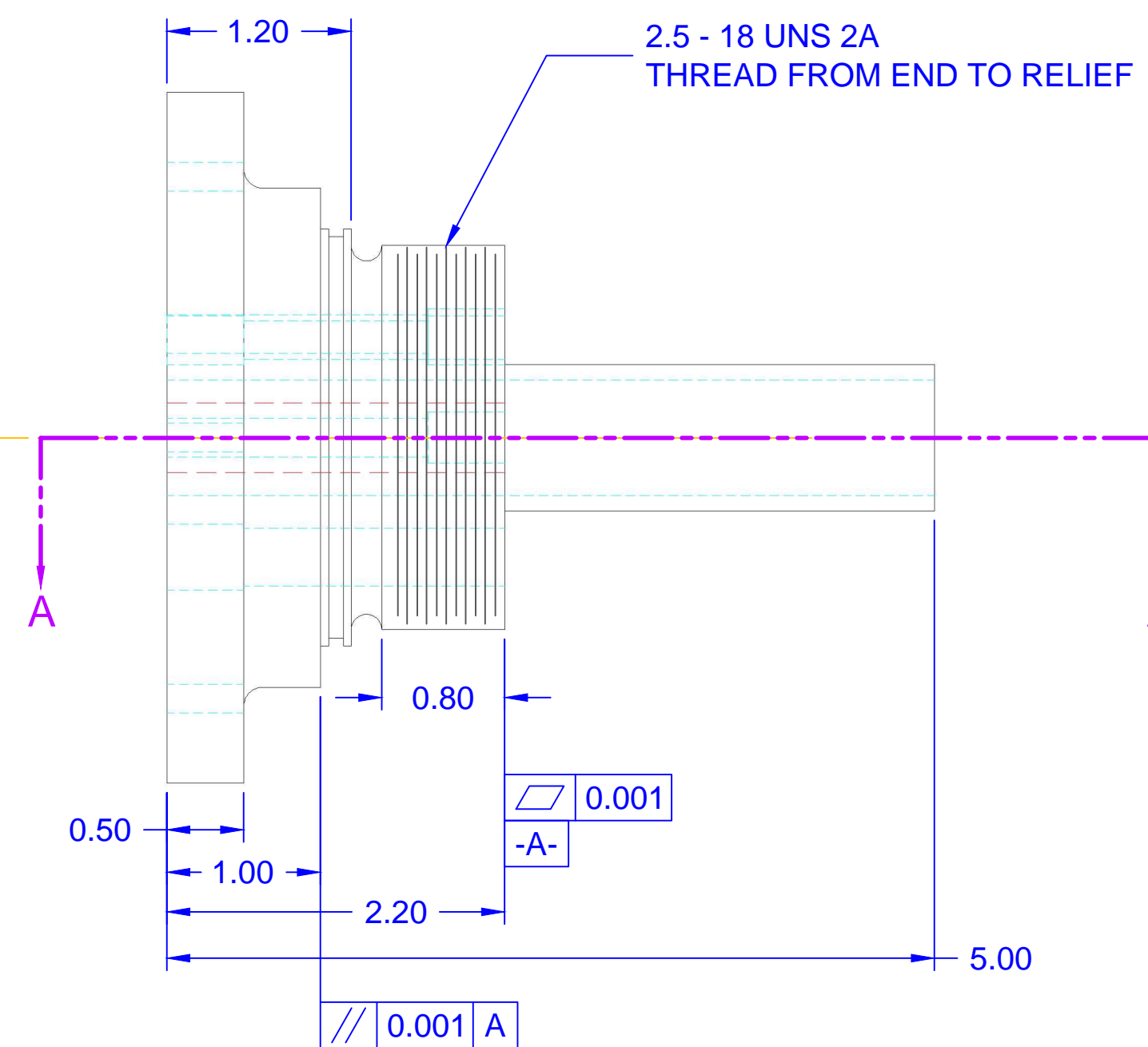
MATERIAL LIST			
No.	QTY	STOCK SIZE	MATERIAL
11	1	Ø0.75 X 12.75 LG.	Titanium (Grade 2)

TAP $\frac{3}{8}$ - 24 X 0.5 DEEP
Ø0.25 THRU

12

Ø0.45 THRU

TAP $\frac{1}{4}$ - NPT
Ø0.375 THRU



TAP $\frac{3}{8}$ - 24 X 0.5 DEEP
Ø0.25 THRU

TAP $\frac{1}{8}$ - NPT
Ø0.25 THRU

120° TYP.

54°

Ø0.760±0.005 THRU

Ø0.95

Ø1.56

Ø2.50

Ø2.71^{+0.000}
-0.005

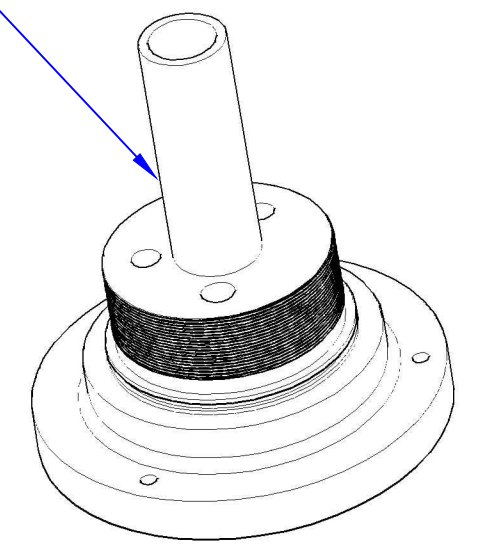
Ø3.25

Ø3.92

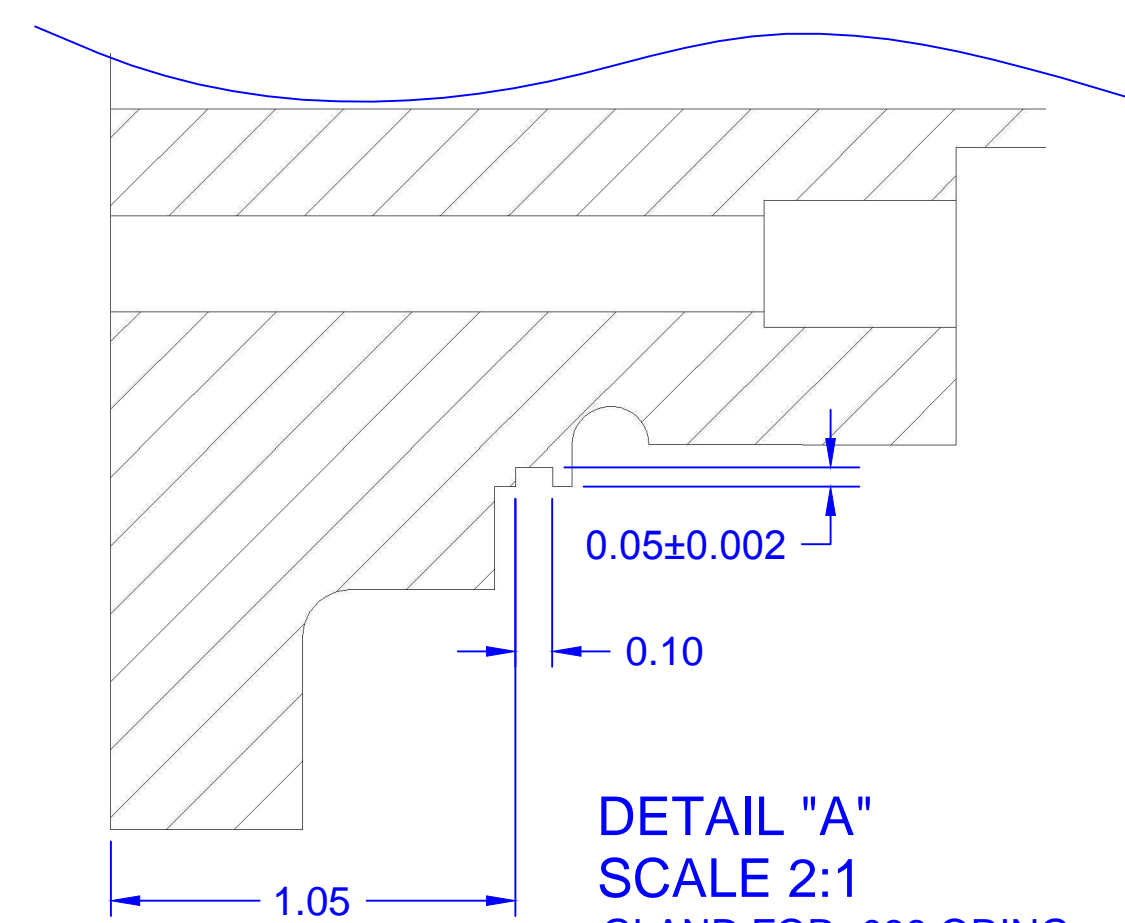
Ø4.450^{+0.004}
-0.002

TAP $\frac{1}{4}$ - 20 THRU X 3 LOC.

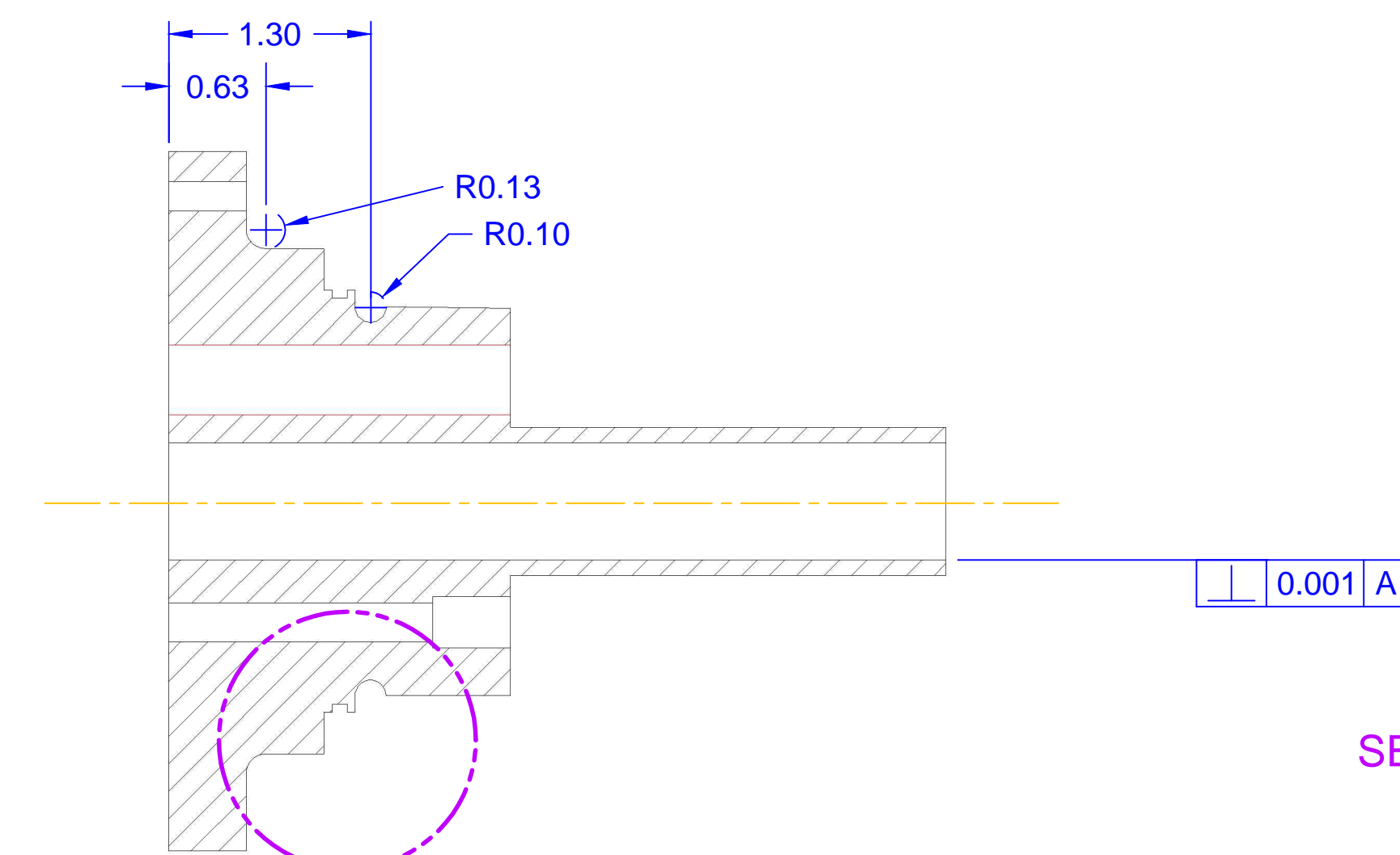
12



BOTTOM CAP



DETAIL "A"
SCALE 2:1
GLAND FOR -038 ORING
SCALE 2:1



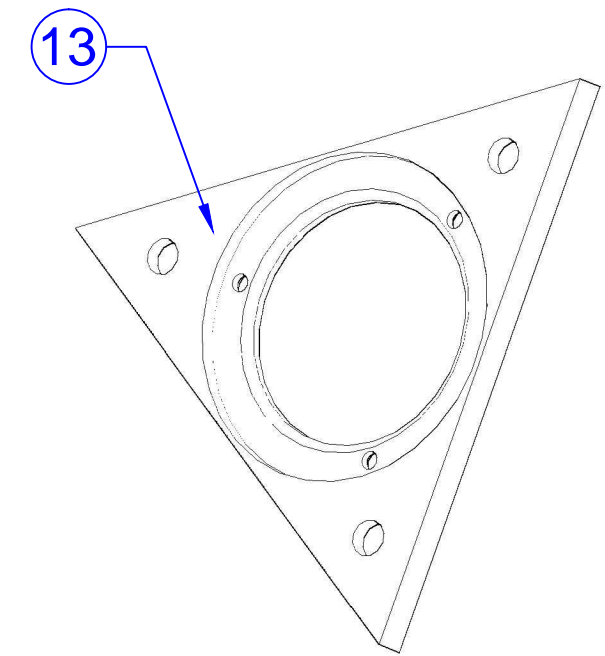
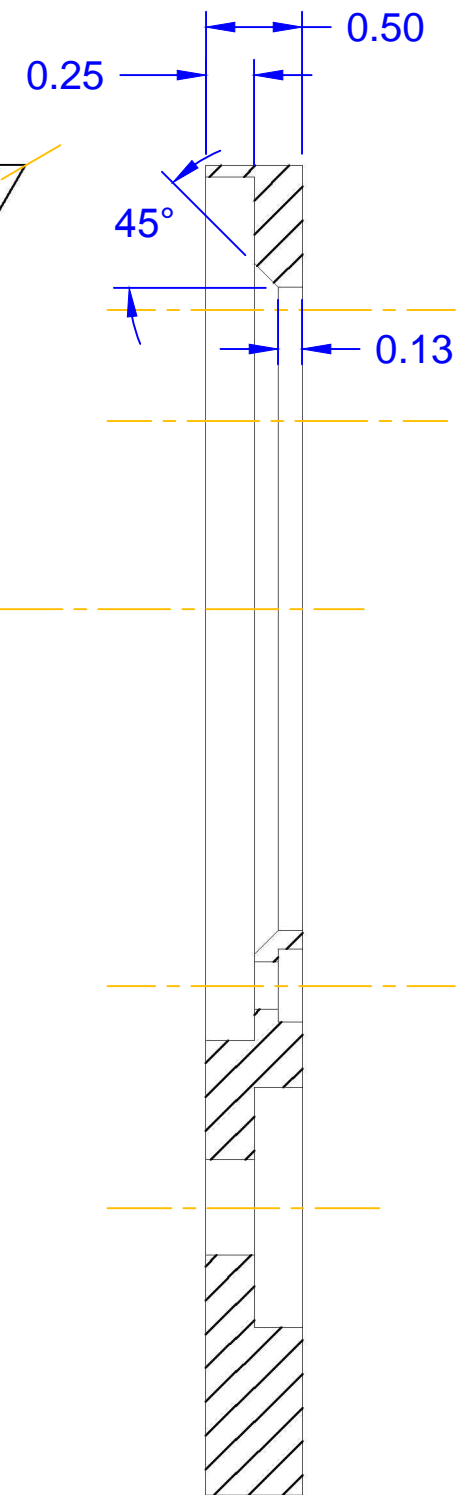
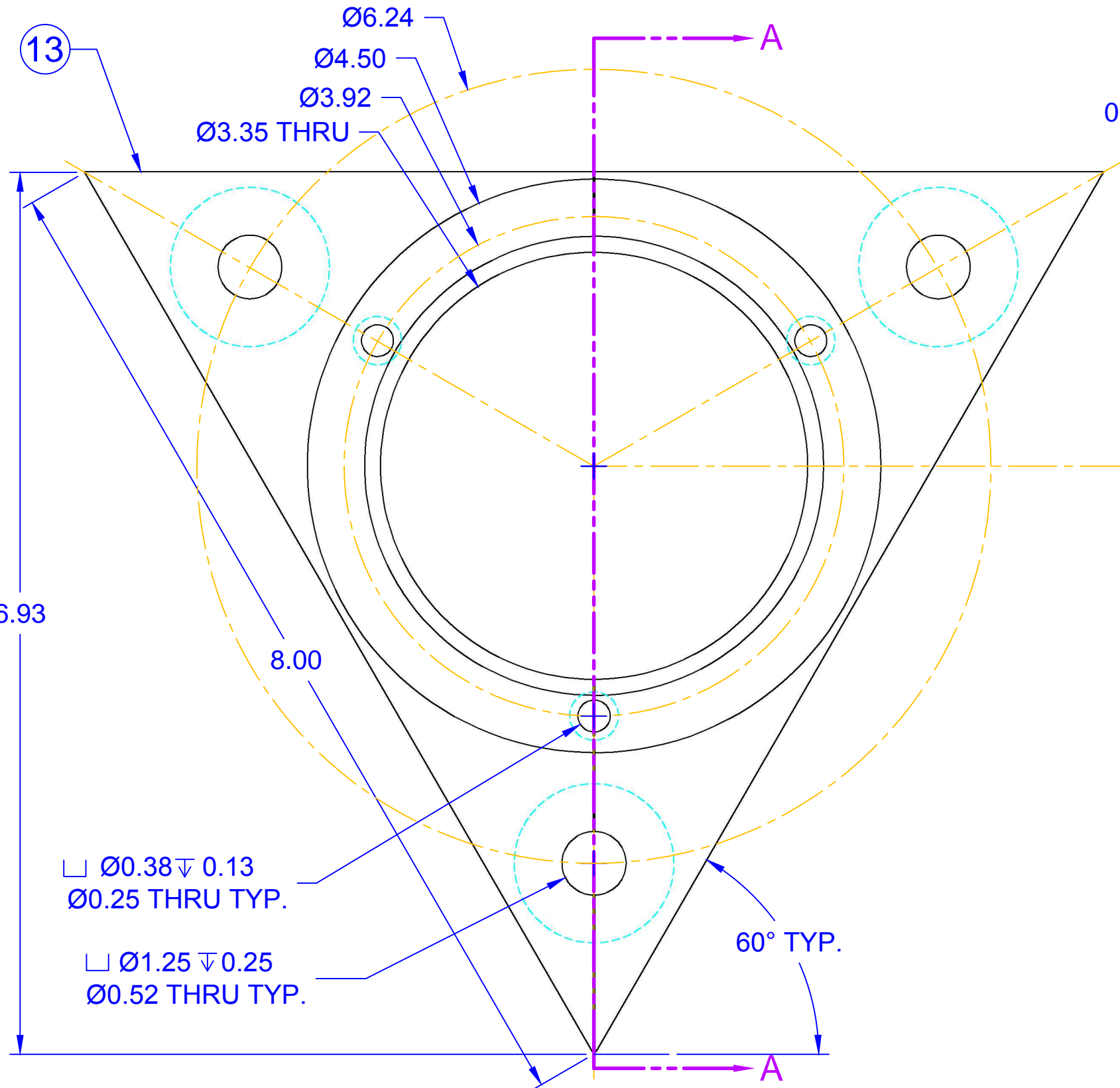
SECTION A-A

SEE DETAIL "A"



SCALE 1:1
ALL DIMENSIONS IN INCHES
ALL TOLERANCES ± 0.01
UNLESS SPECIFIED

DWG NAME		MATERIAL LIST	
No.	QTY	STOCK SIZE	MATERIAL
12	1	Ø4.5 X 5 LGS.	Titanium (Grade 2)
BTM. CAP			



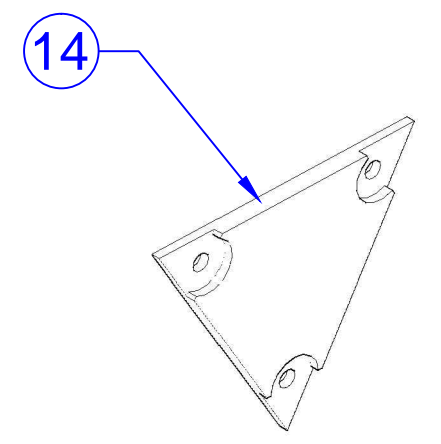
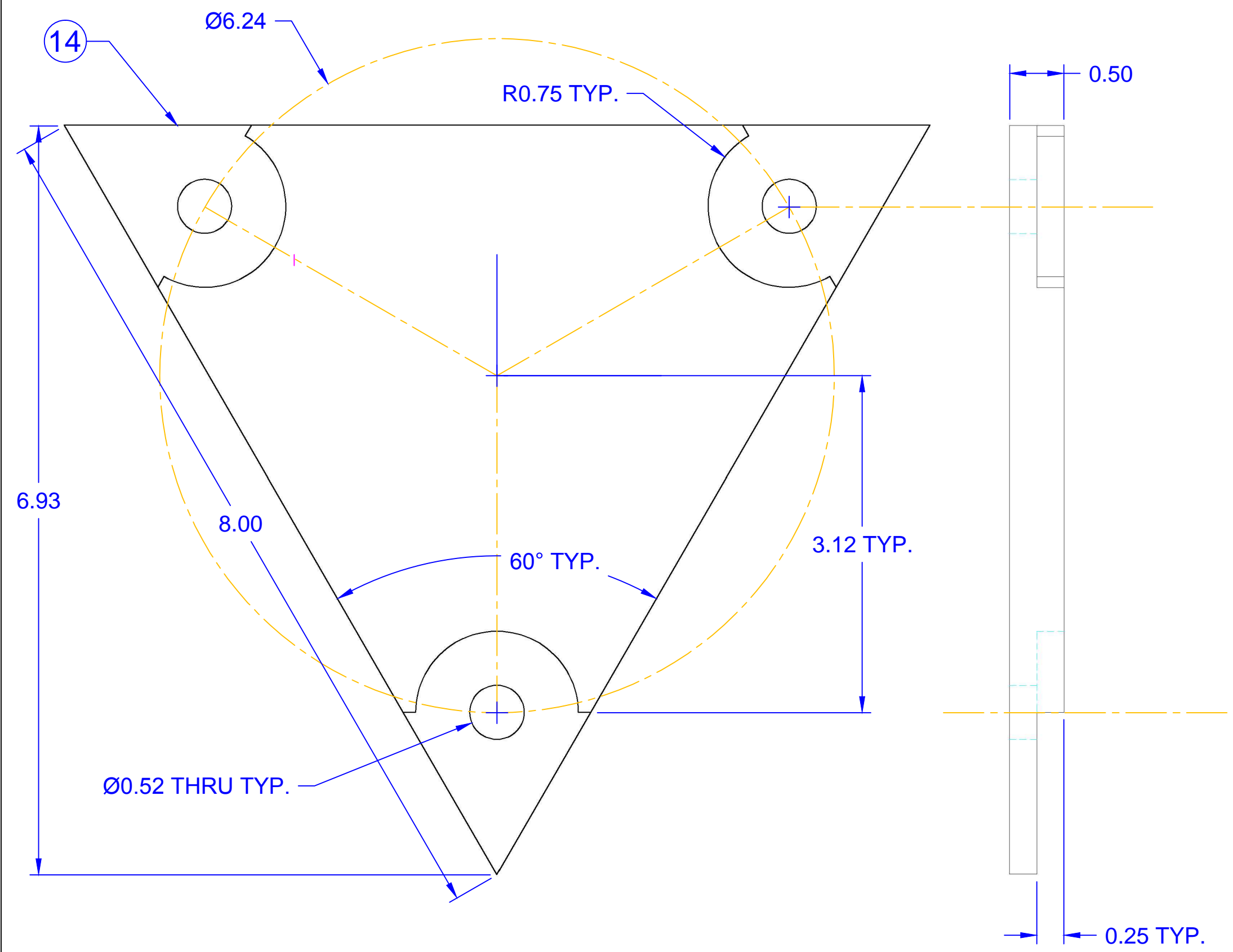
SECTION A-A



SCALE 1:1
 ALL DIMENSIONS IN INCHES
 ALL TOLERANCES ± 0.01
 UNLESS SPECIFIED

MATERIAL LIST			
No.	QTY	STOCK SIZE	MATERIAL
13	1	8" X 8" X 0.5"	Titanium (Grade 2)

DWG NAME	BTM. PLATE		
DWG BY	CHECK	CHECK	
NMB			



BASE PLATE

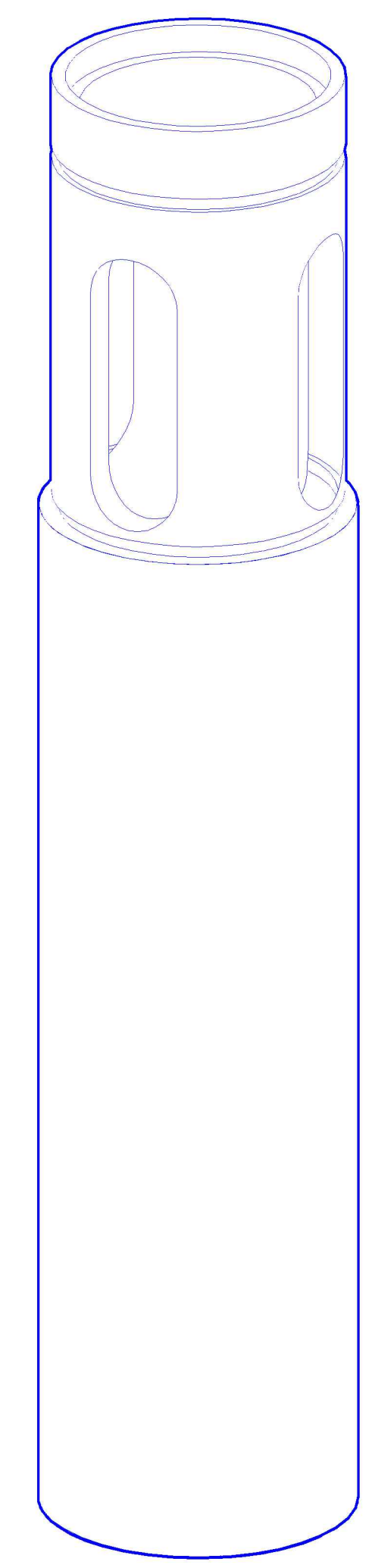
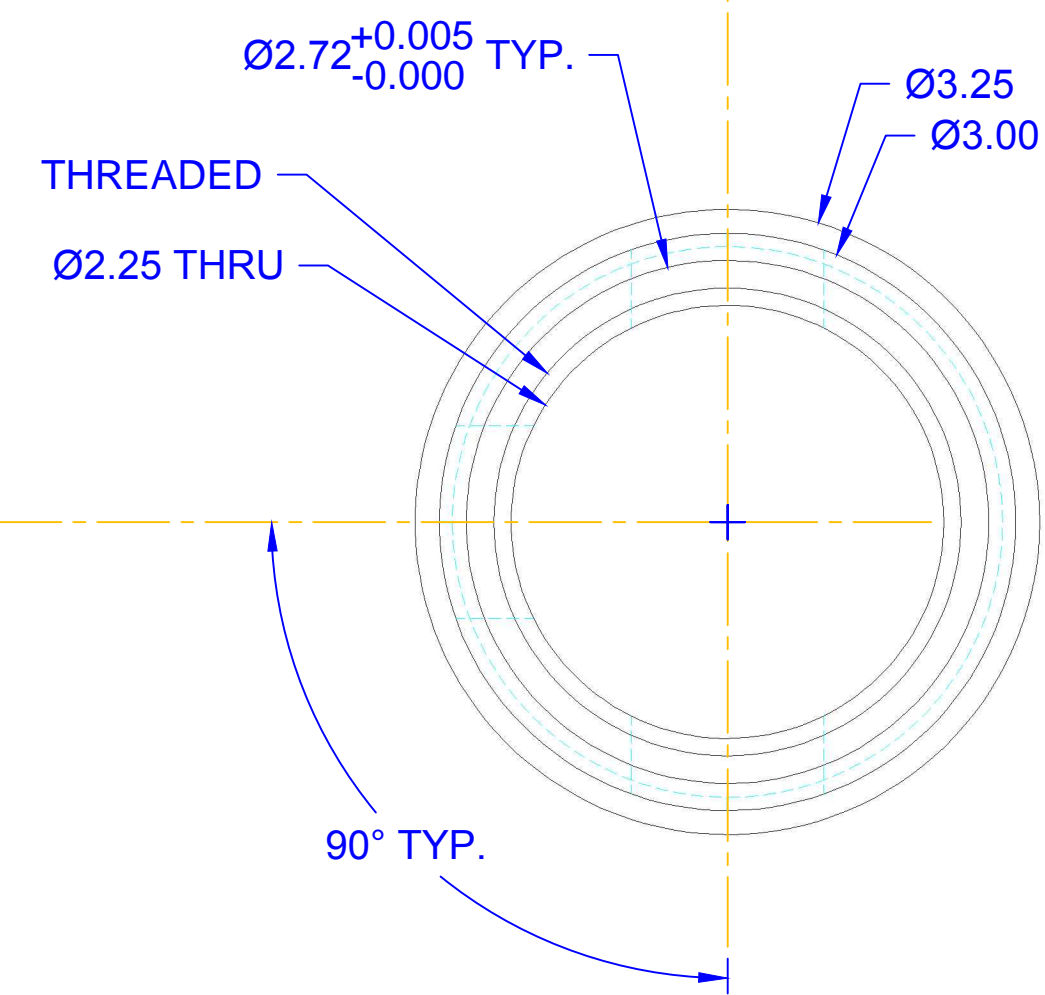
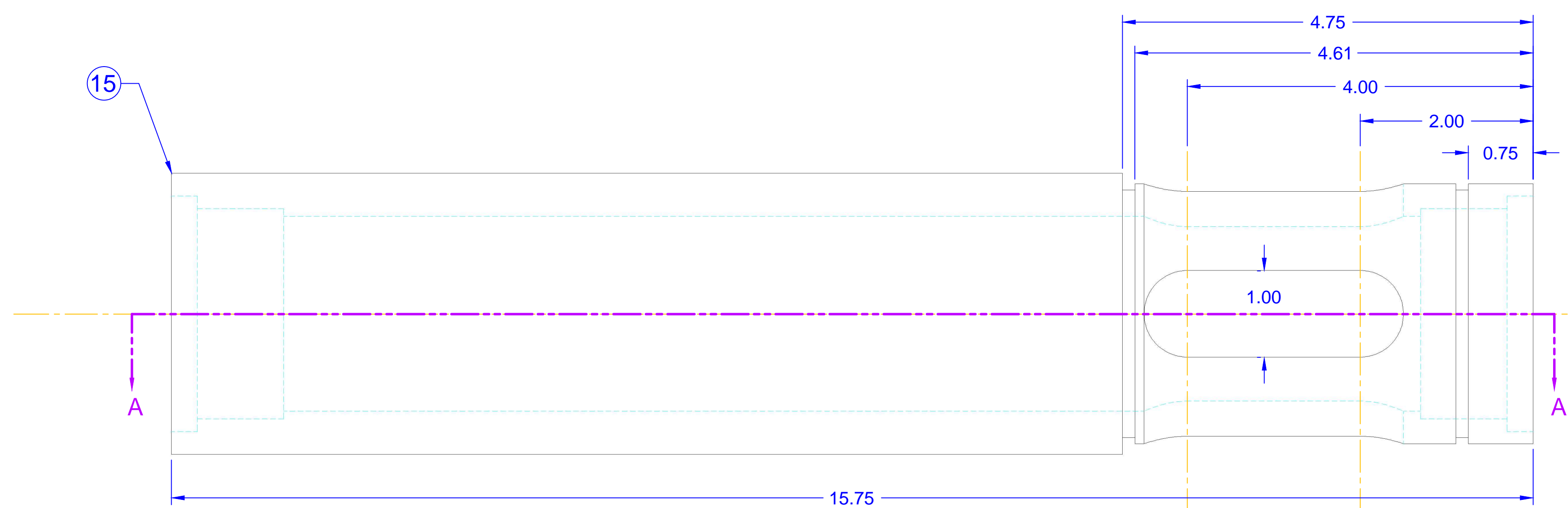


SCALE 1:1
 ALL DIMENSIONS IN INCHES
 ALL TOLERANCES ± 0.01
 UNLESS SPECIFIED

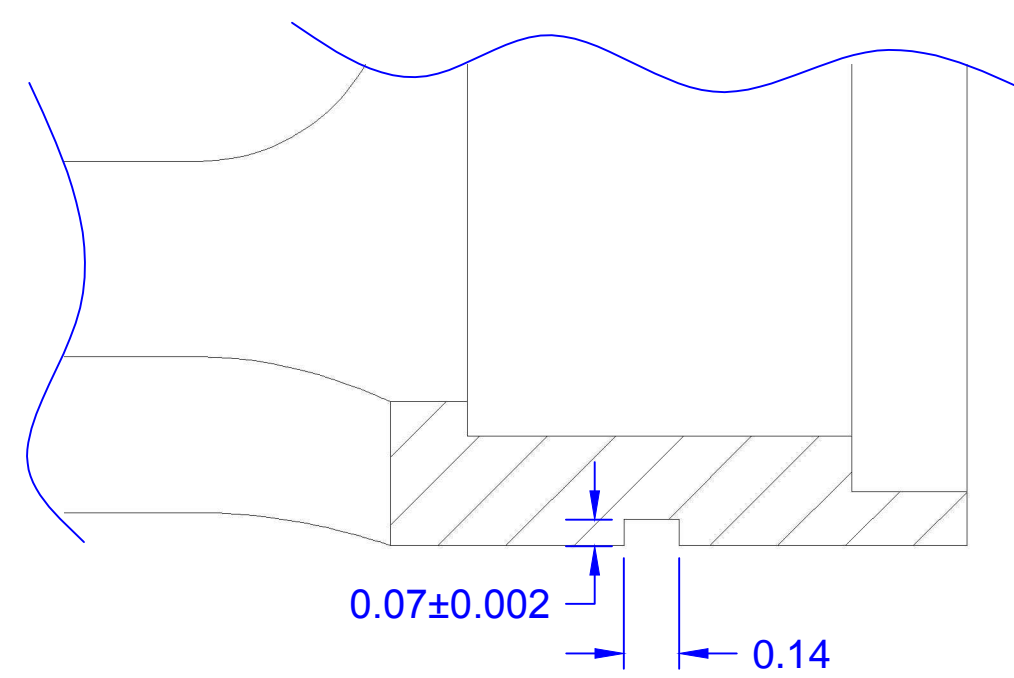
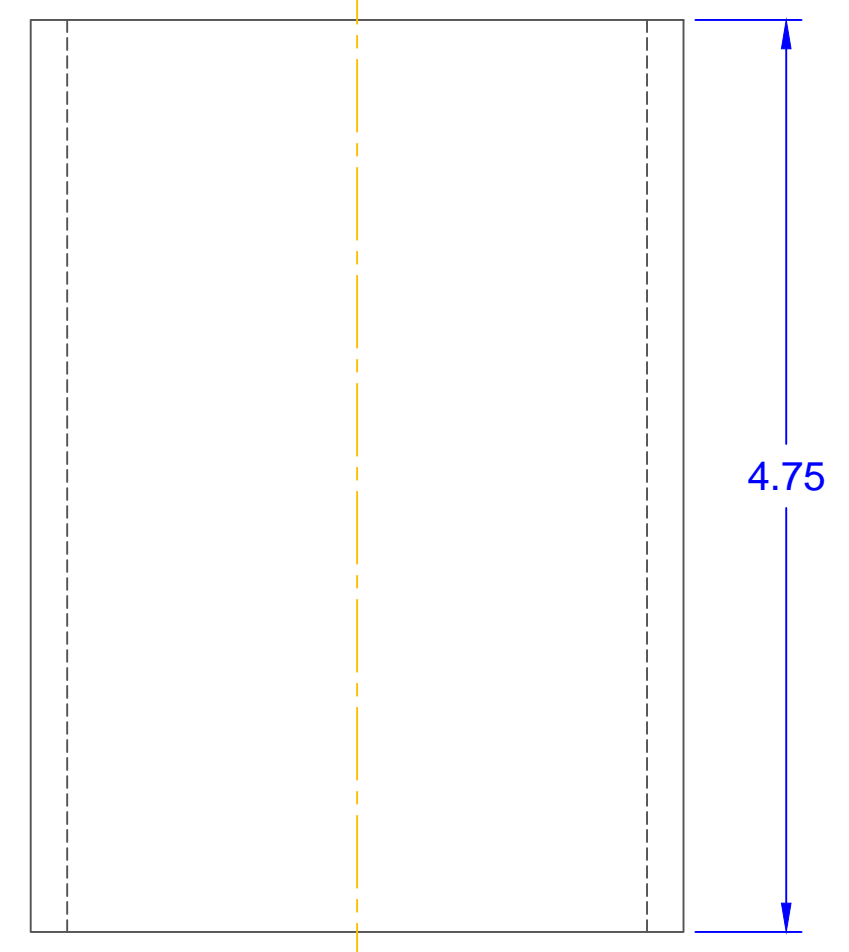
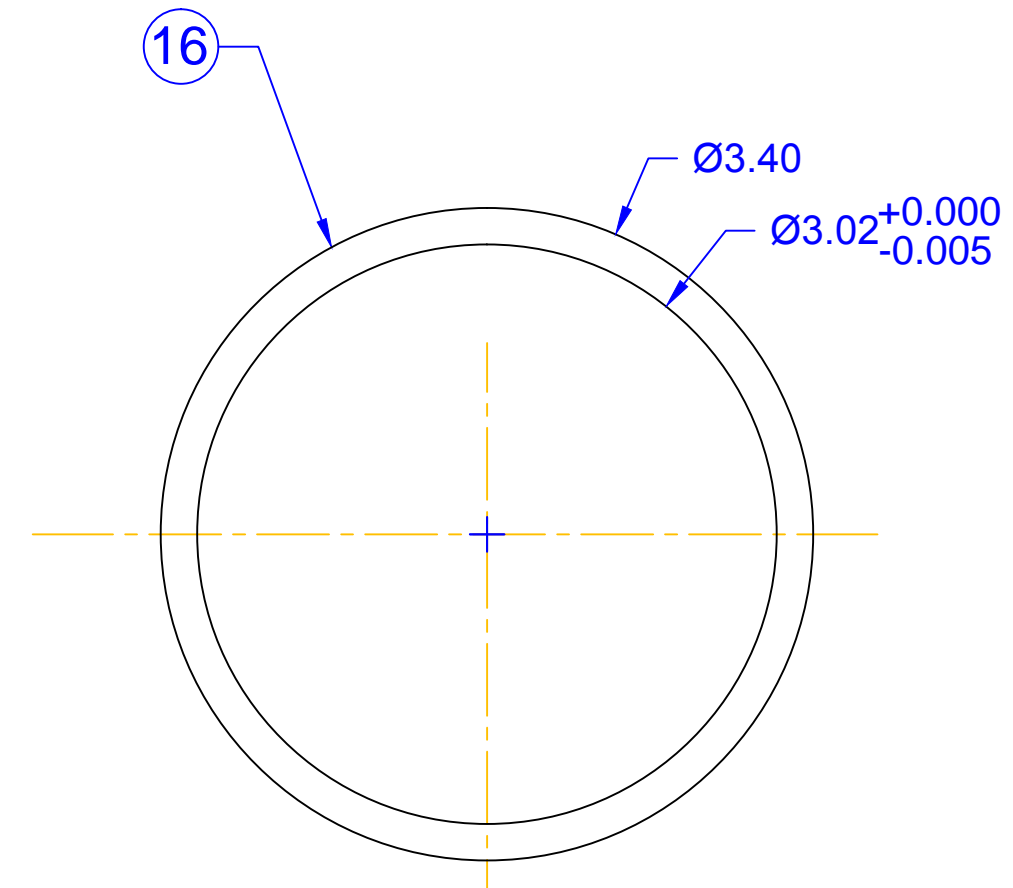
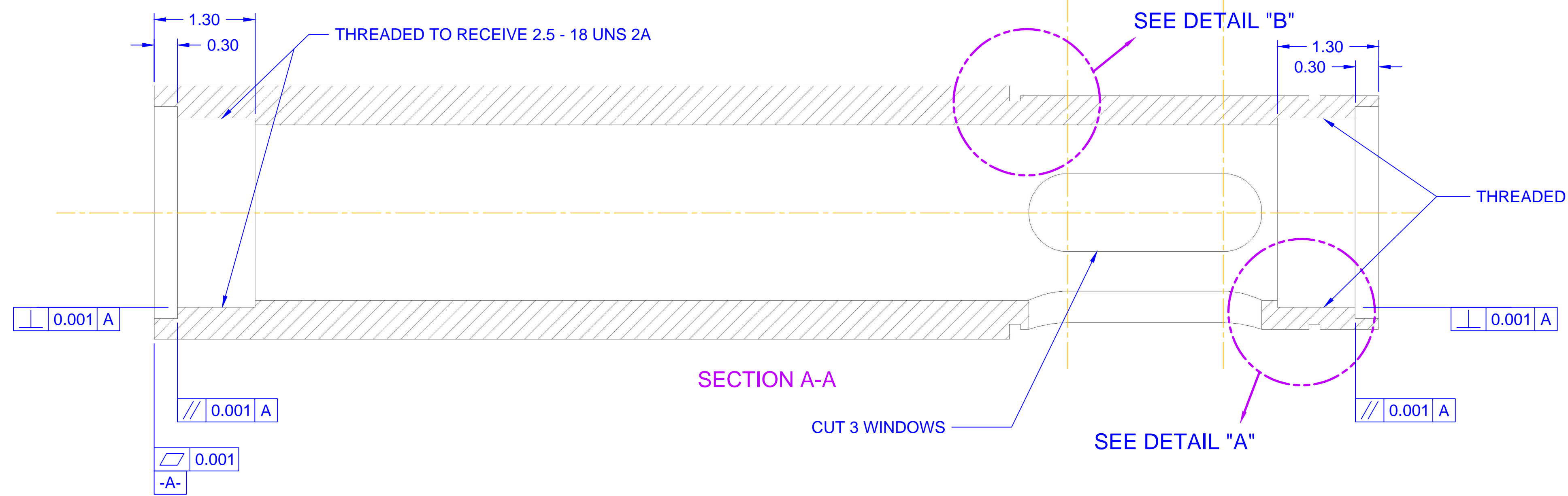
DWG BY	CHECK	CHECK
NMB		

DWG NAME
BASE PLATE

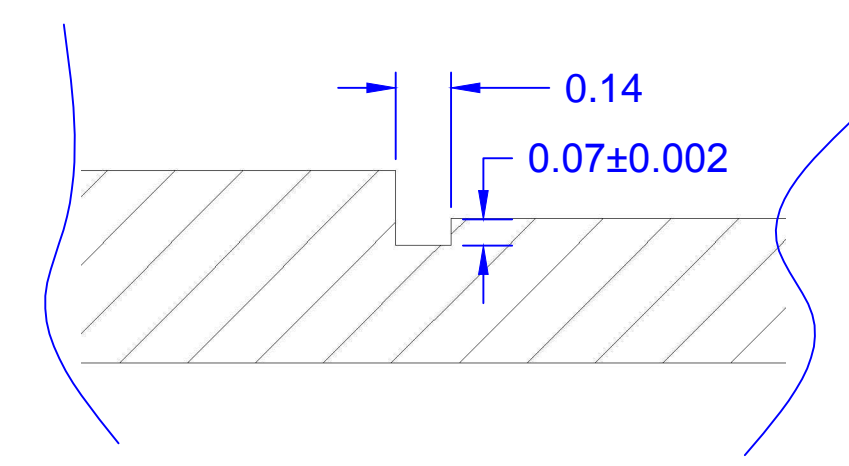
MATERIAL LIST			
No.	QTY	STOCK SIZE	MATERIAL
14	1	8" X 8" X 0.5"	Titanium (Grade 2)



TENSION TUBE



DETAIL "A"
SCALE 2:1
GLAND FOR -150 ORING
SCALE 2:1



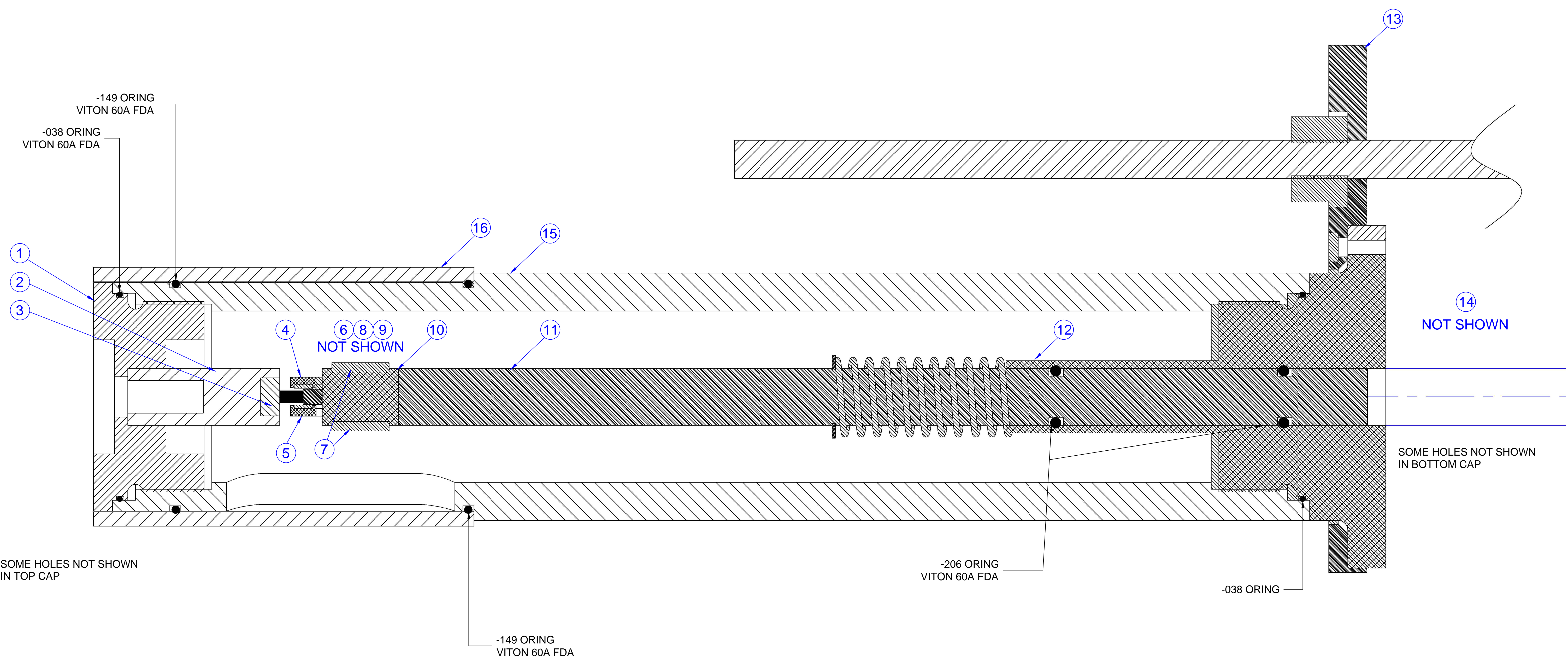
DETAIL "B"
SCALE 2:1
GLAND FOR -150 ORING
SCALE 2:1

SCALE 1:1
ALL DIMENSIONS IN INCHES
ALL TOLERANCES ± 0.01
UNLESS SPECIFIED

*NOTE:
CTE LEXAN = 68.4µm/mC
CTE TI (Grade 2) = 6.6-9.2µm/mC

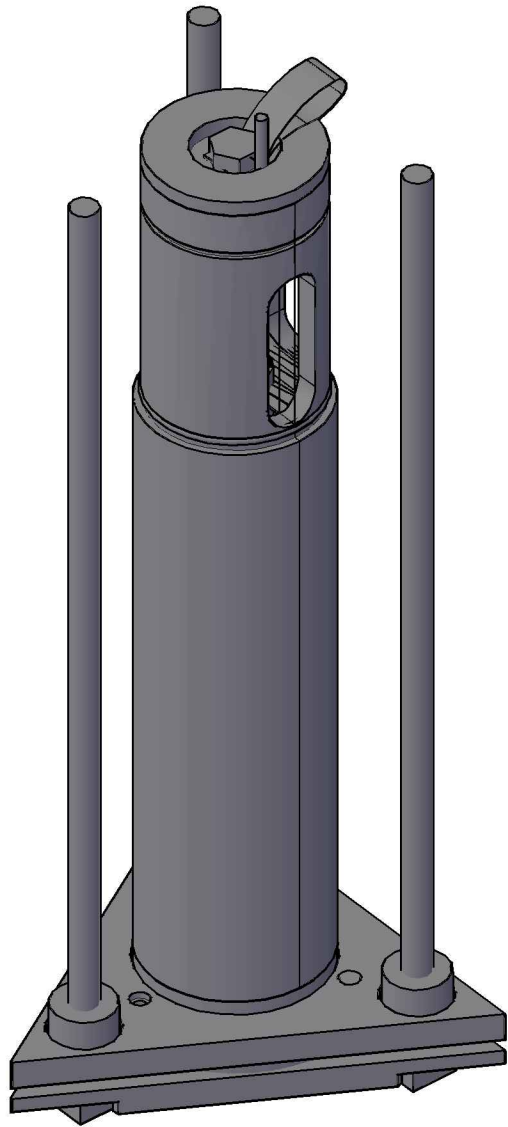
DWG NAME		MATERIAL LIST	
No.	QTY	STOCK SIZE	MATERIAL
15	1	Ø3.25 OD X 2.25 ID X 15.75 LG.	Titanium (G2)
16	1	Ø3.40 X 4.75 LG.	LEXAN



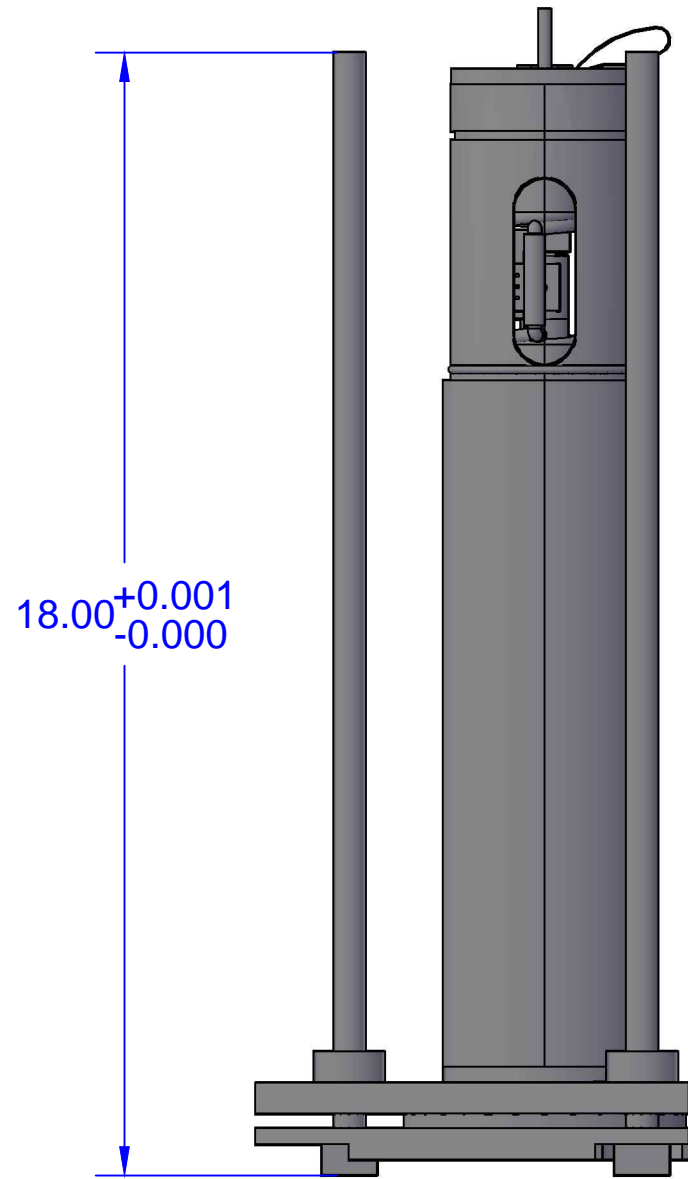


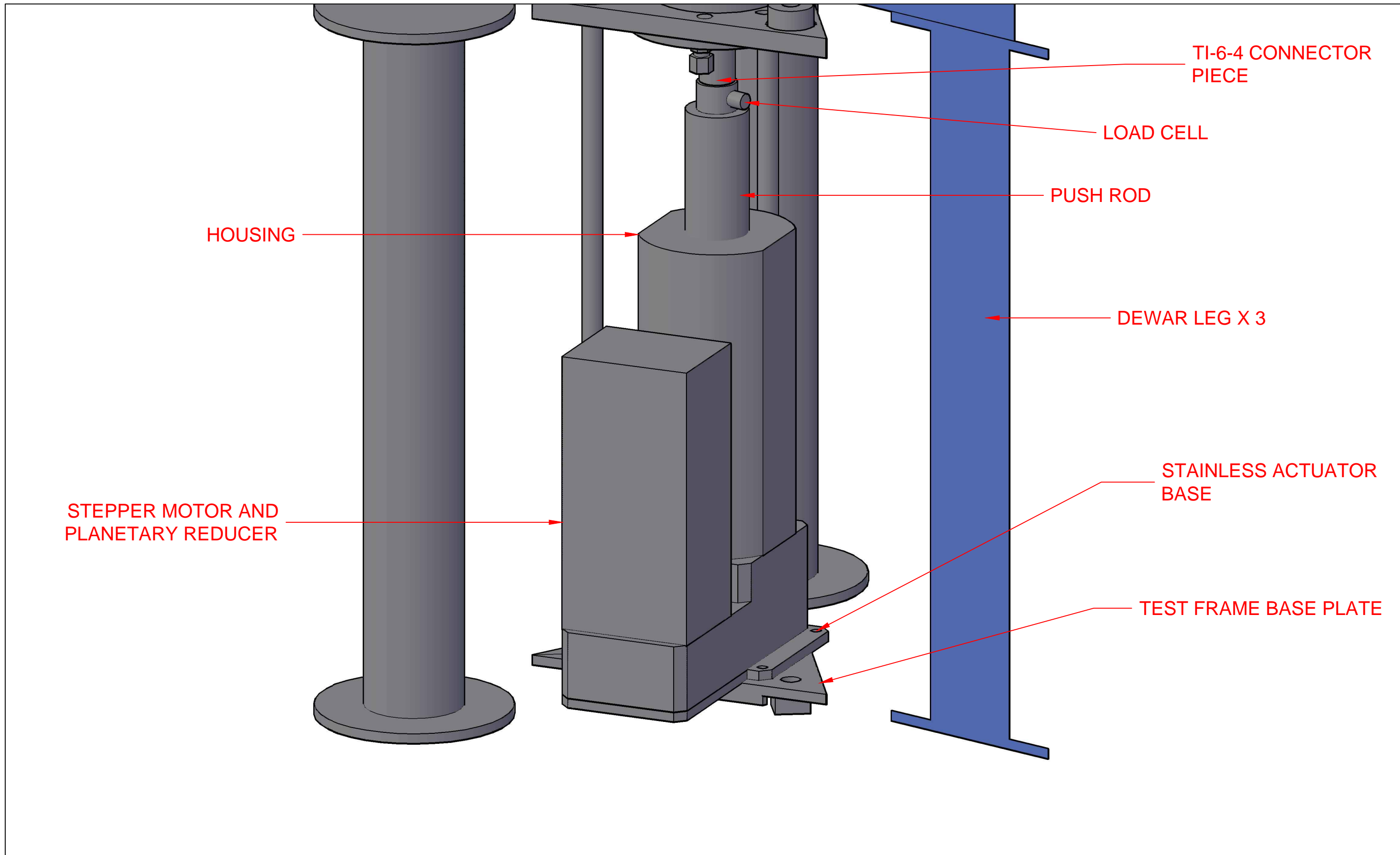
NOT DRAWN TO SCALE
 ALL DIMENSIONS IN INCHES
 ALL TOLERANCES ± 0.01
 UNLESS SPECIFIED

DWG NAME		MATERIAL LIST		
No.	QTY	STOCK SIZE	MATERIAL	
SECTIONAL				



collapsed test frame

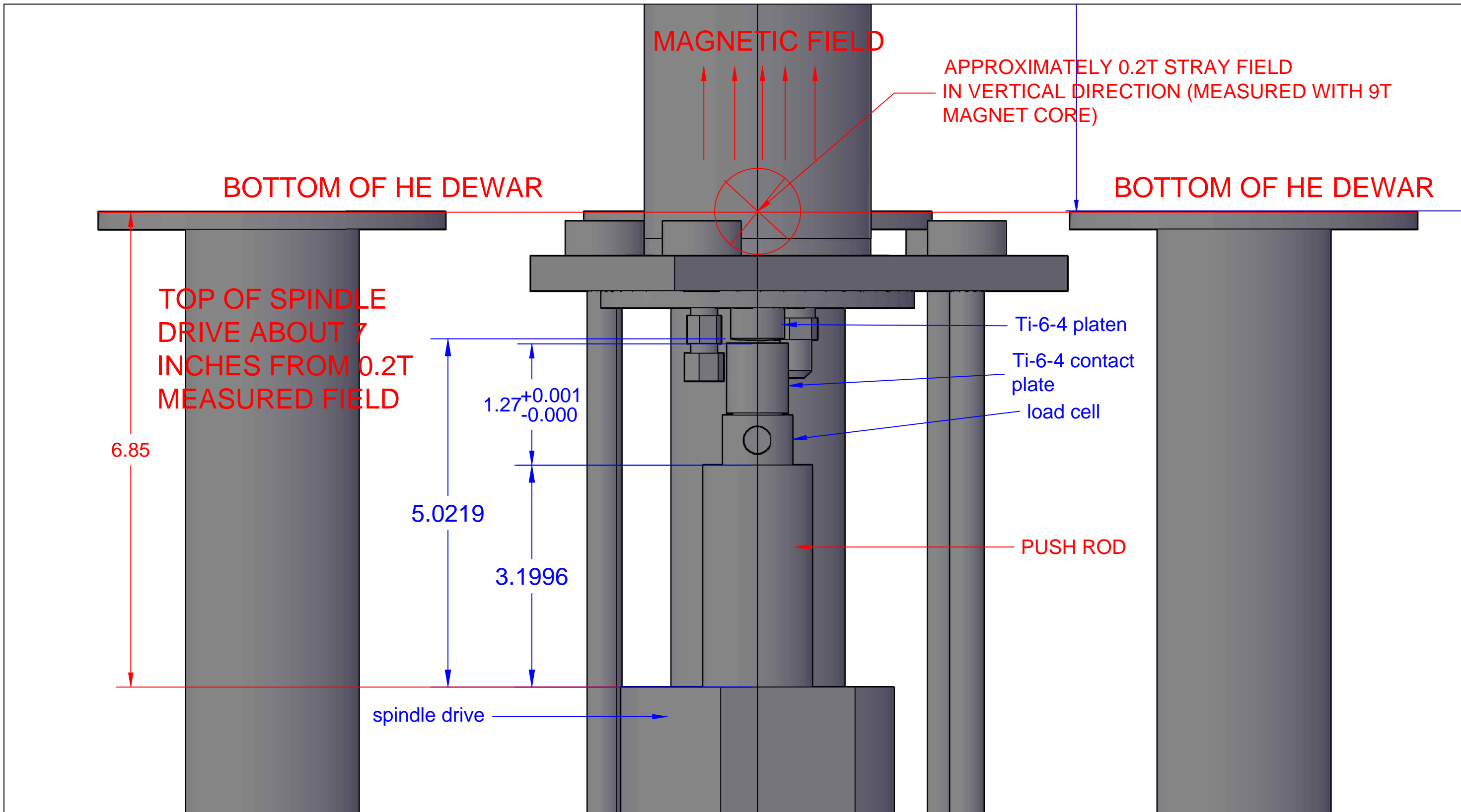




SCALE 1:1
 ALL DIMENSIONS IN INCHES
 ALL TOLERANCES ± 0.01
 UNLESS SPECIFIED

DWG BY	CHECK	CHECK
NMB		

DWG NAME		MATERIAL LIST		
No.	QTY	STOCK SIZE	MATERIAL	
14	1	8" X 8" X 0.5"	Titanium (Grade 2)	

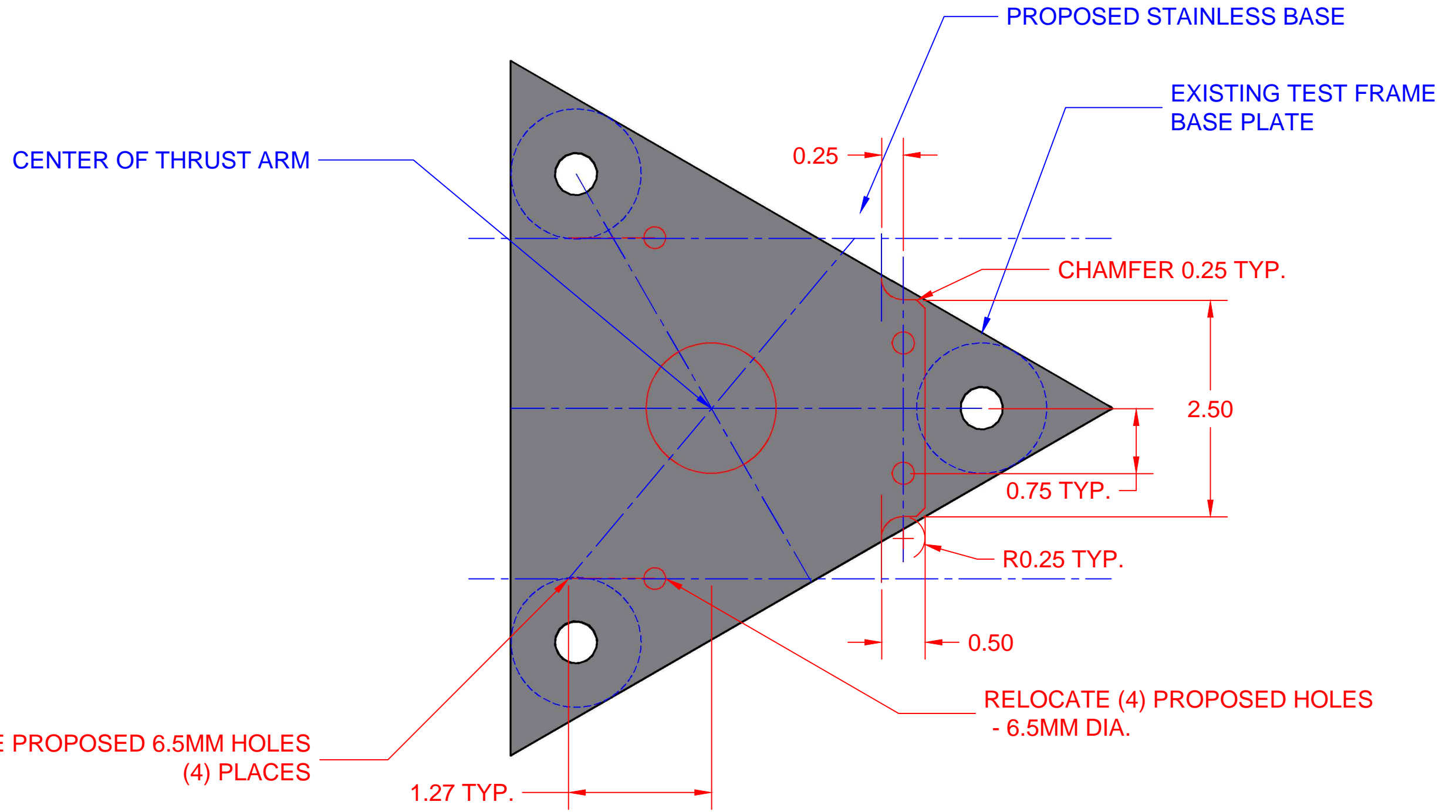


SCALE 1:1
 ALL DIMENSIONS IN INCHES
 ALL TOLERANCES ± 0.01
 UNLESS SPECIFIED

DWG BY	CHECK	CHECK
NMB		

DWG NAME	BASE PLATE
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MATERIAL LIST			
No.	QTY	STOCK SIZE	MATERIAL
14	1	8" X 8" X 0.5"	Titanium (Grade 2)



DIMENSIONS IN INCHES



SCALE 1:1
 ALL DIMENSIONS IN INCHES
 ALL TOLERANCES ± 0.01
 UNLESS SPECIFIED

DWG BY	CHECK	CHECK
NMB		

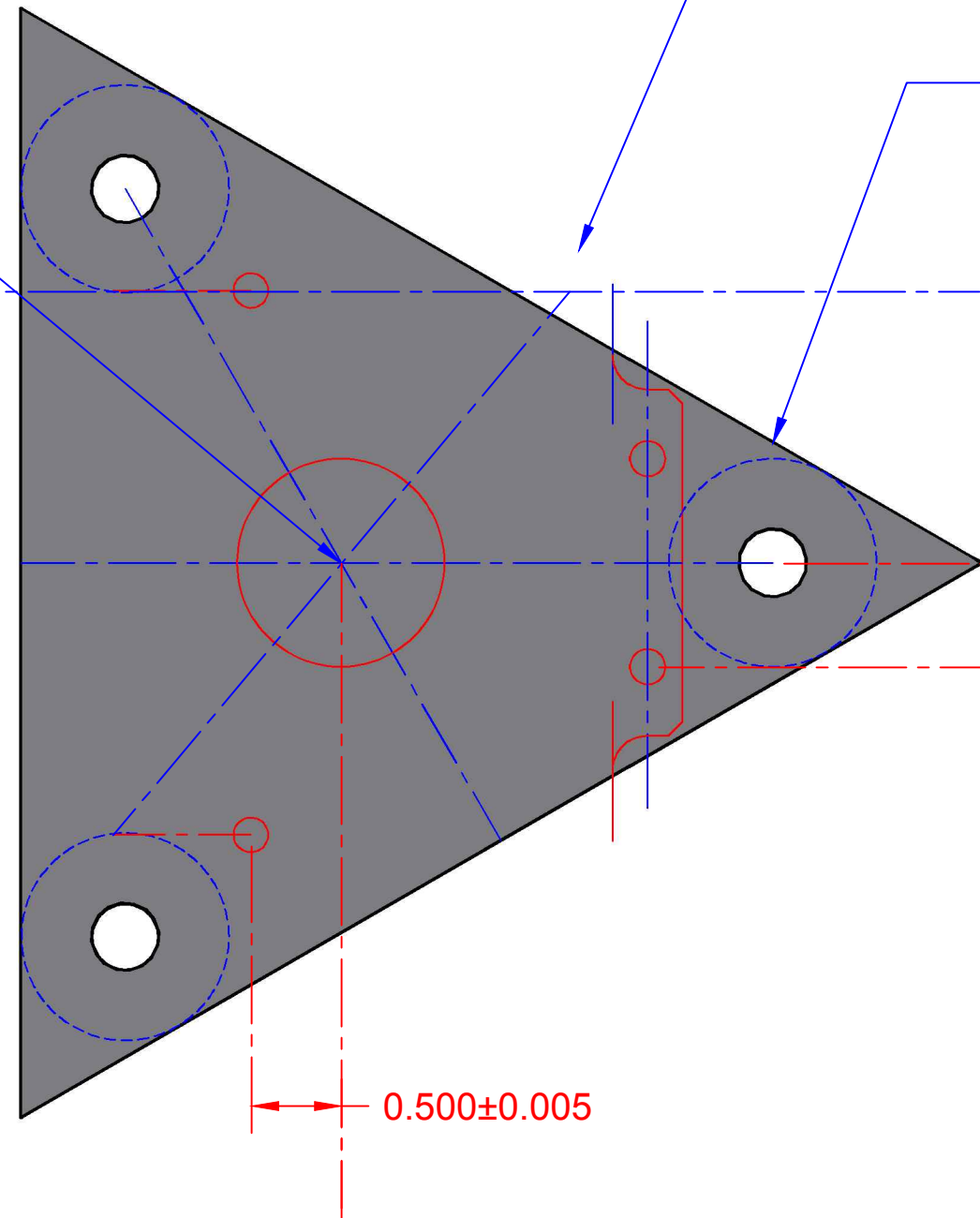
DWG NAME
BASE PLATE

MATERIAL LIST			
No.	QTY	STOCK SIZE	MATERIAL
14	1	8" X 8" X 0.5"	Titanium (Grade 2)

CENTER OF THRUST ARM

PROPOSED STAINLESS BASE

EXISTING TEST FRAME
BASE PLATE



0.750±0.005

0.500±0.005

DIMENSIONS IN INCHES



SCALE 1:1
ALL DIMENSIONS IN INCHES
ALL TOLERANCES ± 0.01
UNLESS SPECIFIED

DWG BY	CHECK	CHECK
NMB		

DWG NAME
BASE PLATE

MATERIAL LIST			
No.	QTY	STOCK SIZE	MATERIAL
14	1	8" X 8" X 0.5"	Titanium (Grade 2)