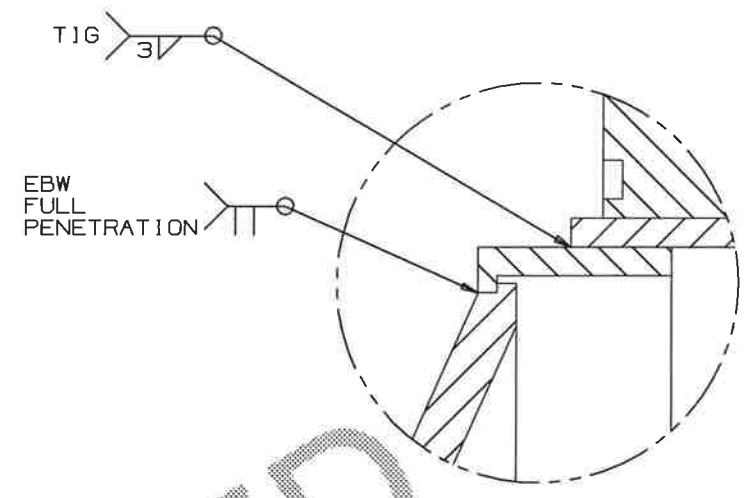
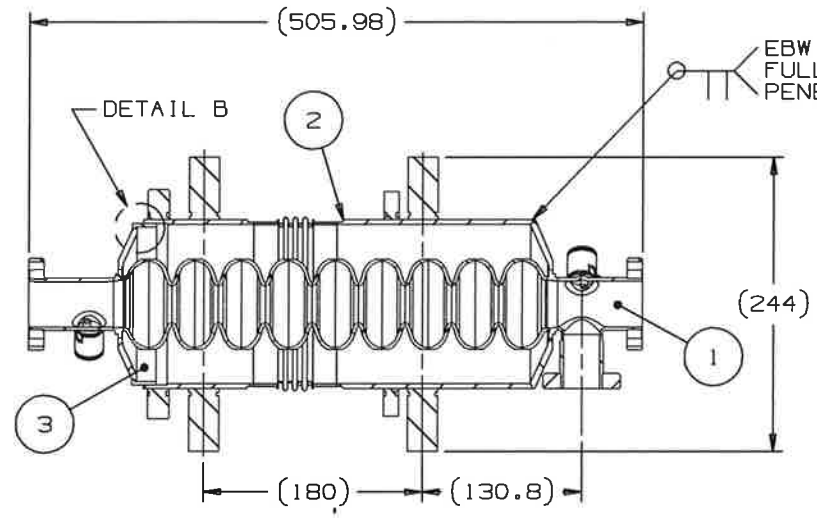


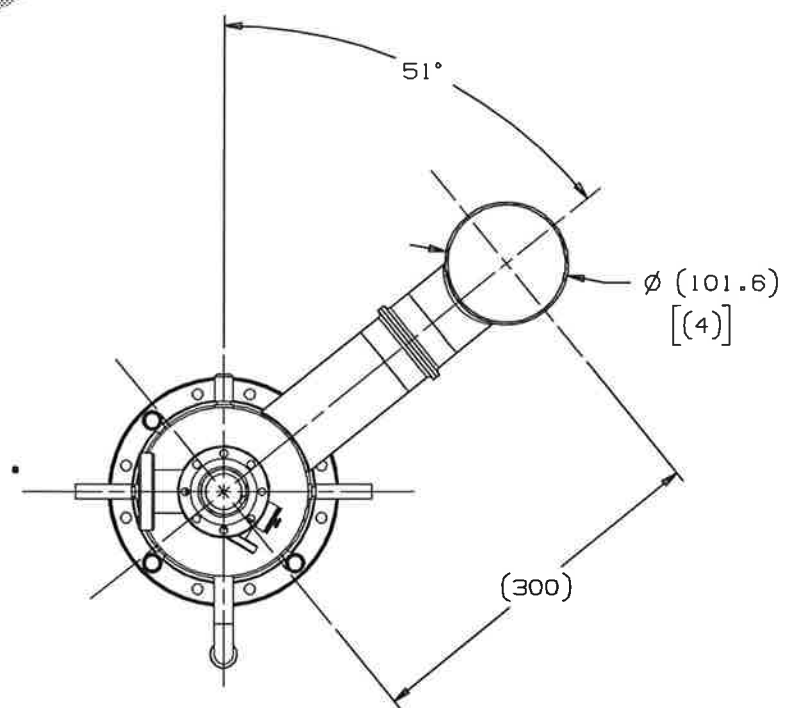
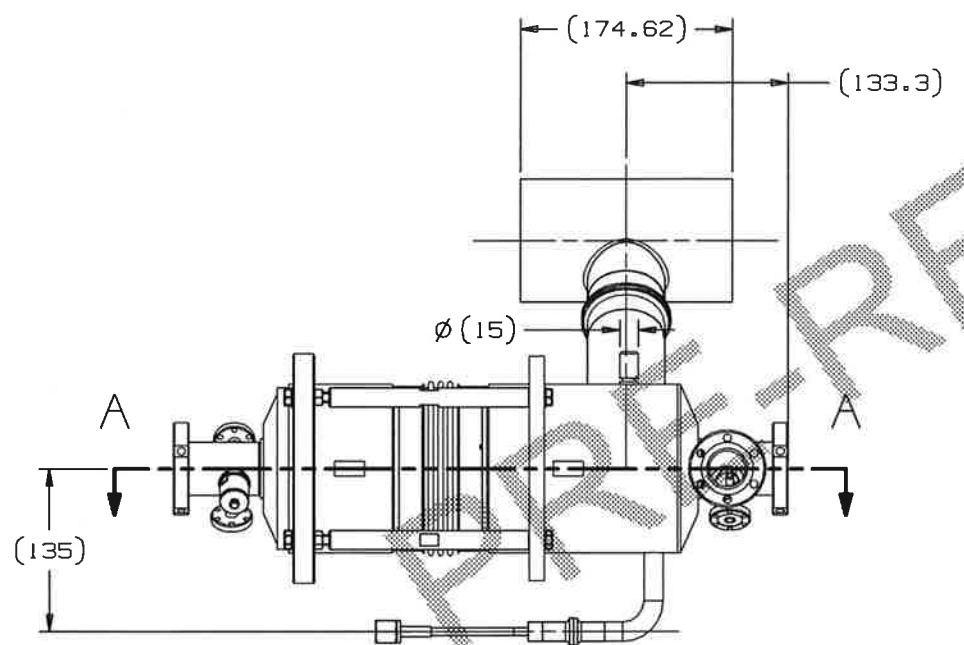
DESCRIPTION: 3.9GHZ ASSY EVEN "A", DRESSED CAVITY
 CATEGORY: ASSEMBLY PROJECT: LCLS11Cryomodules

REV	REVISION CONTROL DOCUMENT	DATES	SIGNATURES
-	F10048855---RCD		DRAWN APPROVED



SECTION A-A

DETAIL B
SCALE 2:1



PRELIMINARY RELEASED

NOTES (UNLESS OTHERWISE SPECIFIED):

1. ASSEMBLY MUST BE FREE FROM DUST, GREASE, OIL, CHIPS, AND BURRS.
2. PLEASE REFER TO J-LAB SPECIFICATION LCLS-11-A.6-TS-0092 FOR ASSEMBLY, SHIPPING, AND HANDLING INSTRUCTIONS.
3. ELECTRON-BEAM WELD FROM BOTH SIDES TO ENSURE FULL PEENTRATION AND OVERLAP FOR FULL JOINT CONSUMPTION.
4. FINAL RING DIAMETER DUE TO POST WELDING SHRINKAGE. ITEM #8 TO BE MACHINED PER DRAWING SPEC. PRIOR TO WELDING. ALTERNATE METHOD: ROUGH MACHINE ITEM #8 AND FINISH PER DIMENSION SHOWN ON THIS DRAWING.

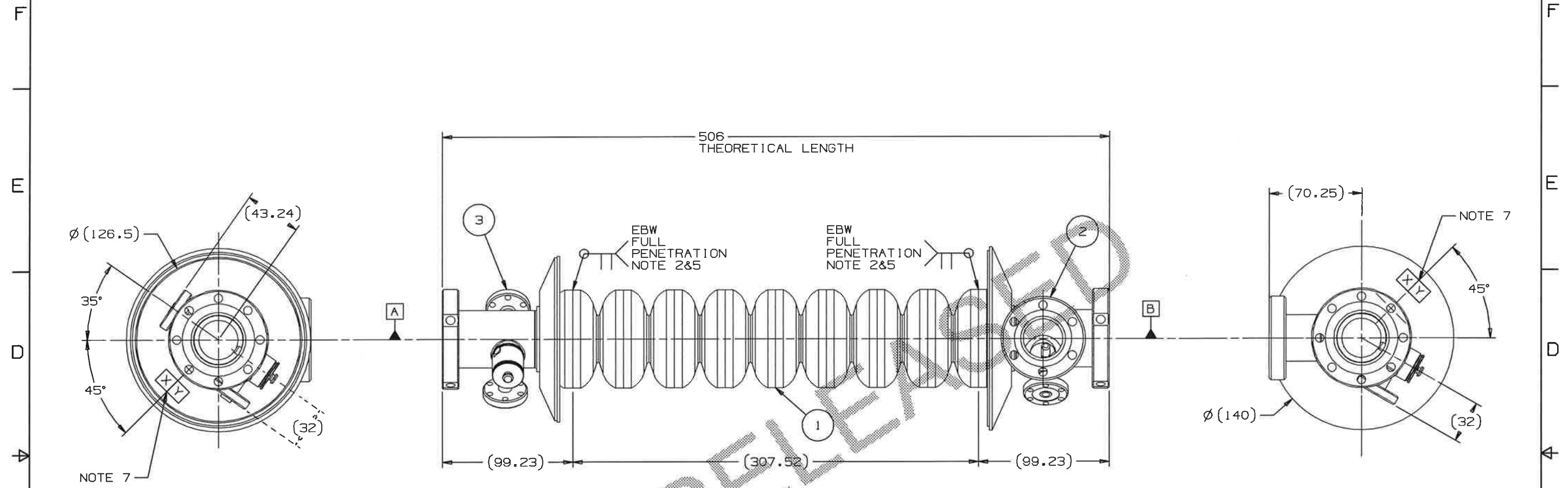
ITEM	PART#	DESCRIPTION	QTY.
3	F10048846	3.9GHZ ADAPTER RING, He TANK	1
2	F10048833	3.9GHZ HELIUM TANK WLDMT	1
1	F10048752	FNAL 3.9GHZ RF CAVITY ASSY	1

PARTS LIST

UNLESS OTHERWISE SPECIFIED		DRAWN	M. KRAMP	DATE	19-Oct-2015	 FERMI NATIONAL ACCELERATOR LABORATORY UNITED STATES DEPARTMENT OF ENERGY	
±X	±X.X	±X.XX	±X/X	±X"	CHECKED		DATE
Z	0.3	0.12	N/A	1"	APPROVED		DATE
BREAK ALL SHARP EDGES 0.5 MAX. DO NOT SCALE DRAWING DIMENSIONS BASED ON ASME Y14.5-2009 MAX. ALL MACH SURFACES 3.2 DRAWING UNITS: MM		USED ON		F10048832		NAME 3.9GHZ ASSY EVEN "A", DRESSED CAVITY	
		MATERIAL		SEE PARTS LIST		SCALE 1:4	
GROUP: Technical Division - Design and Drafting		CASE CODE: OUSFB		SIZE A2	DRAWING NUMBER F10048855	SHEET 1 of 1	

DESCRIPTION: FNAL 3.9GHZ RF CAVITY ASSY
 CATEGORY: WELDMENT PROJECT: LCLS11Cryomodule

REV	REVISION CONTROL DOCUMENT	DATES	SIGNATURES
-	F10048752---RCD		DRAWN APPROVED



NOTES (UNLESS OTHERWISE SPECIFIED):

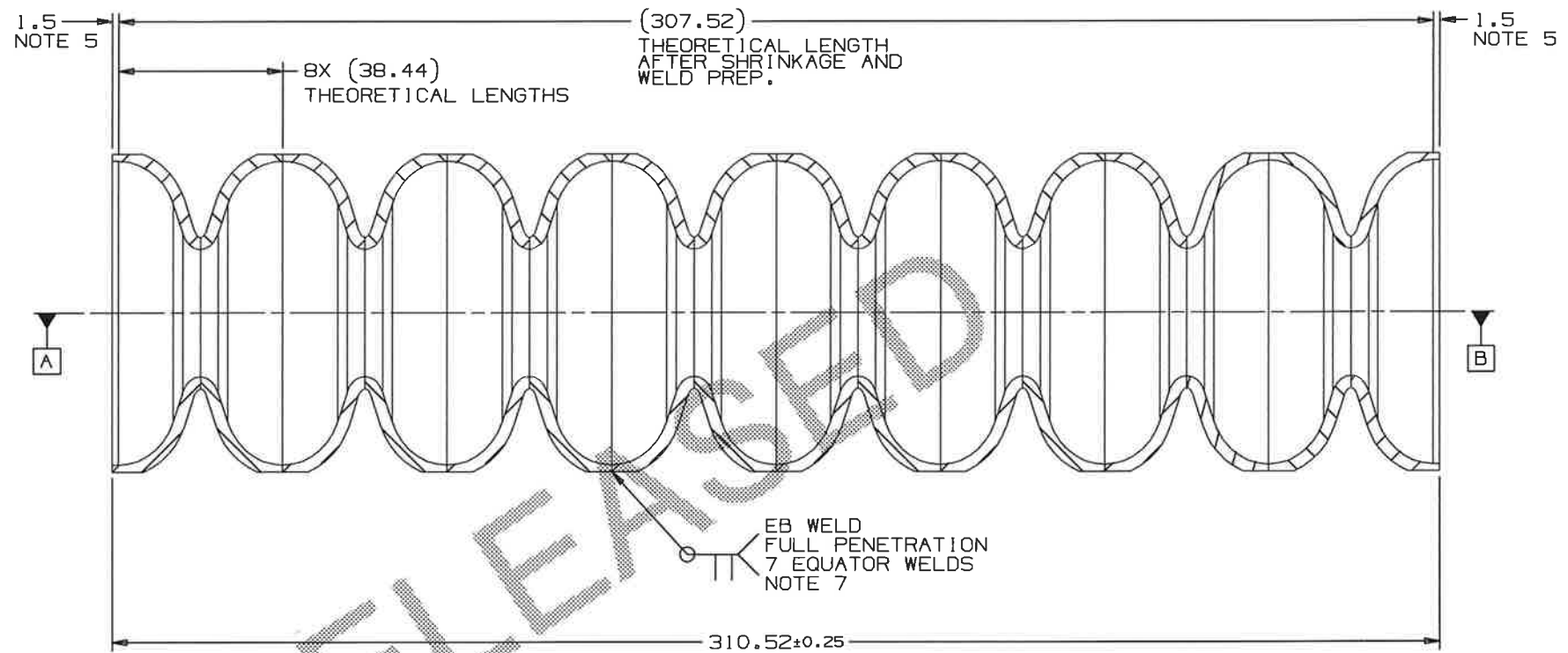
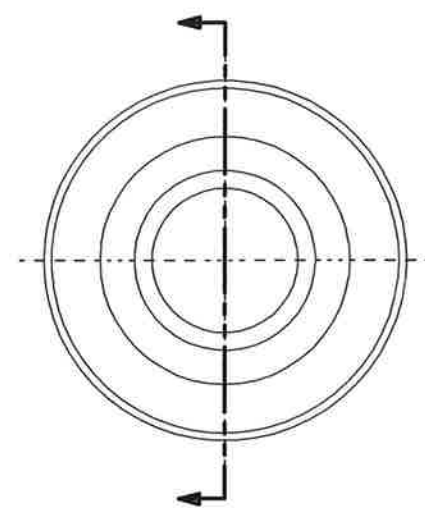
- WELDMENT TO BE FREE OF DUST, GREASE, OIL, CHIPS, AND BURRS.
- WELDING NOTES:
 - ASSEMBLY TO BE VACUUM TIGHT: NO LEAK SHALL BE DETECTABLE ON THE MOST SENSITIVE SCALE OF A HELIUM MASS SPECTROMETER LEAK DETECTOR WITH A MINIMUM SENSITIVITY OF 2×10^{-10} ATM CC/SEC FOR HELIUM.
 - ASSEMBLY TO BE CLEANED, AND PACKAGED SO AS TO ASSURE NO CONTAMINATION FOR FOREIGN MATERIALS, METAL CHIPS, OR OTHER CONTAMINATES. CLEANING PROCEDURE TO BE APPROVED BY FERMILAB.
 - ALL DESIGN, ASSEMBLY, AND HANDLING IS TO CONFORM TO STANDARD ULTRA HIGH VACUUM PRACTICES.
 - ALL ELECTRON BEAM WELDING, ACID ETCHING, CLEANLINESS, AND HANDLING PROCEDURES ARE DETAILED IN DESY SPECIFICATION MWF-SL-1 09-2005 AND MUST BE FOLLOWED.
- THIS DEVICE IS EASILY DEFORMED. A FIXTURE IS REQUIRED FOR ALL HANDLING.
- ENSURE THAT THE CLOCKING OF THE SUB-ASSEMBLIES ARE HELD TO $\pm 0.5^\circ$.
- ITEMS 1, 2, AND 3 ARE TO BE CONCENTRIC WITHIN $\phi 0.5\text{mm}$ ALONG DATUM A-B.
- DEFINITION OF FORM AND TOLERANCES CONCERNING WELD JOINT PREPARATION AT THE IRIS AND THE EQUATOR TO BE COORDINATED BETWEEN MANUFACTURERS AND FERMILAB.
- SCRIBE 4mm HIGH, 0.2mm DEEP LETTERS X-FIRM CODE, Y-MANUFACTURING NUMBER.
- ALL DIMENSIONS WITH TRAILING ZEROS DENOTE TOLERANCE.

ITEM	PART#	DESCRIPTION	QTY.
3	F10048754	3.9GHZ ASSY END GROUP, NO-MC	1
2	F10048753	3.9GHZ ASSY END GROUP, MC-SIDE	1
1	F10048744	3.9GHZ ASSEMBLY, INNER DUMBBELLS	1

PARTS LIST			
UNLESS OTHERWISE SPECIFIED	DRAWN	M. KRAMP	DATE 28-Oct-2015
±X	±X.X	±X.XX	±X/X
±X°	±X.X°	±X.XX°	±X/X°
Z	0.3	0.12	N/A
BROKE ALL SHARP EDGES 0.5 MAX. DO NOT SCALE DRAWING DIMENSIONS BASED ON ASME Y14.5-2009 MAX. ALL MACH SURFACES 3.2 DRAWING UNITS: MM			
APPROVED		DATE	
USED ON		F10048855, F10048856	
MATERIAL		SEE PARTS LIST	
GROUP: Technical Division - Design and Drafting		CAGE CODE: DUSFB	
FERMI NATIONAL ACCELERATOR LABORATORY UNITED STATES DEPARTMENT OF ENERGY		FNAL 3.9GHZ RF CAVITY ASSY	
SCALE 1:1	SIZE A2	DRAWING NUMBER F10048752	SHEET 1 of 1

DESCRIPTION: 3.9GHZ ASSEMBLY, INNER DUMBBELLS
 CATEGORY: WELDMENT PROJECT: LCLS11Cryomodule

REV	REVISION CONTROL DOCUMENT	DATES	SIGNATURES
-	F10048744---RCD		DRAWN APPROVED



NOTES:

- ALL PARTS ARE TO BE CONCENTRIC WITHIN $\pm 0.5\text{mm}$ ALONG DATUM A-B
- DEFINITION OF FORM AND TOLERANCES CONCERNING WELD JOINT PREPARATION AT THE IRIS AND THE EQUATOR TO BE COORDINATED BETWEEN MANUFACTURERS AND FNAL
- INDIVIDUAL PART DIMENSIONS ARE FINAL LENGTH AFTER ACID ETCHING AND TUNING
- THIS DEVICE IS EASILY DEFORMED. A FIXTURE IS REQUIRED FOR ALL HANDLING.
- ADDITIONAL MATERIAL NEEDED FOR CELL TUNING PLUS ALLOWANCE FOR E-BEAM WELD SHRINKAGE. FINAL SURFACE TO BE MACHINED UNTIL TUNED.
- DO NOT BREAK SHARP EDGES ON END CELL

7. WELDING NOTES:

- ASSEMBLY TO BE VACUUM TIGHT. NO LEAK SHALL BE DETECTABLE ON THE MOST SENSITIVE SCALE OF A HELIUM MASS SPECTROMETER LEAK DETECTOR WITH A MINIMUM SENSITIVITY OF 2×10^{-10} ATM-CC/SEC FOR HELIUM.
- ASSEMBLY TO BE CLEANED, AND PACKAGED SO AS TO ASSURE NO CONTAMINATION FROM FOREIGN MATERIALS, METAL CHIPS OR OTHER CONTAMINATES. CLEANING PROCEDURE TO BE APPROVED BY FERMILAB.
- ALL DESIGN, ASSEMBLY, AND HANDLING IS TO CONFORM TO STANDARD ULTRA HIGH VACUUM PRACTICES
- ALL ELECTRON BEAM WELDING, ACID ETCHING, CLEANLINESS, AND HANDLING PROCEDURES ARE DETAILED IN DESY SPECIFICATION MWF-SL 09-2005 AND MUST BE FOLLOWED.

ITEM	PART#	DESCRIPTION	QTY.
1	F10048745	3.9GHZ WELDMENT, MID-DUMBBELL	8

UNLESS OTHERWISE SPECIFIED					DRAWN	M. KRAMP	DATE	02-Nov-2015
±X	±X.X	±X.XX	±X/X	±X"	CHECKED		DATE	
Z	0.3	0.12	N/A	1"	APPROVED		DATE	
BREAK ALL SHARP EDGES 0.5 MAX. DO NOT SCALE DRAWING DIMENSIONS BASED ON ASME Y14.5-2009 MAX. ALL MACH SURFACES 3.2 DRAWING UNITS: MM					USED ON F10048752			
MATERIAL					SEE PARTS LIST			
GROUP: Technical Division - Design and Drafting					CASE CODE: DUSFB			

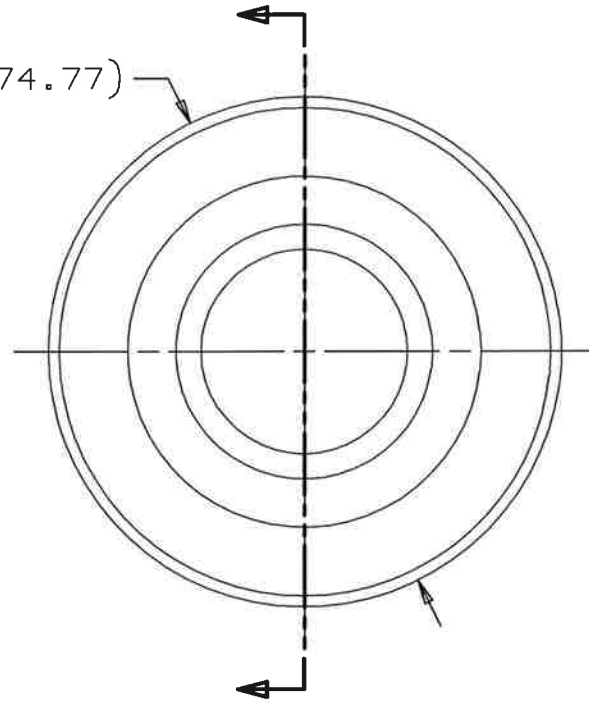
FERMI NATIONAL ACCELERATOR LABORATORY
 UNITED STATES DEPARTMENT OF ENERGY
 NAME
3.9GHZ ASSEMBLY, INNER DUMBBELLS
 SCALE 1:1 SIZE A2 DRAWING NUMBER F10048744 SHEET 1 of 1 REV -

PRE-RELEASED

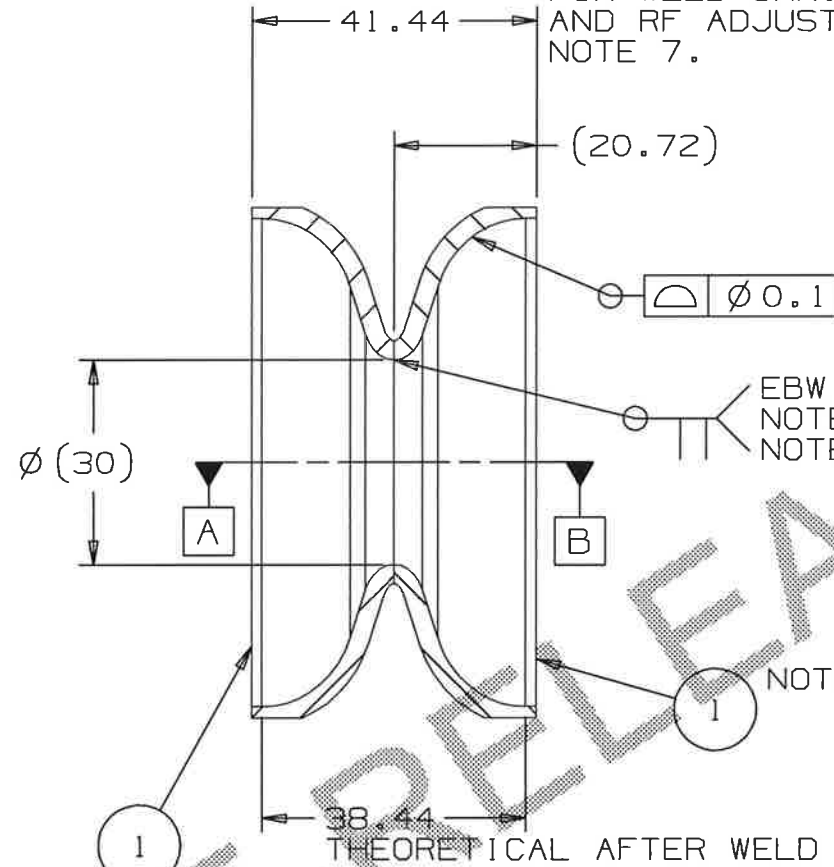
DESCRIPTION: 3.9GHZ WELDMENT, MID-DUMBBELL
 CATEGORY: WELDMENT PROJECT: LCLS11Cryomodule

REV	REVISION CONTROL DOCUMENT	DATES	SIGNATURES	
-	F10048745---RCD		DRAWN	
			APPROVED	

∅ (74.77)



WITH 1.5MM PER SIDE FOR WELD SHRINKAGE AND RF ADJUSTMENT NOTE 7.



∅ 0.1

EBW NOTE 2 NOTE 6

NOTE 4

NOTE 4

GENERAL NOTES: (UNLESS OTHERWISE SPECIFIED)

1. WELDMENT TO BE FREE OF DIRT DUST GREASE, OIL, CHIPS, AND BURRS.

2. WELDING NOTES:

A. ASSEMBLY TO BE VACUUM TIGHT. NO LEAK SHALL BE DETECTABLE ON THE MOST SENSITIVE SCALE OF A HELIUM MASS SPECTROMETER LEAK DETECTOR WITH A MINIMUM SENSITIVITY OF 2x10⁻¹⁰ ATM-CC/SEC FOR HELIUM.

B. ASSEMBLY TO BE CLEANED, AND PACKAGED SO AS TO ASSURE NO CONTAMINATION FROM FOREIGN MATERIALS, METAL CHIPS OR OTHER CONTAMINATES. CLEANING PROCEDURE TO BE APPROVED BY FERMILAB.

C. ALL DESIGN, ASSEMBLY, AND HANDLING IS TO CONFORM TO STANDARD ULTRA HIGH VACUUM PRACTICES.

D. ALL ELECTRON BEAM WELDING, ACID ETCHING, CLEANLINESS, AND HANDLING PROCEDURES ARE DETAILED IN DESY SPECIFICATION MWF-SL 09-2005 AND MUST BE FOLLOWED.

3. RF SURFACES IS TO BE FREE OF DAMAGE

4. ALL PARTS ARE TO BE CONCENTRIC WITHIN 0.05mm ALONG DATUM A-B

5. DO NOT BREAK EDGES ON CELL.

6. DUAL PASS WELD--WELD BOTH SIDES TO ENSURE OVERLAP.

7. ADDITIONAL MATERIAL NEEDED FOR CELL TUNING PLUS ALLOWANCE FOR E-BEAM WELD SHRINKAGE. FINAL SURFACES TO BE MACHINED UNTIL TUNED.

ITEM	PART#	DESCRIPTION	QTY.
1	F10048751	3.9GHZ MID-CELL	2

PARTS LIST

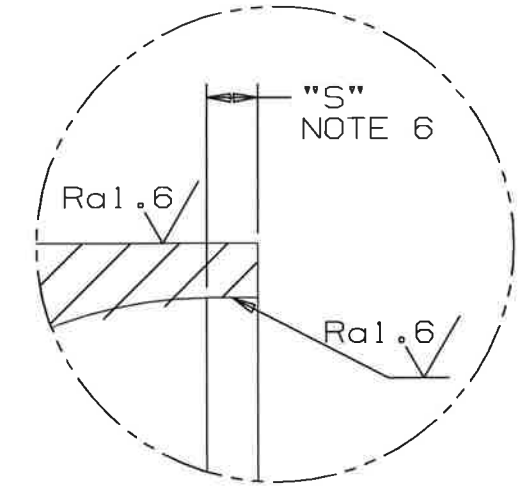
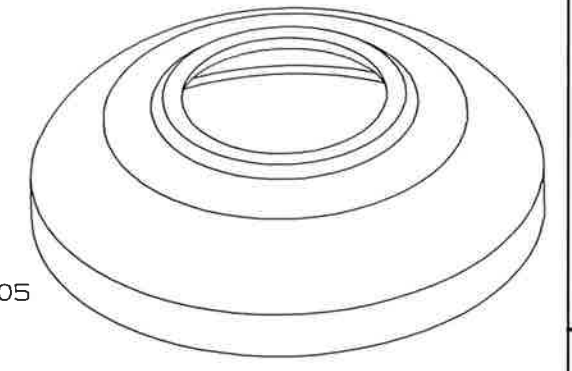
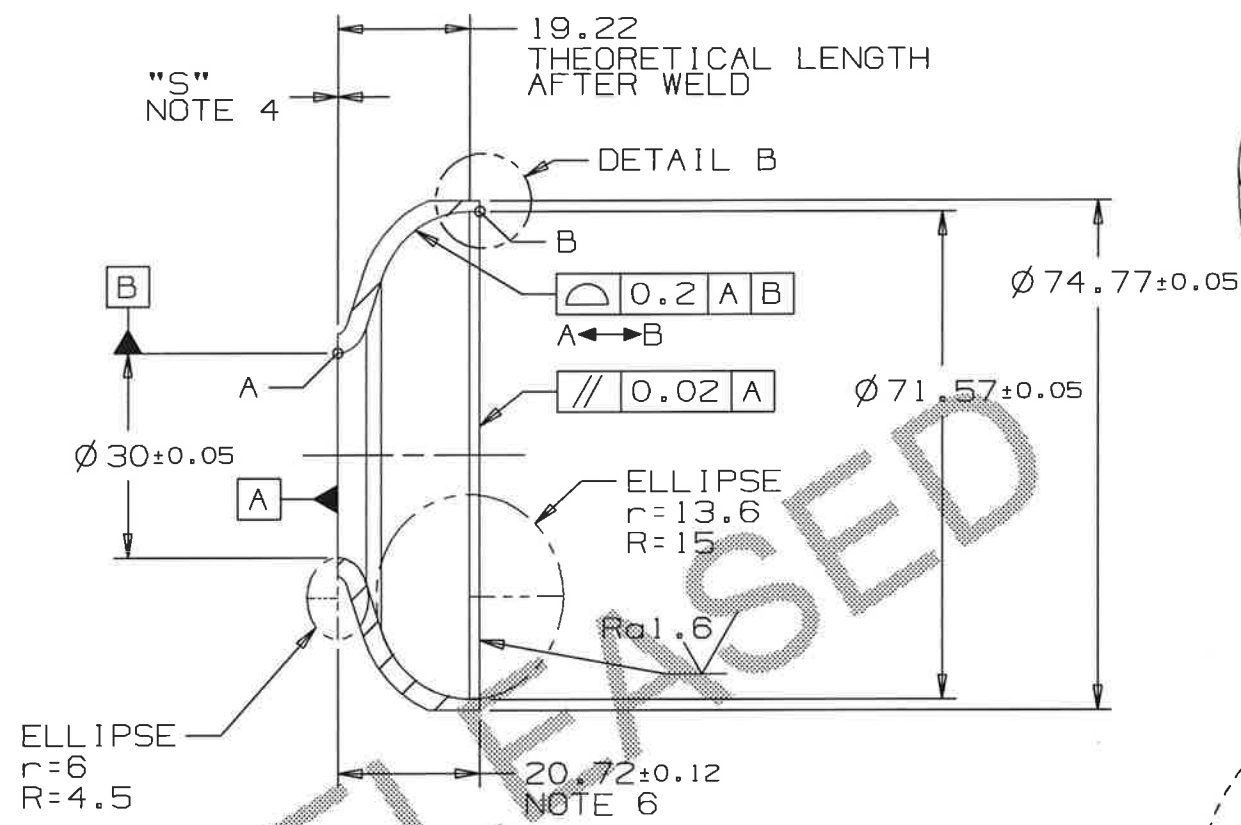
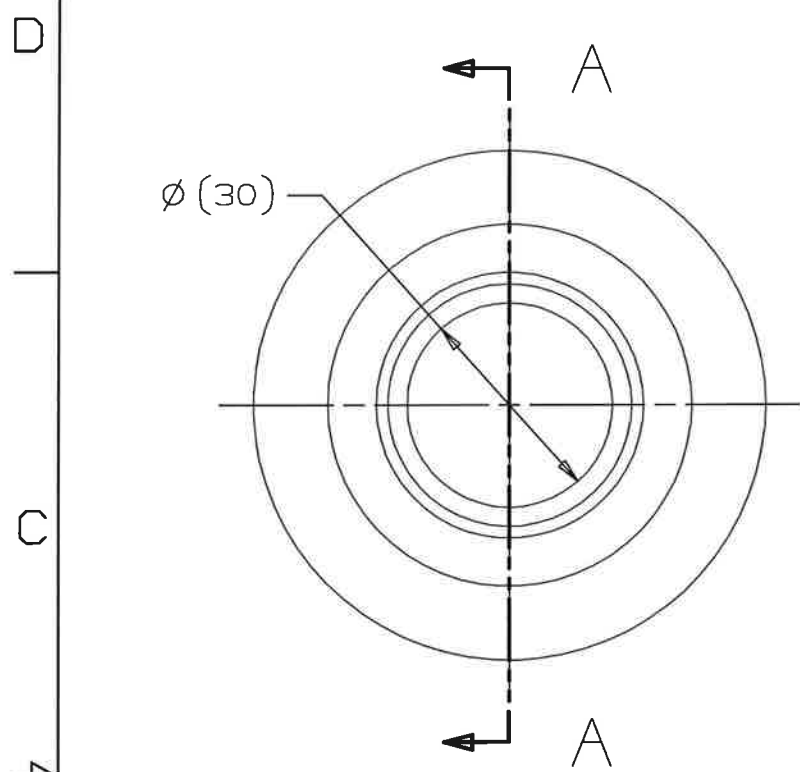
UNLESS OTHERWISE SPECIFIED					DRAWN	M. KRAMP	DATE	02-Nov-2015
±X	±X.X	±X.XX	±X/X	±X°	CHECKED		DATE	
2	0.3	0.12	N/A	1°	APPROVED		DATE	
BREAK ALL SHARP EDGES 0.5 MAX. DO NOT SCALE DRAWING DIMENSIONS BASED ON ASME Y14.5-2009 MAX. ALL MACH SURFACES 3.2 DRAWING UNITS: MM					USED ON			
					F10048744			
MATERIAL					SEE PARTS LIST			
GROUP: Technical Division - Design and Drafting					CAGE CODE: OUSR6			

FERMI NATIONAL ACCELERATOR LABORATORY UNITED STATES DEPARTMENT OF ENERGY				
NAME				
3.9GHZ WELDMENT, MID-DUMBBELL				
SCALE	SIZE	DRAWING NUMBER	SHEET	REV
1:1	A3	F10048745	1 OF 1	-

PRE-RELEASED

DESCRIPTION: 3.9GHZ MID-CELL
 CATEGORY: CELL PROJECT: LCLS11Cryomodule

REV	REVISION CONTROL DOCUMENT	DATES	SIGNATURES
-	F10048751---RCD		
			DRAWN
			APPROVED



PRE-RELEASED

GENERAL NOTES: (UNLESS OTHERWISE SPECIFIED)

- 1) THE INTERNAL SURFACE MAY SHOW NO DAMAGE CAUSED BY FORMING
- 2) DIAMETER, FORM, AND POSITION TOLERANCES MEASURED IN HALF CELL'S STRAINED CONDITION
- 3) DO NOT BREAK EDGES ON END CELL
- 4) SUPPLEMENT FOR WELD SHRINKAGE ("S") TO BE DETERMINED BY EB-WELDERS.
- 5) DUE TO THE MANUFACTURING PROCESS THE WALLTHICKNESS BETWEEN IRIS AND EQUATOR IS NOT CONSTANT.

- 6) ADDITIONAL MATERIAL NEEDED FOR CELL TUNING PLUS ALLOWANCE FOR E-BEAM WELD SHRINKAGE ("S"). FINAL SURFACE TO BE MACHINED UNTIL TUNED.

UNLESS OTHERWISE SPECIFIED				
±X	±X.X	±X.XX	±X/X	±X°
2	0.3	0.12	N/A	1°

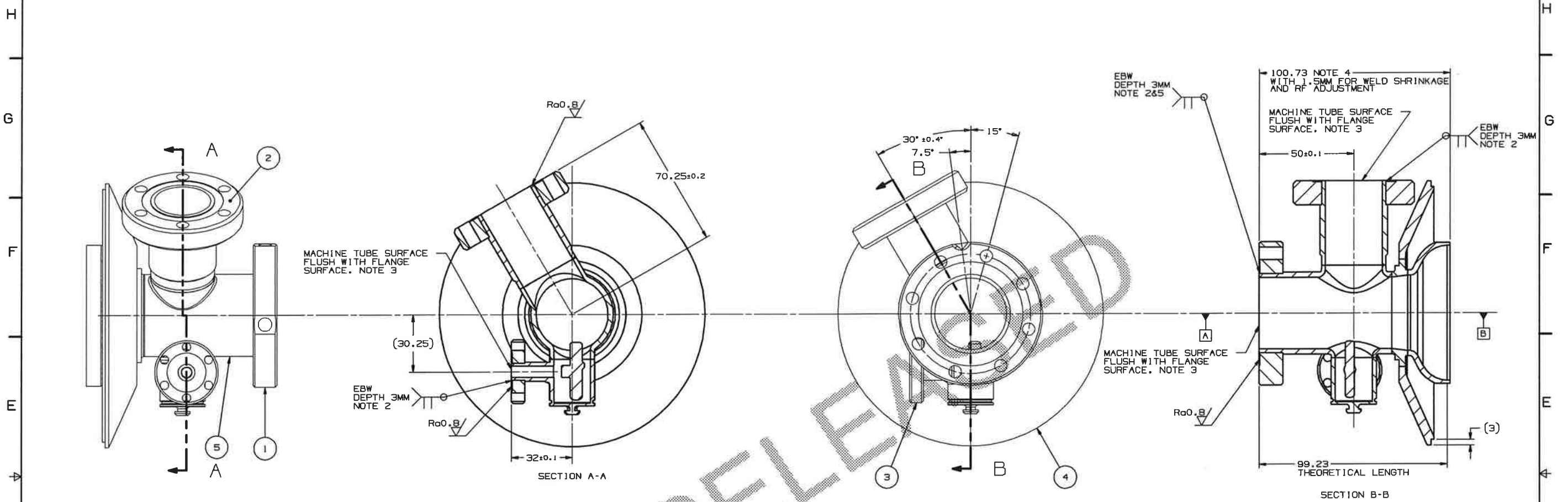
BREAK ALL SHARP EDGES 0.5 MAX.
 DO NOT SCALE DRAWING
 DIMENSIONS BASED ON ASME Y14.5-2009
 MAX. ALL MACH SURFACES 3.2
 DRAWING UNITS: MM

DRAWN	M. KRAMP	DATE	23-Oct-2015
CHECKED		DATE	
APPROVED		DATE	
USED ON	F10048745		
MATERIAL	NIOBIUM, RRR 300 GRADE		
GROUP:	Technical Division - Design and Drafting CAGE CODE: 0U5R6		

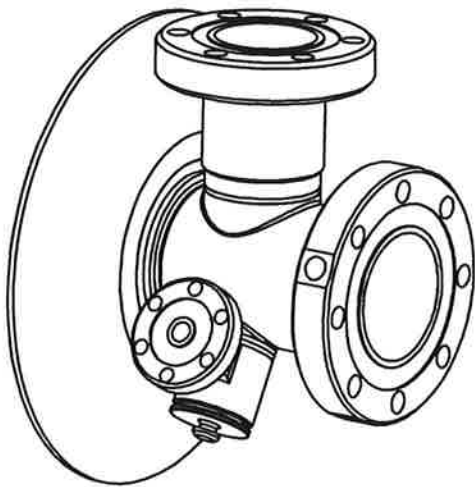
 FERMI NATIONAL ACCELERATOR LABORATORY UNITED STATES DEPARTMENT OF ENERGY				
NAME				
3.9GHZ MID-CELL				
SCALE	SIZE	DRAWING NUMBER	SHEET	REV
1:1	A3	F10048751	1 OF 1	-

DESCRIPTION: 3.9GHZ ASSY END GROUP, MC-SIDE
 CATEGORY: WELDMENT PROJECT: COLLETTOR

REV	REVISION CONTROL DOCUMENT	DATES	SIGNATURES
-	F10048753---RCD		DRAWN APPROVED



- NOTES (UNLESS OTHERWISE SPECIFIED):
- WELDMENT TO BE FREE OF DUST, GREASE, OIL, CHIPS, AND BURRS.
 - WELDING NOTES:
 - A. ASSEMBLY TO BE VACUUM TIGHT: NO LEAK SHALL BE DETECTABLE ON THE MOST SENSITIVE SCALE OF A HELIUM MASS SPECTROMETER LEAK DETECTOR WITH A MINIMUM SENSITIVITY OF 2×10^{-10} ATM CC/SEC FOR HELIUM.
 - B. ASSEMBLY TO BE CLEANED, AND PACKAGED SO AS TO ASSURE NO CONTAMINATION FOR FOREIGN MATERIALS, METAL CHIPS, OR OTHER CONTAMINATES. CLEANING PROCEDURE TO BE APPROVED BY FERMILAB.
 - C. ALL DESIGN, ASSEMBLY, AND HANDLING IS TO CONFORM TO STANDARD ULTRA HIGH VACUUM PRACTICES.
 - D. ALL ELECTRON BEAM WELDING, ACID ETCHING, CLEANLINESS, AND HANDLING PROCEDURES ARE DETAILED IN DESY SPECIFICATION MWF-SL 09-2005 AND MUST BE FOLLOWED.
 - SEALING SURFACE MUST BE FREE OF SCRATCHES WITH NO RADIAL SCORING. SURFACE MUST BE FREE OF DAMAGES.
 - ADDITIONAL MATERIAL NEEDED FOR CELL TUNING PLUS ALLOWANCE FOR E-BEAM WELD SHRINKAGE. FINAL SURFACE TO BE MACHINED UNTIL TUNED.
 - ITEMS 1, 4, AND 5 ARE TO BE CONCENTRIC WITHIN $\phi 0.05\text{mm}$ ALONG DATUM A-B.
 - DO NOT BREAK EDGES ON END CELL.



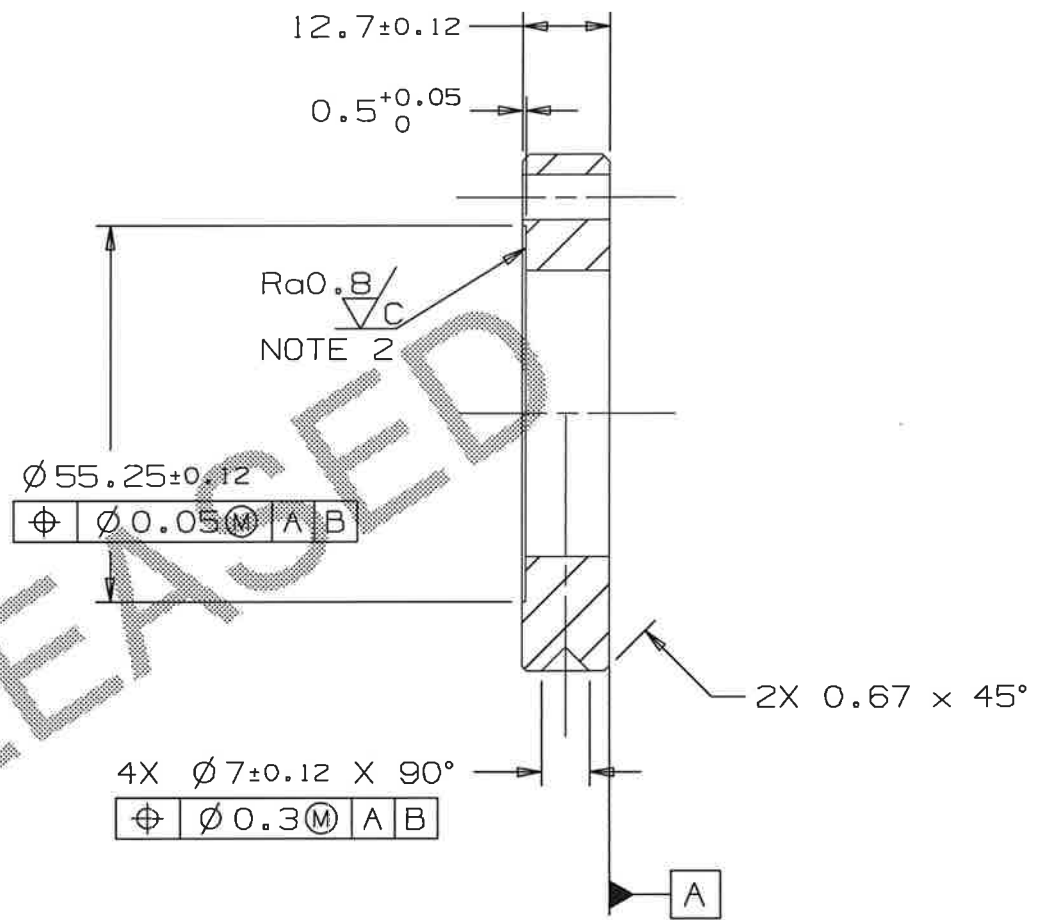
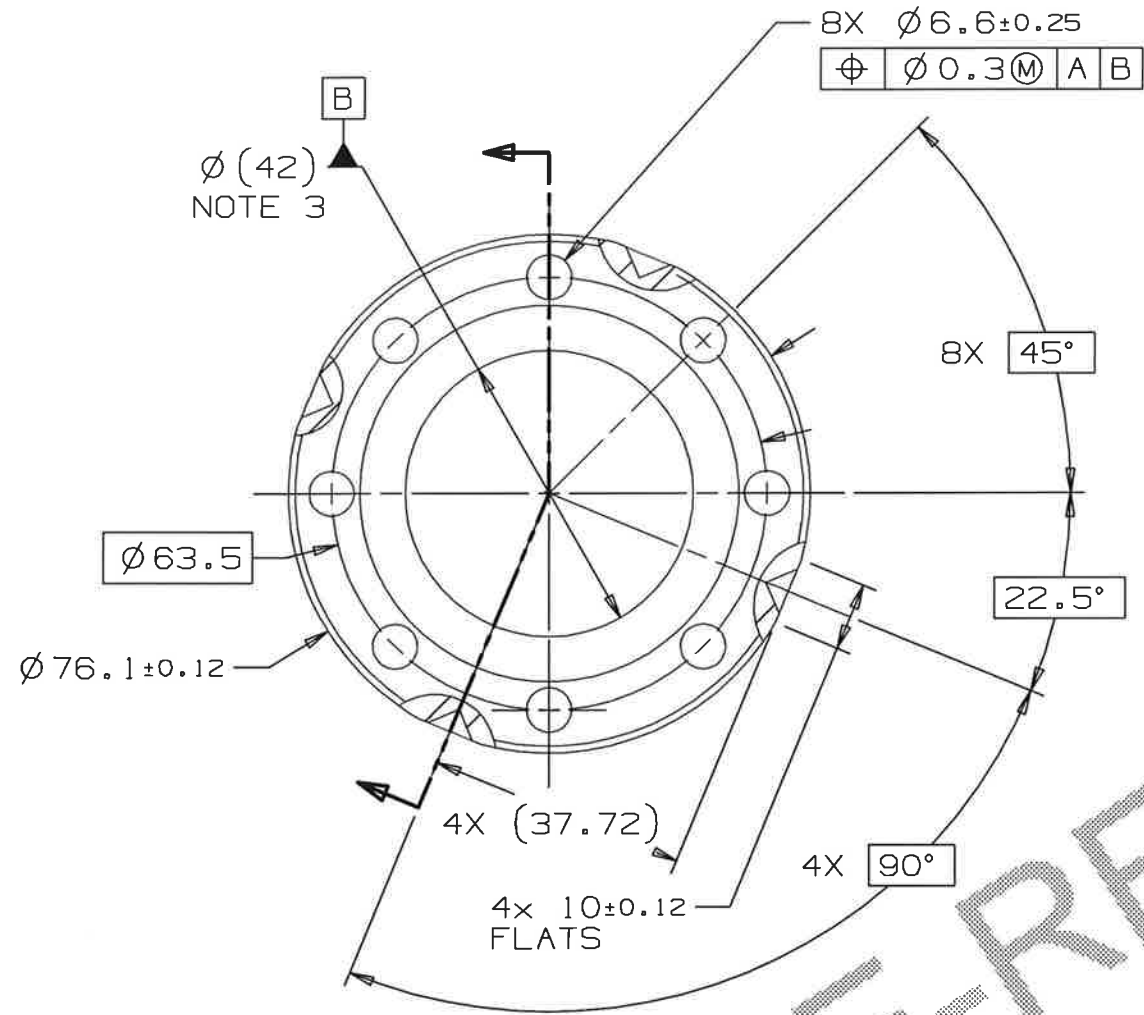
ITEM	PART#	DESCRIPTION	QTY.
5	F10049229	WELDMENT, MC END TUBE	1
4	F10049228	WELDMENT, MC END DISC	1
3	F10048827	3.9GHZ NW-6 FLANGE	1
2	F10048826	3.9GHZ NW-34 FLANGE	1
1	F10048825	3.9GHZ NW-40 FLANGE	1

UNLESS OTHERWISE SPECIFIED				
±X	±X.X	±X.XX	±X/X	±X'
2	0.3	0.12	N/A	1'
BREAK ALL SHARP EDGES 0.5 MAX. DO NOT SCALE DRAWING. DIMENSIONS BASED ON ASME Y14.5-2009 MAX. ALL MACH SURFACES 3.2 DRAWING UNITS: MM				
DRAWN		M. KRAMP	DATE	26-Oct-2015
CHECKED			DATE	
APPROVED			DATE	
USED ON F10048752				
MATERIAL SEE PARTS LIST				
GROUP: Technical Division - Design and Drafting CASE CODE: 045850				

 FERMILAB NATIONAL ACCELERATOR LABORATORY UNITED STATES DEPARTMENT OF ENERGY			
3.9GHZ ASSY END GROUP, MC-SIDE			
SCALE	SIZE	DRAWING NUMBER	SHEET
1:1	A1	F10048753	1 of 1
			REV
			-

DESCRIPTION: 3.9GHZ NW-40 FLANGE
 CATEGORY: FLANGE PROJECT: LCLS11Cryomodule

REV	REVISION CONTROL DOCUMENT	DATES	SIGNATURES
-	F10048825---RCD		DRAWN APPROVED



- GENERAL NOTES: (UNLESS OTHERWISE SPECIFIED)
1. WELDMENT TO BE FREE OF DUST, GREASE, OIL, CHIPS, AND BURRS.
 2. SEALING SURFACE MUST BE FREE OF SCRATCHES WITH NO RADIAL SCORING.
 3. DIMENSION CORRESPONDS WITH PART NUMBERS F10048763 & F10048830. TOLERANCE IS TO BE COORDINATED BETWEEN MANUFACTURERS AND EB-WELDERS

UNLESS OTHERWISE SPECIFIED				
±X	±X.X	±X.XX	±X/X	±X°
2	0.3	0.12	N/A	1°

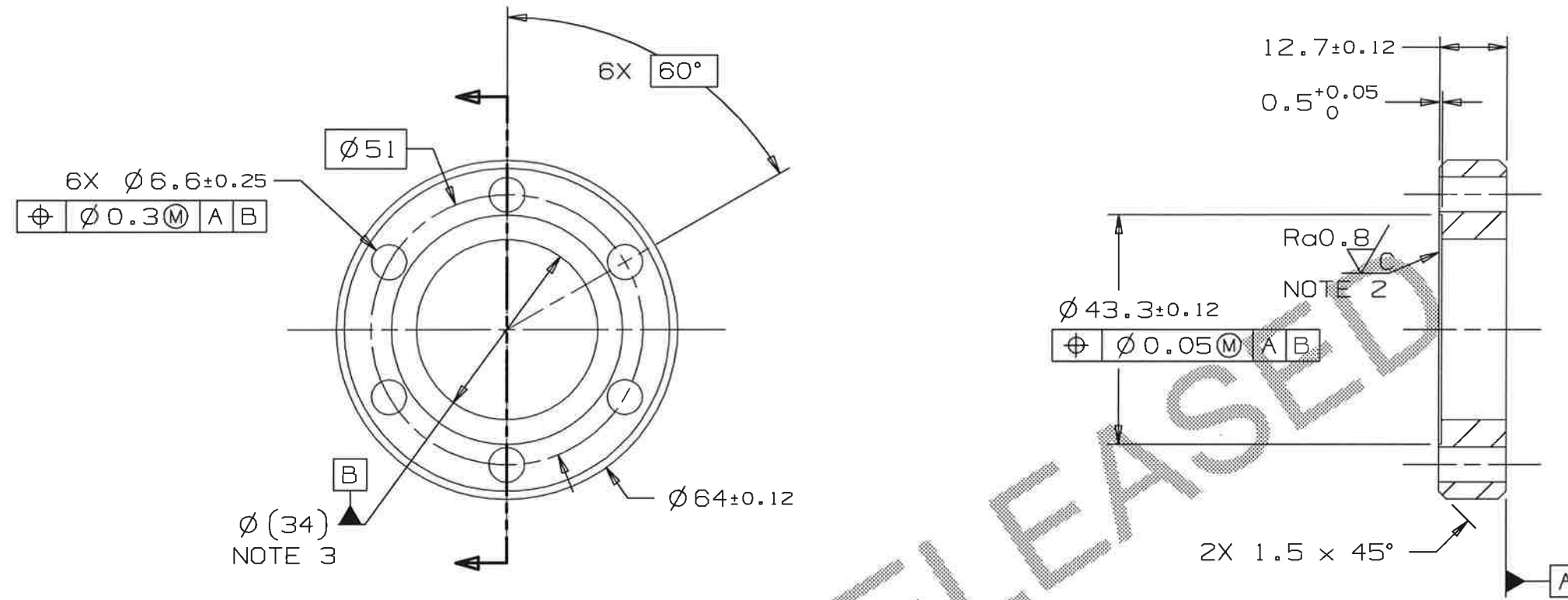
BREAK ALL SHARP EDGES 0.5 MAX.
 DO NOT SCALE DRAWING
 DIMENSIONS BASED ON ASME Y14.5-2009
 MAX. ALL MACH SURFACES 3.2
 DRAWING UNITS: MM

DRAWN	M. KRAMP	DATE	02-Nov-2015
CHECKED		DATE	
APPROVED		DATE	
USED ON	F10048753, F10048754		
MATERIAL	Nb55Ti		
GROUP: Technical Division - Design and Drafting CAGE CODE: 0U5R6			

FERMI NATIONAL ACCELERATOR LABORATORY UNITED STATES DEPARTMENT OF ENERGY				
				NAME 3.9GHZ NW-40 FLANGE
SCALE 1:1	SIZE A3	DRAWING NUMBER F10048825	SHEET 1 OF 1	REV -

DESCRIPTION: 3.9GHZ NW-34 FLANGE
 CATEGORY: FLANGE PROJECT: LCLS11Cryomodule

REV	REVISION CONTROL DOCUMENT	DATES	SIGNATURES
-	F10048826---RCD		DRAWN APPROVED



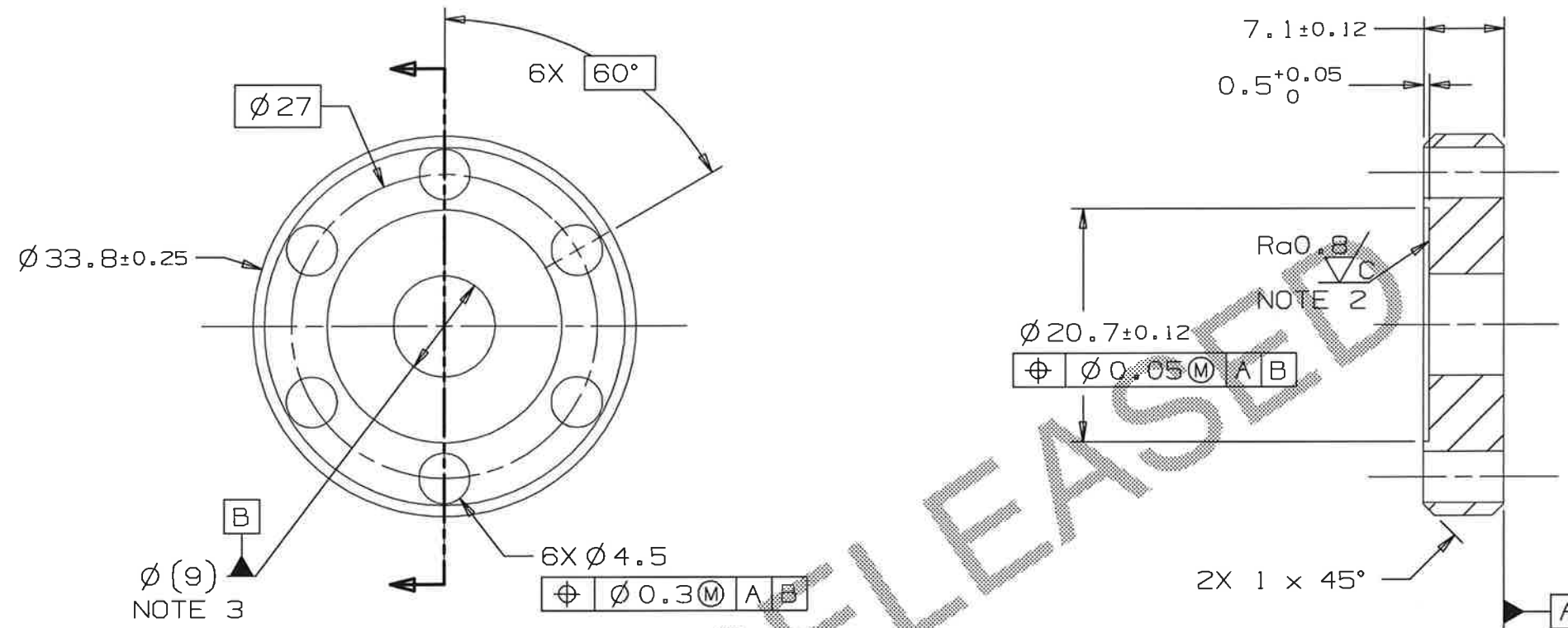
GENERAL NOTES: (UNLESS OTHERWISE SPECIFIED)

1. WELDMENT TO BE FREE OF DUST, GREASE, OIL, CHIPS, AND BURRS.
2. SEALING SURFACE MUST BE FREE OF SCRATCHES WITH NO RADIAL SCORING.
3. DIMENSION CORRESPONDS WITH PART NUMBER F10048764. TOLERANCE IS TO BE COORDINATED BETWEEN MANUFACTURERS AND EB-WELDERS

UNLESS OTHERWISE SPECIFIED					DRAWN	M. KRAMP	DATE	02-Nov-2015	FERMI NATIONAL ACCELERATOR LABORATORY UNITED STATES DEPARTMENT OF ENERGY			
±X	±X.X	±X.XX	±X/X	±X°	CHECKED		DATE		NAME			
2	0.3	0.12	N/A	1°	APPROVED		DATE		3.9GHZ NW-34 FLANGE			
BREAK ALL SHARP EDGES 0.5 MAX. DO NOT SCALE DRAWING DIMENSIONS BASED ON ASME Y14.5-2009 MAX. ALL MACH SURFACES 3.2 DRAWING UNITS: MM					USED ON				SCALE			
					F10048753				1:1			
					MATERIAL				DRAWING NUMBER			
					Nb55Ti				A3			
					GROUP: Technical Division - Design and Drafting				CAGE CODE: OUSR6			
									SHEET			
									1 OF 1			
									REV			
									-			

DESCRIPTION: 3.9GHZ NW-6 FLANGE
 CATEGORY: FLANGE PROJECT: LCLS11Cryomodule

REV	REVISION CONTROL DOCUMENT	DATES	SIGNATURES
-	F10048827---RCD		DRAWN APPROVED



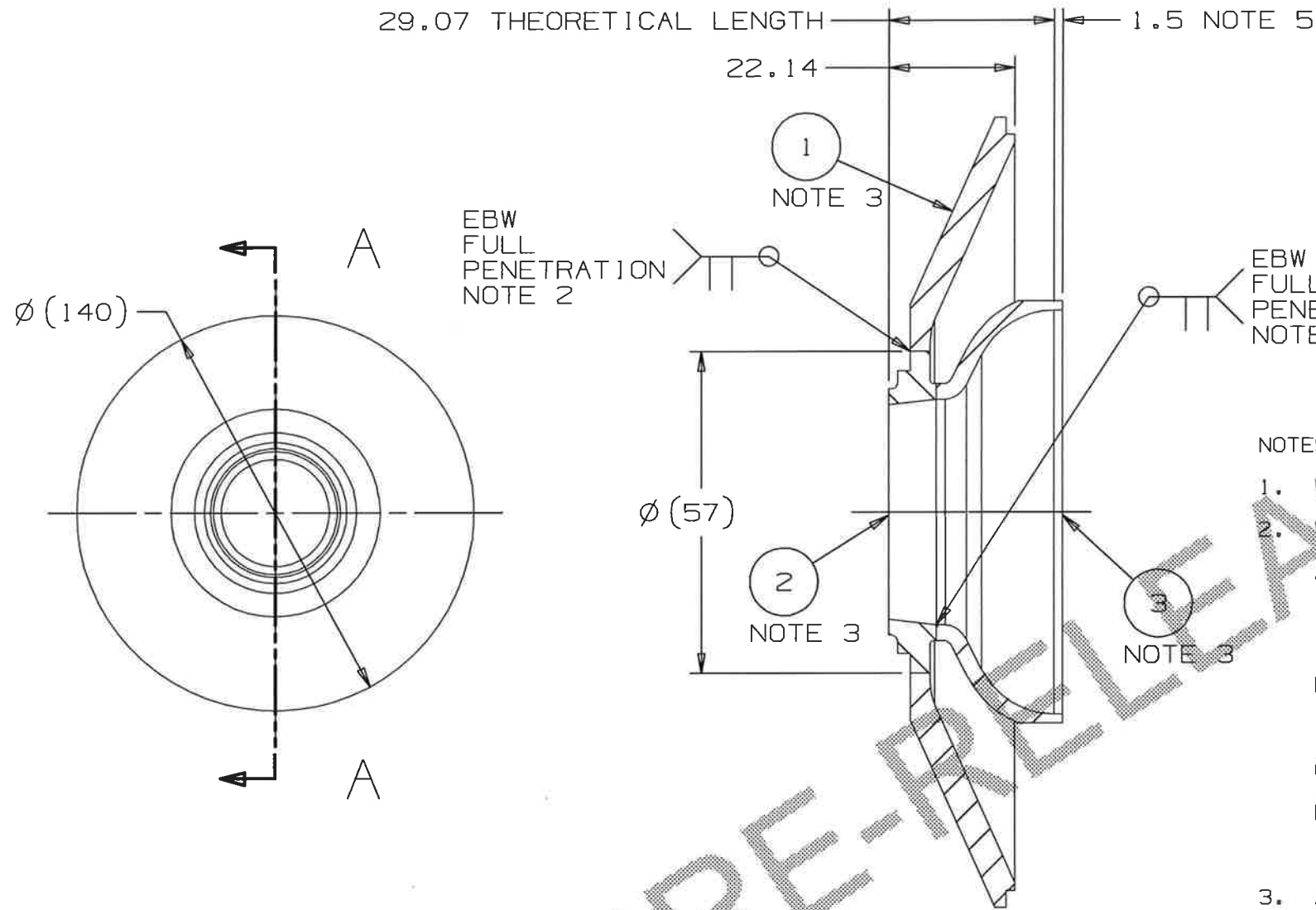
GENERAL NOTES: (UNLESS OTHERWISE SPECIFIED)

1. WELDMENT TO BE FREE OF DUST, GREASE, OIL, CHIPS, AND BURRS.
2. SEALING SURFACE MUST BE FREE OF SCRATCHES WITH NO RADIAL SCORING.
3. DIMENSION CORRESPONDS WITH PART NUMBER F10048766. TOLERANCE IS TO BE COORDINATED BETWEEN MANUFACTURERS AND EB-WELDERS

UNLESS OTHERWISE SPECIFIED					DRAWN	M. KRAMP	DATE	02-Nov-2015	FERMI NATIONAL ACCELERATOR LABORATORY UNITED STATES DEPARTMENT OF ENERGY					
$\pm X$	$\pm X.X$	$\pm X.XX$	$\pm X/X$	$\pm X^\circ$	CHECKED		DATE		NAME					
Z	0.3	0.12	N/A	1*	APPROVED		DATE		3.9GHZ NW-6 FLANGE					
BREAK ALL SHARP EDGES 0.5 MAX. DO NOT SCALE DRAWING DIMENSIONS BASED ON ASME Y14.5-2009 MAX. ALL MACH SURFACES 3.2 DRAWING UNITS: MM					USED ON			F10048753, F10048754						
					MATERIAL			Nb55Ti						
					GROUP: Technical Division - Design and Drafting			CAGE CODE: OUSR6		SCALE	SIZE	DRAWING NUMBER	SHEET	REV
								2:1		A3	F10048827	1 OF 1	-	

DESCRIPTION: WELDMENT, MC END DISC
 CATEGORY: WELDMNT PROJECT: LCLS11Cryomodule

REV	REVISION CONTROL DOCUMENT	DATES	SIGNATURES
-	F10049228---RCD		DRAWN APPROVED



NOTES (UNLESS OTHERWISE SPECIFIED):


1. WELDMENT TO BE FREE OF DUST, GREASE, OIL, CHIPS, AND BURRS.
2. WELDING NOTES:
 - A. ASSEMBLY TO BE VACUUM TIGHT: NO LEAK SHALL BE DETECTABLE ON THE MOST SENSITIVE SCALE OF A HELIUM MASS SPECTROMETER LEAK DETECTOR WITH A MINIMUM SENSITIVITY OF 2×10^{-10} ATM CC/SEC FOR HELIUM.
 - B. ASSEMBLY TO BE CLEANED, AND PACKAGED SO AS TO ASSURE NO CONTAMINATION FOR FOREIGN MATERIALS, METAL CHIPS, OR OTHER CONTAMINATES. CLEANING PROCEDURE TO BE APPROVED BY FERMILAB.
 - C. ALL DESIGN, ASSEMBLY, AND HANDLING IS TO CONFORM TO STANDARD ULTRA HIGH VACUUM PRACTICES.
 - D. ALL ELECTRON BEAM WELDING, ACID ETCHING, CLEANLINESS, AND HANDLING PROCEDURES ARE DETAILED IN DESY SPECIFICATION MWF-SL 09-2005 AND MUST BE FOLLOWED.
3. ALL PARTS TO BE CONCENTRIC WITHIN $\varnothing 0.04\text{mm}$.
4. DO NOT BREAK EDGES ON END CELL.
5. ADDITIONAL MATERIAL NEEDED FOR CELL TUNING. PLUS ALLOWANCE FOR E-BEAM WELD SHRINKAGE. FINAL SURFACE TO BE MACHINED UNTIL TUNED.

SECTION A-A
SCALE 1:1

ITEM	PART#	DESCRIPTION	QTY.
3	F10048780	3.9GHZ END-CELL	1
2	F10048762	3.9GHZ NIOBIUM RING	1
1	F10048758	3.9GHZ END DISH, MC	1

PARTS LIST

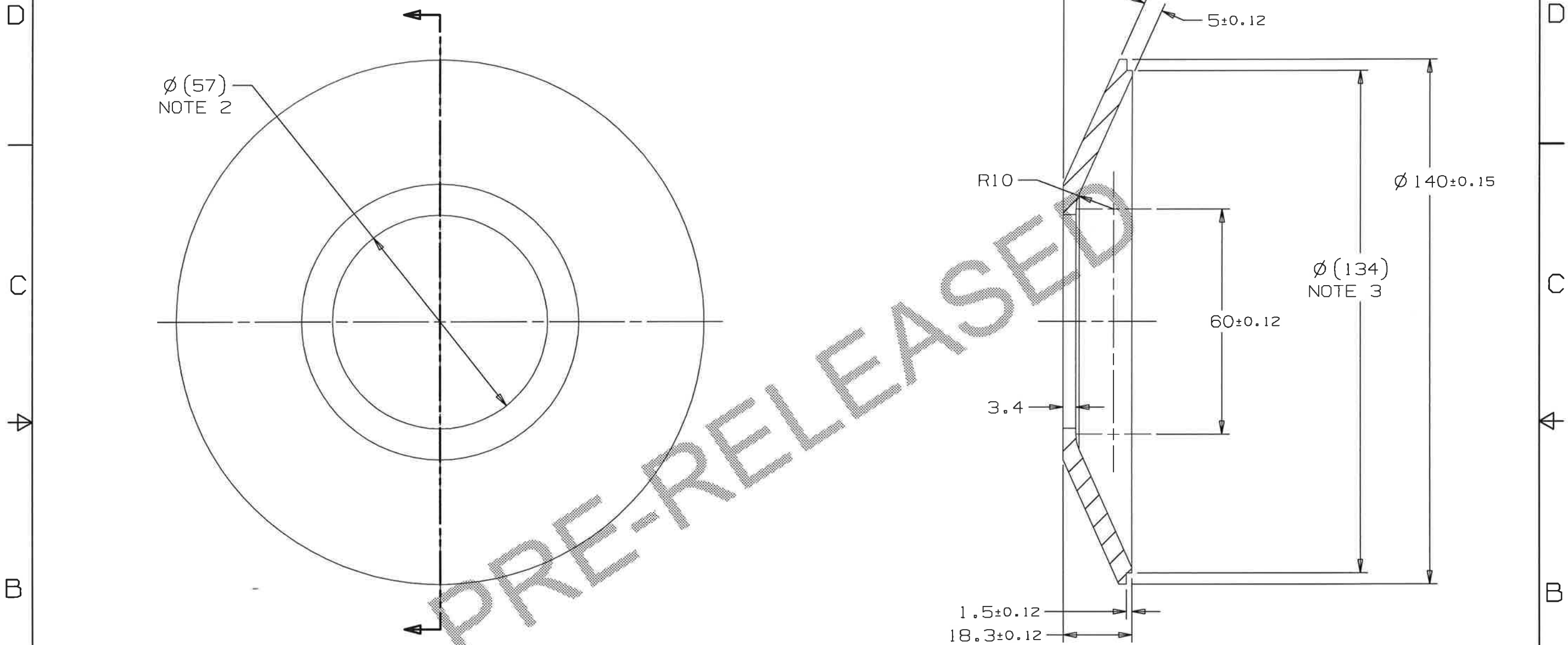
UNLESS OTHERWISE SPECIFIED					DRAWN	M. KRAMP	DATE	02-Nov-2015
±X	±X.X	±X.XX	±X/X	±X*	CHECKED		DATE	
2	0.3	0.12	N/A	1*	APPROVED		DATE	
BREAK ALL SHARP EDGES 0.5 MAX. DO NOT SCALE DRAWING DIMENSIONS BASED ON ASME Y14.5-2009 MAX. ALL MACH SURFACES 3.2 DRAWING UNITS: MM					USED ON			
					F10048753			
MATERIAL					SEE PARTS LIST			
GROUP: Technical Division - Design and Drafting					CAGE CODE: 0U5R6			

 FERMI NATIONAL ACCELERATOR LABORATORY UNITED STATES DEPARTMENT OF ENERGY				
NAME				
WELDMENT, MC END DISC				
SCALE	SIZE	DRAWING NUMBER	SHEET	REV
1:2 & AS SHOWN	A3	F10049228	1 OF 1	-

PRE-RELEASED

DESCRIPTION: 3.9GHZ END DISH, MC
 CATEGORY: DISK PROJECT: LCLS11Cryomodule

REV	REVISION CONTROL DOCUMENT	DATES	SIGNATURES	
-	F10048758---RCD		DRAWN	
			APPROVED	

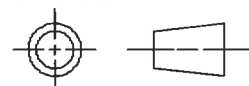


NOTES (UNLESS OTHERWISE SPECIFIED):

1. WELDMENT TO BE FREE OF DUST, GREASE, OIL, CHIPS, AND BURRS.
2. DIMENSION COORESponds WITH PART NUMBER F10048762. TOLERANCE IS TO BE COORDINATED BETWEEN MANUFACTURING AND EB-WELDERS.
3. DIMENSION COORESponds WITH PART NUMBER F10048839. TOLERANCE IS TO BE COORDINATED BETWEEN MANUFACTURING AND EB-WELDERS.

UNLESS OTHERWISE SPECIFIED				
±X	±X.X	±X.XX	±X/X	±X°
2	0.3	0.12	N/A	1°

BREAK ALL SHARP EDGES 0.5 MAX.
 DO NOT SCALE DRAWING
 DIMENSIONS BASED ON ASME Y14.5-2009
 MAX. ALL MACH SURFACES 3.2
 DRAWING UNITS: MM

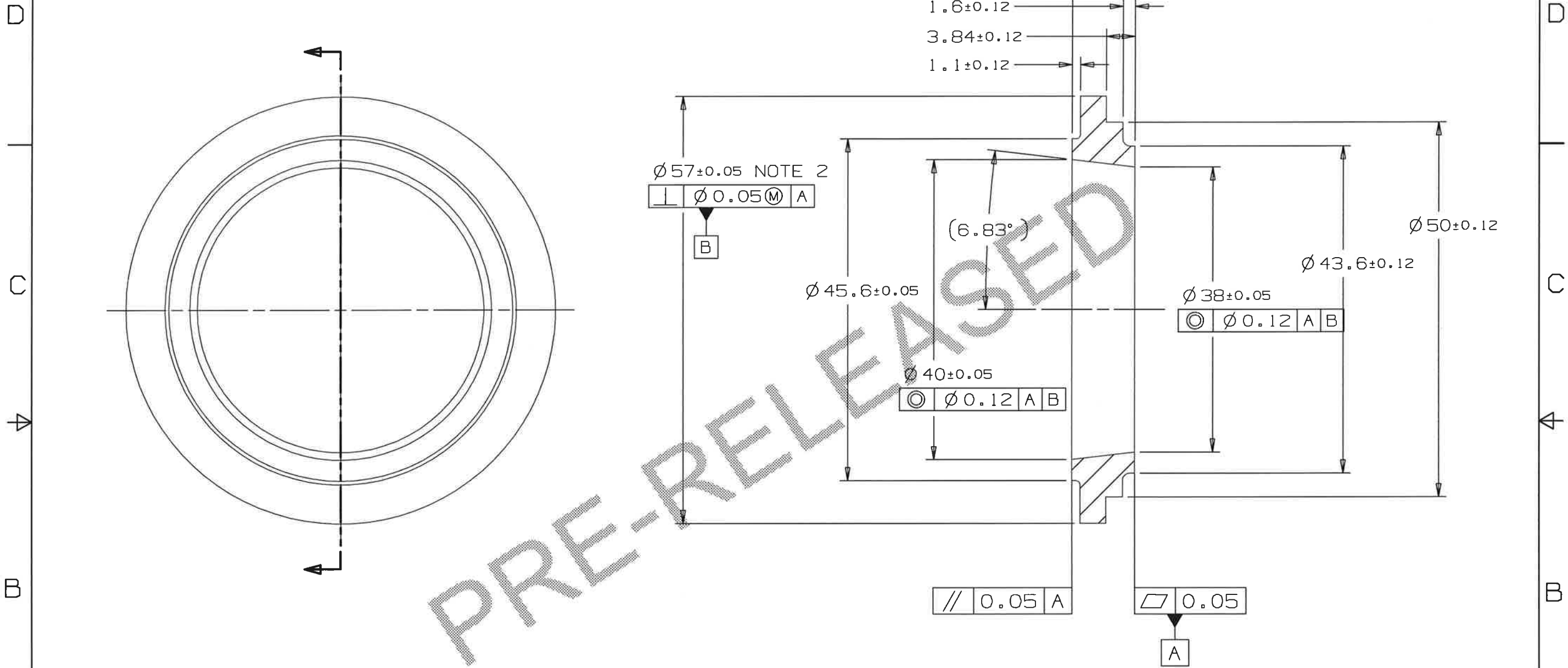


DRAWN	M. KRAMP	DATE	26-Oct-2015
CHECKED		DATE	
APPROVED		DATE	
USED ON	F10048753		
MATERIAL	Nb55Ti		
GROUP: Technical Division - Design and Drafting CAGE CODE: OUSR6			

 FERMI NATIONAL ACCELERATOR LABORATORY UNITED STATES DEPARTMENT OF ENERGY		NAME	
		3.9GHZ END DISH, MC	
SCALE	SIZE	DRAWING NUMBER	SHEET
1:1	A3	F10048758	1 OF 1
			REV
			-

DESCRIPTION: 3.9GHZ NIOBIUM RING
 CATEGORY: RING PROJECT: LCLS11Cryomodule

REV	REVISION CONTROL DOCUMENT	DATES	SIGNATURES
-	F10048762---RCD		DRAWN APPROVED



NOTES (UNLESS OTHERWISE SPECIFIED):

1. WELDMENT TO BE FREE OF DUST, GREASE, OIL, CHIPS, AND BURRS.
2. DIMENSION COORESPONDS WITH PART NUMBERS F10048757 AND F10048758 TOLERANCE IS TO BE COORDINATED BETWEEN MANUFACTURING AND EB-WELDERS.

UNLESS OTHERWISE SPECIFIED				
±X	±X.X	±X.XX	±X/X	±X°
2	0.3	0.12	N/A	1°

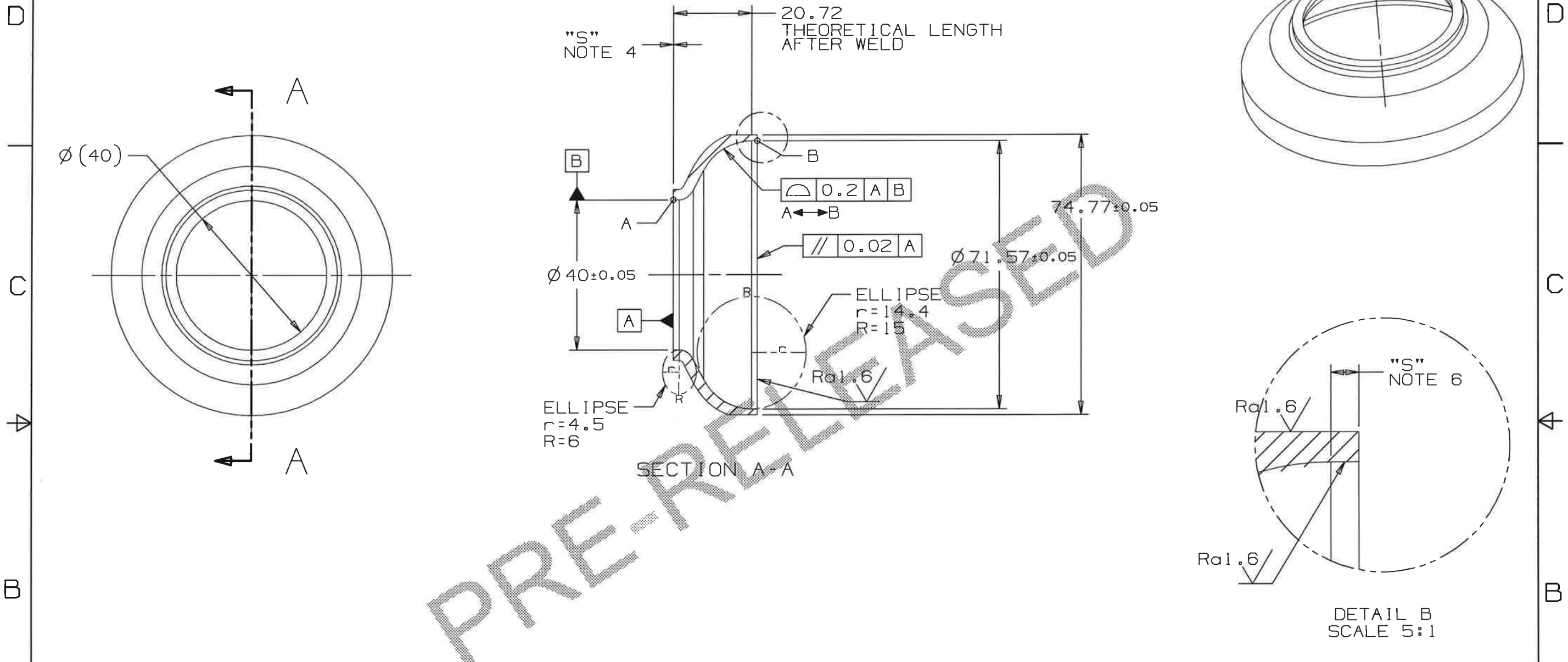
BREAK ALL SHARP EDGES 0.5 MAX.
 DO NOT SCALE DRAWING
 DIMENSIONS BASED ON ASME Y14.5-2009
 MAX. ALL MACH SURFACES 3.2
 DRAWING UNITS: MM

DRAWN	M. KRAMP	DATE	26-Oct-2015
CHECKED		DATE	
APPROVED		DATE	
USED ON	F10049223, F10049228		
MATERIAL	NIOBIUM, RRR 300 GRADE		
GROUP: Technical Division - Design and Drafting CAGE CODE: QUSR6			

FERMIONATIONAL ACCELERATOR LABORATORY UNITED STATES DEPARTMENT OF ENERGY			
3.9GHZ NIOBIUM RING			
SCALE	SIZE	DRAWING NUMBER	SHEET
1:1	A3	F10048762	1 OF 1
			REV
			-

DESCRIPTION: 3.9GHZ END-CELL
 CATEGORY: CELL PROJECT: LCLS11Cryomodule

REV	REVISION CONTROL DOCUMENT	DATES	SIGNATURES
-	F10048780---RCD		DRAWN APPROVED



GENERAL NOTES: (UNLESS OTHERWISE SPECIFIED)

- 1) THE INTERNAL SURFACE MAY SHOW NO DAMAGE CAUSED BY FORMING
- 2) DIAMETER, FORM, AND POSITION TOLERANCES MEASURED IN HALF CELL'S STRAINED CONDITION
- 3) DO NOT BREAK EDGES ON END CELL
- 4) SUPPLEMENT FOR WELD SHRINKAGE ("S") TO BE DETERMINED BY EB-WELDERS.
- 5) DUE TO THE MANUFACTURING PROCESS THE WALLTHICKNESS BETWEEN IRIS AND EQUATOR IS NOT CONSTANT.

6) ADDITIONAL MATERIAL NEEDED FOR CELL TUNING PLUS ALLOWANCE FOR E-BEAM WELD SHRINKAGE ("S"). FINAL SURFACE TO BE MACHINED UNTIL TUNED.

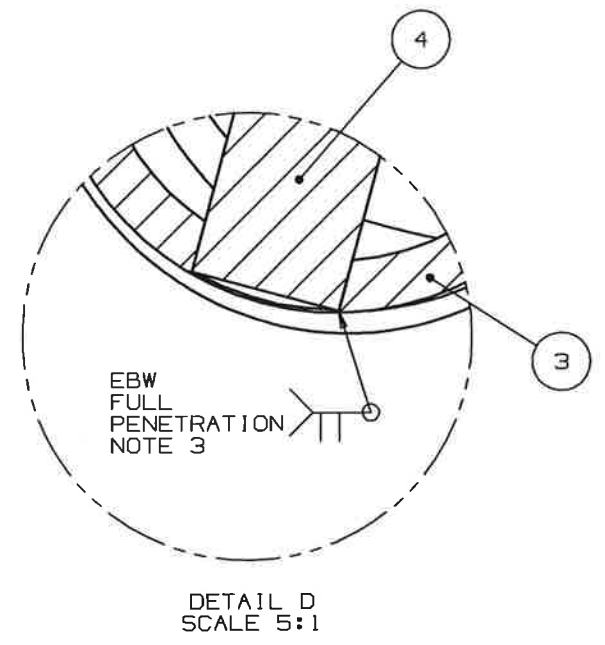
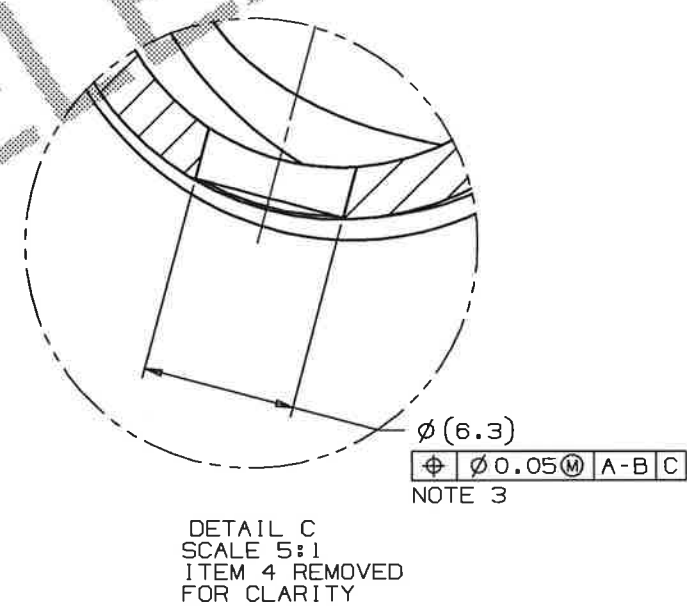
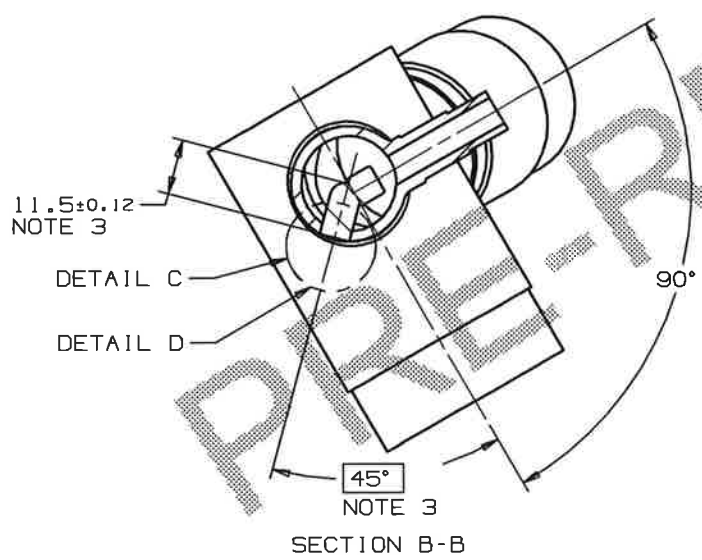
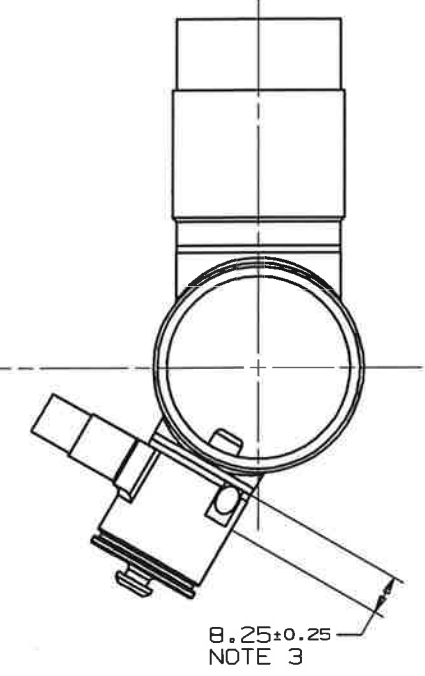
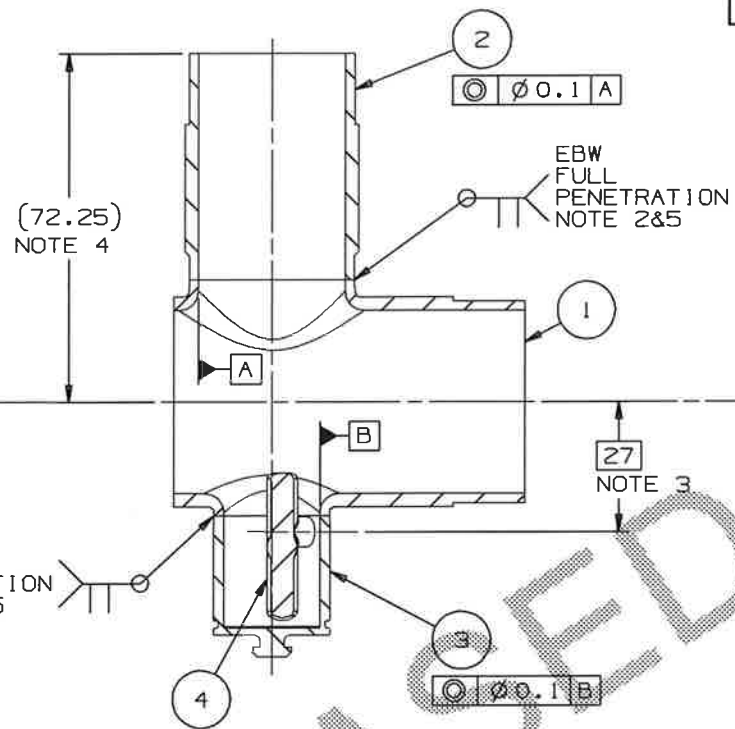
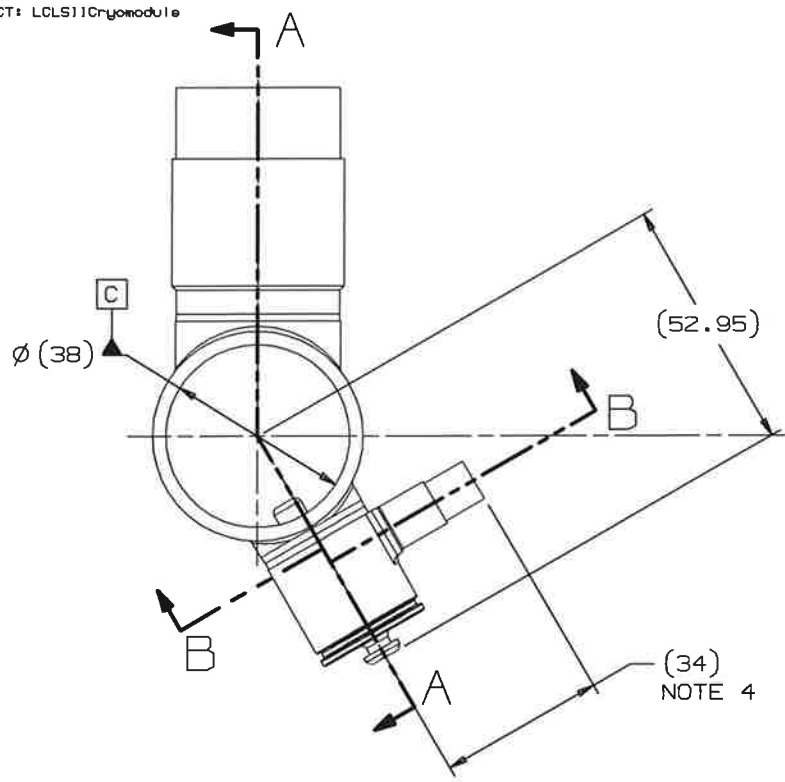
UNLESS OTHERWISE SPECIFIED				
±X	±X.X	±X.XX	±X/X	±X°
2	0.3	0.12	N/A	1°

BREAK ALL SHARP EDGES 0.5 MAX.
 DO NOT SCALE DRAWING
 DIMENSIONS BASED ON ASME Y14.5-2009
 MAX. ALL MACH SURFACES 3.2
 DRAWING UNITS: MM

DRAWN	M. KRAMP	DATE	23-Oct-2015
CHECKED		DATE	
APPROVED		DATE	
USED ON	F10049223, F10049228		
MATERIAL	NIOBIUM, RRR 300 GRADE		
GROUP: Technical Division - Design and Drafting	CAGE CODE: 0U5R6		

FERMI NATIONAL ACCELERATOR LABORATORY UNITED STATES DEPARTMENT OF ENERGY			
NAME			
3.9GHZ END-CELL			
SCALE	SIZE	DRAWING NUMBER	SHEET
1:1	A3	F10048780	1 OF 1
			REV
			-

REV	REVISION CONTROL DOCUMENT	DATES	SIGNATURES
-	F10049229---RCD		DRAWN APPROVED



NOTES (UNLESS OTHERWISE SPECIFIED):

- WELDMENT TO BE FREE OF DUST, GREASE, OIL, CHIPS, AND BURRS.
- WELDING NOTES:
 - ASSEMBLY TO BE VACUUM TIGHT: NO LEAK SHALL BE DETECTABLE ON THE MOST SENSITIVE SCALE OF A HELIUM MASS SPECTROMETER LEAK DETECTOR WITH A MINIMUM SENSITIVITY OF 2×10^{-10} ATM CC/SEC FOR HELIUM.
 - ASSEMBLY TO BE CLEANED, AND PACKAGED SO AS TO ASSURE NO CONTAMINATION FOR FOREIGN MATERIALS, METAL CHIPS, OR OTHER CONTAMINATES. CLEANING PROCEDURE TO BE APPROVED BY FERMILAB.
 - ALL DESIGN, ASSEMBLY, AND HANDLING IS TO CONFORM TO STANDARD ULTRA HIGH VACUUM PRACTICES.
 - ALL ELECTRON BEAM WELDING, ACID ETCHING, CLEANLINESS, AND HANDLING PROCEDURES ARE DETAILED IN DESY SPECIFICATION MWF-SL 09-2005 AND MUST BE FOLLOWED.
- FLAT AND HOLE TO BE MACHINED AFTER EBW OF ITEMS 1,2,&3 WITH FINAL HOLE SIZE TO BE FIT WITH OD OF ITEM 4 AND THEN EBW'D.
- FINAL LENGTH AFTER MACHINING OPERATION DETAILED ON DRAWING F10048754.
- WELD PREP JOINTS TO MATCH WALL THICKNESS AT DISCRETION OF MANUFACTURER.

ITEM	PART#	DESCRIPTION	QTY.
4	F10048767	3.9GHZ HOM ANTENNA	1
3	F10048766	3.9GHZ HOM HOUSING	1
2	F10048764	3.9GHZ MC TUBE	1
1	F10048763	3.9GHZ END TUBE, MC	1

PARTS LIST

UNLESS OTHERWISE SPECIFIED				
±X	±X.X	±X.XX	±X/X	±X°
2	0.3	0.12	N/A	1°

BREAK ALL SHARP EDGES 0.5 MAX.
 DO NOT SCALE DRAWING
 DIMENSIONS BASED ON ASME Y14.5-2009
 MAX. ALL MACH SURFACES 3.2
 DRAWING UNITS: MM

DRAWN	M. KRAMP	DATE	10/27/15
CHECKED		DATE	
APPROVED		DATE	

USED ON
 F10048753

MATERIAL
 SEE PARTS LIST

GROUP: Technical Division - Design and Drafting | CAGE CODE: DUSFB

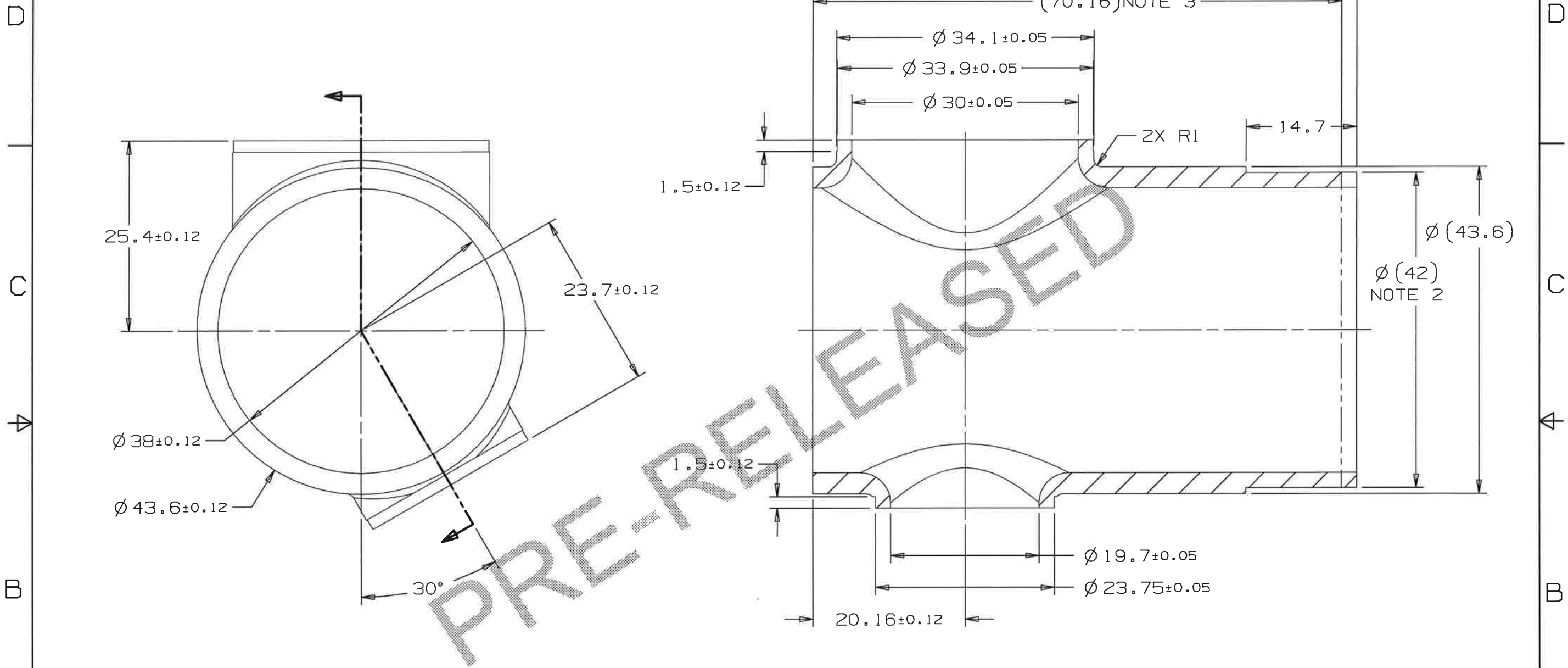
FERMI NATIONAL ACCELERATOR LABORATORY
 UNITED STATES DEPARTMENT OF ENERGY

NAME
 WELDMENT, MC END TUBE

SCALE	SIZE	DRAWING NUMBER	SHEET	REV
1:1	A2	F10049229	1 of 1	-

DESCRIPTION: 3.9GHZ END TUBE, MC
 CATEGORY: TUBE PROJECT: LCLS11Cryomodule

REV	REVISION CONTROL DOCUMENT	DATES	SIGNATURES
-	F10048763---RCD		DRAWN APPROVED



GENERAL NOTES: (UNLESS OTHERWISE SPECIFIED)

1. WELDMENT TO BE FREE OF DUST, GREASE, OIL, CHIPS, AND BURRS.
2. DIMENSION CORRESPONDS WITH PART NUMBER F10048825. TOLERANCE IS TO BE COORDINATED BETWEEN MANUFACTURERS AND EB-WELDERS
3. FINAL LENGTH AFTER MACHINING SHOWN ON DRAWING F10048754.

UNLESS OTHERWISE SPECIFIED				
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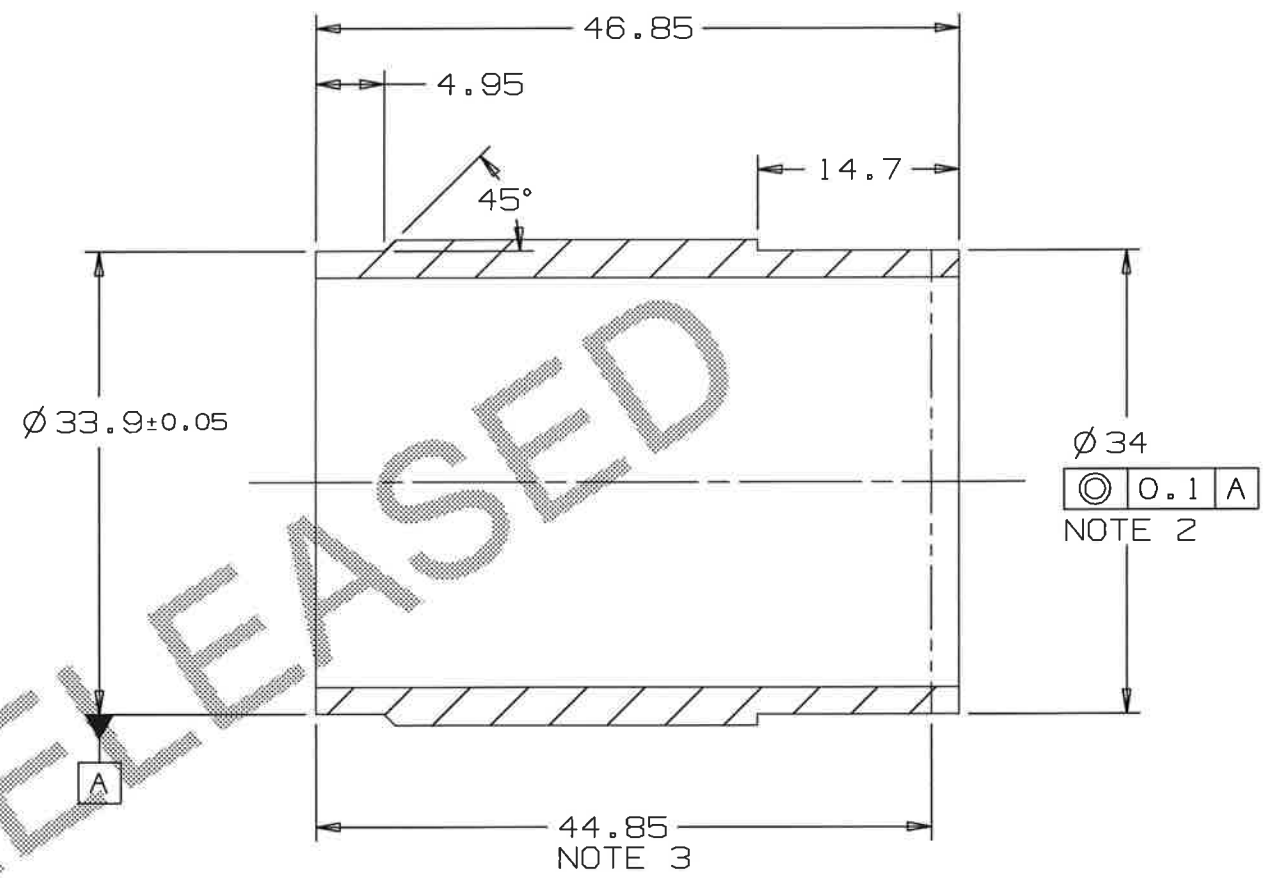
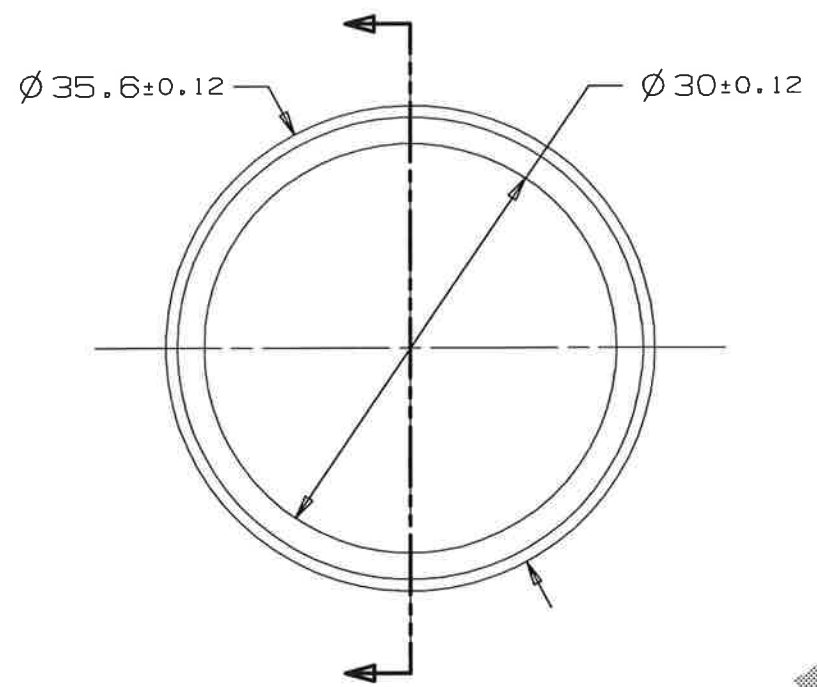
BREAK ALL SHARP EDGES 0.5 MAX.
 DO NOT SCALE DRAWING
 DIMENSIONS BASED ON ASME Y14.5-2009
 MAX. ALL MACH SURFACES 3.2
 DRAWING UNITS: MM

DRAWN	M. KRAMP	DATE	10/27/15
CHECKED		DATE	
APPROVED		DATE	
USED ON	F10049229		
MATERIAL	NIOBIUM RRR 300 GRADE		
GROUP:	Technical Division - Design and Drafting		
CAGE CODE:	0U5R6		

FERMI NATIONAL ACCELERATOR LABORATORY UNITED STATES DEPARTMENT OF ENERGY			
NAME			
3.9GHZ END TUBE, MC			
SCALE	SIZE	DRAWING NUMBER	SHEET
2:1	A3	F10048763	1 OF 1
REV			
-			

DESCRIPTION: 3.9GHZ MC TUBE
 CATEGORY: TUBE PROJECT: LCLS11Cryomodule

REV	REVISION CONTROL DOCUMENT	DATES	SIGNATURES
-	F10048764---RCD		DRAWN APPROVED



PRE-RELEASED

GENERAL NOTES: (UNLESS OTHERWISE SPECIFIED)

- PART TO BE FREE OF DUST , GREASE, OIL, CHIPS, AND BURRS.
- DIMENSION CORRESPONDS WITH PART NUMBER F10048826. TOLERANCE IS TO BE COORDINATED BETWEEN MANUFACTURERS AND EB-WELDERS
- FINAL LENGTH AFTER MACHINING OPERATION DETAILED ON DRAWING NUMBER F10048753

UNLESS OTHERWISE SPECIFIED				
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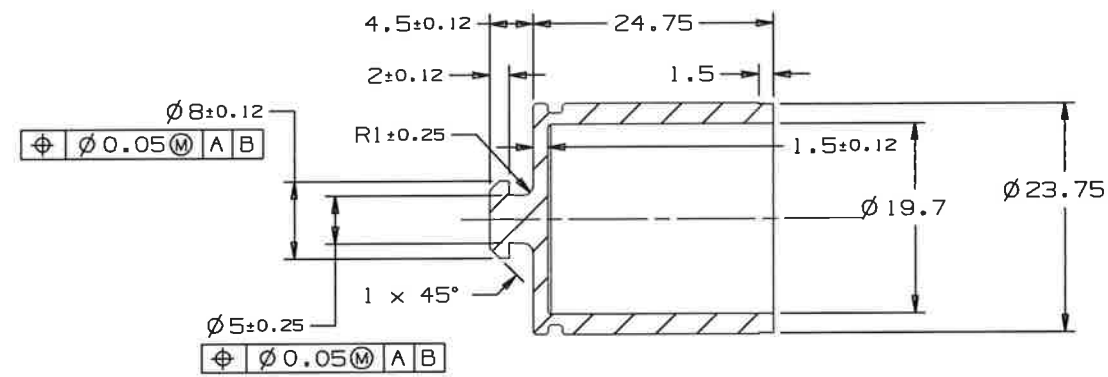
BREAK ALL SHARP EDGES 0.5 MAX.
 DO NOT SCALE DRAWING
 DIMENSIONS BASED ON ASME Y14.5-2009
 MAX. ALL MACH SURFACES 3.2
 DRAWING UNITS: MM

DRAWN	M.KRAMP	DATE	26-Oct-2015
CHECKED		DATE	
APPROVED		DATE	
USED ON	F10049229		
MATERIAL	NIOBIUM, RRR 300 GRADE		
GROUP: Technical Division - Design and Drafting CAGE CODE: OUSR6			

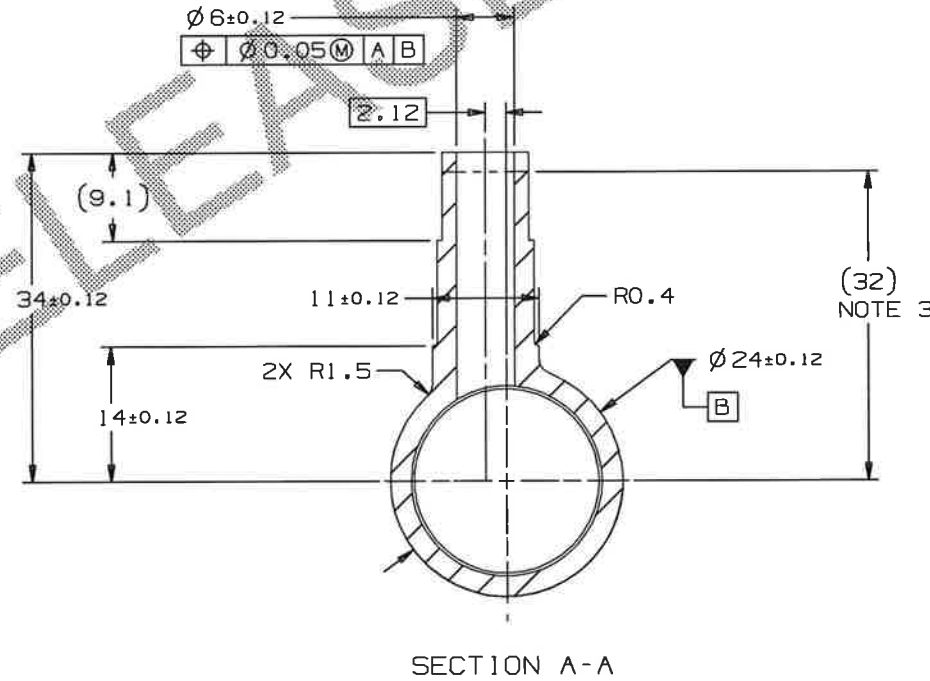
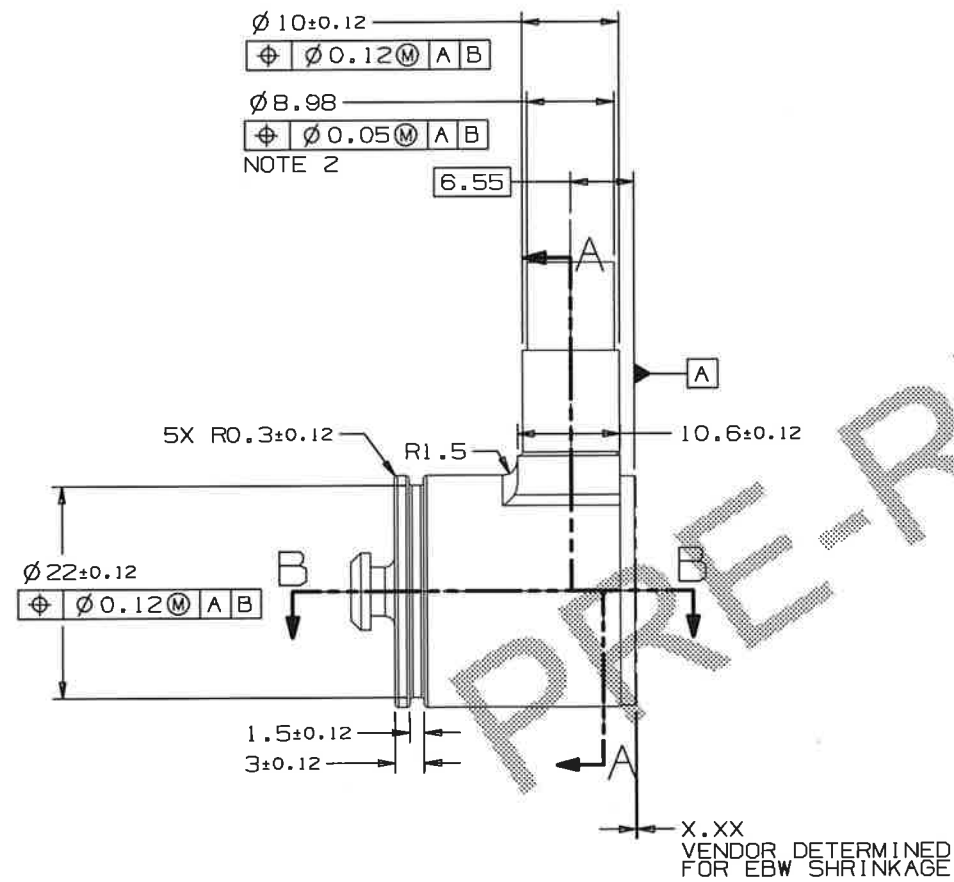
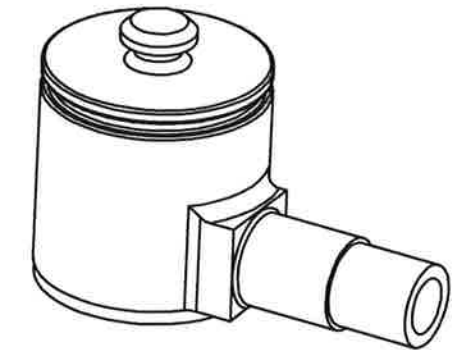
 FERMI NATIONAL ACCELERATOR LABORATORY UNITED STATES DEPARTMENT OF ENERGY		NAME	
		3.9GHZ MC TUBE	
SCALE	SIZE	DRAWING NUMBER	SHEET
2:1	A3	F10048764	1 OF 1
REV			
-			

DESCRIPTION: 3.9GHZ HOM HOUSING
 CATEGORY: HOUSING PROJECT: LCLS11Cryomodule

REV	REVISION CONTROL DOCUMENT	DATES	SIGNATURES
-	F10048766---RCD		DRAWN APPROVED



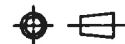
SECTION B-B



SECTION A-A

NOTES (UNLESS OTHERWISE SPECIFIED):

- PART TO BE FREE OF DUST, GREASE, OIL, CHIPS, AND BURRS.
- DIMENSION CORRESPONDS WITH PART NUMBER F10048827. TOLERANCE IS TO BE COORDINATED BETWEEN MANUFACTURING AND EB-WELDERS.
- FINAL LENGTH AFTER MACHINING SHOWN ON F10048753.

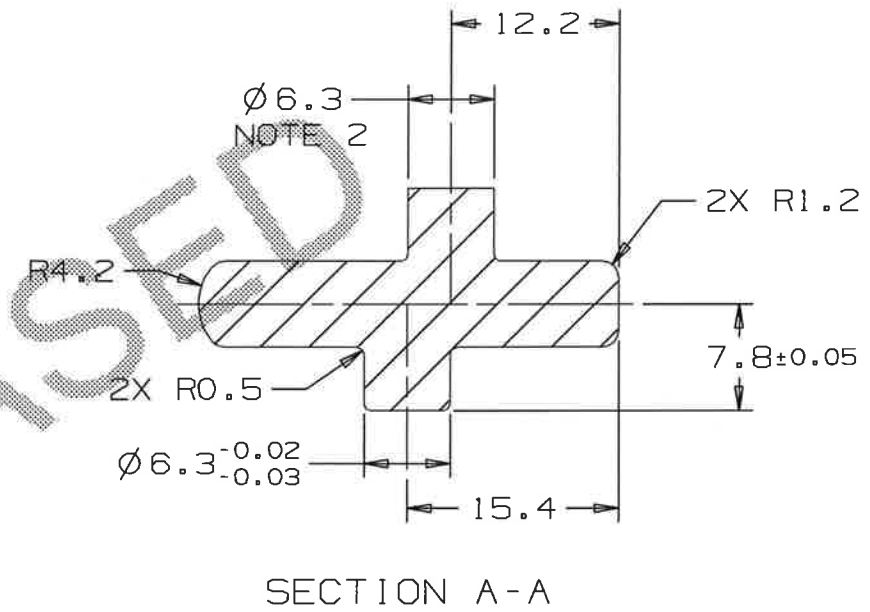
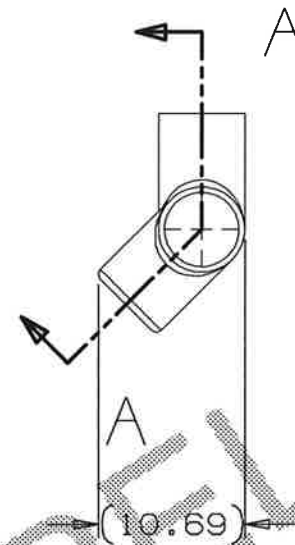
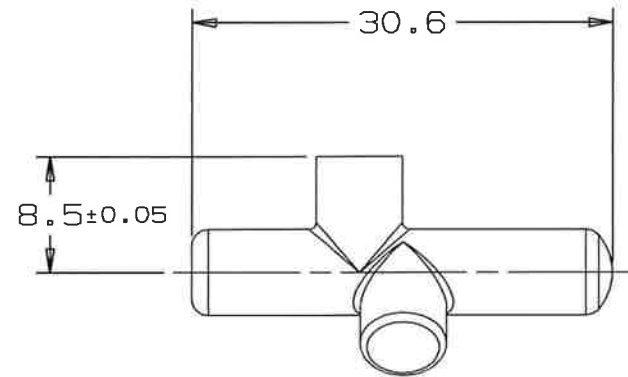


UNLESS OTHERWISE SPECIFIED					DRAWN	M. KRAMP	DATE	26-Oct-2015
±X	±X.X	±X.XX	±X/X	±X"	CHECKED		DATE	
2	0.3	0.12	N/A	1"	APPROVED		DATE	
BREAK ALL SHARP EDGES 0.5 MAX. DO NOT SCALE DRAWING DIMENSIONS BASED ON ASME Y14.5-2009 MAX. ALL MACH SURFACES 3.2 DRAWING UNITS: MM					USED ON F10048766, F10049229			
MATERIAL NIOBIUM, RRR 300 GRADE					SCALE 1:1			
GROUP: Technical Division - Design and Drafting CASE CODE: DUSFB					SIZE A2		DRAWING NUMBER F10048766	
					SHEET 1 of 1		REV -	

FERMIL NATIONAL ACCELERATOR LABORATORY UNITED STATES DEPARTMENT OF ENERGY			
NAME 3.9GHZ HOM HOUSING			
SCALE	SIZE	DRAWING NUMBER	SHEET
1:1	A2	F10048766	1 of 1
REV -			

DESCRIPTION: 3.9GHZ HOM ANTENNA
 CATEGORY: ANTENNA PROJECT: LCLS11Cryomodule

REV	REVISION CONTROL DOCUMENT	DATES	SIGNATURES	
-	F10048767---RCD		DRAWN	
			APPROVED	



NOTES (UNLESS OTHERWISE SPECIFIED):

- PART TO BE FREE OF DUST, GREASE, OIL, CHIPS, AND BURRS.
- DIMENSION COORESponds WITH PART NUMBER F10048766. TOLERANCE IS TO BE COORDINATED BETWEEN MANUFACTURING AND EB-WELDERS.

UNLESS OTHERWISE SPECIFIED				
±X	±X.X	±X.XX	±X/X	±X°
2	0.3	0.12	N/A	1°

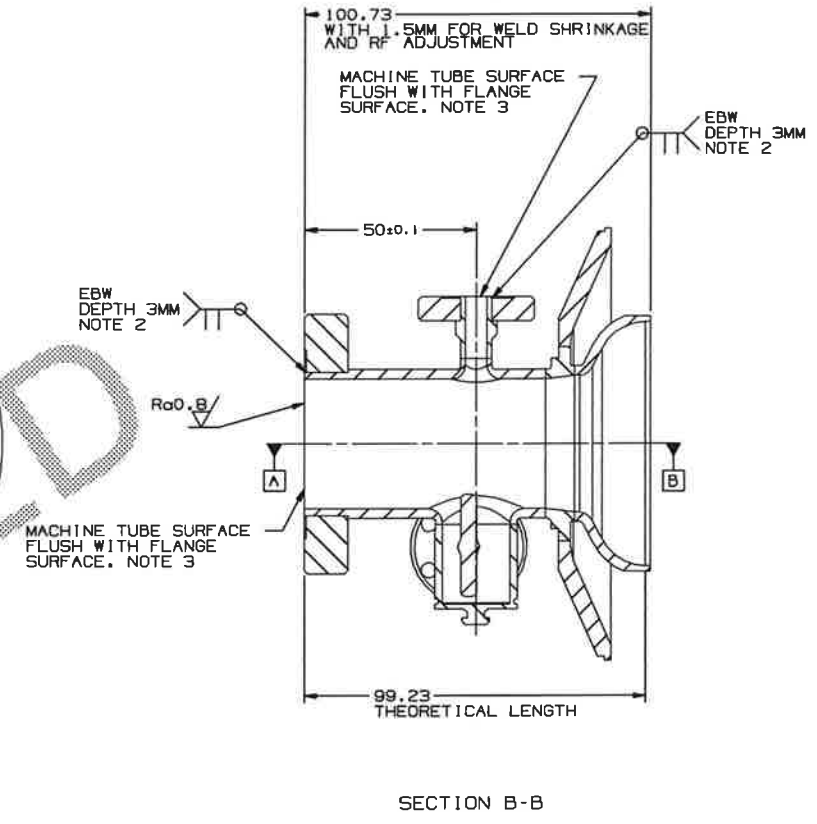
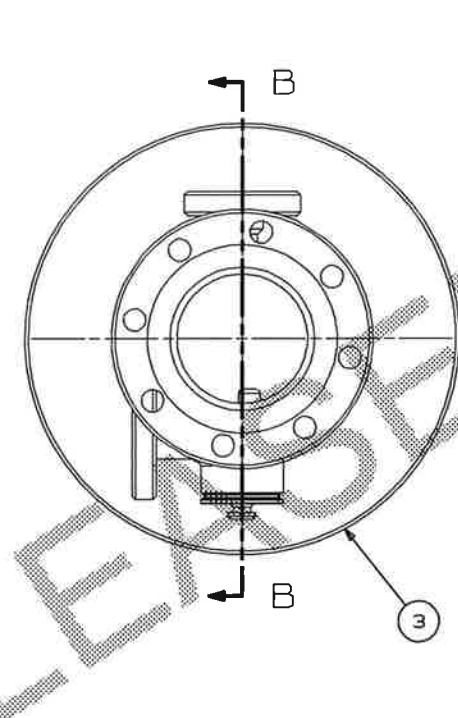
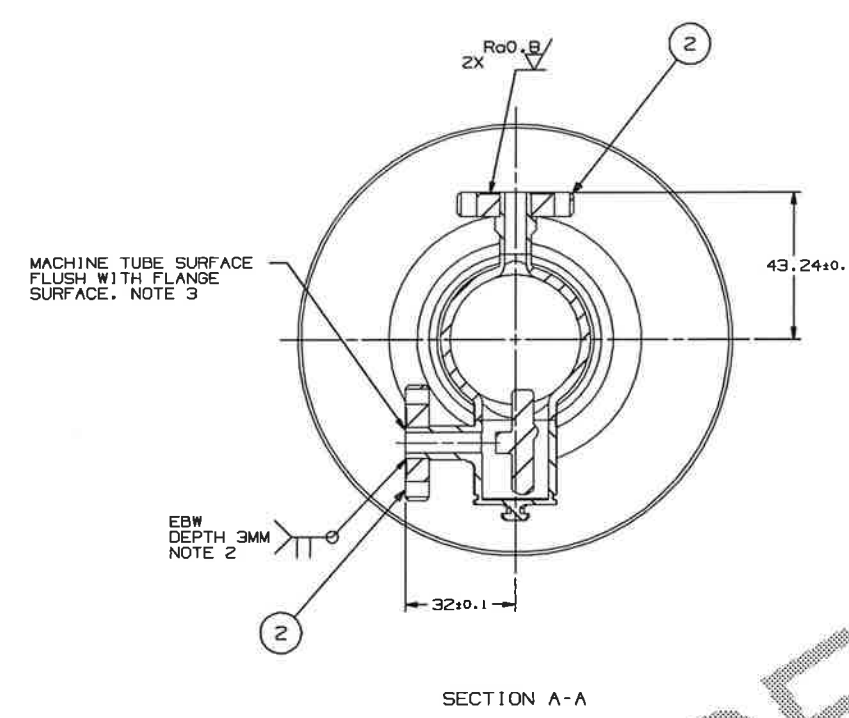
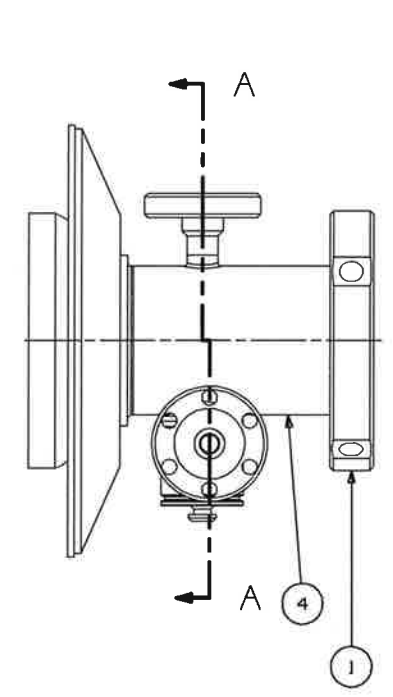
BREAK ALL SHARP EDGES 0.5 MAX.
 DO NOT SCALE DRAWING
 DIMENSIONS BASED ON ASME Y14.5-2009
 MAX. ALL MACH SURFACES 3.2
 DRAWING UNITS: MM

DRAWN	M. KRAMP	DATE	26-Oct-2015
CHECKED		DATE	
APPROVED		DATE	
USED ON	F10049225		
MATERIAL	NIOBIUM, RRR 300 GRADE		
GROUP: Technical Division - Design and Drafting	CAGE CODE: 0U5R6		

FERMILAB NATIONAL ACCELERATOR LABORATORY UNITED STATES DEPARTMENT OF ENERGY			
NAME			
3.9GHZ HOM ANTENNA			
SCALE	SIZE	DRAWING NUMBER	SHEET
2:1	A3	F10048767	1 OF 1
REV			
-			

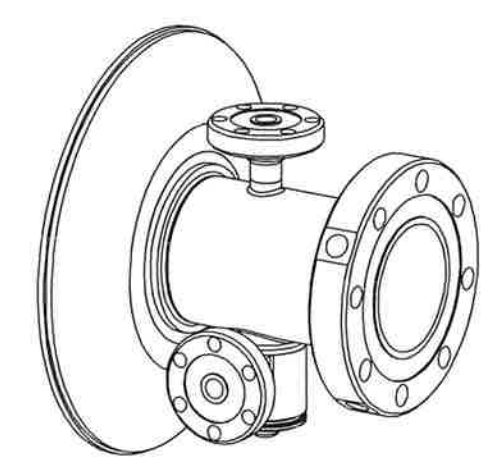
DESCRIPTION: 3.9GHZ ASSY END GROUP, NO-MC
 CATEGORY: WELDMENT
 PROJECT: LCLS110

REV	REVISION CONTROL DOCUMENT	DATES	SIGNATURES
-	F10048754---RCD		DRAWN APPROVED



PRE-RELEASED

- NOTES (UNLESS OTHERWISE SPECIFIED):
- WELDMENT TO BE FREE OF DUST, GREASE, OIL, CHIPS, AND BURRS.
 - WELDING NOTES:
 - ASSEMBLY TO BE VACUUM TIGHT: NO LEAK SHALL BE DETECTABLE ON THE MOST SENSITIVE SCALE OF A HELIUM MASS SPECTROMETER LEAK DETECTOR WITH A MINIMUM SENSITIVITY OF 2×10^{-10} ATM CC/SEC FOR HELIUM.
 - ASSEMBLY TO BE CLEANED, AND PACKAGED SO AS TO ASSURE NO CONTAMINATION FOR FOREIGN MATERIALS, METAL CHIPS, OR OTHER CONTAMINATES. CLEANING PROCEDURE TO BE APPROVED BY FERMILAB.
 - ALL DESIGN, ASSEMBLY, AND HANDLING IS TO CONFORM TO STANDARD ULTRA HIGH VACUUM PRACTICES.
 - ALL ELECTRON BEAM WELDING, ACID ETCHING, CLEANLINESS, AND HANDLING PROCEDURES ARE DETAILED IN DESY SPECIFICATION MWF-SL 09-2005 AND MUST BE FOLLOWED.
 - SEALING SURFACE MUST BE FREE OF SCRATCHES WITH NO RADIAL SCORING. SURFACE MUST BE FREE OF DAMAGES.
 - ADDITIONAL MATERIAL NEEDED FOR CELL TUNING PLUS ALLOWANCE FOR E-BEAM WELD SHRINKAGE. FINAL SURFACE TO BE MACHINED UNTIL TUNED.
 - ITEMS 1, 3, AND 4 ARE TO BE CONCENTRIC WITHIN $\varnothing 0.05\text{mm}$ ALONG DATUM A-B.
 - DO NOT BREAK EDGES ON END CELL.



UNLESS OTHERWISE SPECIFIED				
±X	±X.X	±X.XX	±X/X	±X'
2	0.3	0.12	N/A	1"

BREAK ALL SHARP EDGES 0.5 MAX.
 DO NOT SCALE DRAWING
 DIMENSIONS BASED ON ASME Y14.5-2009
 MAX. ALL MACH SURFACES 3.2
 DRAWING UNITS: MM

DRAWN	M. KRAMP	DATE	28-Oct-2015
CHECKED		DATE	
APPROVED		DATE	

USED ON
 F10048752

MATERIAL
 SEE PARTS LIST

GROUP: Technical Division - Design and Drafting CASE CODE: OUSPB

ITEM	PART#	DESCRIPTION	QTY.
4	F10049224	WELDMENT, NON-MC END TUBE	1
3	F10049223	WELDMENT, NON-MC END DISC	1
2	F10048827	3.9GHZ NW-6 FLANGE	2
1	F10048825	3.9GHZ NW-40 FLANGE	1

PARTS LIST

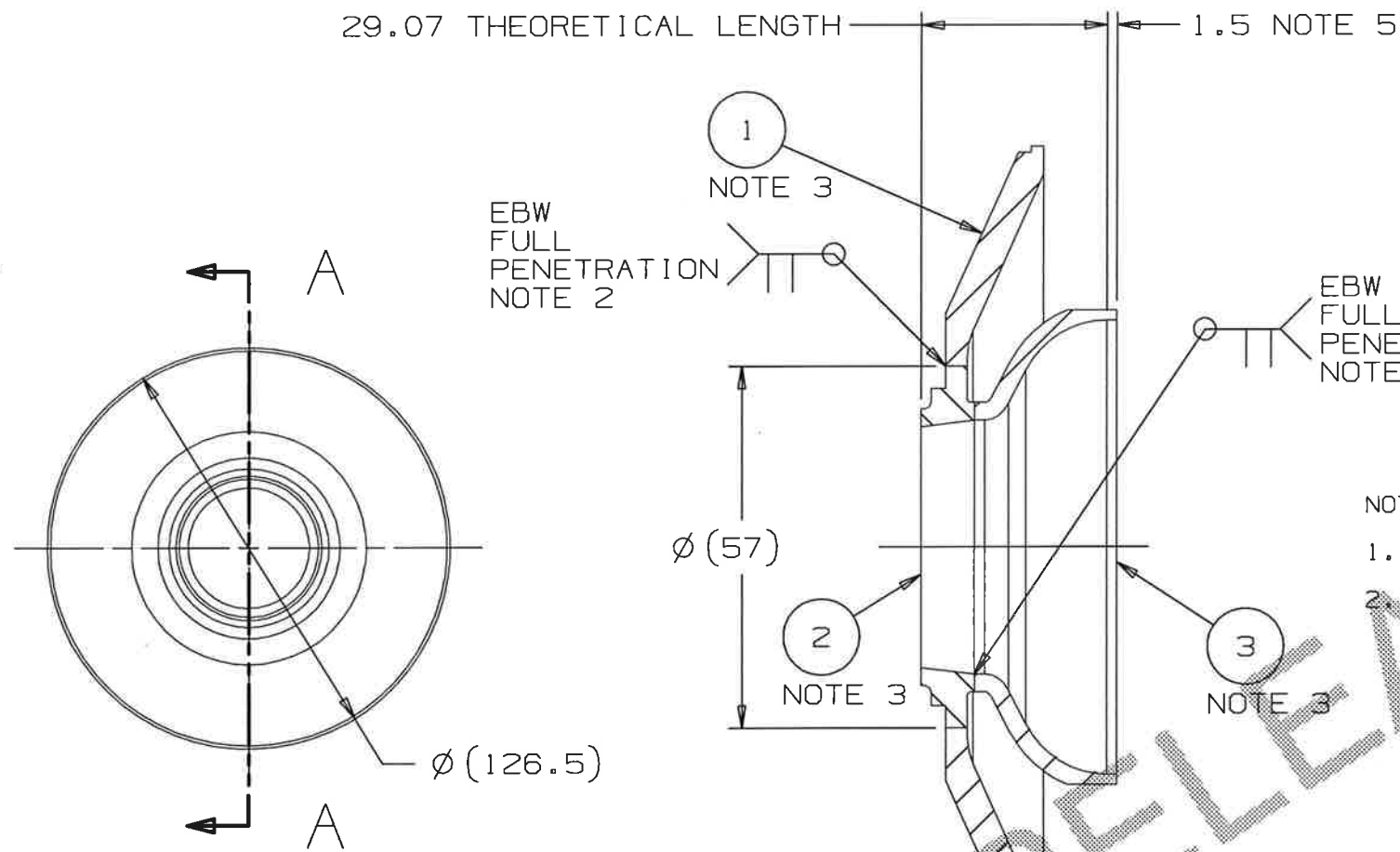
FERMI NATIONAL ACCELERATOR LABORATORY
 UNITED STATES DEPARTMENT OF ENERGY

3.9GHZ ASSY END GROUP, NO-MC

SCALE	1:1	SIZE	A1	DRAWING NUMBER	F10048754	SHEET	1 of 1	REV	-
-------	-----	------	----	----------------	-----------	-------	--------	-----	---

DESCRIPTION: WELDMENT, NON-MC END DISC
 CATEGORY: WELDMENT PROJECT: LCLS11Cryomodule

REV	REVISION CONTROL DOCUMENT	DATES	SIGNATURES
-	F10049223---RCD		DRAWN APPROVED



- NOTES (UNLESS OTHERWISE SPECIFIED):
- WELDMENT TO BE FREE OF DUST, GREASE, OIL, CHIPS, AND BURRS.
 - WELDING NOTES:
 - ASSEMBLY TO BE VACUUM TIGHT: NO LEAK SHALL BE DETECTABLE ON THE MOST SENSITIVE SCALE OF A HELIUM MASS SPECTROMETER LEAK DETECTOR WITH A MINIMUM SENSITIVITY OF 2×10^{-10} ATM CC/SEC FOR HELIUM.
 - ASSEMBLY TO BE CLEANED, AND PACKAGED SO AS TO ASSURE NO CONTAMINATION FOR FOREIGN MATERIALS, METAL CHIPS, OR OTHER CONTAMINATES. CLEANING PROCEDURE TO BE APPROVED BY FERMILAB.
 - ALL DESIGN, ASSEMBLY, AND HANDLING IS TO CONFORM TO STANDARD ULTRA HIGH VACUUM PRACTICES.
 - ALL ELECTRON BEAM WELDING, ACID ETCHING, CLEANLINESS, AND HANDLING PROCEDURES ARE DETAILED IN DESY SPECIFICATION MWF-SL 09-2005 AND MUST BE FOLLOWED.
 - ALL PARTS TO BE CONCENTRIC WITHIN $\varnothing 0.04\text{mm}$.
 - DO NOT BREAK EDGES ON END CELL.
 - ADDITIONAL MATERIAL NEEDED FOR CELL TUNING. PLUS ALLOWANCE FOR E-BEAM WELD SHRINKAGE. FINAL SURFACE TO BE MACHINED UNTIL TUNED.

SECTION A-A
 SCALE 1:1

ITEM	PART#	DESCRIPTION	QTY.
3	F10048780	3.9GHZ END-CELL	1
2	F10048762	3.9GHZ NIOBIUM RING	1
1	F10048757	3.9GHZ END DISH, NO-MC	1

PARTS LIST

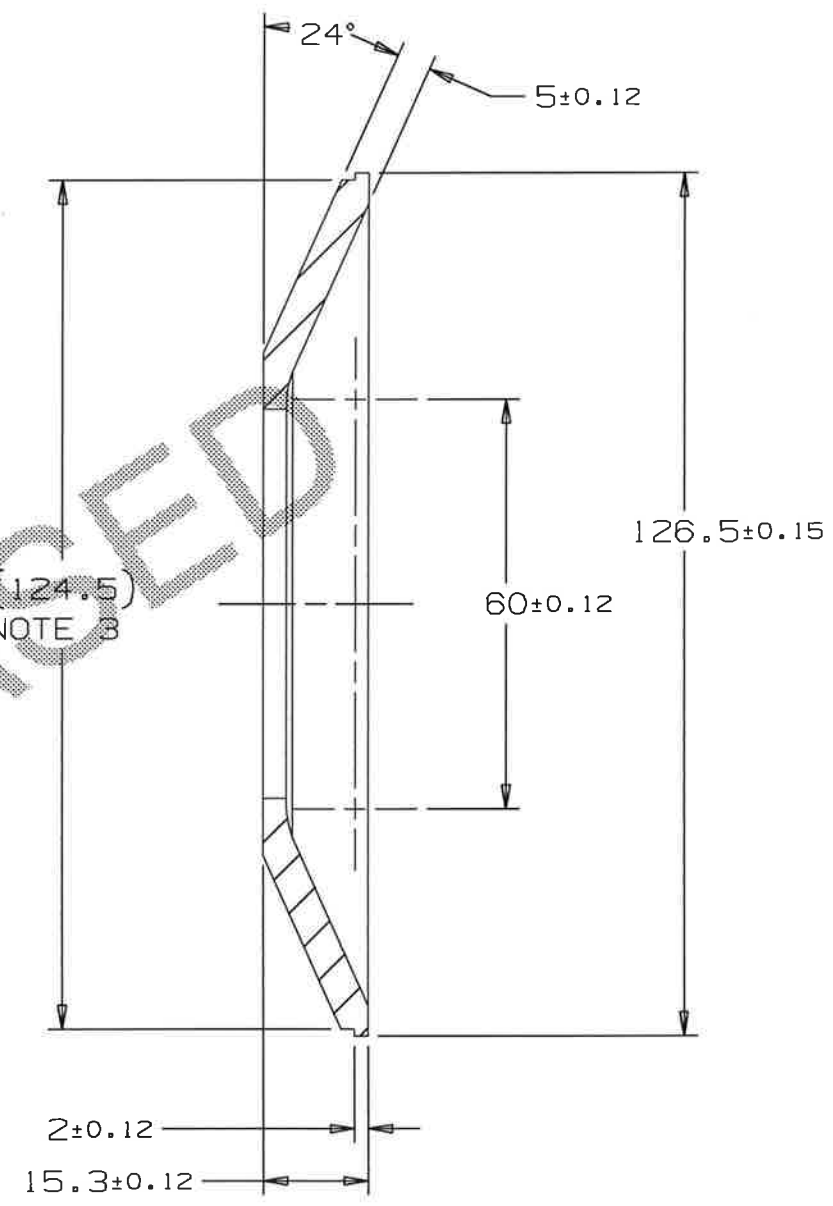
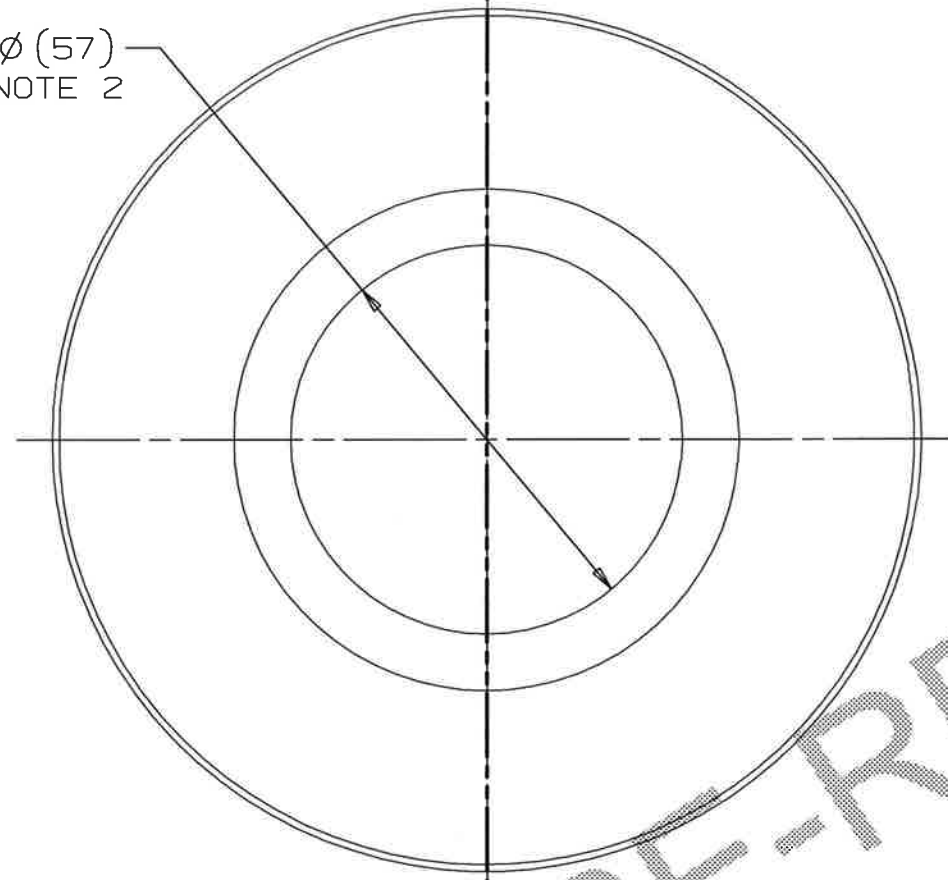
UNLESS OTHERWISE SPECIFIED					DRAWN	M. KRAMP	DATE	02-Nov-2015
$\pm X$	$\pm X.X$	$\pm X.XX$	$\pm X/X$	$\pm X^\circ$	CHECKED		DATE	
2	0.3	0.12	N/A	1°	APPROVED		DATE	
BREAK ALL SHARP EDGES 0.5 MAX. DO NOT SCALE DRAWING DIMENSIONS BASED ON ASME Y14.5-2009 MAX. ALL MACH SURFACES 3.2 DRAWING UNITS: MM					USED ON F10048754			
					MATERIAL SEE PARTS LIST			
GROUP: Technical Division - Design and Drafting					CAGE CODE: OUSR6			

FERMI NATIONAL ACCELERATOR LABORATORY UNITED STATES DEPARTMENT OF ENERGY				
NAME WELDMENT, NON-MC END DISC				
SCALE 1:2 & AS SHOWN	SIZE A3	DRAWING NUMBER F10049223	SHEET 1 OF 1	REV -

DESCRIPTION: 3.9GHZ END DISH, NO-MC
 CATEGORY: DISH PROJECT: LCLS11Cryomodule

REV	REVISION CONTROL DOCUMENT	DATES	SIGNATURES	
-	F10048757---RCD		DRAWN	
			APPROVED	

∅ (57)
 NOTE 2



PRE-RELEASED

NOTES (UNLESS OTHERWISE SPECIFIED):

1. WELDMENT TO BE FREE OF DUST , GREASE, OIL, CHIPS, AND BURRS.
2. DIMENSION COORESponds WITH PART NUMBER F10048762. TOLERANCE IS TO BE COORDINATED BETWEEN MANUFACTURING AND EB-WELDERS.
3. DIMENSION COORESponds WITH PART NUMBER F10048846. TOLERANCE IS TO BE COORDINATED BETWEEN MANUFACTURING AND EB-WELDERS.

UNLESS OTHERWISE SPECIFIED				
±X	±X.X	±X.XX	±X/X	±X*
2	0.3	0.12	N/A	1*

BREAK ALL SHARP EDGES 0.5 MAX.
 DO NOT SCALE DRAWING
 DIMENSIONS BASED ON ASME Y14.5-2009
 MAX. ALL MACH SURFACES 3.2
 DRAWING UNITS: MM

DRAWN	M. KRAMP	DATE	28-Oct-2015
CHECKED		DATE	
APPROVED		DATE	
USED ON	F10049223		
MATERIAL	Nb55Ti		
GROUP: Technical Division - Design and Drafting	CAGE CODE: 0U5R6		

FERMI NATIONAL ACCELERATOR LABORATORY
 UNITED STATES DEPARTMENT OF ENERGY

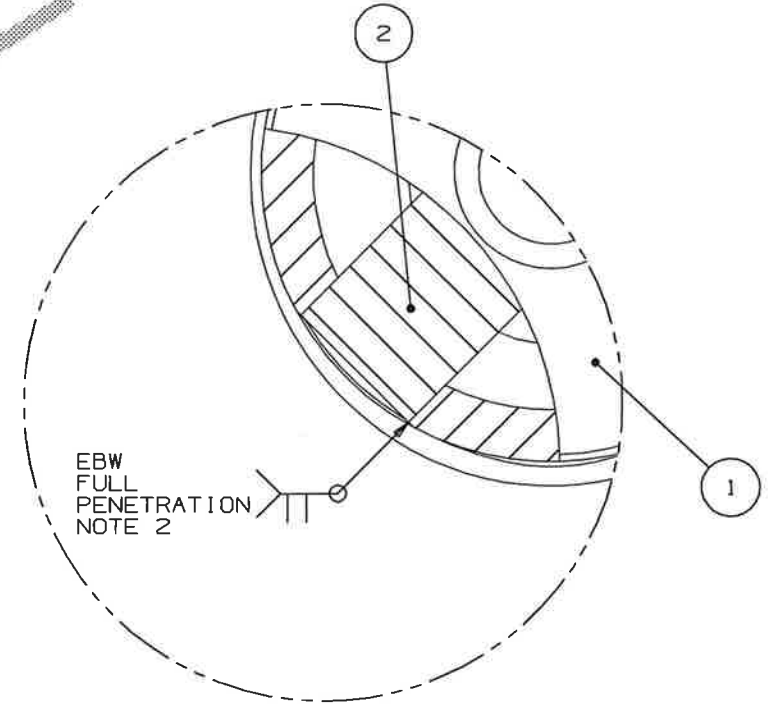
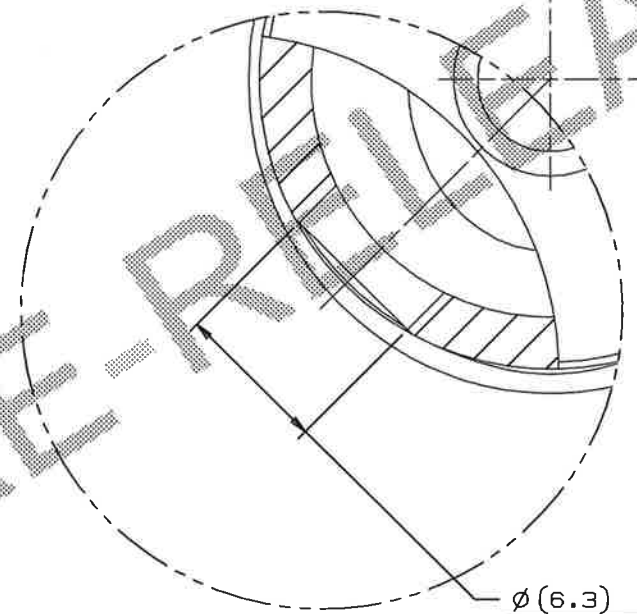
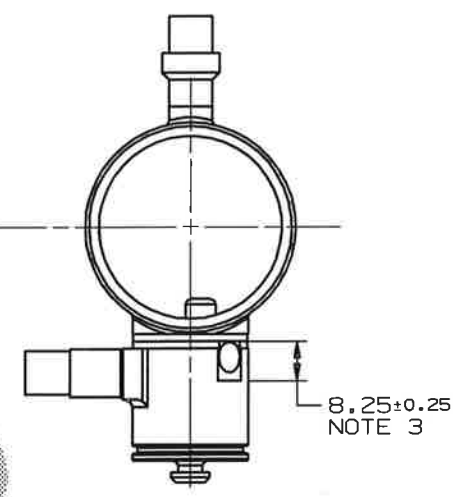
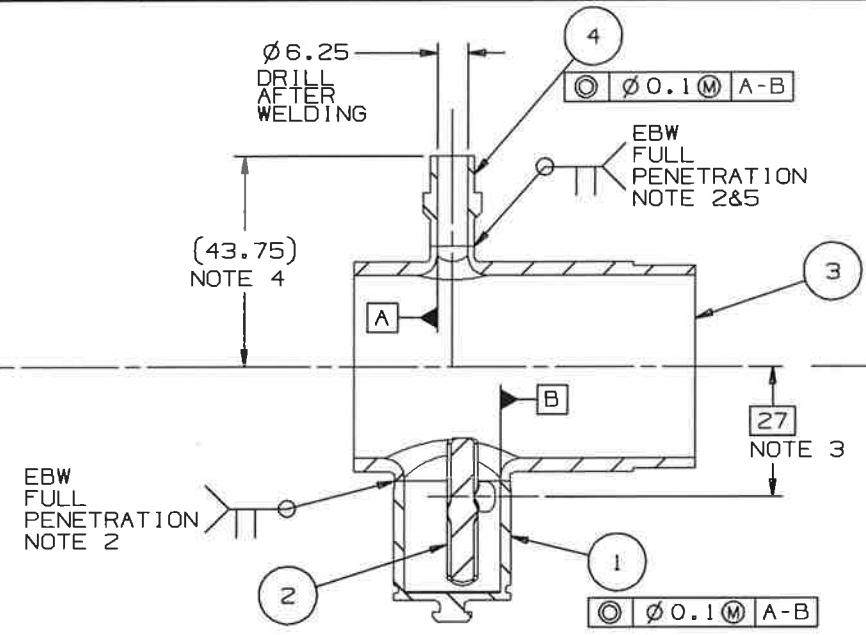
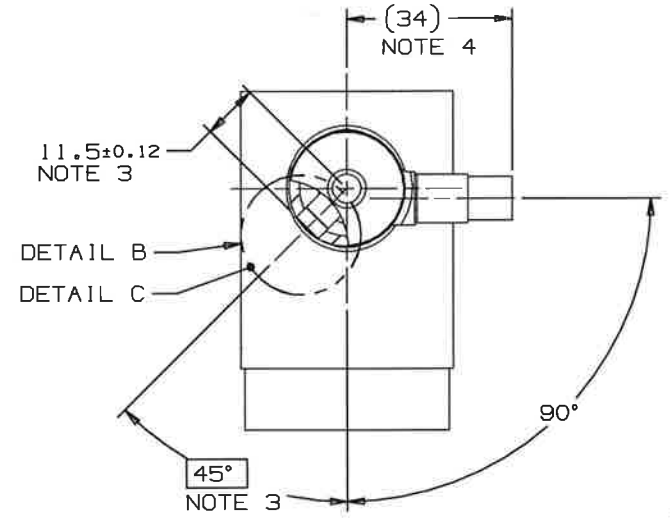
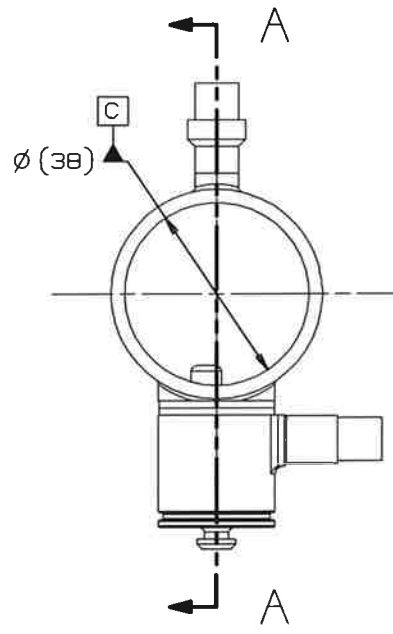
NAME

3.9GHZ END DISH, NO-MC

SCALE	SIZE	DRAWING NUMBER	SHEET	REV
1:1	A3	F10048757	1 OF 1	-

REV	REVISION CONTROL DOCUMENT	DATES	SIGNATURES
-	F10049224---RCD		DRAWN APPROVED

DESCRIPTION: WELDMENT, NON-MC END TUBE
 CATEGORY: WELDMENT PROJECT: LCLS11Cryomodule



PRE-RELEASED

NOTES (UNLESS OTHERWISE SPECIFIED):

- WELDMENT TO BE FREE OF DUST, GREASE, OIL, CHIPS, AND BURRS.
- WELDING NOTES:
 - ASSEMBLY TO BE VACUUM TIGHT: NO LEAK SHALL BE DETECTABLE ON THE MOST SENSITIVE SCALE OF A HELIUM MASS SPECTROMETER LEAK DETECTOR WITH A MINIMUM SENSITIVITY OF 2×10^{-10} ATM CC/SEC FOR HELIUM.
 - ASSEMBLY TO BE CLEANED, AND PACKAGED SO AS TO ASSURE NO CONTAMINATION FOR FOREIGN MATERIALS, METAL CHIPS, OR OTHER CONTAMINATES. CLEANING PROCEDURE TO BE APPROVED BY FERMILAB.
 - ALL DESIGN, ASSEMBLY, AND HANDLING IS TO CONFORM TO STANDARD ULTRA HIGH VACUUM PRACTICES.
 - ALL ELECTRON BEAM WELDING, ACID ETCHING, CLEANLINESS, AND HANDLING PROCEDURES ARE DETAILED IN DESY SPECIFICATION MHF-SL-1-1999 AND MUST BE FOLLOWED.
- FLAT AND HOLE TO BE MACHINED AFTER EBW OF ITEMS 1,3,&4 WITH FINAL HOLE SIZE TO BE FIT WITH OD OF ITEM 2 AND THEN EBW'D.
- FINAL LENGTH AFTER MACHINING OPERATION DETAILED ON DRAWING F00439180.
- WELD PREP JOINTS TO MATCH WALL THICKNESS AT DISCRETION OF MANUFACTURER.

DETAIL B
SCALE 5:1
ITEM 2 REMOVED
FOR CLARITY

DETAIL C
SCALE 5:1

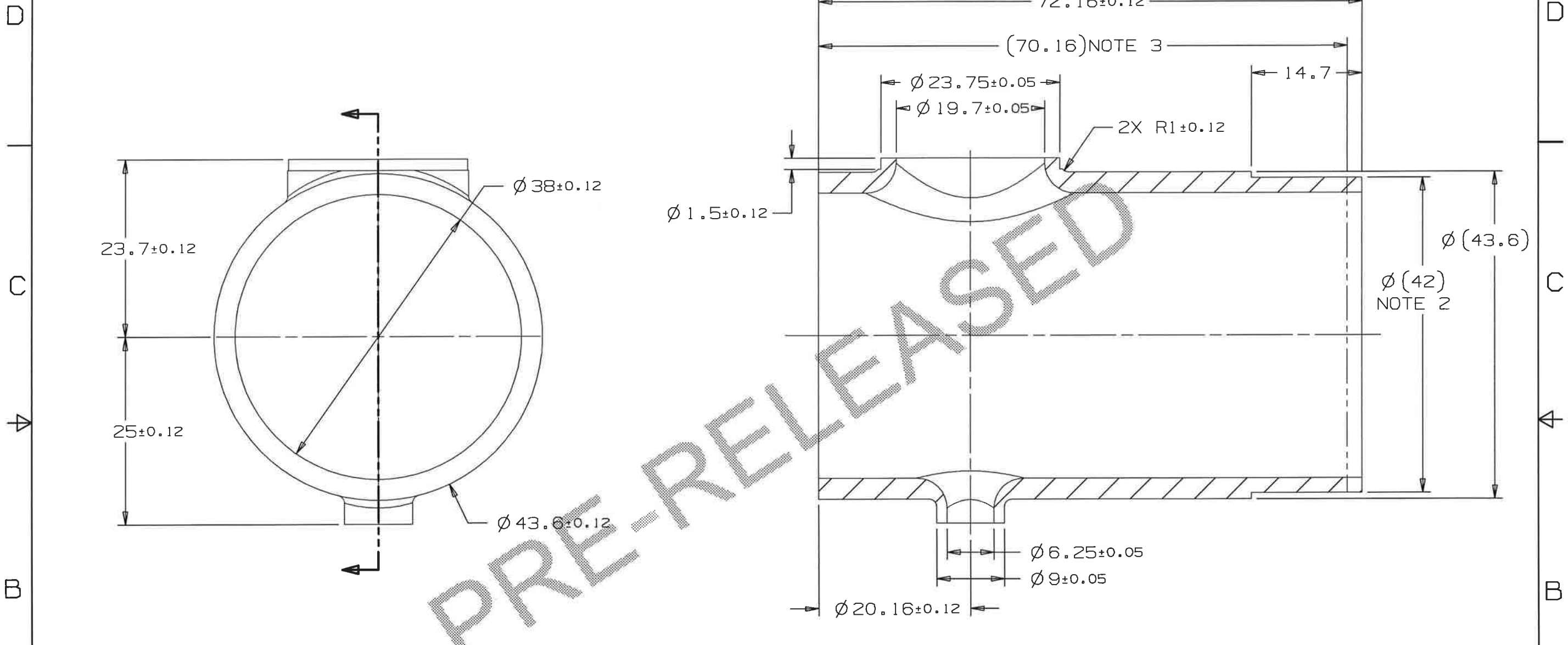
ITEM	PART#	DESCRIPTION	QTY.
4	F10048831	3.9GHZ PICK-UP TUBE	1
3	F10048830	3.9GHZ END TUBE, MC	1
2	F10048767	3.9GHZ HOM ANTENNA	1
1	F10048766	3.9GHZ HOM HOUSING	1
PARTS LIST			

UNLESS OTHERWISE SPECIFIED				
±X	±X.X	±X.XX	±X/X	±X°
2	0.3	0.12	N/A	1°
BREAK ALL SHARP EDGES 0.5 MAX. DO NOT SCALE DRAWING DIMENSIONS BASED ON ASME Y14.5-2009 MAX. ALL MACH SURFACES 3.2 DRAWING UNITS: MM				
DRAWN	M. KRAMP	DATE	02-Nov-2015	
CHECKED		DATE		
APPROVED		DATE		
USED ON F10048754				
MATERIAL SEE PARTS LIST				
GROUP: Technical Division - Design and Drafting CASE CODE: DUSFB				

FERMI NATIONAL ACCELERATOR LABORATORY UNITED STATES DEPARTMENT OF ENERGY			
WELDMENT, NON-MC END TUBE			
SCALE 1:1	SIZE A2	DRAWING NUMBER F10049224	SHEET REV 1 of 1 -

DESCRIPTION: 3.9GHZ END TUBE, NO-MC
 CATEGORY: TUBE PROJECT: LCLS11Cryomodule

REV	REVISION CONTROL DOCUMENT	DATES	SIGNATURES
-	F10048830---RCD		DRAWN APPROVED



GENERAL NOTES: (UNLESS OTHERWISE SPECIFIED)

- PART TO BE FREE OF DUST, GREASE, OIL, CHIPS, AND BURRS.
- DIMENSION CORRESPONDS WITH PART NUMBER F10048825. TOLERANCE IS TO BE COORDINATED BETWEEN MANUFACTURERS AND EB-WELDERS
- FINAL LENGTH AFTER MACHINING SHOWN ON DRAWING F10048753.

UNLESS OTHERWISE SPECIFIED				
$\pm X$	$\pm X.X$	$\pm X.XX$	$\pm X/X$	$\pm X^\circ$
2	0.3	0.12	N/A	1*

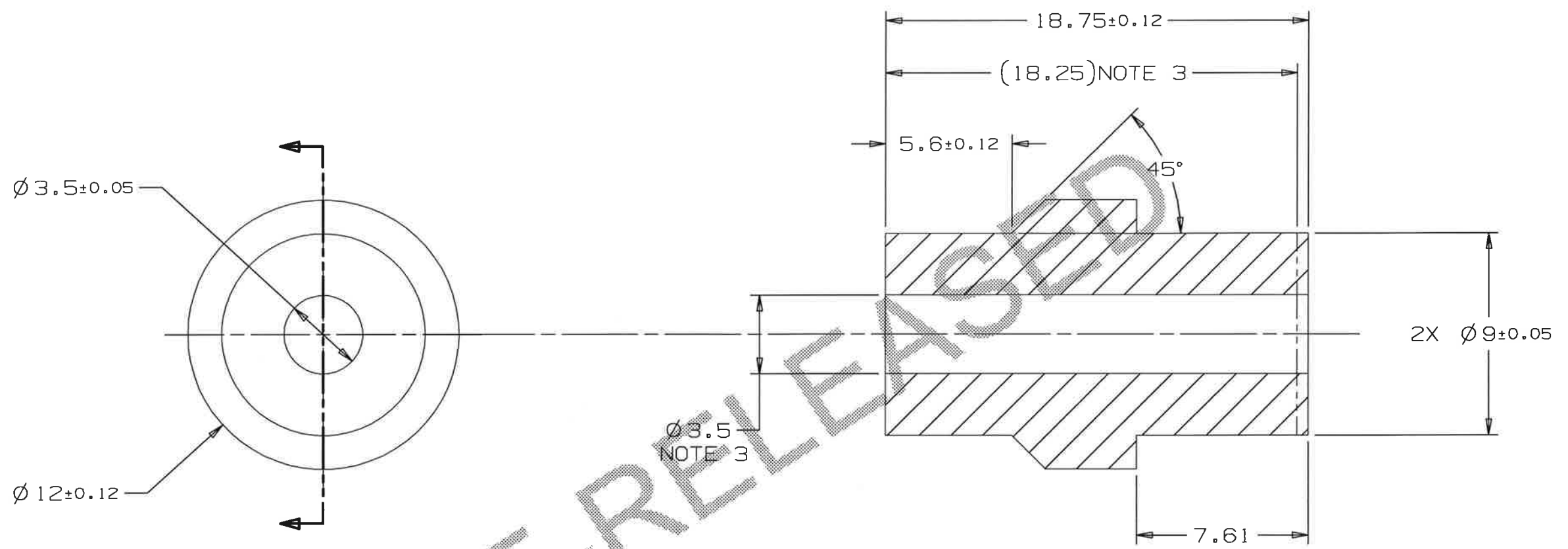
BREAK ALL SHARP EDGES 0.5 MAX.
 DO NOT SCALE DRAWING
 DIMENSIONS BASED ON ASME Y14.5-2009
 MAX. ALL MACH SURFACES 3.2
 DRAWING UNITS: MM

DRAWN	M. KRAMP	DATE	26-Oct-2015
CHECKED		DATE	
APPROVED		DATE	
USED ON	F10049224		
MATERIAL	NIOBIUM, RRR 300 GRADE		
GROUP:	Technical Division - Design and Drafting		
CAGE CODE:	045R6		

FERMI NATIONAL ACCELERATOR LABORATORY UNITED STATES DEPARTMENT OF ENERGY			
NAME			
3.9GHZ END TUBE, NO-MC			
SCALE	SIZE	DRAWING NUMBER	SHEET
2:1	A3	F10048830	1 OF 1
			REV
			-

DESCRIPTION: 3.9GHZ PICK-UP TUBE
 CATEGORY: TUBE PROJECT: LCL511Cryomodule

REV	REVISION CONTROL DOCUMENT	DATES	SIGNATURES
-	F10048831---RCD		DRAWN APPROVED



PRE-RELEASED

GENERAL NOTES: (UNLESS OTHERWISE SPECIFIED)

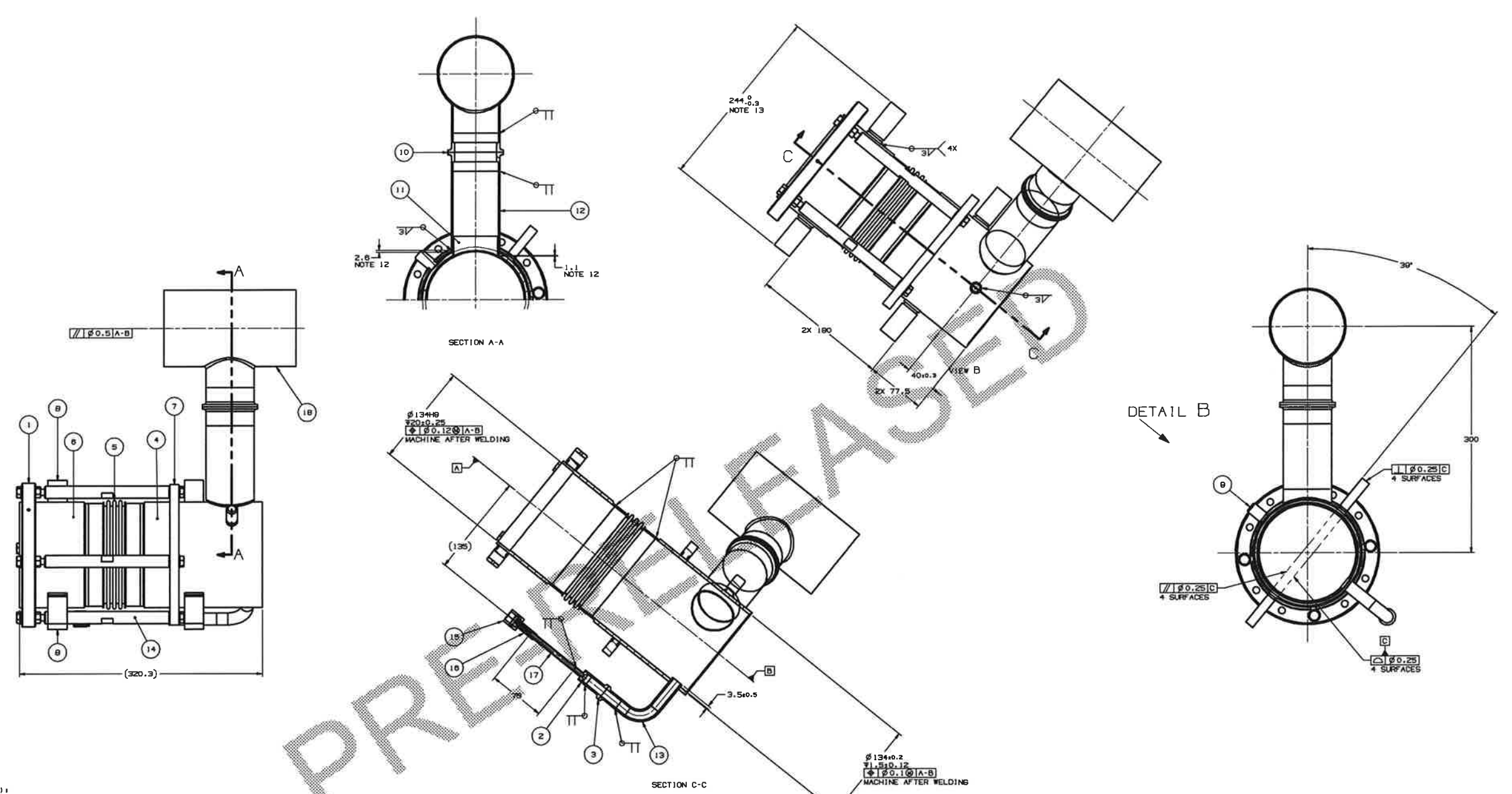
1. PART TO BE FREE OF DUST , GREASE, OIL, CHIPS, AND BURRS.
2. FINAL LENGTH AFTER MACHINING SHOWN ON DRAWING F10048754.
3. FINAL DIAMETER AFTER WELDING SHOWN ON DRAWING F10049224.

UNLESS OTHERWISE SPECIFIED				
±X	±X.X	±X.XX	±X/X	±X°
2	0.3	0.12	N/A	1°

BREAK ALL SHARP EDGES 0.5 MAX.
 DO NOT SCALE DRAWING
 DIMENSIONS BASED ON ASME Y14.5-2009
 MAX. ALL MACH SURFACES 3.2
 DRAWING UNITS: MM

DRAWN	M. KRAMP	DATE	27-Oct-2015
CHECKED		DATE	
APPROVED		DATE	
USED ON	F10049224		
MATERIAL	NIOBIUM, RRR 300 GRADE		
GROUP:	Technical Division - Design and Drafting CAGE CODE: 0U5R6		

		FERMI NATIONAL ACCELERATOR LABORATORY UNITED STATES DEPARTMENT OF ENERGY	
		NAME	
		3.9GHZ PICK-UP TUBE	
SCALE	SIZE	DRAWING NUMBER	SHEET
5:1	A3	F10048831	1 OF 1
			REV
			-



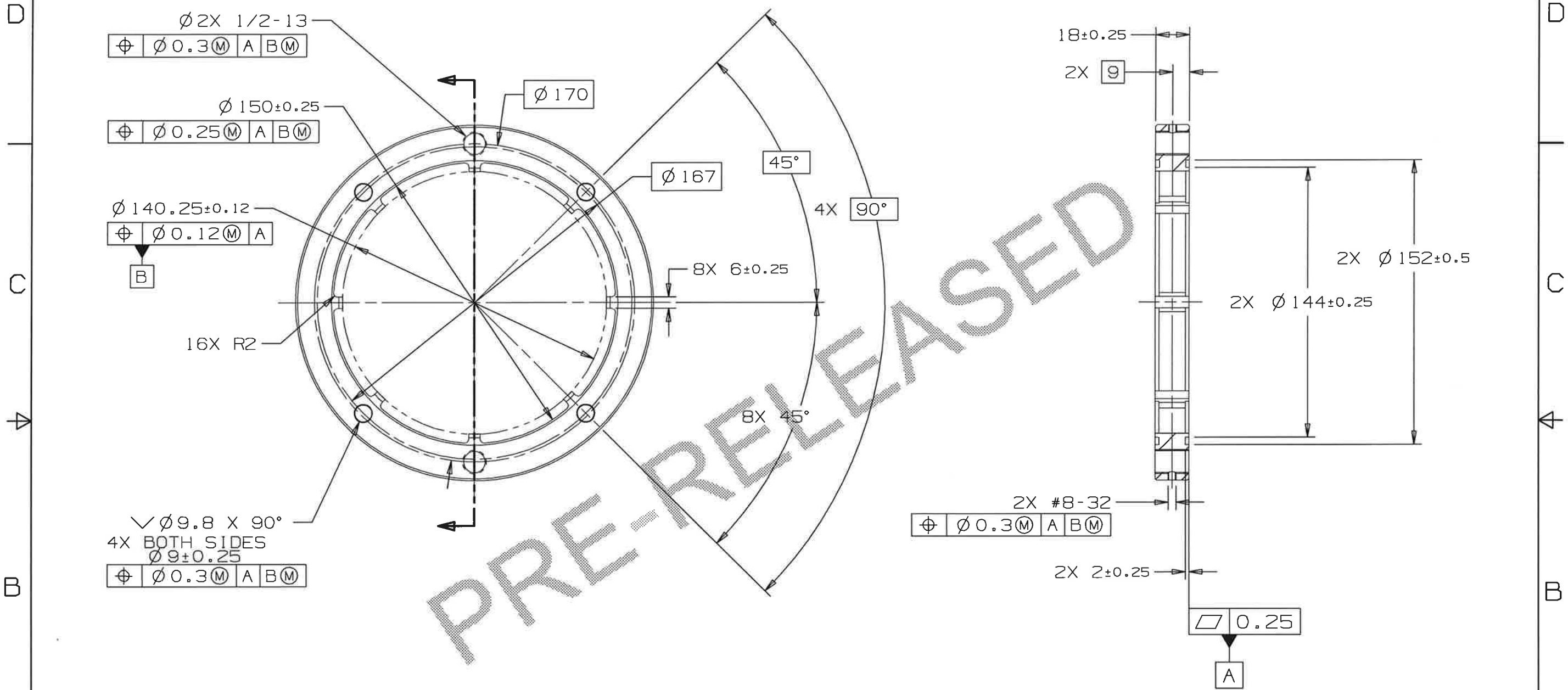
- NOTES (UNLESS OTHERWISE SPECIFIED):
- PLEASE SEE FERMI LAB ENGINEERING DOCUMENT ED-0000XXXX, "LOCS-11 PROTOTYPE HELIUM VESSEL WELDMENT" FOR ADDITIONAL MANUFACTURING INFORMATION.
 - ASSEMBLY MUST BE FREE FROM DUST, GREASE, OIL, AND CHIPS. MUST BE PROPERLY PACKAGED TO AVOID DAMAGE DURING SHIPPING.
 - ALL WELDS TO BE SMOOTH FOR COSMETIC APPEARANCE.
 - ALL WELDS MUST BE CONTAMINANT FREE. WELD JOINT MUST BE CLEANED PROPERLY TO REMOVE MILL SCALE, DIRT, DUST, GREASE, OIL, MOISTURE AND OXIDATION.
 - ALL CLEANING AND WELDING PROCEDURES WILL CONFORM TO THE AMERICAN WELDING SOCIETY SPECIFICATION AWS B2.4M1 2007, "GUIDE FOR FUSION WELDING OF TITANIUM AND TITANIUM ALLOYS".
 - WELD MUST BE PERFORMED WITH AN ARGON PURGED SYSTEM. A CONTINUOUS ARGON FLOW IS REQUIRED INSIDE THE TUBE TO GET THE OXYGEN COUNT OF 20 PPM OR LESS. WELD MUST BE FREE OF ALL TITANIUM OXIDATION AND DISCOLORATION. EXCEPTIONS CAN BE MADE BUT MUST BE DETAILED PER NOTE 7.
 - WRITTEN PROCEDURE DESCRIBING THE CLEANING & WELDING PROCEDURE MUST BE SUPPLIED TO FERMI LAB FOR APPROVAL PRIOR TO ANY PRODUCT WELDING.
 - WELDER MUST BE QUALIFIED IN TITANIUM WELDING. VERIFICATION DOCUMENTS AS WELL AS SAMPLE WELDS MUST BE SUPPLIED TO FERMI LAB PRIOR TO ANY PRODUCT WELDING.
 - LEAK CHECK. NO LEAK SHALL BE DETECTABLE ON THE MOST SENSITIVE SCALE OF A HELIUM LEAK DETECTOR WITH A MINIMUM SENSITIVITY (MOL) OF 2×10^{-4} MBAR x LITER / SEC. THE VACUUM LEVEL DURING THE LEAK CHECK SHALL BE LESS THAN 1×10^{-4} TORR.
 - ALL WELD PROCEDURES MUST FOLLOW GUIDELINES LISTED IN THE LATEST EDITION OF THE ASME BPVC SECTION 9, DIVISION 1.
 - ALL TITANIUM WELDS MUST BE RADIOGRAPHED ACCORDING TO THE GUIDELINES IN THE LATEST EDITION OF THE ASME BPVC SECTION 9, DIVISION 1, PARAGRAPH UW-51.
 - A "PULL-OUT" AND BUTT WELD OF THIS JOINT IS ACCEPTABLE, BUT MUST HAVE PRIOR APPROVAL FROM FERMI LAB. TEST SAMPLES MUST BE MADE AND EVALUATED BY FERMI LAB AS PART OF THE ACCEPTABLE CRITERIA.
 - MATERIAL MAY BE REMOVED FROM ITEM 7 TO MATCH DIMENSION.

ITEM	PART #	DESCRIPTION	QTY.
16	FC0054009	TEE, REDUCING TUBE, 4"x.063" TO 2.5"x.063" 316L SS	1
17	FC0053994	TUBE, 1/4" OD X .035" WALL, 316L SS SEAMLESS	1
18	FC0021975	SOCKET WELD FLANG 1/4 INCH	1
15	FC0021928	FEMALE NUT 1/4 INCH	1
14	F10050223	KIT, TUNER SPANNING ROD	4
13	F10049898	ELBOW, HELIUM FILL LINE	1
12	F10049862	PIPE, 3.9GHZ HE VESSEL TO TRANSITION	1
11	F10049588	RING, WELD BACKING, 3.9GHZ HE VESSEL	1
10	F10049584	3.9GHZ 2-PHASE TRANSITION RING, TI-SS	1
9	F10049845	3.9GHZ He TANK FIXTURE, INVAR ROD	1
8	F10049844	3.9GHZ He TANK PAD	4
7	F10049843	3.9GHZ He TANK TUNER RING	1
6	F10049842	3.9GHZ He TANK SECTION, NON MC END	1
5	F10049841	3.9GHZ He TANK BELLOWS	1
4	F10049839	3.9GHZ He TANK SECTION, MC END	1
3	F10017488	RING, TI-SS TRANSITION - FILL LINE	1
2	F10010159	ADAPTER, HELIUM FILL LINE	1
1	F10009483	TUNER SUPPORT RING, PIEZO SIDE	1

UNLESS OTHERWISE SPECIFIED		DATE	02-Nov-2015
BY	W. KRAMP	DATE	
CHKD		DATE	
APPV		DATE	
BREAK ALL DIMS UNLESS OTHERWISE SPECIFIED DIMENSIONS BASED ON ASME Y14.9-2009 UNLESS OTHERWISE SPECIFIED DIMENSIONS IN INCHES			
SEE PARTS LIST		PARTS LIST	
FERMI NATIONAL ACCELERATOR LABORATORY UNITED STATES DEPARTMENT OF ENERGY			
3.9GHZ HELIUM TANK WLDMT		SCALE	1/1
F1004833		SHEET	1

DESCRIPTION: TUNER SUPPORT RING, PIEZO SIDE
 CATEGORY: RING PROJECT: LCLS11Cryomodule

REV	REVISION CONTROL DOCUMENT	DATES	SIGNATURES
-	F10009463---RCD		DRAWN APPROVED



PRE-RELEASED

NOTES (UNLESS OTHERWISE SPECIFIED):

- PART MUST BE FREE OF DIRT, GREASE, OIL AND CHIPS.
- PART TO BE FREE OF ALL SHARP EDGES, CORNERS, AND BURRS.

UNLESS OTHERWISE SPECIFIED				
±X	±X.X	±X.XX	±X/X	±X°
2	0.3	0.12	N/A	1°

BREAK ALL SHARP EDGES 0.5 MAX.
 DO NOT SCALE DRAWING
 DIMENSIONS BASED ON ASME Y14.5-2009
 MAX. ALL MACH SURFACES 3.2
 DRAWING UNITS: MM

DRAWN	M. KRAMP	DATE	20-Oct-2015
CHECKED		DATE	
APPROVED		DATE	
USED ON	F10048833		
MATERIAL	TITANIUM GRADE 2		
GROUP: Technical Division - Design and Drafting CAGE CODE: OUSR6			

FERMI NATIONAL ACCELERATOR LABORATORY
 UNITED STATES DEPARTMENT OF ENERGY

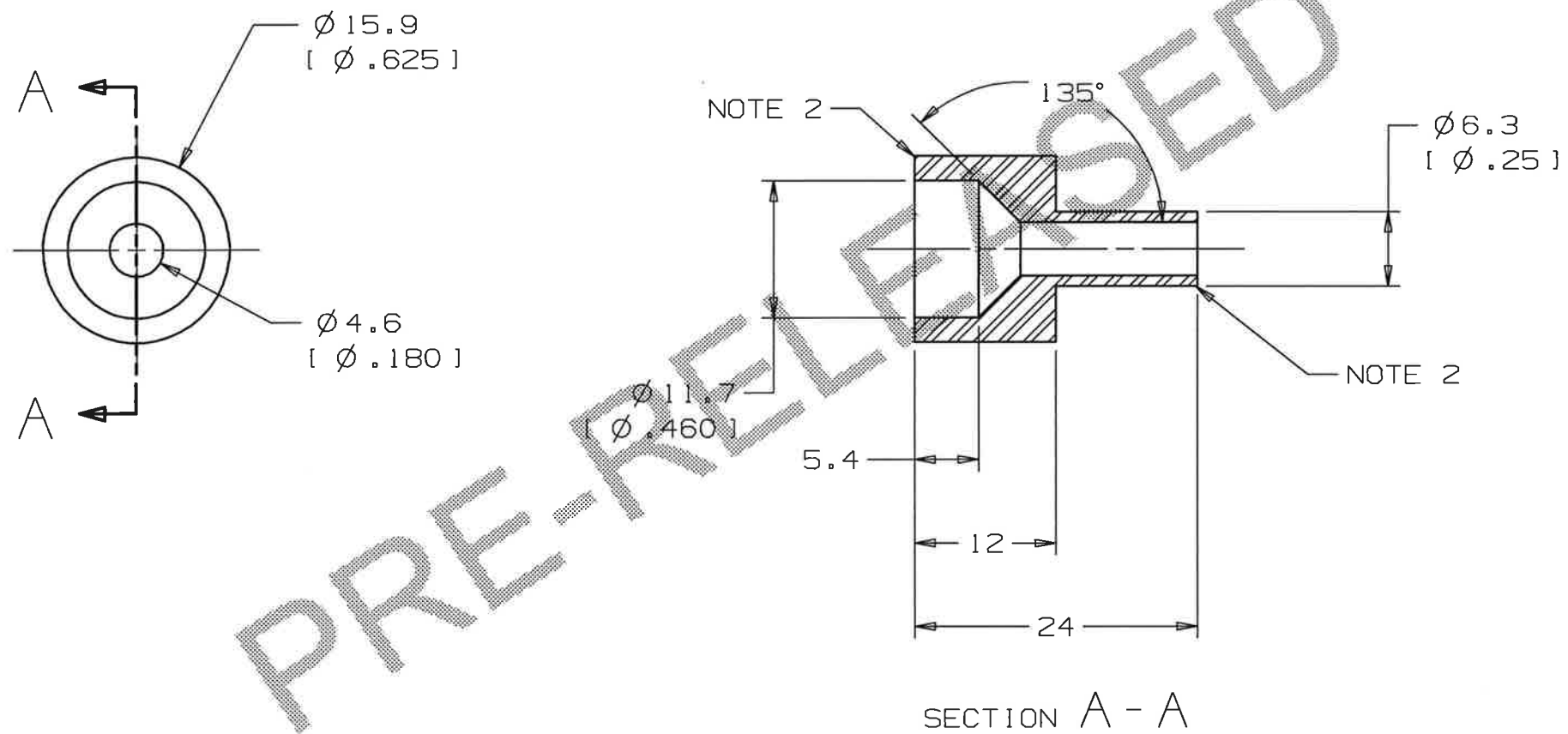
NAME: _____

TUNER SUPPORT RING, PIEZO SIDE

SCALE	SIZE	DRAWING NUMBER	SHEET	REV
1:2	A3	F10009463	1 OF 1	-

DESCRIPTION: ADAPTER, HELIUM FILL LINE, 5/8" TUBE - 1/4" TUBE
 CATEGORY: ADAPTER PROJECT: LCLSII Cryomodule

REV	REVISION CONTROL DOCUMENT	DATES	SIGNATURES
-	F10010159---RCD		DRAWN APPROVED



PRE-RELEASED

NOTES (UNLESS OTHERWISE SPECIFIED):

- PART MUST BE FREE FROM DUST, GREASE, OIL, AND CHIPS.
- DO NOT BREAK SHARP EDGES, REQUIRED FOR BUTT WELDING.
- ALL DIMENSIONS IN [] ARE INCHES.

UNLESS OTHERWISE SPECIFIED				
±X	±X.X	±X.XX	±X/X	±X*
2	0.3	0.12	N/A	1*
BREAK ALL SHARP EDGES 0.5 MAX. DO NOT SCALE DRAWING DIMENSIONS BASED ON ASME Y14.5M-1994 MAX. ALL MACH SURFACES 3.2 DRAWING UNITS: MM				
DRAWN		M.SAWTELL	DATE	26-Feb-2014
CHECKED		M.KRAMP	DATE	30-May-2014
APPROVED		C.GRIMM	DATE	30-May-2014
USED ON F10015802				
MATERIAL				
GROUP: Technical Division - Design and Drafting CAGE CODE: 0U5R6				

FERMI NATIONAL ACCELERATOR LABORATORY UNITED STATES DEPARTMENT OF ENERGY		NAME		
		ADAPTER, HELIUM FILL LINE		
SCALE 2:1	SIZE A3	DRAWING NUMBER F10010159	SHEET 1 OF 1	REV -

D

C

B

A

D

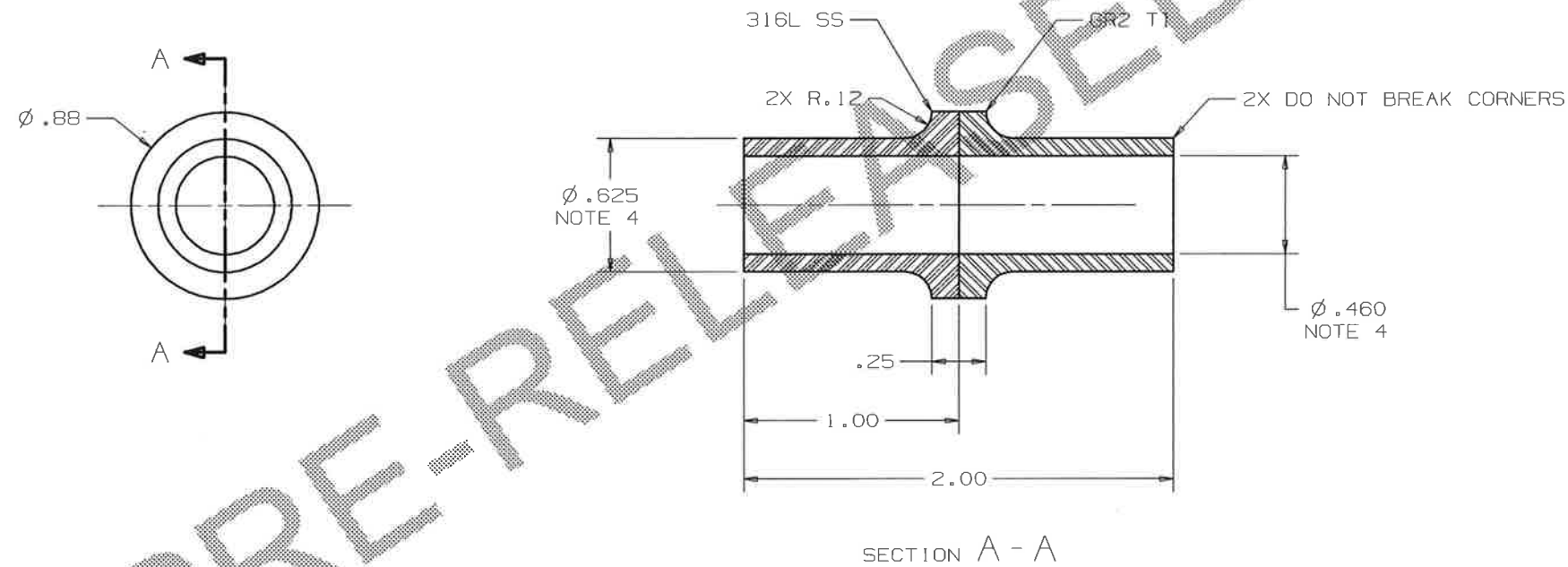
C

B

A

DESCRIPTION: FILL LINE ID TRANSITION RING, T1-SS
 CATEGORY: RING PROJECT: LCLS11Chrymodule


REV	REVISION CONTROL DOCUMENT	DATES	SIGNATURES
A	F10017488-A-RCD	06-Aug-2015 07-Aug-2015	DRAWN: G. LANGLOIS APPROVED: C. GRIMM



NOTES (UNLESS OTHERWISE SPECIFIED):

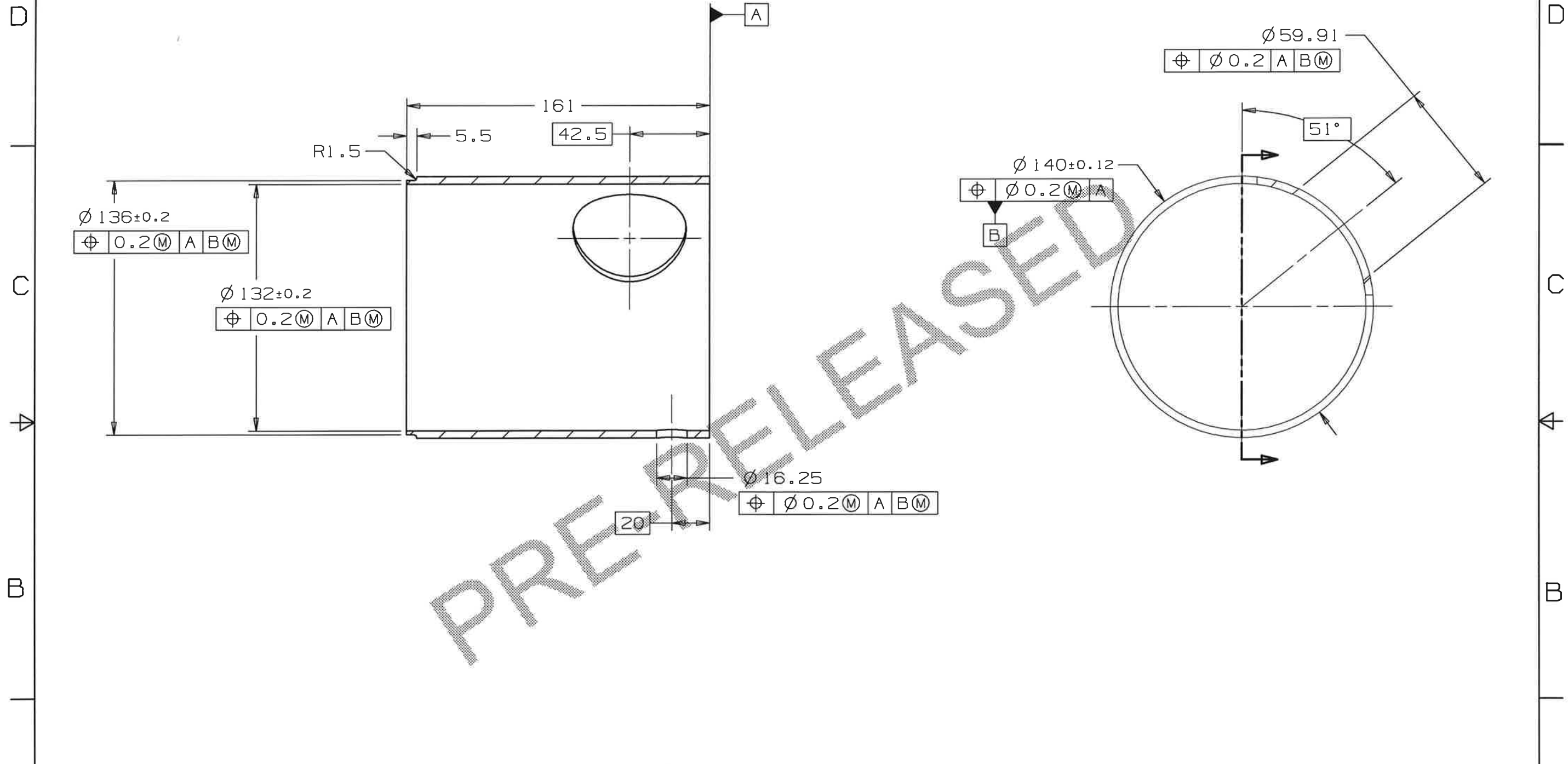
- PART MUST BE FREE OF DIRT, GREASE, OIL, CHIPS, AND BURRS.
- DO NOT BREAK SHARP EDGES, REQUIRED FOR ORBITAL WELDING.
- DESIGN SPECIFICATION:
 DESIGN PRESSURE: 2 BAR - WARM
 4 BAR - COLD
 OPERATION TEMPERATURE: 300 K - WARM
 2 K - COLED
- ALL COMPONENTS MATED TO THIS PART FOR ORBITAL WELDING MUST EXACTLY MATCH DIMENSIONS SHOWN.
- SUGGESTED VENDOR:
 HIGH ENRGY METALS, INC.,
 293 BUSINESS PARK LOOP, SEQUIM WA 98382



UNLESS OTHERWISE SPECIFIED				
±.X	±.XX	±.XXX	±X/X	±X°
±1	.02	.005	1/16	1°
BREAK ALL SHARP EDGES .015 MAX. DO NOT SCALE DRAWING DIMENSIONS BASED ON ASME Y14.5M-1994 MAX. ALL MACH SURFACES 125 DRAWING UNITS: INCHES				
DRAWN: M.SAWTELL		DATE: 27-Feb-2014	 FERMI NATIONAL ACCELERATOR LABORATORY UNITED STATES DEPARTMENT OF ENERGY	
CHECKED: M.KRAMP		DATE: 30-May-2014		
APPROVED: C.GRIMM		DATE: 30-May-2014		
USED ON: F10015802			NAME: RING, T1-SS TRANSITION - FILL LINE	
MATERIAL: 316L STAINLESS STEEL, ANNEALED, UNS S31600 / GRADE 2 TITANIUM			SCALE: 2:1	SIZE: C
GROUP: Technical Division - Design and Drafting CASE CODE: DUSRB			DRAWING NUMBER: F10017488	SHEET: 1 OF 1
			REV: A	

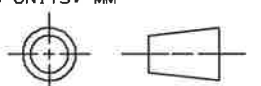
DESCRIPTION: 3.9GHZ He TANK SECTION, MC END
 CATEGORY: TANK PROJECT: LCLS1 Cryomodule


REV	REVISION CONTROL DOCUMENT	DATES	SIGNATURES	
-	F10048839---RCD		DRAWN	
			APPROVED	



PRE-RELEASED

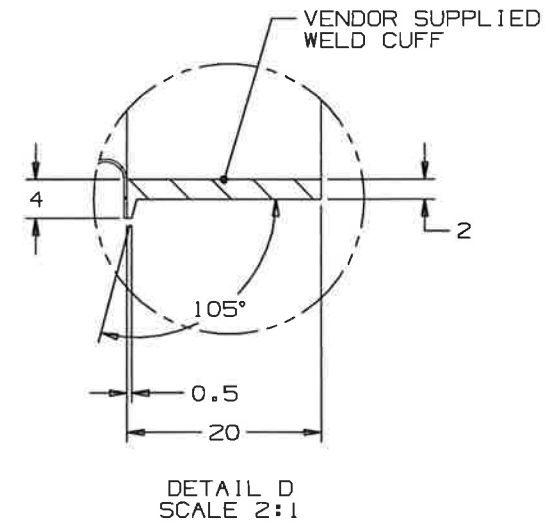
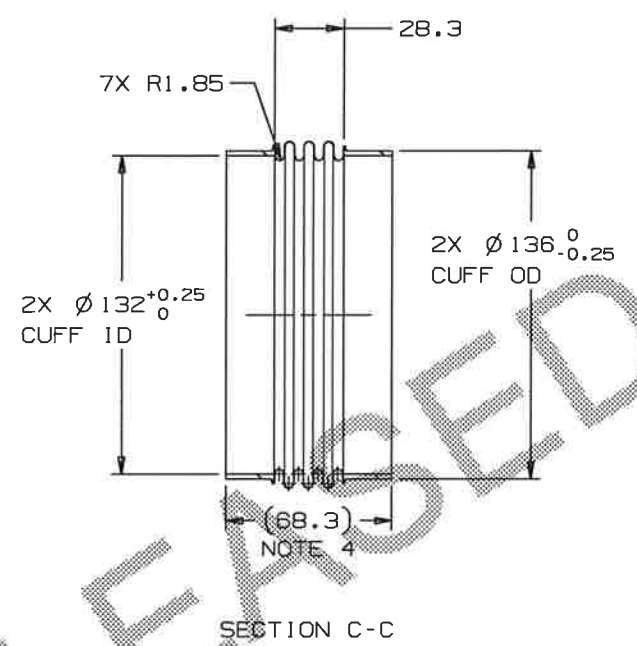
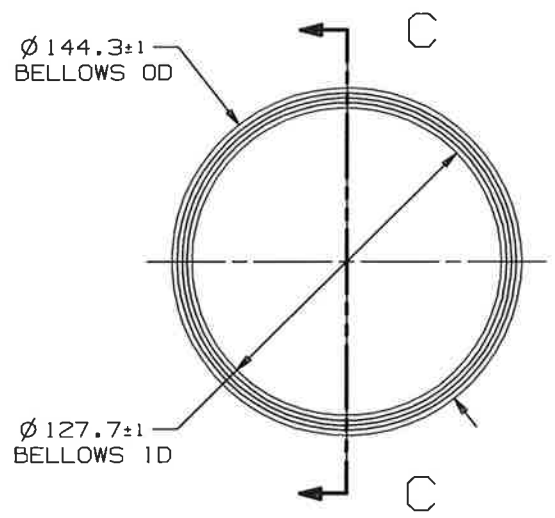
- NOTES (UNLESS OTHERWISE SPECIFIED):
- PART MUST BE FREE OF DIRT, GREASE, OIL AND CHIPS.
 - PART TO BE FREE OF ALL SHARP EDGES, CORNERS, AND BURRS.

UNLESS OTHERWISE SPECIFIED					DRAWN	M. KRAMP	DATE	20-Oct-2015
±X	±X.X	±X.XX	±X/X	±X°	CHECKED		DATE	
2	0.3	0.12	N/A	1°	APPROVED		DATE	
BREAK ALL SHARP EDGES 0.5 MAX. DO NOT SCALE DRAWING DIMENSIONS BASED ON ASME Y14.5-2009 MAX. ALL MACH SURFACES 3.2 DRAWING UNITS: MM					USED ON F10048833			
					MATERIAL TITANIUM GRADE 2			
GROUP: Technical Division - Design and Drafting					CAGE CODE: 0U5R6			

 FERMI NATIONAL ACCELERATOR LABORATORY UNITED STATES DEPARTMENT OF ENERGY				
NAME 3.9GHZ He TANK SECTION, MC END				
SCALE 1:2	SIZE A3	DRAWING NUMBER F10048839	SHEET 1 OF 1	REV -

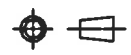
DESCRIPTION: 3.9GHZ He TANK BELLOWS
 CATEGORY: BELLOWS PROJECT: LCLS11Cryomodule

REV	REVISION CONTROL DOCUMENT	DATES	SIGNATURES
-	F10048841---RCD		DRAWN APPROVED



NOTES (UNLESS OTHERWISE SPECIFIED):

- PART MUST BE FREE OF DIRT, GREASE, OIL AND CHIPS.
- 3-4 CONVOLUTIONS ARE REQUIRED. DETAILS ARE TO BE SET BY THE SUPPLIER IN ACCORDANCE WITH ASME OR EMJA STANDARDS. INNER AND OUTER DIAMETERS ARE TO BE CONTROLLED WITH THE DIMENSIONS SHOWN
- BELLOWS SHALL BE HYDROFORMED WITH NO CRACKS, HOLES, PITS, DENTS, OR OTHER VISIBLE FLAWS THAT WOULD RENDER THE BELLOWS USELESS FOR CRYOGENIC VACUUM USE.
- WELD CUFFS SHALL BE DESIGNED BY THE SUPPLIER. THE FINAL LENGTH OF THE BELLOWS SHALL BE 65 mm AT A MINIMUM. THE FINAL BELLOWS DESIGN SHALL BE DETAILED IN A DRAWING AND PROVIDED TO FERMILAB FOR APPROVAL PRIOR TO PRODUCTION FABRICATION. THE FINAL DESIGN "FREE LENGTH" MUST BE HELD TO +/-0.5mm. DESIGN MOVEMENT RANGE: ± 2 mm.
- ALL CLEANING AND WELDING PROCEDURES WILL CONFORM TO THE AMERICAN WELDING SOCIETY SPECIFICATION: AWS G2.4/G2.4M: 2007, "GUIDE FOR THE FUSION WELDING OF TITANIUM AND TITANIUM ALLOYS."
- THE VENDOR'S WRITTEN PROCEDURE DESCRIBING THE CLEANING AND WELDING PROCEDURES MUST BE SUPPLIED TO FERMILAB FOR WRITTEN APPROVAL BEFORE ANY PRODUCT WELDING.
- INSPECTION OF FINAL PRODUCT WILL BE CONDUCTED AT FERMILAB PRIOR TO ANY ULTRASONIC OR WIRE-BRUSH CLEANING. DO NOT MODIFY THE FINAL WELDS PRIOR TO FINAL ACCEPTANCE. WELDS SHOWING AND OXIDATION LEVEL HIGHER THAN AN "AMBER" DISCOLORATION WILL BE GROUNDS FOR NON-ACCEPTANCE.
- ALL WELDS TO BE VACUUM TIGHT. NO LEAK SHALL BE DETECTABLE ON THE MOST SENSITIVE SCALE OF A HELIUM LEAK DETECTOR WITH A MINIMUM SENSITIVITY OF 2×10^{-10} ATM. CC/SEC. STABILIZE BELLOWS PRIOR TO VACUUM LEAK TESTING TO AVOID DAMAGE.
- MATERIAL CERTIFICATIONS ARE REQUIRED AND MUST BE INCLUDED WITH SHIPPING. THERE WILL BE NO PRODUCT ACCEPTANCE WITHOUT THE PROPER MATERIAL CERTIFICATIONS.
- WORKING PRESSURE:
2 BAR WARM (300K)
4 BAR COLD (2K)
- MAX. LIFE CYCLES: LESS THAN 100,000



UNLESS OTHERWISE SPECIFIED				
$\pm X$	$\pm X.X$	$\pm X.XX$	$\pm X/X$	$\pm X^*$
2	0.3	0.12	N/A	1*

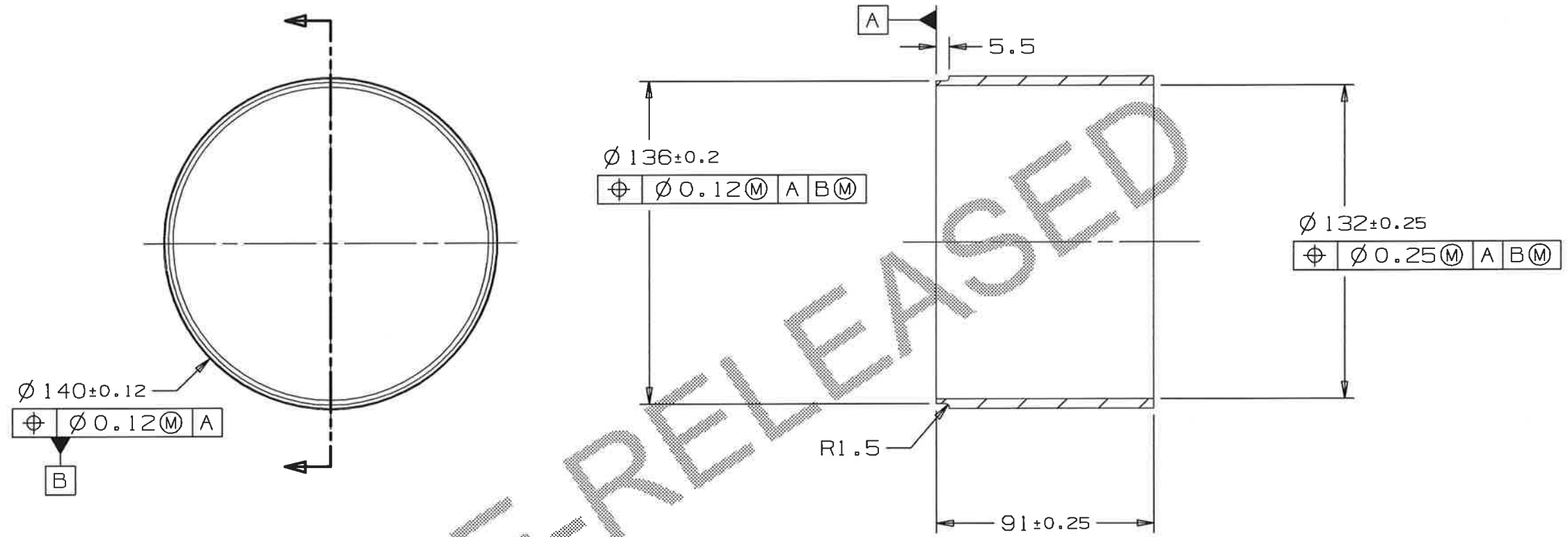
BREAK ALL SHARP EDGES 0.5 MAX.
 DO NOT SCALE DRAWING
 DIMENSIONS BASED ON ASME Y14.5-2009
 MAX. ALL MACH SURFACES 3.2
 DRAWING UNITS: MM

DRAWN	M. KRAMP	DATE	20-Oct-2015
CHECKED		DATE	
APPROVED		DATE	
USED ON	F10048833		
MATERIAL	TITANIUM GRADE 2		
GROUP: Technical Division - Design and Drafting	CASE CODE: OUSFB		

FERMILAB FERMILAB NATIONAL ACCELERATOR LABORATORY UNITED STATES DEPARTMENT OF ENERGY			
NAME			
3.9GHZ He TANK BELLOWS			
SCALE	SIZE	DRAWING NUMBER	SHEET
1:1	A2	F10048841	2 OF 2
REV			
-			

DESCRIPTION: 3.9GHZ He TANK SECTION, NON MC END
 CATEGORY: TANK PROJECT: LCLS11Cryomodule

REV	REVISION CONTROL DOCUMENT	DATES	SIGNATURES
-	F10048842---RCD		DRAWN APPROVED



PRE-RELEASED

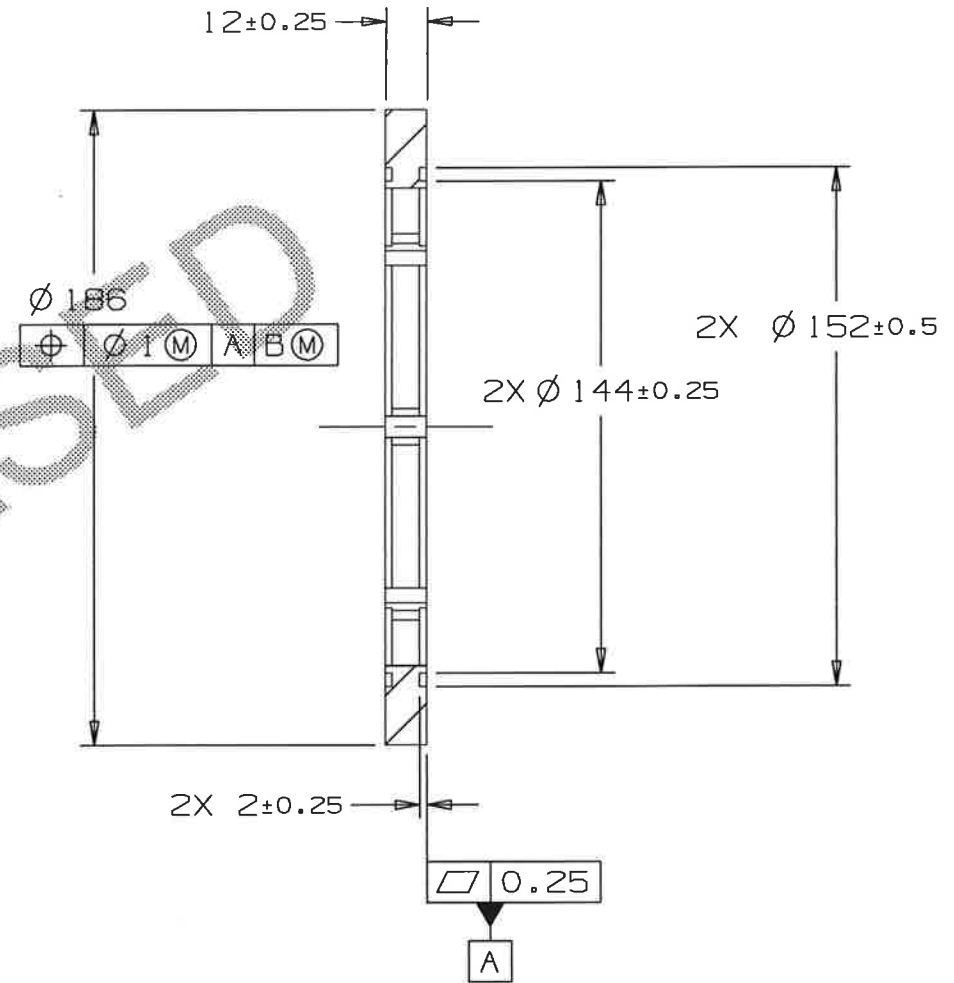
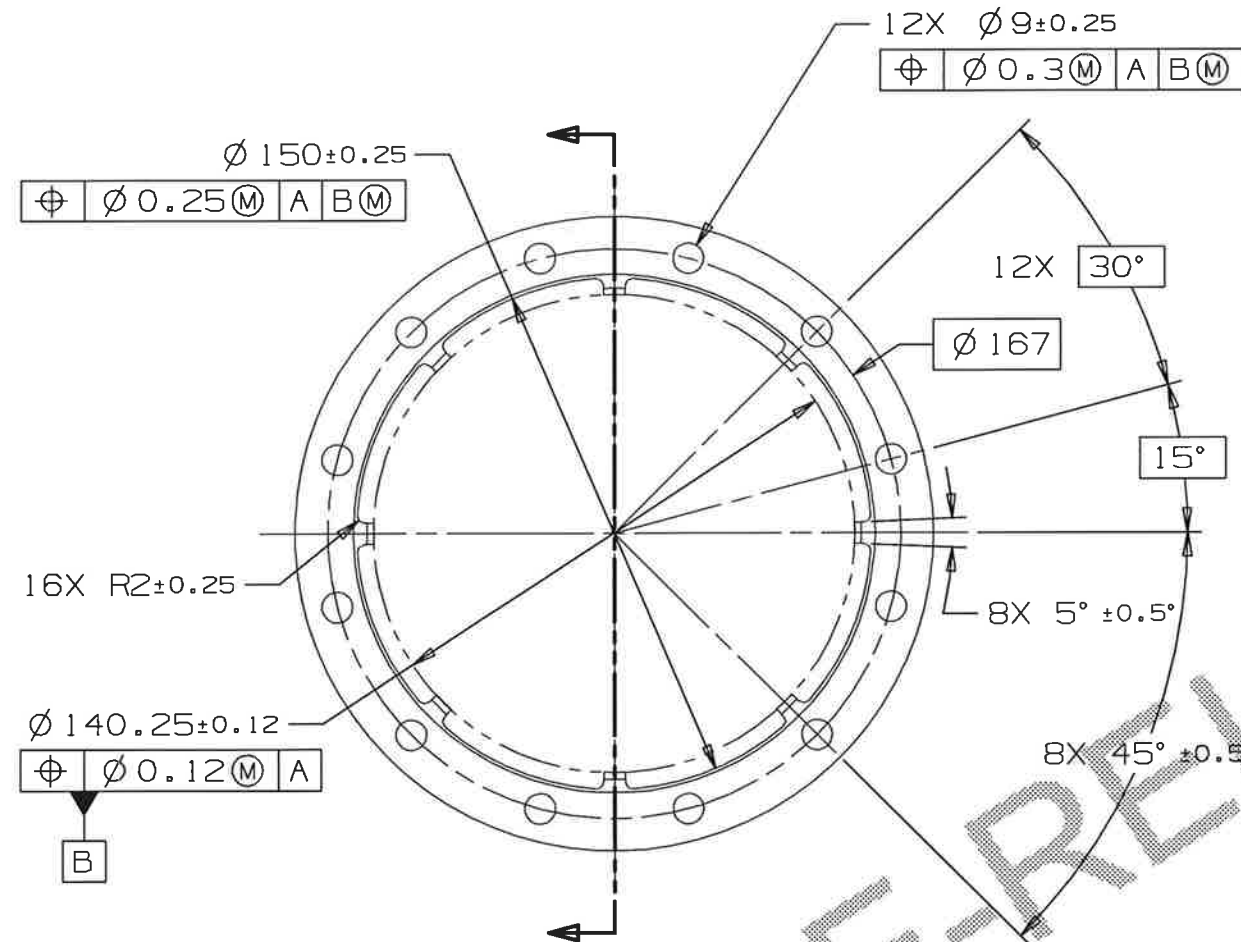
- NOTES (UNLESS OTHERWISE SPECIFIED):
- PART MUST BE FREE OF DIRT, GREASE, OIL AND CHIPS.
 - PART TO BE FREE OF ALL SHARP EDGES, CORNERS, AND BURRS.

UNLESS OTHERWISE SPECIFIED					DRAWN	M. KRAMP	DATE	20-Oct-2015
±X	±X.X	±X.XX	±X/X	±X*	CHECKED		DATE	
2	0.3	0.12	N/A	1*	APPROVED		DATE	
BREAK ALL SHARP EDGES 0.5 MAX. DO NOT SCALE DRAWING DIMENSIONS BASED ON ASME Y14.5-2009 MAX. ALL MACH SURFACES 3.2 DRAWING UNITS: MM					USED ON F10048833			
					MATERIAL TITANIUM GRADE 2			
GROUP: Technical Division - Design and Drafting					CAGE CODE: 0U5R6			

 FERMI NATIONAL ACCELERATOR LABORATORY UNITED STATES DEPARTMENT OF ENERGY			
NAME 3.9GHZ He TANK SECTION, NON MC END			
SCALE 1:2	SIZE A3	DRAWING NUMBER F10048842	SHEET 1 OF 1
			REV -

DESCRIPTION: 3.9GHZ He TANK TUNER RING
 CATEGORY: RING PROJECT: LCLS11Cryomodule

REV	REVISION CONTROL DOCUMENT	DATES	SIGNATURES
-	F10048843---RCD		DRAWN APPROVED



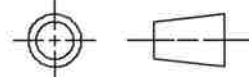
PRE-RELEASED

NOTES (UNLESS OTHERWISE SPECIFIED):


- PART MUST BE FREE OF DIRT, GREASE, OIL AND CHIPS.
- PART TO BE FREE OF ALL SHARP EDGES, CORNERS, AND BURRS.

UNLESS OTHERWISE SPECIFIED				
±X	±X.X	±X.XX	±X/X	±X*
2	0.3	0.12	N/A	1*

BREAK ALL SHARP EDGES 0.5 MAX.
 DO NOT SCALE DRAWING
 DIMENSIONS BASED ON ASME Y14.5-2009
 MAX. ALL MACH SURFACES 3.2
 DRAWING UNITS: MM

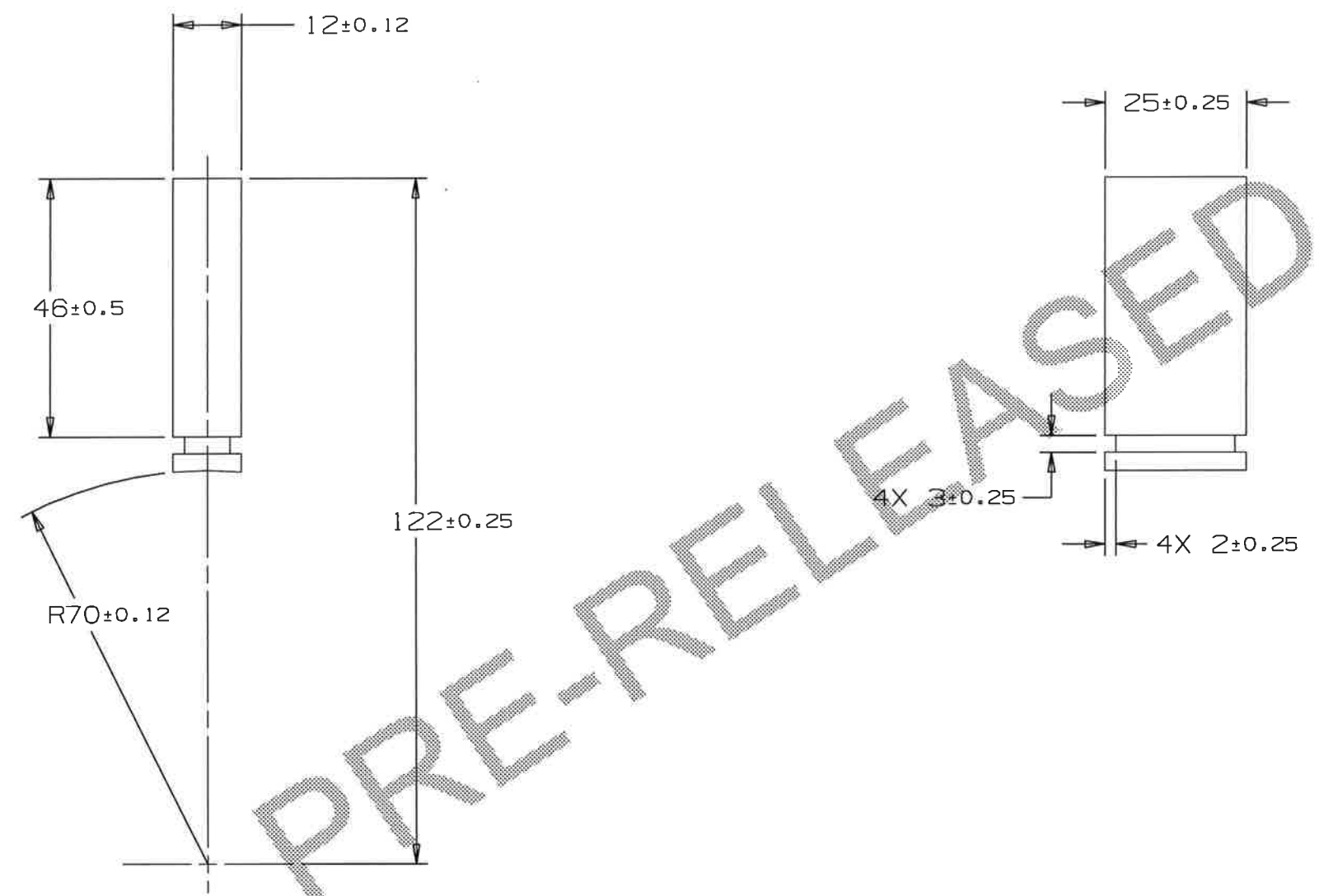


DRAWN	M. KRAMP	DATE	20-Oct-2015
CHECKED		DATE	
APPROVED		DATE	
USED ON	F10048833		
MATERIAL	TITANIUM GRADE 2		
GROUP:	Technical Division - Design and Drafting		
CAGE CODE:	OUSR6		

 FERMI NATIONAL ACCELERATOR LABORATORY UNITED STATES DEPARTMENT OF ENERGY			
NAME			
3.9GHZ He TANK TUNER RING			
SCALE	SIZE	DRAWING NUMBER	SHEET
1:2	A3	F10048843	1 OF 1
			REV
			-

DESCRIPTION: 3.9GHZ He TANK PAD
 CATEGORY: PAD PROJECT: LCLS11Cryomodule

REV	REVISION CONTROL DOCUMENT	DATES	SIGNATURES	
-	F10048844---RCD		DRAWN	
			APPROVED	



UNLESS OTHERWISE SPECIFIED				
±X	±X.X	±X.XX	±X/X	±X*
2	0.3	0.12	N/A	1*

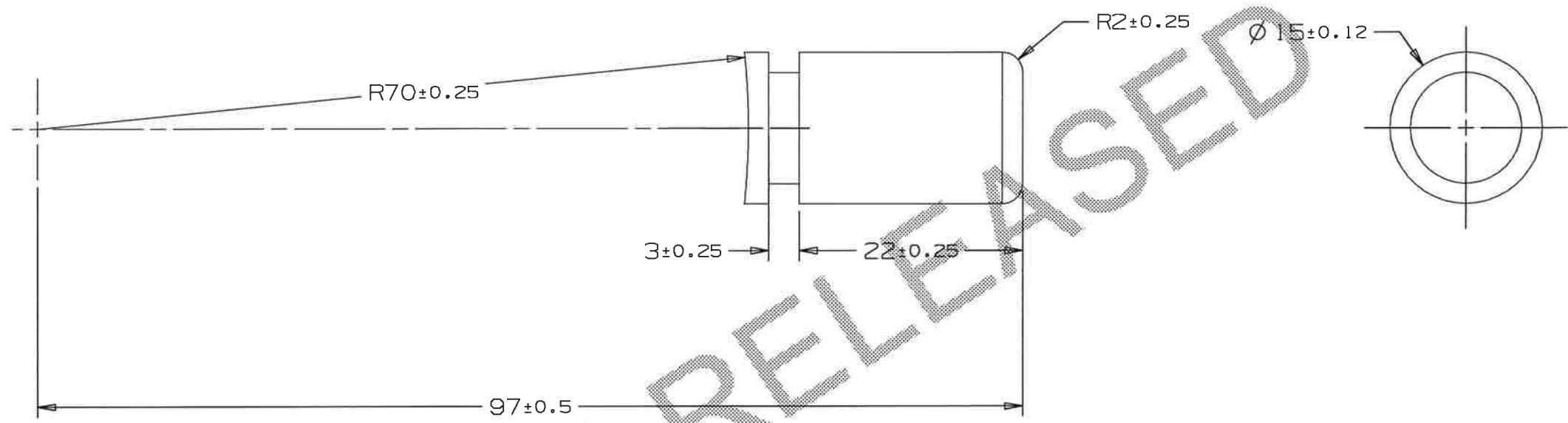
BREAK ALL SHARP EDGES 0.5 MAX.
 DO NOT SCALE DRAWING
 DIMENSIONS BASED ON ASME Y14.5-2009
 MAX. ALL MACH SURFACES 3.2
 DRAWING UNITS: MM

DRAWN	M. KRAMP	DATE	20-Oct-2015
CHECKED		DATE	
APPROVED		DATE	
USED ON	F10048833		
MATERIAL	TITANIUM GRADE 2		
GROUP:	Technical Division - Design and Drafting		
CAGE CODE:	0U5R6		

FERMI NATIONAL ACCELERATOR LABORATORY UNITED STATES DEPARTMENT OF ENERGY			
NAME			
3.9GHZ He TANK PAD			
SCALE	SIZE	DRAWING NUMBER	SHEET
1:1	A3	F10048844	1 OF 1
			REV
			-

DESCRIPTION: 3.9GHZ He TANK FIXTURE, INVAR ROD
 CATEGORY: POST PROJECT: LCLS11Cryomodule

REV	REVISION CONTROL DOCUMENT	DATES	SIGNATURES	
-	F10048845---RCD		DRAWN	
			APPROVED	



PRE-RELEASED

NOTES (UNLESS OTHERWISE SPECIFIED):

- PART MUST BE FREE OF DIRT, GREASE, OIL AND CHIPS.
- PART TO BE FREE OF ALL SHARP EDGES, CORNERS, AND BURRS.

UNLESS OTHERWISE SPECIFIED				
±X	±X.X	±X.XX	±X/X	±X*
2	0.3	0.12	N/A	1*

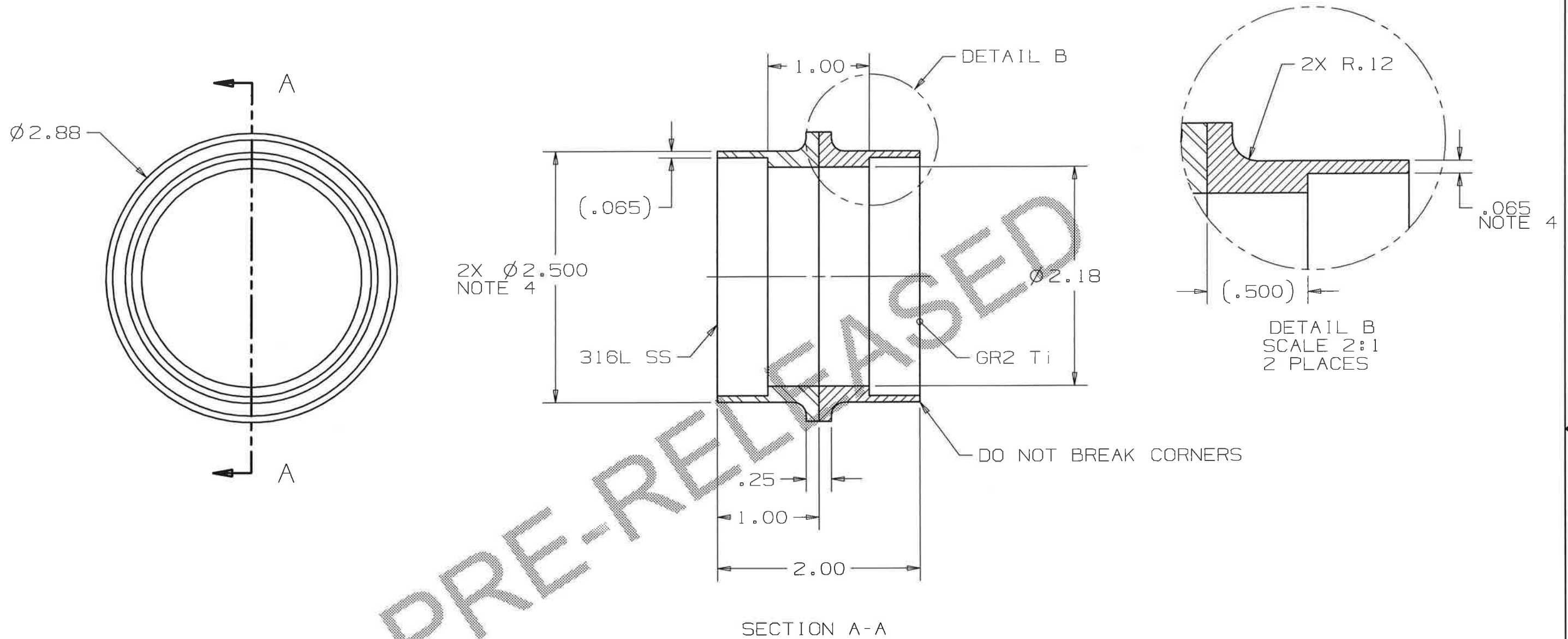
BREAK ALL SHARP EDGES 0.5 MAX.
 DO NOT SCALE DRAWING
 DIMENSIONS BASED ON ASME Y14.5-2009
 MAX. ALL MACH SURFACES 3.2
 DRAWING UNITS: MM

DRAWN	M. KRAMP	DATE	20-Oct-2015
CHECKED		DATE	
APPROVED		DATE	
USED ON	F10048833		
MATERIAL	TITANIUM GRADE 2		
GROUP: Technical Division - Design and Drafting CAGE CODE: QJ5R6			

FERMI NATIONAL ACCELERATOR LABORATORY UNITED STATES DEPARTMENT OF ENERGY				
NAME				
3.9GHZ He TANK FIXTURE, INVAR ROD				
SCALE	SIZE	DRAWING NUMBER	SHEET	REV
2:1	A3	F10048845	1 OF 1	-

DESCRIPTION: 3.9GHZ 2-PHASE TRANSITION RING, TI-SS
 CATEGORY: TRANSITION PROJECT: LCLS11Crjomodule

REV	REVISION CONTROL DOCUMENT	DATES	SIGNATURES	
-	F10049564---RCD		DRAWN	
			APPROVED	



NOTES (UNLESS OTHERWISE SPECIFIED):

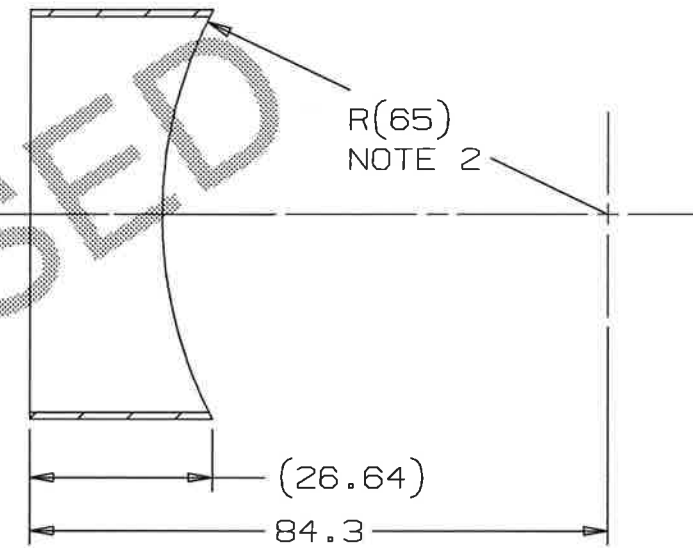
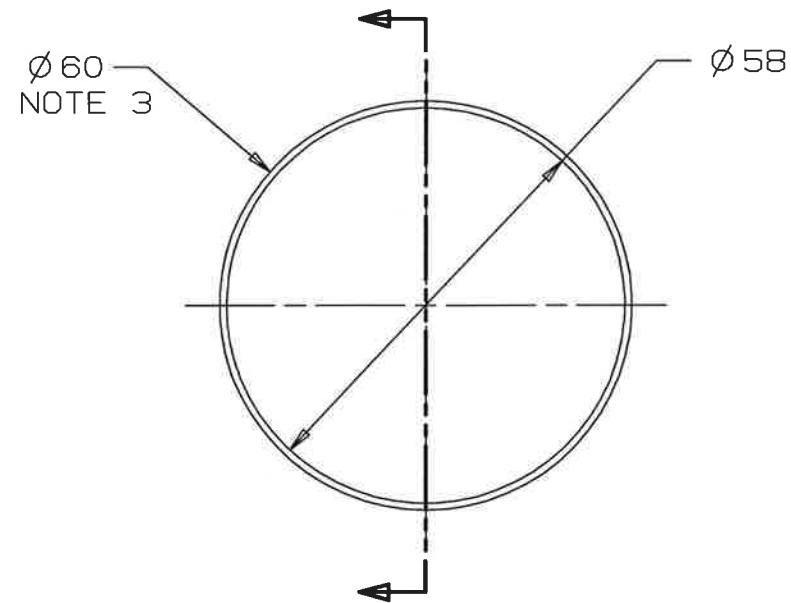
- PART MUST BE FREE OF DIRT, GREASE, OIL, CHIPS, AND BURRS.
- DO NOT BREAK SHARP EDGES, REQUIRED FOR ORBITAL WELDING.
- DESIGN SPECIFICATION:
 DESIGN PRESSURE: 2 BAR - WARM
 4 BAR - COLD
 OPERATION TEMPERATURE: 300 K - WARM
 2 K - COLED
- ALL COMPONENTS MATED TO THIS PART FOR ORBITAL WELDING MUST EXACTLY MATCH DIMENSIONS SHOWN.
- SUGGESTED VENDOR:
 HIGH ENEGRY METALS, INC.,

PRE-RELEASED

UNLESS OTHERWISE SPECIFIED					DRAWN	M. KRAMP	DATE	03-Nov-2015	FERMI NATIONAL ACCELERATOR LABORATORY UNITED STATES DEPARTMENT OF ENERGY				
±.X	±.XX	±.XXX	±X/X	±X°	CHECKED		DATE						
.1	.02	.005	1/16	1°	APPROVED		DATE		NAME				
BREAK ALL SHARP EDGES .015 MAX. DO NOT SCALE DRAWING DIMENSIONS BASED ON ASME Y14.5-2009 MAX. ALL MACH SURFACES 125/ DRAWING UNITS: INCHES					USED ON			3.9GHZ 2-PHASE TRANSITION RING, TI-SS					
					MATERIAL			SCALE 1:1					
					316L STAINLESS STEEL / GRADE 2 TITANIUM			SIZE B		DRAWING NUMBER F10049564		SHEET 1 OF 1	REV -
					GROUP: Technical Division - Design and Drafting			CAGE CODE: OU5R6					

DESCRIPTION: RING, WELD BACKING, 3.9GHZ HE VESSEL
 CATEGORY: RING PROJECT: LCLS11Cryomodule

REV	REVISION CONTROL DOCUMENT	DATES	SIGNATURES	
-	F10049568---RCD		DRAWN	
			APPROVED	



PRE-RELEASED

NOTES (UNLESS OTHERWISE SPECIFIED):

- PART MUST BE FREE FROM DUST, GREASE, OIL, AND CHIPS.
- DIMENSION TO MATCH FINAL TUBE OUTSIDE DIAMETER, MINUS 0.5mm, ON DRAWING F10048839.
- REVIEW SPECIFICATION FOR THIS DIMENSION BASED ON DRAWING F10049662.

UNLESS OTHERWISE SPECIFIED				
±X	±X.X	±X.XX	±X/X	±X*
2	0.3	0.12	N/A	1*

BREAK ALL SHARP EDGES 0.5 MAX.
 DO NOT SCALE DRAWING
 DIMENSIONS BASED ON ASME Y14.5-2009
 MAX. ALL MACH SURFACES 3.2
 DRAWING UNITS: MM

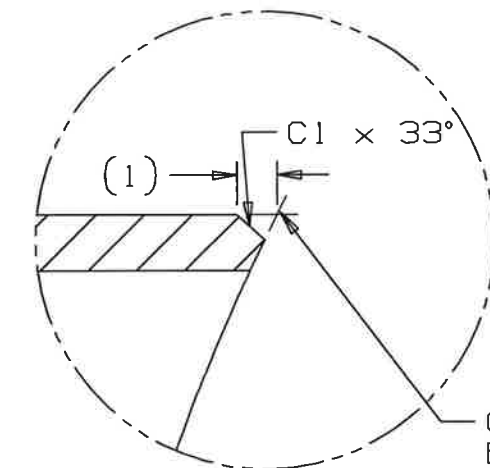
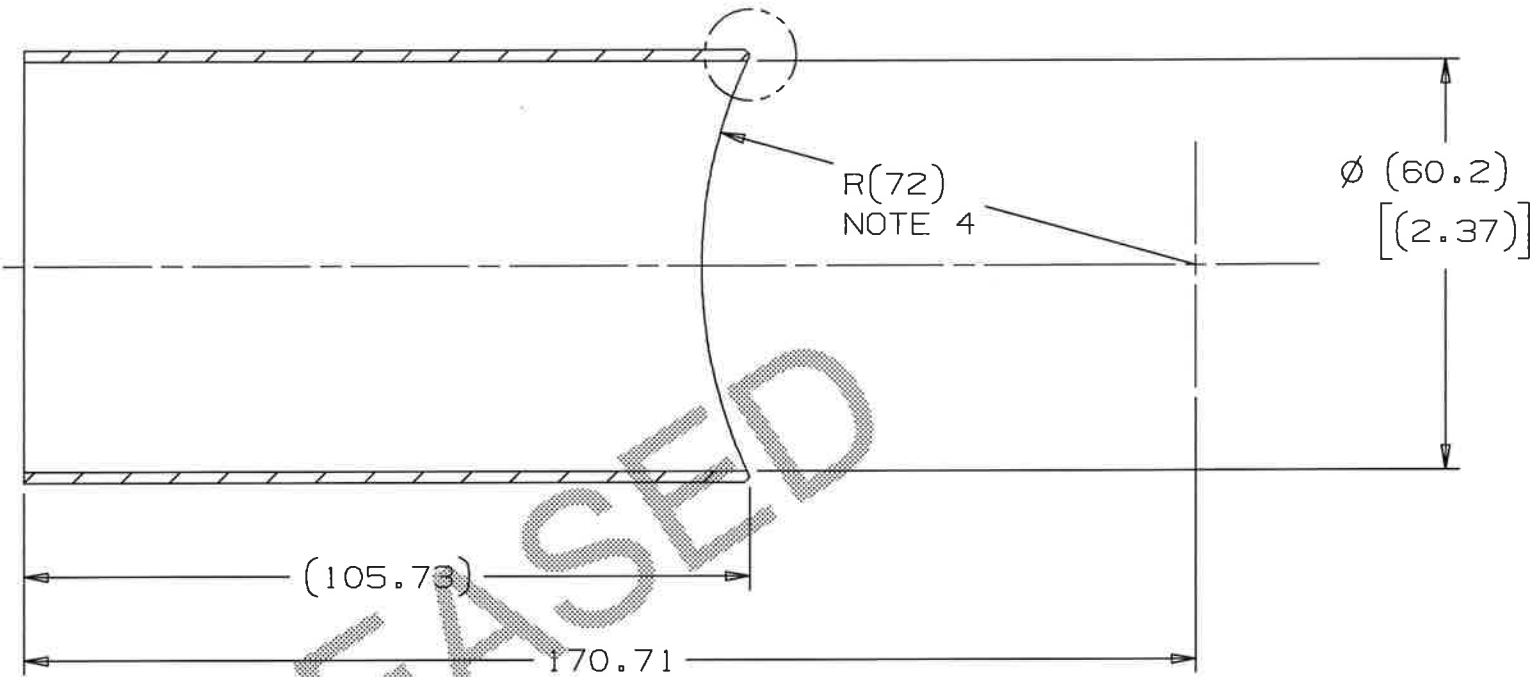
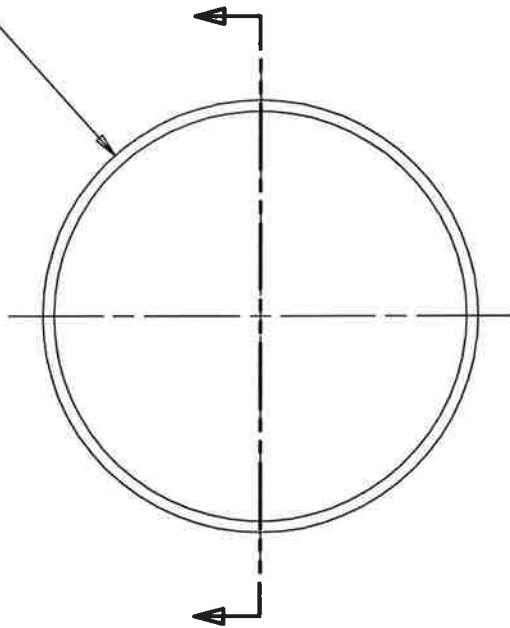
DRAWN	M. KRAMP	DATE	03-Nov-2015
CHECKED		DATE	
APPROVED		DATE	
USED ON	F10048833		
MATERIAL	TITANIUM GRADE 2		
GROUP: Technical Division - Design and Drafting CAGE CODE: 0U5R6			

FERMI NATIONAL ACCELERATOR LABORATORY UNITED STATES DEPARTMENT OF ENERGY				
				NAME
RING, WELD BACKING, 3.9GHZ HE VESSEL				
SCALE	SIZE	DRAWING NUMBER	SHEET	REV
1:1	A3	F10049568	1 OF 1	-

DESCRIPTION: PIPE, 3.9GHZ HE VESSEL TO TRANSITION
 CATEGORY: PIPE PROJECT: LCLS11Cryomodule

REV	REVISION CONTROL DOCUMENT	DATES	SIGNATURES	
-	F10049662---RCD		DRAWN	
			APPROVED	

∅ 63.5
[2.5]



CORNER BEFORE CHAMFERING

DETAIL B
SCALE 5:1

NOTES (UNLESS OTHERWISE SPECIFIED):

- PART MUST BE FREE FROM DUST, GREASE, OIL, AND CHIPS.
- ALL DIMENSIONS IN BRACKETS, [X.XX], ARE IN INCHES.
- DIMENSION TO MATCH FINAL TUBE INNER DIAMETER ON DRAWING F10017486.
- DIMENSION TO MATCH FINAL TUBE OUTSIDE DIAMETER, PLUS AN ADDITIONAL 2mm, ON DRAWING F10048839.
- DO NOT BREAK SHARP EDGES, REQUIRED FOR ORBITAL WELDING.

UNLESS OTHERWISE SPECIFIED				
±X	±X.X	±X.XX	±X/X	±X°
Z	0.3	0.12	N/A	1°

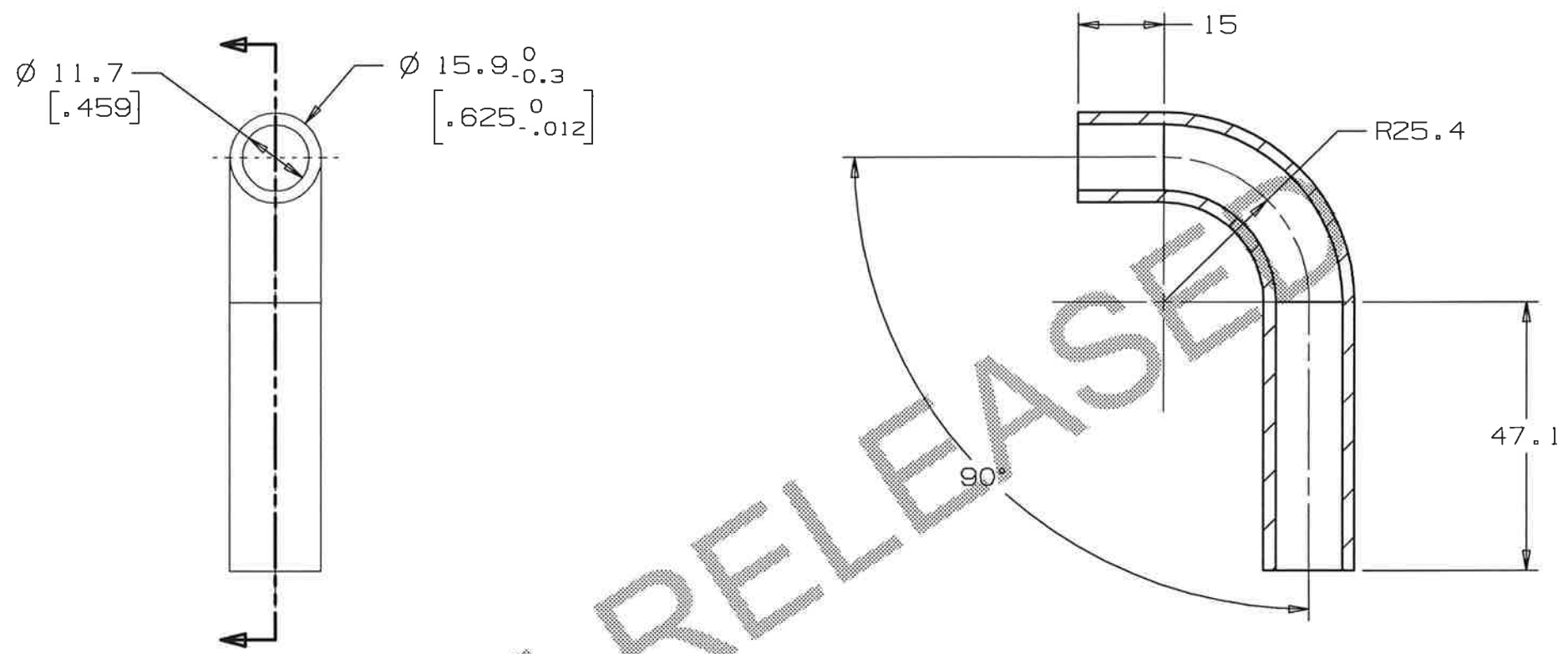
BREAK ALL SHARP EDGES 0.5 MAX.
 DO NOT SCALE DRAWING
 DIMENSIONS BASED ON ASME Y14.5-2009
 MAX. ALL MACH SURFACES 3.2
 DRAWING UNITS: MM

DRAWN	M. KRAMP	DATE	03-Nov-2015
CHECKED		DATE	
APPROVED		DATE	
USED ON	F10048833		
MATERIAL	TITANIUM GRADE 2		
GROUP: Technical Division - Design and Drafting	CAGE CODE: OUSR6		

FERMI NATIONAL ACCELERATOR LABORATORY UNITED STATES DEPARTMENT OF ENERGY			
NAME			
PIPE, 3.9GHZ HE VESSEL TO TRANSITION			
SCALE	SIZE	DRAWING NUMBER	SHEET
1:1	A3	F10049662	1 OF 1
			REV
			-

DESCRIPTION: ELBOW, HELIUM FILL LINE
 CATEGORY: ELBOW PROJECT: LCLS11Cryomodule

REV	REVISION CONTROL DOCUMENT	DATES	SIGNATURES	
-	F10049886---RCD		DRAWN	
			APPROVED	

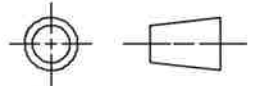


PRE-RELEASED


- NOTES (UNLESS OTHERWISE SPECIFIED):
- PART MUST BE FREE FROM DUST, GREASE, OIL, CHIPS, AND BURRS.
 - DIMENSIONS IN (.XX) ARE IN INCHES.

UNLESS OTHERWISE SPECIFIED				
±X	±X.X	±X.XX	±X/X	±X*
2	0.3	0.12	N/A	1*

BREAK ALL SHARP EDGES 0.5 MAX.
 DO NOT SCALE DRAWING
 DIMENSIONS BASED ON ASME Y14.5-2009
 MAX. ALL MACH SURFACES 3.2
 DRAWING UNITS: MM



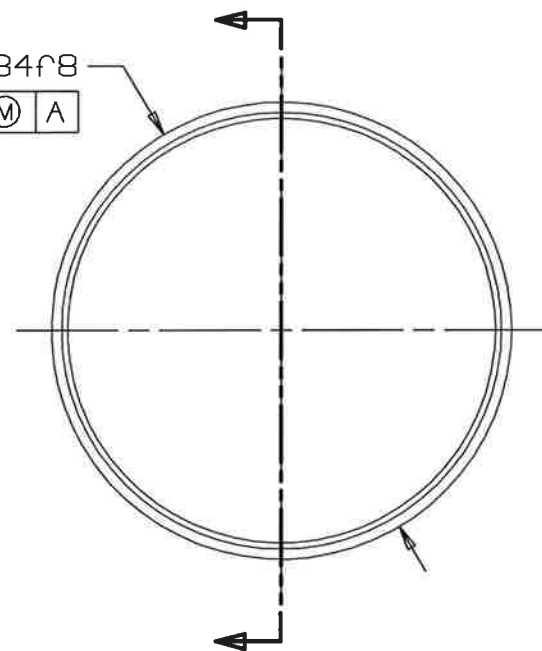
DRAWN	M. KRAMP	DATE	09-Nov-2015
CHECKED		DATE	
APPROVED		DATE	
USED ON	F10048847		
MATERIAL	TITANIUM GRADE 2		
GROUP: Technical Division - Design and Drafting	CAGE CODE: 0U5R6		

 FERMI NATIONAL ACCELERATOR LABORATORY UNITED STATES DEPARTMENT OF ENERGY		NAME	
		ELBOW, HELIUM FILL LINE	
SCALE	SIZE	DRAWING NUMBER	SHEET
1:1	A3	F10049886	1 OF 1
			REV
			-

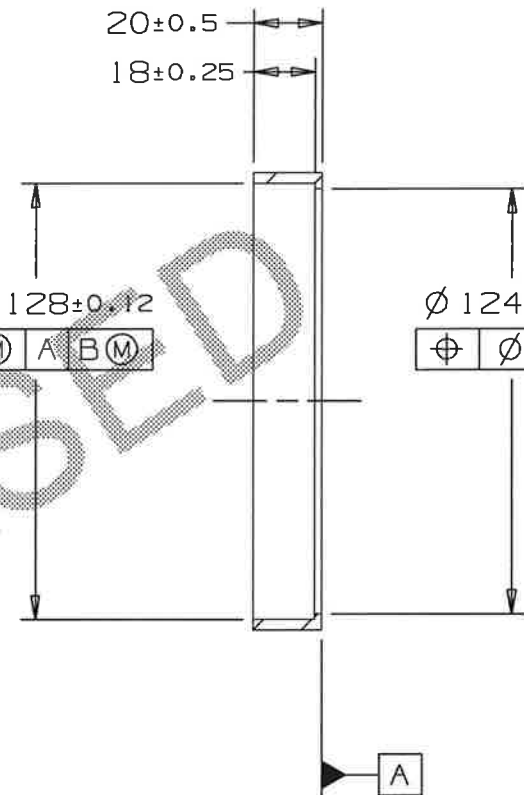
DESCRIPTION: 3.9GHZ ADAPTER RING, He TANK
 CATEGORY: ADAPTER PROJECT: LCLS11Cryomodule

REV	REVISION CONTROL DOCUMENT	DATES	SIGNATURES	
-	F10048846---RCD		DRAWN	
			APPROVED	

Ø 134r8
 ⊕ Ø 0.12 (M) A
 B



20±0.5
 18±0.25
 Ø 128±0.12
 ⊕ Ø 0.12 (M) A B (M)



Ø 124.5±0.12
 ⊕ Ø 0.12 (M) A B (M)

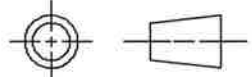
PRE-RELEASED

NOTES (UNLESS OTHERWISE SPECIFIED):


- PART MUST BE FREE OF DIRT, GREASE, OIL AND CHIPS.
- PART TO BE FREE OF ALL SHARP EDGES, CORNERS, AND BURRS.

UNLESS OTHERWISE SPECIFIED				
±X	±X.X	±X.XX	±X/X	±X°
2	0.3	0.12	N/A	1°

BREAK ALL SHARP EDGES 0.5 MAX.
 DO NOT SCALE DRAWING
 DIMENSIONS BASED ON ASME Y14.5-2009
 MAX. ALL MACH SURFACES 3.2
 DRAWING UNITS: MM

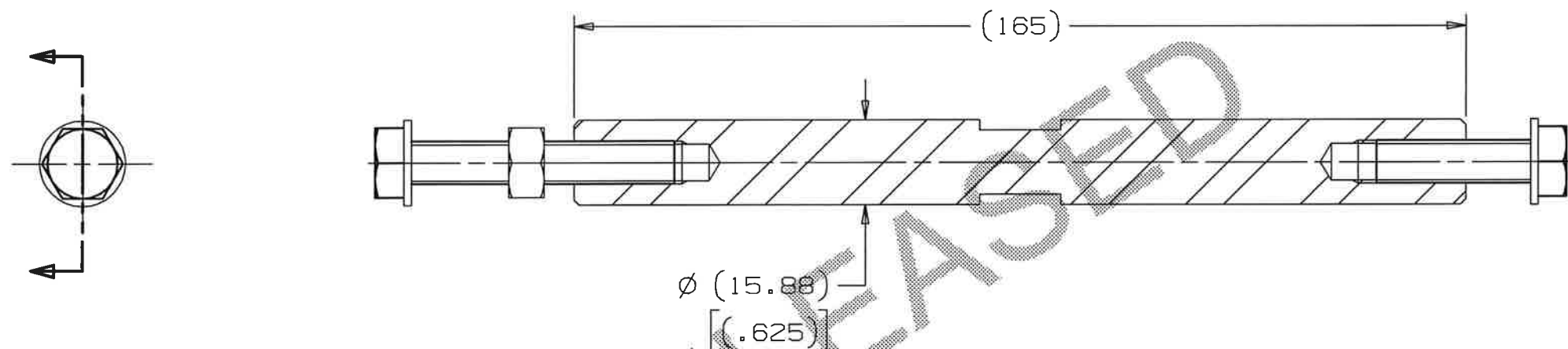


DRAWN	M. KRAMP	DATE	20-Oct-2015
CHECKED		DATE	
APPROVED		DATE	
USED ON	F10048833		
MATERIAL	TITANIUM GRADE 2		
GROUP: Technical Division - Design and Drafting	CAGE CODE: 0U5R6		

 FERMI NATIONAL ACCELERATOR LABORATORY UNITED STATES DEPARTMENT OF ENERGY				
NAME				
3.9GHZ ADAPTER RING, He TANK				
SCALE	SIZE	DRAWING NUMBER	SHEET	REV
1:2	A3	F10048846	1 OF 1	-

DESCRIPTION: KIT, TUNER SPANNING ROD
 CATEGORY: KIT PROJECT: LCLS11Cryomodule

REV	REVISION CONTROL DOCUMENT	DATES	SIGNATURES	
-	F10050223---RCD		DRAWN	
			APPROVED	



ITEM	PART#	DESCRIPTION	QTY.
5	FC0047833	HHCS, M8x1.25x50LGxFT, Si Brz	1
4	FC0047879	HHCS, M8x1.25x30LGxFT, Si Brz	1
3	FC0041393	NUT_HEX, M8x1.25x6.5, SB	1
2	FC0016265	WASHER, M8-8.4x16x1.4, SS316L	2
1	F10050222	ROD, TUNER SPANNING	1

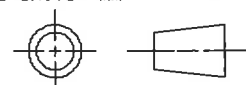
PARTS LIST

NOTES (UNLESS OTHERWISE SPECIFIED):

- KIT MUST BE FREE OF DIRT, GREASE, OIL AND CHIPS.
- KIT TO BE FREE OF ALL SHARP EDGES, CORNERS, AND BURRS.
- ITEM 2 TO BE ELECTROPOLISHED.

UNLESS OTHERWISE SPECIFIED				
±X	±X.X	±X.XX	±X/X	±X°
2	0.3	0.12	N/A	1°

BREAK ALL SHARP EDGES 0.5 MAX.
 DO NOT SCALE DRAWING
 DIMENSIONS BASED ON ASME Y14.5-2009
 MAX. ALL MACH SURFACES 3.2
 DRAWING UNITS: MM

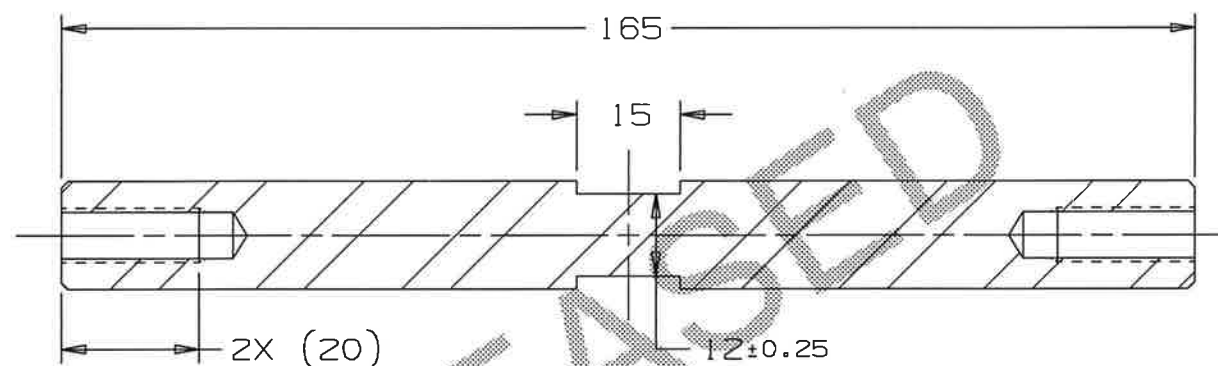
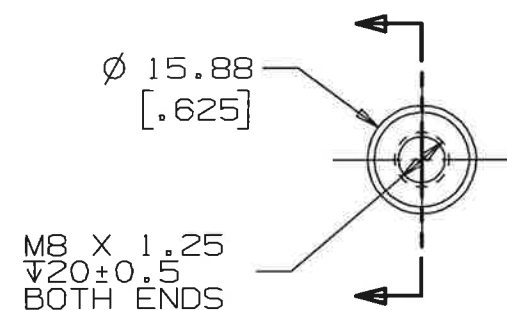


DRAWN	M. KRAMP	DATE	16-Nov-2015
CHECKED		DATE	
APPROVED		DATE	
USED ON	F10048855, F10048856		
MATERIAL	SEE PARTS LIST		
GROUP: Technical Division - Design and Drafting		CAGE CODE: OUSR6	

 FERMI NATIONAL ACCELERATOR LABORATORY UNITED STATES DEPARTMENT OF ENERGY			
NAME			
KIT, TUNER SPANNING ROD			
SCALE	SIZE	DRAWING NUMBER	SHEET
1:1	A3	F10050223	1 OF 1
			REV
			-

DESCRIPTION: ROD, TUNER SPANNING
 CATEGORY: ROD PROJECT: LCLS11Cryomodule

REV	REVISION CONTROL DOCUMENT	DATES	SIGNATURES	
-	F10050222---RCD		DRAWN	
			APPROVED	



PRE-RELEASED

NOTES (UNLESS OTHERWISE SPECIFIED):

- PART MUST BE FREE OF DIRT, GREASE, OIL AND CHIPS.
- PART TO BE FREE OF ALL SHARP EDGES, CORNERS, AND BURRS.
- FINISH: ELECTROPOLISH

UNLESS OTHERWISE SPECIFIED					DRAWN	M. KRAMP	DATE	16-Nov-2015
\pm X	\pm X.X	\pm X.XX	\pm X/X	\pm X*	CHECKED		DATE	
2	0.3	0.12	N/A	1*	APPROVED		DATE	
BREAK ALL SHARP EDGES 0.5 MAX. DO NOT SCALE DRAWING DIMENSIONS BASED ON ASME Y14.5-2009 MAX. ALL MACH SURFACES 3.2 DRAWING UNITS: MM					USED ON			
					F10050223			
MATERIAL					STAINLESS STEEL 316L			
GROUP: Technical Division - Design and Drafting					CAGE CODE: 0U5R6			



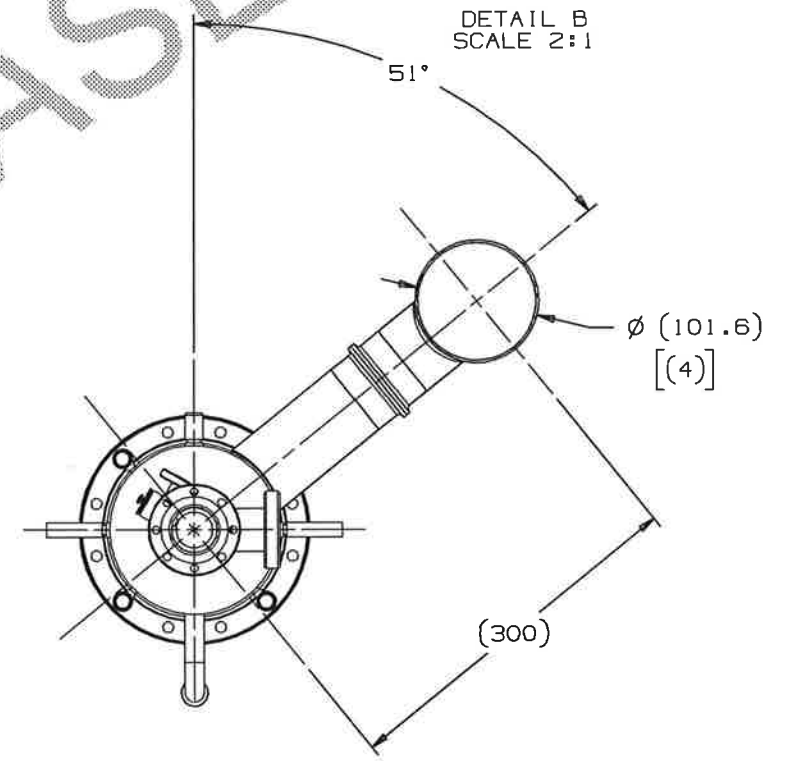
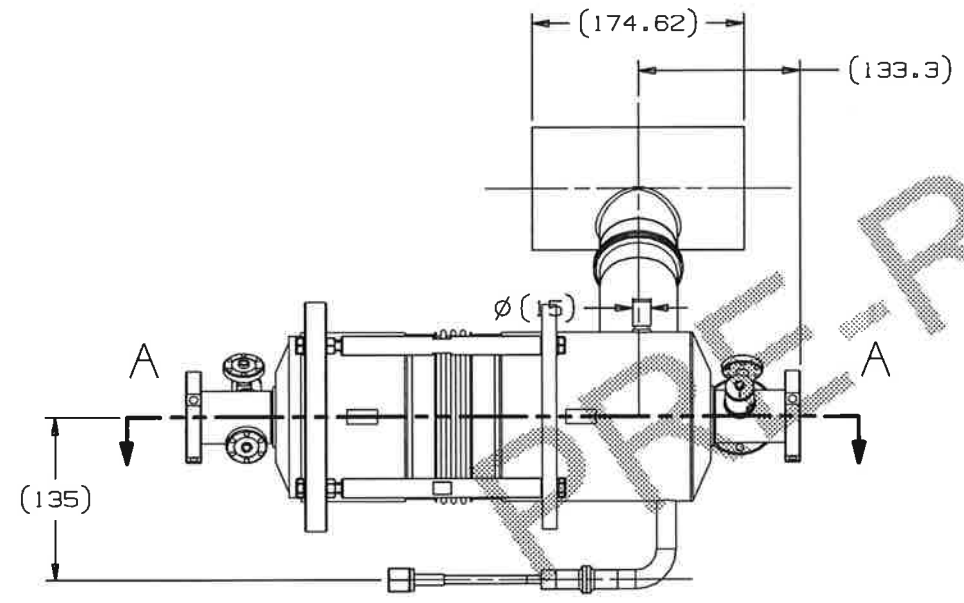
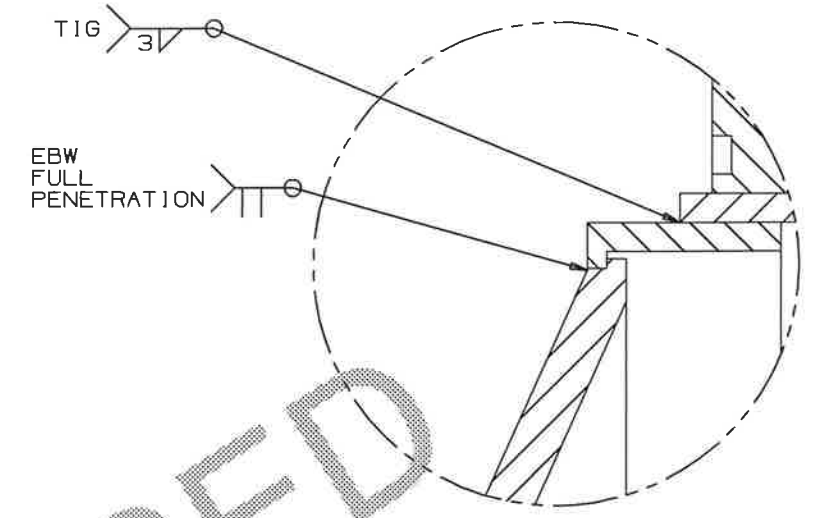
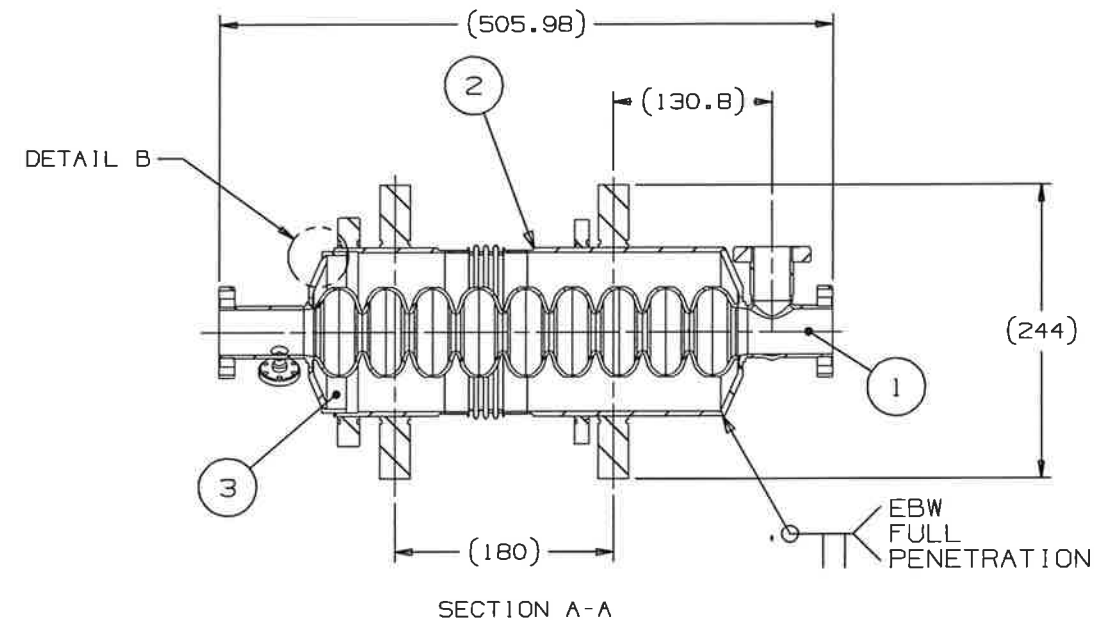
FERMI NATIONAL ACCELERATOR LABORATORY
 UNITED STATES DEPARTMENT OF ENERGY

NAME
 ROD, TUNER SPANNING

SCALE	SIZE	DRAWING NUMBER	SHEET	REV
1:1	A3	F10050222	1 OF 1	-

DESCRIPTION: 3.9GHZ ASSY ODD "B" DRESSED CAVITY
 CATEGORY: ASSEMBLY PROJECT: LCLS11Cryomodule

REV	REVISION CONTROL DOCUMENT	DATES	SIGNATURES
-	F10048856---RCD		DRAWN APPROVED



NOTES (UNLESS OTHERWISE SPECIFIED):

- ASSEMBLY MUST BE FREE FROM DUST, GREASE, OIL, CHIPS, AND BURRS.
- PLEASE REFER TO J-LAB SPECIFICATION LCLS-11-A.6-TS-0092 FOR ASSEMBLY, SHIPPING, AND HANDLING INSTRUCTIONS.
- ELECTRON-BEAM WELD FROM BOTH SIDES TO ENSURE FULL PENETRATION AND OVERLAP FOR FULL JOINT CONSUMPTION.
- FINAL RING DIAMETER DUE TO POST WELDING SHRINKAGE. ITEM #8 TO BE MACHINED PER DRAWING SPEC. PRIOR TO WELDING. ALTERNATE METHOD: ROUGH MACHINE ITEM #8 AND FINISH PER DIMENSION SHOWN ON THIS DRAWING.

ITEM	PART#	DESCRIPTION	QTY.
3	F10048846	3.9GHZ ADAPTER RING, He TANK	1
2	F10048833	3.9GHZ HELIUM TANK WLDMT	1
1	F10048752	FNAL 3.9GHZ RF CAVITY ASSY	1

PARTS LIST

UNLESS OTHERWISE SPECIFIED		DRAWN	M. KRAMP	DATE	19-Oct-2015	 FERMI NATIONAL ACCELERATOR LABORATORY UNITED STATES DEPARTMENT OF ENERGY	
±X	±X.X	±X.XX	±X/X	±X°	CHECKED		DATE
2	0.3	0.12	N/A	1°	APPROVED		DATE
BREAK ALL SHARP EDGES 0.5 MAX. DO NOT SCALE DRAWING DIMENSIONS BASED ON ASME Y14.5-2009 MAX. ALL MACH SURFACES 3.2 DRAWING UNITS: MM		USED ON		F10048834		NAME 3.9GHZ ASSY ODD "B", DRESSED CAVITY	
		MATERIAL		SEE PARTS LIST		SCALE 1:4	
GROUP: Technical Division - Design and Drafting CAGE CODE: DQ598		DRAWING NUMBER		F10048856		SHEET 1 OF 1	