

Princeton Plasma Physics Laboratory Procedure			
NSTX-U MIDPLANE FLANGE BAY F REMOVAL AND REINSTALLATION OF MPTS COLLECTION OPTICS BOX			
Number: D-NSTXU-DIAG-4076		Revision: 0	Effective Date: Expiration Date: <i>(3yr. unless otherwise stipulated)</i>
CAT: <input checked="" type="checkbox"/>A1 <input type="checkbox"/>A2 <input type="checkbox"/>A3		Justification: (If required) CE and/or ES&H Head:	
Author: Justin Bradley			Date:
Responsible Engineer: Robert Ellis			Date:
Procedure Requirements designated by Responsible Engineer			
LABWIDE:			
√	Work Planning Form # 3063 (ENG-032)		Lockout/Tagout (ESH-016)
	Confined Space Permit (5008, Sec. 8, Chap 5)	√	Lift Procedure (ENG-021)
	Master Equip. List Mod (MC-002/MC-003)	√	ES&H Review (NEPA, IH, etc.)
	RWP (HP-OP-20)	√	Independent Review
√	Walkdown	√	Pre-job Brief
√	Post-job Brief	√	Job Hazard Analysis – JHA (ESH-004)
	T-MOD (ENG-036)		Special archiving requested for completed Run Copies: _____ _____
√	Run Copy Required (performance of procedure must be documented and archived per ENG-030)		
D-SITE SPECIFIC:			
√	D-Site Work Permit (OP-AD-09)		Door Permit (OP-G-93)
	Work on Tritium Contaminated Sys. (OP-AD-77)		Activity Certification Committee Review
√	USI Screening (OP-AD-131)		
FOR INSTALLATION PROCEDURES ONLY: Was an ECN required? – No.			
If ECN was required, list drawing numbers affected:			

MANDATORY REVIEWERS (set according to ENG-030 Attachment 1)
Quality Assurance – Andres Castaneda
ES&H – Neil Gerrish
USI Screener – Stefan Gerhardt

OPTIONAL REVIEWERS (set according to ENG-030 Attachment 1)			
	Decline and sign	Accept – no comment	Accept - comment
ATI – Joe Winston			
RE Diagnostics – Brently Stratton			
Senior Physicist – Benoit Leblanc			
TA Vacuum Systems – Dang Cai			
IH – Neil Gerrish			
Lift Manager – Mike Viola			

REVIEWERS (designated by Chief Engineer for A1)
Independent Reviewer - Mike Kalish

TRAINING (designated by Responsible Engineer)			
No training required <input checked="" type="checkbox"/>		Instructor _____	
Personnel (group, job title, or individual name)	Read Only*	Instruction	Hands-On
Lead Technician		√	
Additional Technician(s)		√	
Accountable Technical Individual (ATI)	√		
QA/QC Representative		√	
Field Supervisor		√	
Responsible Engineer _____			

* “Read Only” training for Administrative, Alarm Response, and Emergency Operations procedures must be documented on a Record of Training form (attachment 6). The completed Run Copy will serve as the documentation of “Read Only” training for all other types of procedures.

1.0 Purpose:

This procedure will provide instructions for the preparation, lift, removal and replacement of the Multi-Point Thomson Scattering (MPTS) Diagnostic Optics Box. This procedure also provides information and guidance on how to execute the job safely and efficiently while protecting the MPTS optical components. The optical components include the fiber optics holder (FOH) which is permanently attached to the end of the fiber optics, and the mirror optics box (MOB) which normally sits on top of a dedicated column, erected from the NTC ground below bay F. Both components are fragile and require great care during the execution of this job. At the start of this procedure the FOH and the MOB are assembled together and will remain that way throughout the job, we will use the acronym FOH+MOB to refer to this combined apparatus. The lifting of the FOH+MOB is a critical lift to be executed on the NSTX-U 109 level platform.

2.0 Scope:

2.1 This procedure shall be completed using cost center 1160-D1AG-8020.

2.2 This procedure shall cover the following:

2.2.1 Preparing Bay F midplane surrounding area for MOB + FOH removal.

2.2.2 Preparing FOH for lift.

2.2.3 Preparing MOB for lift.

2.2.4 Brining in lift mechanism.

2.2.5 MOB + FOH lift.

2.2.6 Reinstallation.

2.2.7 Testing Optics Box.

3.0 References:

3.1 Drawing No. E9D11026: MPTS Optics Box Lift Device Assembly (Sht. 1-4).

3.2 Drawing No. E9D11228: MPTS Collection Optics Box Laboratory Test Fixture.

3.3 Drawing No. E9D11233: MPTS Collection Optics Box Top Cover Assembly.

3.4 Drawing No. E9D11234: MPTS Collection Optics Box Bezel Window.

3.5 Drawing No. E9D11235: MPTS Collection Optics Box Window.

3.6 Drawing No. E9D11236: MPTS Collection Optics Box Mirror Adjustment Jig.

3.7 Critical Lift Procedure No. D-L-NSTX-1010 "Lift MPTS Optis Box and Move onto Support Table"

4.0 Precautions:

4.1 Individuals are not permitted to lift more than 50 lbs. at any one time. If an object weighs in excess of 50lbs., then it shall be lifted by more than one individual, or with the aid of mechanical system(s).

- 4.2 An approved method of fall protection shall be established for individuals working at elevated positions.
- 4.3 Use appropriate PPE (per JHA) and/or per guidance from Industrial Hygiene.
- 4.4 Before removal Health Physics shall survey all materials that were in the test cell during the last run of NSTX or any material or tools left in the test cell overnight.
- 4.5 No other work will be allowed above or in the vicinity of the MPTS working area during the execution of this procedure.
- 4.6 The Noise level within the NSTX-U Test Cell shall be kept sufficiently low such that verbal commands can be clearly understood.

5.0 **Prerequisites:**

- 5.1 There must be a sufficient number of available personnel required to perform this task completely, the minimum number is 9.
- 5.2 One individual shall be selected to be the Lead Technician during the execution of this procedure. The Lead Technician shall make decisions when needed to continue and/or stop the work. The Lead Technician will have the responsibility of verifying that each task within sections 5, 6, and 7 have been completed.

Appointed Lead Technician: _____

- 5.3 Personnel whom the Lead Technician shall work with on this job are:

- (1) PPPL Construction Field Supervisor – Joe Winston x2745
- (2) COG Physicist – Benoit LeBlanc x2008
- (3) COG Engineer – Justin Bradley x3037
- (4) PPPL Quality Control Representative
- (5) PPPL Qualified Lift Engineer
- (6) PPPL Qualified Lift Watch
- (7) Two (2) PPPL Qualified Riggers

- 5.4 Obtain a D-site work permit from the shift supervisor.

Lead Tech: _____ Permit No.: _____

- 5.5 All workers and Performing Techs must review and sign the Job Hazard Analysis for this job.

Lead Tech: _____ JHA No.: _____

- 5.6 The Work Control Center must log in this procedure and provide an approved Engineering Work Package before the work can begin. Under no circumstances should the work proceed without the approved “blue or yellow folder” from the WCC.

Lead Tech: _____

- 5.7 A Lift watch has been established for all stages of the Optics Box Movement.

Lead Tech: _____ Lift Watch: _____

5.8 Benoit LeBlanc is available to Oversee the lifting of the Optics Box during movement and replacement stages.

Lead Tech: _____ B. Leblanc: _____

5.9 A Pre-job Briefing must be completed prior to work starting, including a review of the JHA. The only personnel allowed to work under this procedure are those that attend this briefing.

5.10 All Prerequisites Completed:

COG Engineer Signoff: _____ Date: _____

6.0 Optics Box Movement Procedure:

6.1 Preparations:

6.1.1 Prepare the Midplane Bay F working area for MOB+FOH removal.

6.1.1.1 Remove any handrails obstructing the collection optics box and yellow caution tape off the working area.

Lead Tech: _____

6.1.1.2 Implement any fall protection systems as necessary at the direction of the field supervisor.

Lead Tech: _____

6.1.1.3 All associated fasteners and washers must be saved in separate plastic bags and identified by the type of support (Cone, Groove, Flat Plate, etc.)

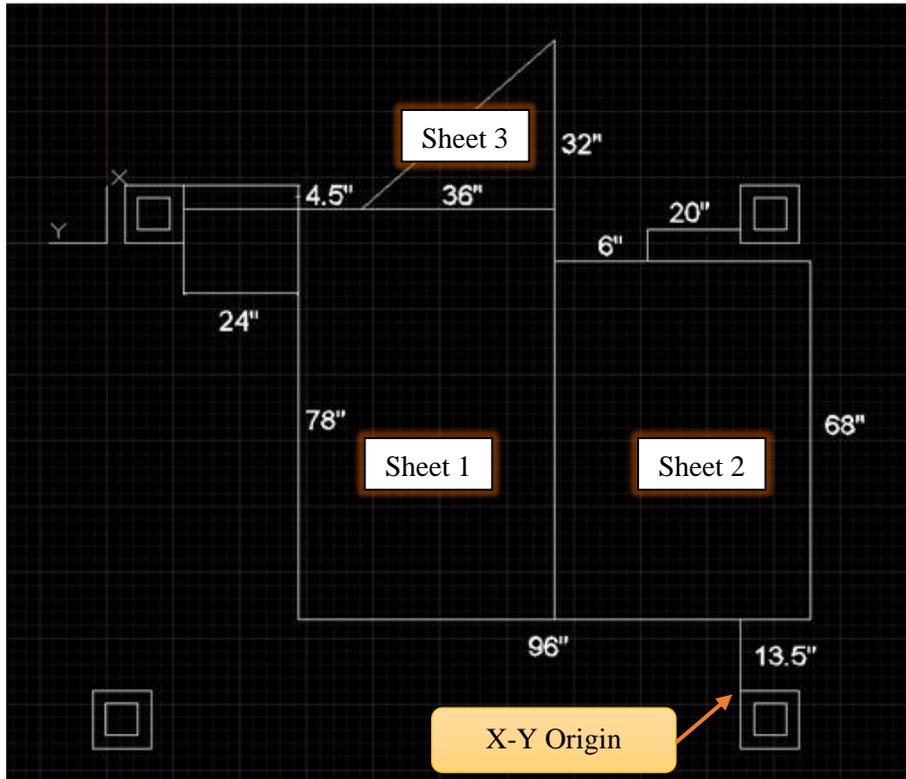
6.1.1.4 Countersink Holes on the 209 platform and lay three sheets of 11 ga stainless steel on the platform floor and bolt the sheets down as shown in Figure 1.

Lead Tech: _____

6.1.1.5 Index and mark the locations of the front-feet movement steps of the gantry fixture onto the stainless sheets as per the coordinates provided in Figure 5. Note that the origin of the X-Y coordinates is located at the top left corner of column 1 as shown in figures 1 and 6.

Lead Tech: _____

Figure 1: Bay F Sheet Layout



6.1.1.6 Bring in the MOB+FOH temporary support table, as shown in figure 2, and leave it off to the side of the floor sheets until the MOB+FOH are lifted.

Lead Tech: _____

Figure 2: Temporary MOB+FOH Table



6.1.2 Preparing the Optics Box (MOB) for lift:

- 6.1.2.1 Remove the handles of the Optics Box (see E-9D11233-3) by removing the #10-32 hex cap screws and #10 washers (again ensuring to bag and label the fasteners removed).

Lead Tech: _____

6.1.3 Preparing the Fiber Bundle (FOH) for lift:

- 6.1.3.1 The fiber bundle must be supported at all stages of lifting to prevent over-flexing and breakage of the internal fibers.
- 6.1.3.2 Inner and Outer radius gauges are provided for technicians to use during all stages of the collection optics box lift to check the bend radius of the fiber bundle during movement stages. See Figure 3 for images of the radius gauges.

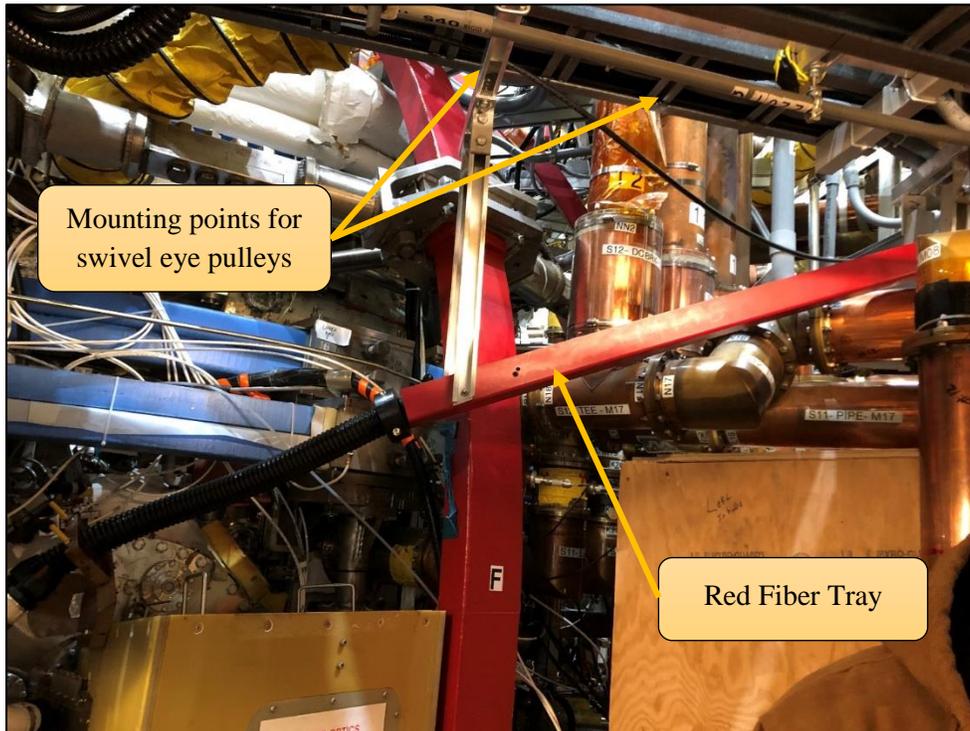
Figure 3: Inner and Outer Radius Gauges (Shown left to right)



- 6.1.3.3 The working bend radius of the fiber bundle is an 18 inch radius or 36 inch diameter bend. The provided radius gauges are capable of measuring radii between 7 and 144 inches.
- 6.1.3.4 The absolute minimum bend radius the fiber bundle can experience is a 16" radius; any movement steps which require bending the bundle tighter than the 18" working radius require the presence of the COG Engineer Justin Bradley and COG Physicist Ben Leblanc.
- 6.1.3.5 Remove the Fiber Bundle red fiber tray shown in Figure 4.

Lead Tech: _____

Figure 4: Fiber Optics Bundle, Red Fiber Tray



6.1.3.6 Remove any temporary structures supporting the fiber bundle and support the fiber bundle as necessary to prevent flexing beyond the allowable working radius of 18 inches.

6.1.3.7 The bundle is to be supported by a minimum of two (2) ropes mounted through swivel eye pulleys temporarily mounted to the overhead Unistrut as shown in Figure 3. If required, technicians may also support the fiber bundle by hand at the direction of the Lead Technician. Additional ropes and swivel eyes may be used as needed.

6.1.4 Bring in Lift Mechanism:

6.1.4.1 Before proceeding any further, all personnel non-essential to this procedure shall vacate the NSTX-U Test Cell. Access to the Test Cell shall be restricted to only personnel essential to the completion of this procedure until the work is complete.

Lead Tech: _____

6.1.4.2 Bring in and prepare Lift Fixture #221 for attachment to the Optics box at the direction of the COG Engineer.

Lead Tech: _____

6.1.4.3 Attach lift fixture #221 to the Optics Box using the lifting hardware per the lift procedure D-L-NSTX-1010 at the direction of the COG engineer.

Lead Tech: _____

6.1.4.4 Perform trial lifts at the direction of the Lead Technician to see how fibers react and how the MOB+FOH react and adjust accordingly. Repeat trial lifts until the load is balanced and ready for movement.

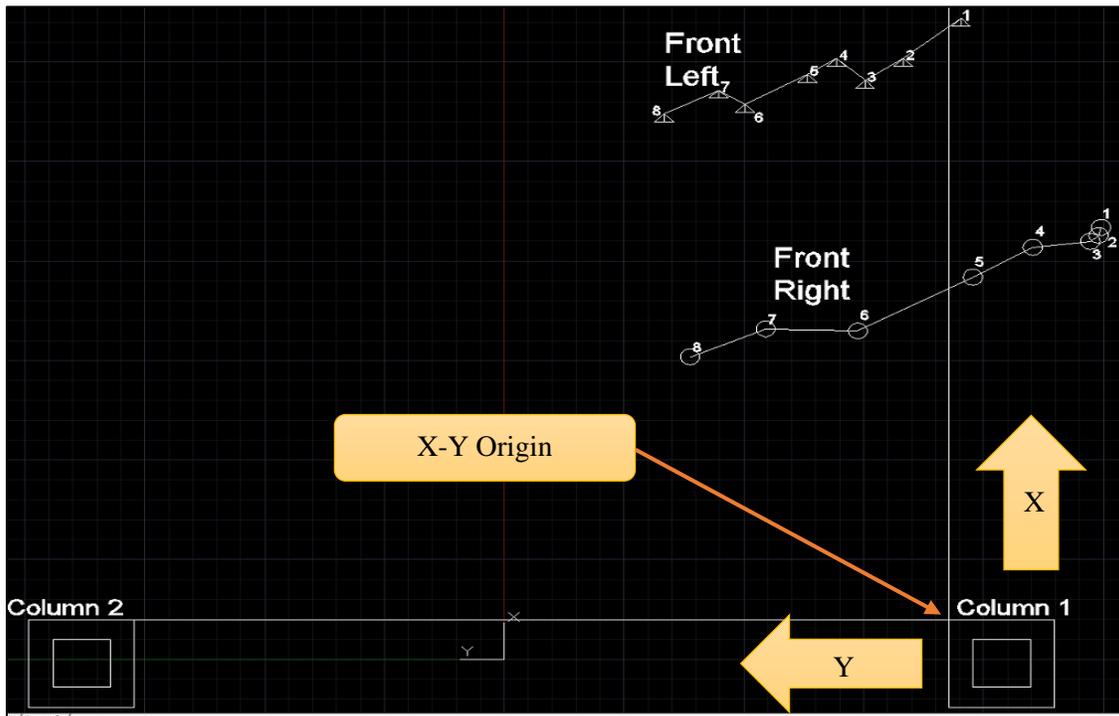
Lead Tech: _____

6.1.5 Lifting and Moving the MOB+FOH:

6.1.5.1 Lift the MOB+FOH in accordance with lift procedure D-L-NSTX-1010.

6.1.5.2 Defer to the following diagram and table shown below in figures 5 and 6 to ensure the Fiber Bundle follows the laid-out fiber path (Points reference column 1).

Figure 5: Lifting Fixture front-caster steps



6.1.5.3 Each step in the movement of the lift fixture and MOB+FOH shall be done with extreme care and without time constraints.

6.1.5.1 During Movement of the FOB+MOH a minimum of two (2) technicians shall support the fiber bundle using the ropes swung through the overhead swivel eye pulleys, with a third technician assigned to check its curvature and provide lifting feedback to the other technicians during the movement steps.

Figure 6: Lifting Fixture front-feet step coordinates on floor sheets

	Front Left		Front Right	
	x	y	x	y
1	75.5	-1.25	49.25	-15.88
2	70.5	4.75	48.25	-15.62
3	67.75	8.75	47.5	-14.75
4	70.5	11.75	46.75	-8.75
5	68.5	14.75	43	-2.5
6	64.75	21.25	36.25	9.5
7	66.5	24	36.5	18
8	63.5	29.75	33	27

6.1.5.2 At the end of each movement step, the supporting ropes for the fiber bundle are to be tied off to a permanent structure in the test cell until ready for the next movement step to prevent loss of support and potential damage to the fiber bundle.

6.1.5.3 Upon completion of all movement steps; Move the temporary table into place to support the MOB+FOH.

Lead Tech: _____

6.1.5.4 Lower the MOB+FOH onto the temporary table and level the optics box on the table using small machinist screw jacks with soft feet to prevent scratching the MOB.

6.1.5.5 Disconnect the MOB+FOH from the lift fixture once the MOB is leveled on the support table.

Lead Tech: _____

6.1.5.6 Secure MOB on the temporary table as per Benoit LeBlanc's instructions.

Lead Tech: _____

6.1.5.7 Make 1 final check of the curvature of the fiber bundle then secure the supporting ropes using a non-slipping knot such as a buntline hitch. Ensure the knot is pulled snug to prevent slipping. Additional rope lines may be attached to the Fiber bundle as needed at the direction of the field supervisor.

6.1.5.8 Caution Tape off the area surrounding the support table and fiber optics bundle and apply signage as follows "CAUTION: FRAGILE OPTICS, DO NOT TOUCH".

Lead Tech: _____

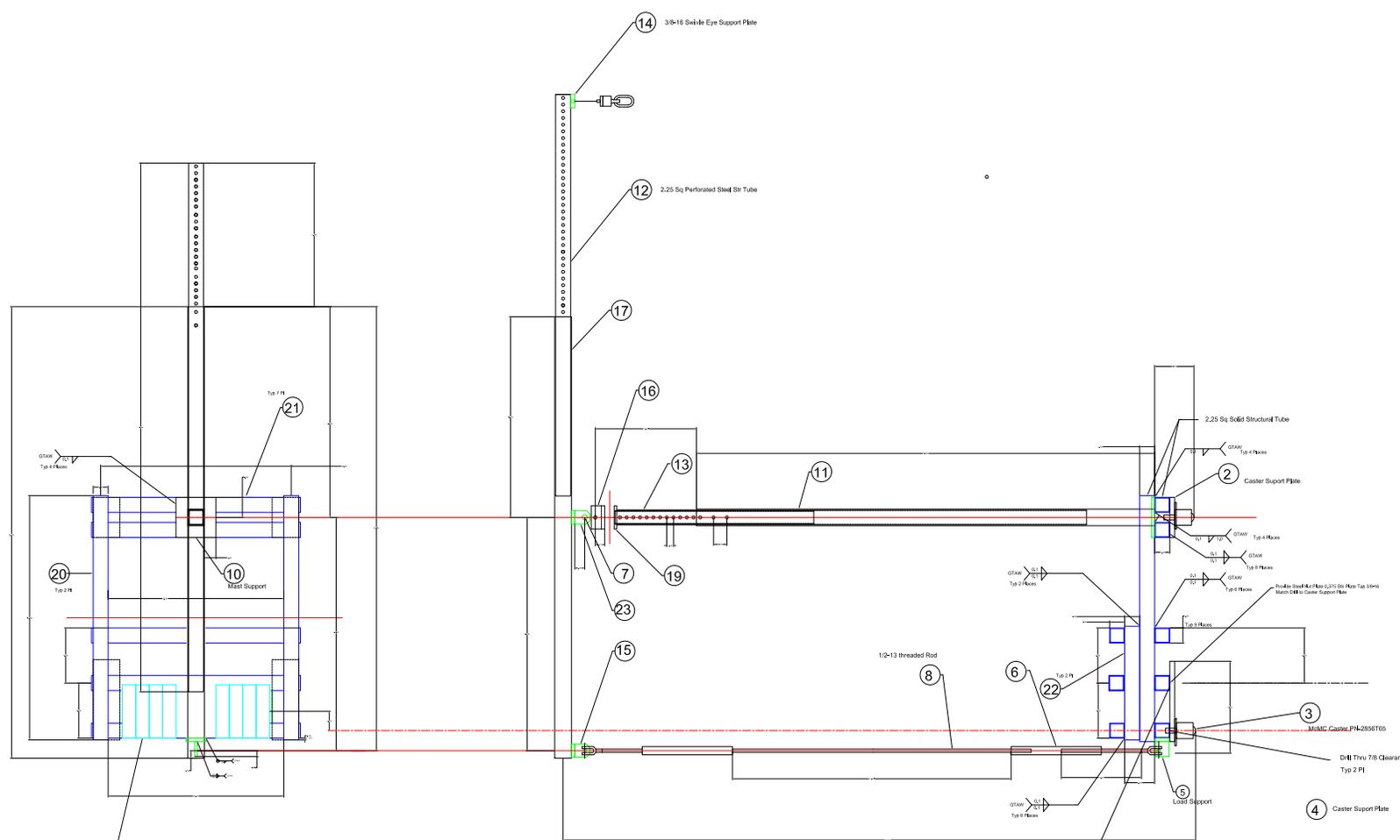
7.0 Final Conditions:

7.1 The Optics Box and Fiber Bundle have been moved off its support and placed on the temporary table.

7.2 The temporary table and Optics Box have been secured to prevent damage.

7.3 All equipment and tools have been removed from the NSTX Test-Cell and properly stored.

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**RELEASED FOR
FABRICATION / INSTALLATION**
PPPL Drafting

Weld Note: Welding and Brazing shall be performed in accordance with the requirements of PPPL procedure ENG-037 and AWS D1.1. Visual weld inspection shall be performed in accordance with the acceptance criteria of AWS D1.1.

APPROVED WELD ENGINEER
MARTH DENALTA

NO.	REV.	DESCRIPTION	DATE	BY	CHECKED	MATERIAL
1	23	BOOM FRONT				E 10 11026 SHC STEEL
2	22	CHANGE VERTICAL SPACETELEPAR SOLID SQ STRUCT TUBE 2.25				E 10 11026 SH STEEL
3	21	CHANGE CROSS MEMBER/TELEPAR SOLID SQ STRUCT TUBE 2.25				E 10 11026 SH STEEL
4	20	CHANGE LONGITUDINAL MEMBER/TELEPAR SOLID SQ STRUCT TUBE 2.25				E 10 11026 SH STEEL
5	19	FRONT TRANSITION TO MAST CONNECTION				E 10 11026 SHC STEEL
6	17	BOOM/TELEPAR SOLID SQ STRUCT TUBE 2.25				E 10 11026 SHC STEEL
7	16	FRONT BOOM TO MAST TRANSITION BRACKET				E 10 11026 SH 4 STEEL
8	15	TURNBuckle LOAD BRACKET				E 10 11026 SH 4 STEEL
9	14	SWIVEL EYE SUPPORT PLATE				E 10 11026 SH 4 STEEL
10	13	MAST EXTENDING/TELEPAR PERFORATED SQ STRUCT TUBE 2.25				E 10 11026 SH 3 STEEL
11	12	BOOM EXTENDING/TELEPAR PERFORATED SQ STRUCT TUBE 2.25				E 10 11026 SHC STEEL
12	11	MAST COLUMN/TELEPAR SOLID SQ STRUCT TUBE 2.25				E 10 11026 SHC STEEL
13	10	MAST SUPPORT PLATE 5/8x 2.25x 1.5/8x 1/4				COMMERCIAL STEEL
14	9	COUNTERWEIGHT BRKZ				COMMERCIAL COATED LEAD
15	8	THREADED ROD 1/2-13				COMMERCIAL BRASS
16	7	FRONT SLEEVE BRKZ/MSK 1/8x1/8x1/8				COMMERCIAL BRASS
17	6	TURNBuckle 1.0x4				COMMERCIAL 316 SS
18	5	TURNBuckle LOWER LOAD BRACKET				E 10 11026 SH 4 STEEL
19	4	REAR CASTER SUPPORT PLATE 3/4 PLATE				E 10 11026 SH 4 STEEL
20	3	BALL CASTER 2500 LB CAPACITY				COMMERCIAL
21	2	FORWARD CASTER SUPPORT PLATE 3/4 PLATE				E 10 11026 SH 4 316/17/18
22	1	5/16-18 SWIVEL EYE				COMMERCIAL STEEL
23	1	MPTS OPTICS BOX LIFT DEVICE				THIS DRAWING

NO.	REV.	DESCRIPTION	DATE	BY	CHECKED	MATERIAL
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COMPUTER GENERATED DRAWING						
MANUAL CHANGES NOT PERMITTED UNLESS OTHERWISE SPECIFIED						
AutoCAD2000 DIMENSIONS ARE IN INCHES MACHINE SURFACES UNLESS OTHERWISE SPECIFIED						
DO NOT VERIFY DIMENSIONS BY MEASURING DRAWING						
SCALE: TOLERANCES NON-CUMULATIVE						
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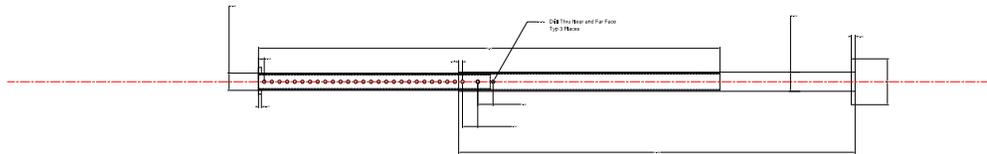
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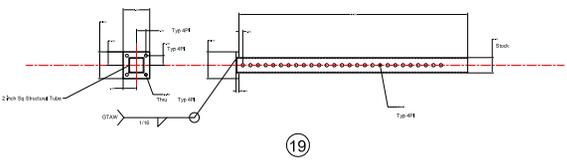
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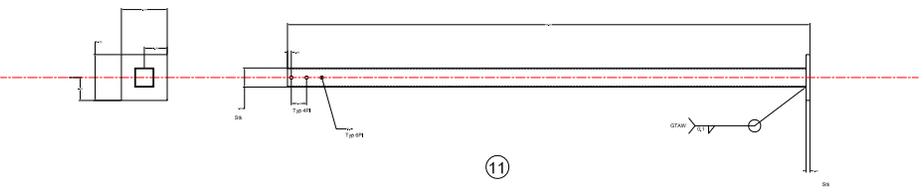
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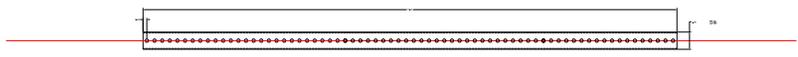


19



11

2.5 Sq Solid Steel Str Tube
0.105 Wall



13

2.25 Sq Perforated Steel Str Tube

RELEASED FOR
 FABRICATION/INSTALLATION
 PPPL Drafting

Weld Note: Welding and Brazing shall be performed in accordance with the requirements of PPPL procedure ENG-037 and AWS D1.1. Visual weld inspection shall be performed in accordance with the acceptance criteria of AWS D1.1.

APPROVED WELD ENGINEER
 WATN DOWLAT

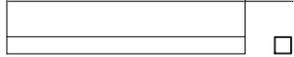
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2	11		MAST COLUMN/TELESTAR BOLT/SQ STRUCT TUBE 2.50	T40 DRAWING	STEEL
1			MPTS OPTICS BOX LIFT DEVICE		

03	02	01	PART NO.	NOMENCLATURE OR DESCRIPTION	DRAWING NO.	MATERIAL
COMPUTER GENERATED DRAWING			CENTRAL FILES	PRINCETON PLASMA PHYSICS LABORATORY		
MANUAL CHANGES NOT PERMITTED			UNLESS OTHERWISE SPECIFIED	PRINCETON UNIVERSITY		
AutoCAD2000			DIMENSIONS ARE IN INCHES	NATIONAL SPHERICAL TORUS EXPERIMENT		
DO NOT VERIFY DIMENSIONS BY SCALING DRAWING			MACHINE SURFACES .15	MPTS OPTICS BOX		
			BREAK SHARP EDGES .005/.020	LIFT DEVICE MAST DETAILS		
SCALE:			TOLERANCES NON-CUMULATIVE	DN: FOM	DATE: 21 JUN 11	CADD FILE: D9D110263.DWG
NEXT ASSEMBLY:			DECIMAL-INCH FRACTIONS	ENG: G LABK	APPROVED:	
			1/8 .000 1/4 .015 3/8 .030 1/2 .060 5/8 .090 3/4 .120 7/8 .150 1 .180 1 1/4 .225 1 1/2 .270 1 3/4 .315 2 .360 2 1/4 .405 2 1/2 .450 2 3/4 .495 3 .540 3 1/4 .585 3 1/2 .630 3 3/4 .675 4 .720 4 1/4 .765 4 1/2 .810 4 3/4 .855 5 .900 5 1/4 .945 5 1/2 .990 6 .000 6 1/4 .005 6 1/2 .010 6 3/4 .015 7 .020 7 1/4 .025 7 1/2 .030 7 3/4 .035 8 .040 8 1/4 .045 8 1/2 .050 8 3/4 .055 9 .060 9 1/4 .065 9 1/2 .070 9 3/4 .075 10 .080 10 1/4 .085 10 1/2 .090 10 3/4 .095 11 .100 11 1/4 .105 11 1/2 .110 11 3/4 .115 12 .120 12 1/4 .125 12 1/2 .130 12 3/4 .135 13 .140 13 1/4 .145 13 1/2 .150 13 3/4 .155 14 .160 14 1/4 .165 14 1/2 .170 14 3/4 .175 15 .180 15 1/4 .185 15 1/2 .190 15 3/4 .195 16 .200 16 1/4 .205 16 1/2 .210 16 3/4 .215 17 .220 17 1/4 .225 17 1/2 .230 17 3/4 .235 18 .240 18 1/4 .245 18 1/2 .250 18 3/4 .255 19 .260 19 1/4 .265 19 1/2 .270 19 3/4 .275 20 .280 20 1/4 .285 20 1/2 .290 20 3/4 .295 21 .300 21 1/4 .305 21 1/2 .310 21 3/4 .315 22 .320 22 1/4 .325 22 1/2 .330 22 3/4 .335 23 .340 23 1/4 .345 23 1/2 .350 23 3/4 .355 24 .360 24 1/4 .365 24 1/2 .370 24 3/4 .375 25 .380 25 1/4 .385 25 1/2 .390 25 3/4 .395 26 .400 26 1/4 .405 26 1/2 .410 26 3/4 .415 27 .420 27 1/4 .425 27 1/2 .430 27 3/4 .435 28 .440 28 1/4 .445 28 1/2 .450 28 3/4 .455 29 .460 29 1/4 .465 29 1/2 .470 29 3/4 .475 30 .480 30 1/4 .485 30 1/2 .490 30 3/4 .495 31 .500 31 1/4 .505 31 1/2 .510 31 3/4 .515 32 .520 32 1/4 .525 32 1/2 .530 32 3/4 .535 33 .540 33 1/4 .545 33 1/2 .550 33 3/4 .555 34 .560 34 1/4 .565 34 1/2 .570 34 3/4 .575 35 .580 35 1/4 .585 35 1/2 .590 35 3/4 .595 36 .600 36 1/4 .605 36 1/2 .610 36 3/4 .615 37 .620 37 1/4 .625 37 1/2 .630 37 3/4 .635 38 .640 38 1/4 .645 38 1/2 .650 38 3/4 .655 39 .660 39 1/4 .665 39 1/2 .670 39 3/4 .675 40 .680 40 1/4 .685 40 1/2 .690 40 3/4 .695 41 .700 41 1/4 .705 41 1/2 .710 41 3/4 .715 42 .720 42 1/4 .725 42 1/2 .730 42 3/4 .735 43 .740 43 1/4 .745 43 1/2 .750 43 3/4 .755 44 .760 44 1/4 .765 44 1/2 .770 44 3/4 .775 45 .780 45 1/4 .785 45 1/2 .790 45 3/4 .795 46 .800 46 1/4 .805 46 1/2 .810 46 3/4 .815 47 .820 47 1/4 .825 47 1/2 .830 47 3/4 .835 48 .840 48 1/4 .845 48 1/2 .850 48 3/4 .855 49 .860 49 1/4 .865 49 1/2 .870 49 3/4 .875 50 .880 50 1/4 .885 50 1/2 .890 50 3/4 .895 51 .900 51 1/4 .905 51 1/2 .910 51 3/4 .915 52 .920 52 1/4 .925 52 1/2 .930 52 3/4 .935 53 .940 53 1/4 .945 53 1/2 .950 53 3/4 .955 54 .960 54 1/4 .965 54 1/2 .970 54 3/4 .975 55 .980 55 1/4 .985 55 1/2 .990 55 3/4 .995 56 .000 56 1/4 .005 56 1/2 .010 56 3/4 .015 57 .020 57 1/4 .025 57 1/2 .030 57 3/4 .035 58 .040 58 1/4 .045 58 1/2 .050 58 3/4 .055 59 .060 59 1/4 .065 59 1/2 .070 59 3/4 .075 60 .080 60 1/4 .085 60 1/2 .090 60 3/4 .095 61 .100 61 1/4 .105 61 1/2 .110 61 3/4 .115 62 .120 62 1/4 .125 62 1/2 .130 62 3/4 .135 63 .140 63 1/4 .145 63 1/2 .150 63 3/4 .155 64 .160 64 1/4 .165 64 1/2 .170 64 3/4 .175 65 .180 65 1/4 .185 65 1/2 .190 65 3/4 .195 66 .200 66 1/4 .205 66 1/2 .210 66 3/4 .215 67 .220 67 1/4 .225 67 1/2 .230 67 3/4 .235 68 .240 68 1/4 .245 68 1/2 .250 68 3/4 .255 69 .260 69 1/4 .265 69 1/2 .270 69 3/4 .275 70 .280 70 1/4 .285 70 1/2 .290 70 3/4 .295 71 .300 71 1/4 .305 71 1/2 .310 71 3/4 .315 72 .320 72 1/4 .325 72 1/2 .330 72 3/4 .335 73 .340 73 1/4 .345 73 1/2 .350 73 3/4 .355 74 .360 74 1/4 .365 74 1/2 .370 74 3/4 .375 75 .380 75 1/4 .385 75 1/2 .390 75 3/4 .395 76 .400 76 1/4 .405 76 1/2 .410 76 3/4 .415 77 .420 77 1/4 .425 77 1/2 .430 77 3/4 .435 78 .440 78 1/4 .445 78 1/2 .450 78 3/4 .455 79 .460 79 1/4 .465 79 1/2 .470 79 3/4 .475 80 .480 80 1/4 .485 80 1/2 .490 80 3/4 .495 81 .500 81 1/4 .505 81 1/2 .510 81 3/4 .515 82 .520 82 1/4 .525 82 1/2 .530 82 3/4 .535 83 .540 83 1/4 .545 83 1/2 .550 83 3/4 .555 84 .560 84 1/4 .565 84 1/2 .570 84 3/4 .575 85 .580 85 1/4 .585 85 1/2 .590 85 3/4 .595 86 .600 86 1/4 .605 86 1/2 .610 86 3/4 .615 87 .620 87 1/4 .625 87 1/2 .630 87 3/4 .635 88 .640 88 1/4 .645 88 1/2 .650 88 3/4 .655 89 .660 89 1/4 .665 89 1/2 .670 89 3/4 .675 90 .680 90 1/4 .685 90 1/2 .690 90 3/4 .695 91 .700 91 1/4 .705 91 1/2 .710 91 3/4 .715 92 .720 92 1/4 .725 92 1/2 .730 92 3/4 .735 93 .740 93 1/4 .745 93 1/2 .750 93 3/4 .755 94 .760 94 1/4 .765 94 1/2 .770 94 3/4 .775 95 .780 95 1/4 .785 95 1/2 .790 95 3/4 .795 96 .800 96 1/4 .805 96 1/2 .810 96 3/4 .815 97 .820 97 1/4 .825 97 1/2 .830 97 3/4 .835 98 .840 98 1/4 .845 98 1/2 .850 98 3/4 .855 99 .860 99 1/4 .865 99 1/2 .870 99 3/4 .875 100 .880 100 1/4 .885 100 1/2 .890 100 3/4 .895 101 .900 101 1/4 .905 101 1/2 .910 101 3/4 .915 102 .920 102 1/4 .925 102 1/2 .930 102 3/4 .935 103 .940 103 1/4 .945 103 1/2 .950 103 3/4 .955 104 .960 104 1/4 .965 104 1/2 .970 104 3/4 .975 105 .980 105 1/4 .985 105 1/2 .990 105 3/4 .995 106 .000 106 1/4 .005 106 1/2 .010 106 3/4 .015 107 .020 107 1/4 .025 107 1/2 .030 107 3/4 .035 108 .040 108 1/4 .045 108 1/2 .050 108 3/4 .055 109 .060 109 1/4 .065 109 1/2 .070 109 3/4 .075 110 .080 110 1/4 .085 110 1/2 .090 110 3/4 .095 111 .100 111 1/4 .105 111 1/2 .110 111 3/4 .115 112 .120 112 1/4 .125 112 1/2 .130 112 3/4 .135 113 .140 113 1/4 .145 113 1/2 .150 113 3/4 .155 114 .160 114 1/4 .165 114 1/2 .170 114 3/4 .175 115 .180 115 1/4 .185 115 1/2 .190 115 3/4 .195 116 .200 116 1/4 .205 116 1/2 .210 116 3/4 .215 117 .220 117 1/4 .225 117 1/2 .230 117 3/4 .235 118 .240 118 1/4 .245 118 1/2 .250 118 3/4 .255 119 .260 119 1/4 .265 119 1/2 .270 119 3/4 .275 120 .280 120 1/4 .285 120 1/2 .290 120 3/4 .295 121 .300 121 1/4 .305 121 1/2 .310 121 3/4 .315 122 .320 122 1/4 .325 122 1/2 .330 122 3/4 .335 123 .340 123 1/4 .345 123 1/2 .350 123 3/4 .355 124 .360 124 1/4 .365 124 1/2 .370 124 3/4 .375 125 .380 125 1/4 .385 125 1/2 .390 125 3/4 .395 126 .400 126 1/4 .405 126 1/2 .410 126 3/4 .415 127 .420 127 1/4 .425 127 1/2 .430 127 3/4 .435 128 .440 128 1/4 .445 128 1/2 .450 128 3/4 .455 129 .460 129 1/4 .465 129 1/2 .470 129 3/4 .475 130 .480 130 1/4 .485 130 1/2 .490 130 3/4 .495 131 .500 131 1/4 .505 131 1/2 .510 131 3/4 .515 132 .520 132 1/4 .525 132 1/2 .530 132 3/4 .535 133 .540 133 1/4 .545 133 1/2 .550 133 3/4 .555 134 .560 134 1/4 .565 134 1/2 .570 134 3/4 .575 135 .580 135 1/4 .585 135 1/2 .590 135 3/4 .595 136 .600 136 1/4 .605 136 1/2 .610 136 3/4 .615 137 .620 137 1/4 .625 137 1/2 .630 137 3/4 .635 138 .640 138 1/4 .645 138 1/2 .650 138 3/4 .655 139 .660 139 1/4 .665 139 1/2 .670 139 3/4 .675 140 .680 140 1/4 .685 140 1/2 .690 140 3/4 .695 141 .700 141 1/4 .705 141 1/2 .710 141 3/4 .715 142 .720 142 1/4 .725 142 1/2 .730 142 3/4 .735 143 .740 143 1/4 .745 143 1/2 .750 143 3/4 .755 144 .760 144 1/4 .765 144 1/2 .770 144 3/4 .775 145 .780 145 1/4 .785 145 1/2 .790 145 3/4 .795 146 .800 146 1/4 .805 146 1/2 .810 146 3/4 .815 147 .820 147 1/4 .825 147 1/2 .830 147 3/4 .835 148 .840 148 1/4 .845 148 1/2 .850 148 3/4 .855 149 .860 149 1/4 .865 149 1/2 .870 149 3/4 .875 150 .880 150 1/4 .885 150 1/2 .890 150 3/4 .895 151 .900 151 1/4 .905 151 1/2 .910 151 3/4 .915 152 .920 152 1/4 .925 152 1/2 .930 152 3/4 .935 153 .940 153 1/4 .945 153 1/2 .950 153 3/4 .955 154 .960 154 1/4 .965 154 1/2 .970 154 3/4 .975 155 .980 155 1/4 .985 155 1/2 .990 155 3/4 .995 156 .000 156 1/4 .005 156 1/2 .010 156 3/4 .015 157 .020 157 1/4 .025 157 1/2 .030 157 3/4 .035 158 .040 158 1/4 .045 158 1/2 .050 158 3/4 .055 159 .060 159 1/4 .065 159 1/2 .070 159 3/4 .075 160 .080 160 1/4 .085 160 1/2 .090 160 3/4 .095 161 .100 161 1/4 .105 161 1/2 .110 161 3/4 .115 162 .120 162 1/4 .125 162 1/2 .130 162 3/4 .135 163 .140 163 1/4 .145 163 1/2 .150 163 3/4 .155 164 .160 164 1/4 .165 164 1/2 .170 164 3/4 .175 165 .180 165 1/4 .185 165 1/2 .190 165 3/4 .195 166 .200 166 1/4 .205 166 1/2 .210 166 3/4 .215 167 .220 167 1/4 .225 167 1/2 .230 167 3/4 .235 168 .240 168 1/4 .245 168 1/2 .250 168 3/4 .255 169 .260 169 1/4 .265 169 1/2 .270 169 3/4 .275 170 .280 170 1/4 .285 170 1/2 .290 170 3/4 .295 171 .300 171 1/4 .305 171 1/2 .310 171 3/4 .315 172 .320 172 1/4 .325 172 1/2 .330 172 3/4 .335 173 .340 173 1/4 .345 173 1/2 .350 173 3/4 .355 174 .360 174 1/4 .365 174 1/2 .370 174 3/4 .375 175 .380 175 1/4 .385 175 1/2 .390 175 3/4 .395 176 .400 176 1/4 .405 176 1/2 .410 176 3/4 .415 177 .420 177 1/4 .425 177 1/2 .430 177 3/4 .435 178 .440 178 1/4 .445 178 1/2 .450 178 3/4 .455 179 .460 179 1/4 .465 179 1/2 .470 179 3/4 .475 180 .480 180 1/4 .485 180 1/2 .490 180 3/4 .495 181 .500 181 1/4 .505 181 1/2 .510 181 3/4 .515 182 .520 182 1/4 .525 182 1/2 .530 182 3/4 .535 183 .540 183 1/4 .545 183 1/2 .550 183 3/4 .555 184 .560 184 1/4 .565 184 1/2 .570 184 3/4 .575 185 .580 185 1/4 .585 185 1/2 .590 185 3/4 .595 186 .600 186 1/4 .605 186 1/2 .610 186 3/4 .615 187 .620 187 1/4 .625 187 1/2 .630 187 3/4 .635 188 .640 188 1/4 .645 188 1/2 .650 188 3/4 .655 189 .660 189 1/4 .665 189 1/2 .670 189 3/4 .675 190 .680 190 1/4 .685 190 1/2 .690 190 3/4 .695 191 .700 191 1/4 .705 191 1/2 .710 191 3/4 .715 192 .720 192 1/4 .725 192 1/2 .730 192 3/4 .735 193 .740 193 1/4 .745 193 1/2 .750 193 3/4 .755 194 .760 194 1/4 .765 194 1/2 .770 194 3/4 .775 195 .780 195 1/4 .785 195 1/2 .790 195 3/4 .795 196 .800 196 1/4 .805 196 1/2 .810 196 3/4 .815 197 .820 197 1/4 .825 197 1/2 .830 197 3/4 .835 198 .840 198 1/4 .845 198 1/2 .850 198 3/4 .855 199 .860 199 1/4 .865 199 1/2 .870 199 3/4 .875 200 .880 200 1/4 .885 200 1/2 .890 200 3/4 .895 201 .900 201 1/4 .905 201 1/2 .910 201 3/4 .915 202 .920 202 1/4 .925 202 1/2 .930 202 3/4 .935 203 .940 203 1/4 .945 203 1/2 .950 203 3/4 .955 204 .960 204 1/4 .965 204 1/2 .970 204 3/4 .975 205 .980 205 1/4 .985 205 1/2 .990 205 3/4 .995 206 .000 206 1/4 .005 206 1/2 .010 206 3/4 .015 207 .020 207 1/4 .025 207 1/2 .030 207 3/4 .035 208 .040 208 1/4 .045 208 1/2 .050 208 3/4 .055 209 .060 209 1/4 .065 209 1/2 .070 209 3/4 .075 210 .080 210 1/4 .085 210 1/2 .090 210 3/4 .095 211 .100 211 1/4 .105 211 1/2 .110 211 3/4 .115 212 .120 212 1/4 .125 212 1/2 .130 212 3/4 .135 213 .140 213 1/4 .145 213 1/2 .150 213 3/4 .155 214 .160 214 1/4 .165 214 1/2 .170 214 3/4 .175 215 .180 215 1/4 .185 215 1/2 .190 215 3/4 .195 216 .200 216 1/4 .205 216 1/2 .210 216 3/4 .215 217 .220 217 1/4 .225 217 1/2 .230 217 3/4 .235 218 .240 218 1/4 .245 218 1/2 .250 218 3/4 .255 219 .260 219 1/4 .265 219 1/2 .270 219 3/4 .275 220 .280 220 1/4 .285 220 1/2 .290 220 3/4 .295 221 .300 221 1/4 .305 221 1/2 .310 221 3/4 .315 222 .320 222 1/4 .325 222 1/2 .330 222 3/4 .335 223 .340 223 1/4 .345 223 1/2 .350 223 3/4 .355 224 .360 224 1/4 .365 224 1/2 .370 224 3/4 .375 225 .380 225 1/4 .385 225 1/2 .390 225 3/4 .395 226 .400 226 1/4 .405 226 1/2 .410 226 3/4 .415 227 .420 227 1/4 .425 227 1/2 .430 227 3/4 .435 228 .440 228 1/4 .445 228 1/2 .450 228 3/4 .455 229 .460 229 1/4 .465 229 1/2 .470 229 3/4 .475 230 .480 230 1/4 .485 230 1/2 .490 230 3/4 .495 231 .500 231 1/4 .505 231 1/2 .510 231 3/4 .515 232 .520 232 1/4 .525 232 1/2 .530 232 3/4 .535 233 .540 233 1/4 .545 233 1/2 .550 233 3/4 .555 234 .560 234 1/4 .565 234 1/2 .570 234 3/4 .575 235 .580 235 1/4 .585 235 1/2 .590 235 3/4 .595 236 .600 236 1/4 .605 236 1/2 .610 236 3/4 .615 237 .620 237 1/4 .625 237 1/2 .630 237 3/4 .635 238 .640 238 1/4 .645 238 1/2 .650 238 3/4 .655 239 .660 239 1/4 .665 239 1/2 .670 239 3/4 .675 240 .680 240 1/4 .685 240 1/2 .690 240 3/4 .695 241 .700 241 1/4 .705 241 1/2 .710 241 3/4 .715 242 .720 242 1/4 .725 242 1/2 .730 242 3/4 .735 243 .740 243 1/4 .745 243 1/2 .750 243			



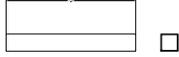
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0.105 Wall

20



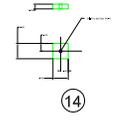
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21

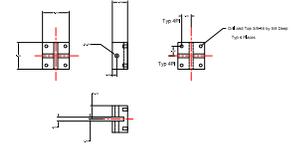


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0.105 Wall

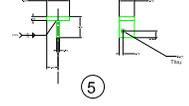
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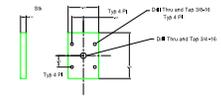
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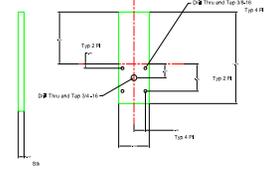
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5



2



4

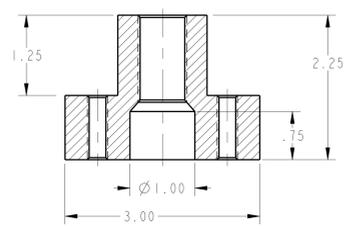
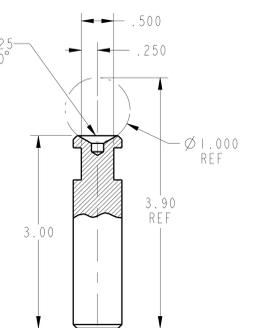
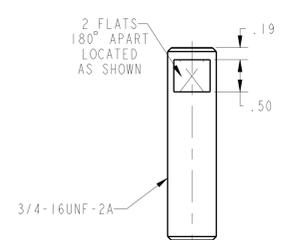
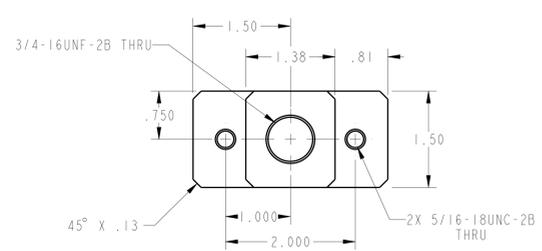
RELEASED FOR FABRICATION / INSTALLATION
PPPL Drawing

Weld Note: Welding and Brazing shall be performed in accordance with the requirements of PPPL procedure ENG-037 and AWS D1.1. Visual weld inspection shall be performed in accordance with the acceptance criteria of AWS D1.1.

APPROVED WELD ENGINEER
MARTIN DENHART

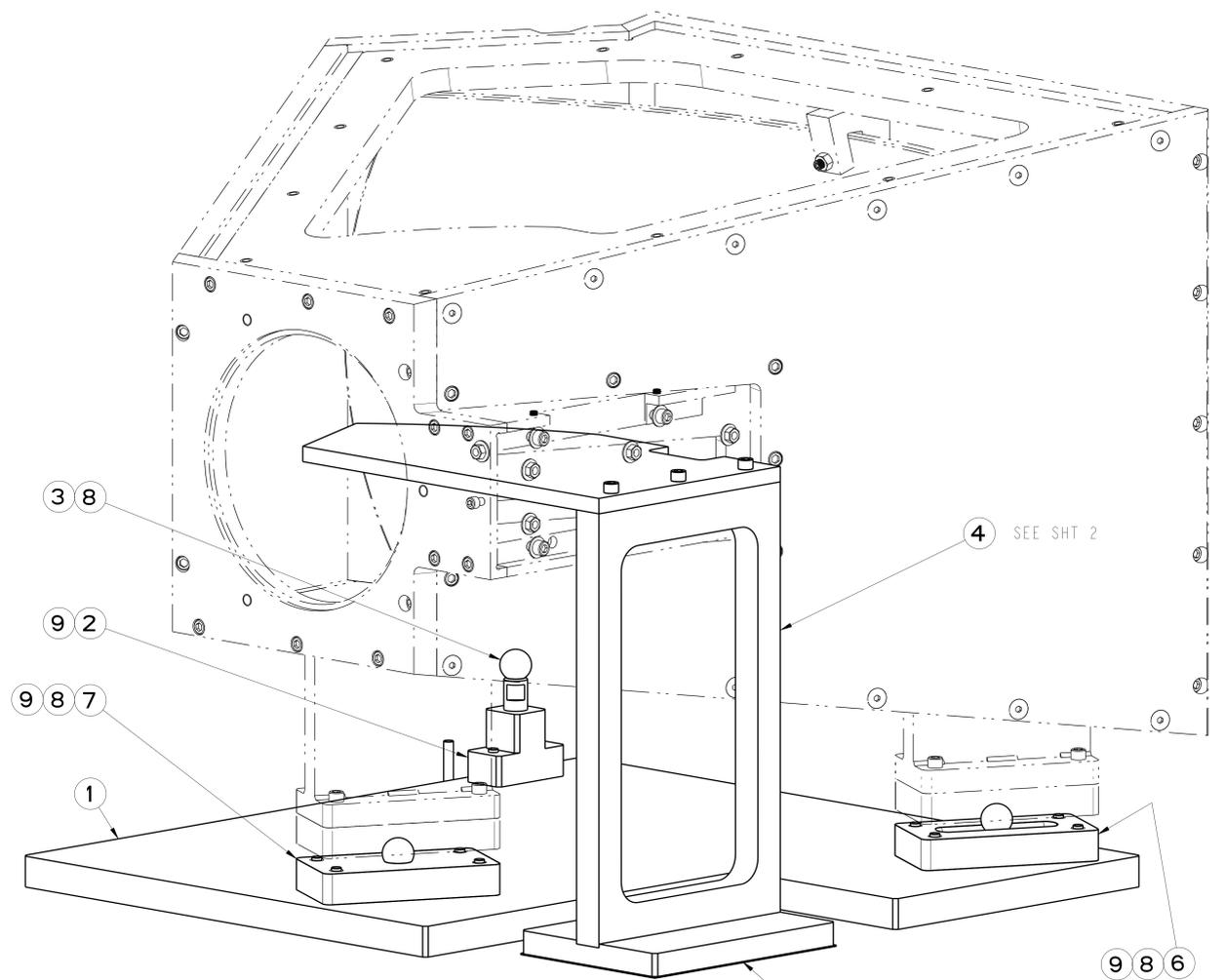
QTY	PART NO.	NOMENCLATURE OR DESCRIPTION	DRAWING NO.	MATERIAL
2	20	CHASSIS VERTICAL SPACER/LEAF SPRING SUPPORT TUBE 2.25	THIS DRAWING	STEEL
8	21	CHASSIS CROSS MEMBER/LEAF SPRING SUPPORT TUBE 2.25	THIS DRAWING	STEEL
2	22	CHASSIS LONGITUDINAL MEMBER/LEAF SPRING SUPPORT TUBE 2.25	THIS DRAWING	STEEL
1	16	FRONT BUSH TO MOUNT TRANSDUCER BRACKET	THIS DRAWING	STEEL
1	14	SHIMMEL PIVOT SUPPORT PLATE	THIS DRAWING	STEEL
1	5	TURBUCHULE LOWER LOAD BRACKET	THIS DRAWING	STEEL
2	4	REAR GASTER SUPPORT PLATE 3/4 PLATE	THIS DRAWING	STEEL
2	2	FORWARD GASTER SUPPORT PLATE 3/4 PLATE	THIS DRAWING	STEEL
1		MPTS OPTICS BOX LIFT DEVICE		

03	02	01	PART NO.	NOMENCLATURE OR DESCRIPTION	DRAWING NO.	MATERIAL
COMPUTER GENERATED DRAWING						
CENTRAL FILES						
PRINCETON PLASMA PHYSICS LABORATORY						
PRINCETON UNIVERSITY						
NATIONAL SPHERICAL TORUS EXPERIMENT						
MPTS OPTICS BOX						
LIFT DEVICE DETAILS						
DO NOT VERIFY DIMENSIONS BY SCALING DRAWING						
DIMENSIONS ARE IN INCHES UNLESS OTHERWISE SPECIFIED						
MACHINE SURFACES: 15						
BROOK SHARP EDGES: 0.005/0.002						
SCALE: TOLERANCES: NON-CUMULATIVE						
NEXT ASSEMBLY		DECIMAL-INCH FRACTIONS	ENG: G LABIK	APPROVED:	DATE: 21 JAN 11	CADD FILE: D9D110264.DWG
3	100	0-12" 1/16"	ENG: G LABIK			
25	100	12-18" 1/16"	DNW: G LABIK			
200	100	18-36" 1/4"	CHK: G NESTOR			
1000	100	36-108" 1/2"	DR: JLM			
				CHK: G LABIK	DATE: 21 JAN 11	SHEET 4 OF 4
				DR: JLM	DATE: 21 JAN 11	REV 0
				DATE: 21 JAN 11	DATE: 21 JAN 11	DATE: 21 JAN 11

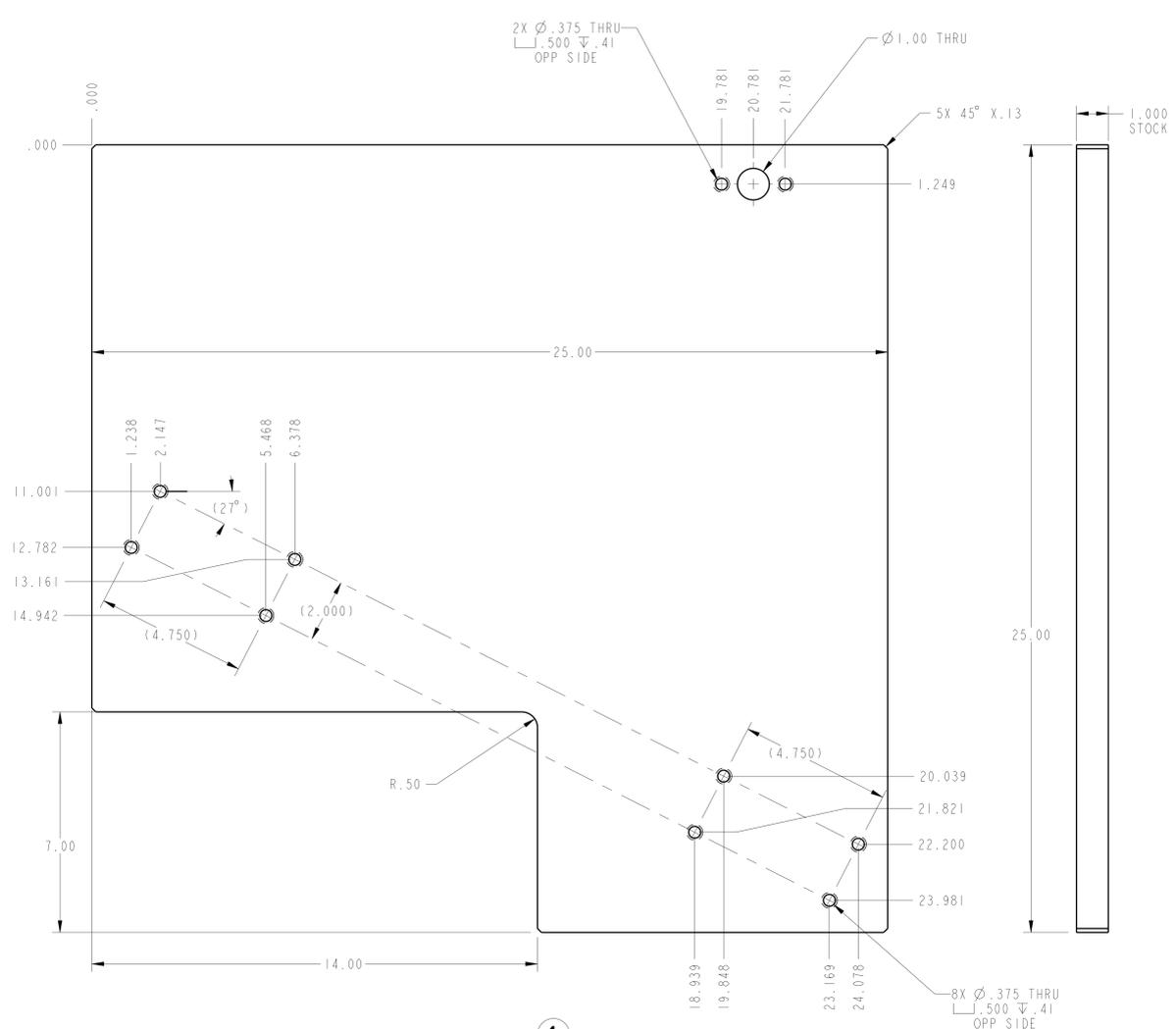


②
SCALE = 1.000

③
SCALE = 1.000



SCALE 0.500



①
SCALE = 0.500

NOTES:
1. UNLESS OTHERWISE SPECIFIED 2 PLACE DECIMAL DIMENSIONS TO BE ±.01.

ITEM NO.	DRAWING NO	NOMENCLATURE OR DESCRIPTION	MATERIAL	QTY RECD
9	NS150792	5/16-18 UNC x 1 3/4 LG HEX SOC HD CAP SCREW	STN STL	10
8	9641K82	BALL, 1in DIA (McMASTER-CARR)	316 SS	3
7	E-9D11228-2	MPTS KENTIC MOUNT 2 (EXISTING)	304 SS	1
6	E-9D11228-1	MPTS KENTIC MOUNT 1 (EXISTING)	304 SS	1
5	E-9D11228-7	SHIM STOCK (THICKNESS AND QTY AS REQUIRED)	SS or PLASTIC	1
4	E-9D11228-01	TEST ARRAY FIXTURE MTG ASSY	SEE SHT 2	1
3	E-9D11228-3	JACK SCREW	304/316 SS	1
2	E-9D11228-2	MPTS MIRROR BOX ADJUSTING BLOCK	304 SS	1
1	E-9D11228-1	BASE PLATE, MPTS TEST FIXTURE	ALUM TOOLING PLATE	1

PARTS LIST

GENERAL NOTES
1. PPPL APPROVED DRAWINGS TAKE PRECEDENCE OVER MODEL DIMENSIONS.
2. WHEN MODELS ARE PROVIDED, VENDOR MUST VERIFY THAT MODEL DIMENSIONS CONFORM WITH PPPL APPROVED DRAWINGS PRIOR TO FABRICATION.

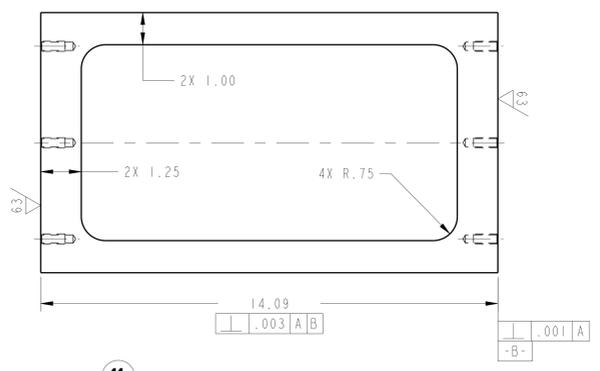
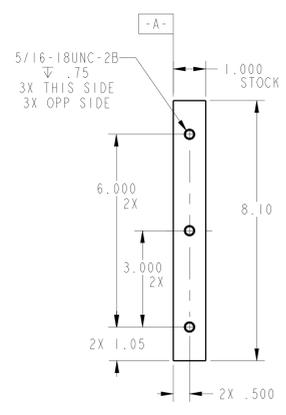
RELEASED FOR FABRICATION/INSTALLATION
PPPL Drawing

RELEASE LEVEL: Fabrication
DWG VERSION NO: 0.2

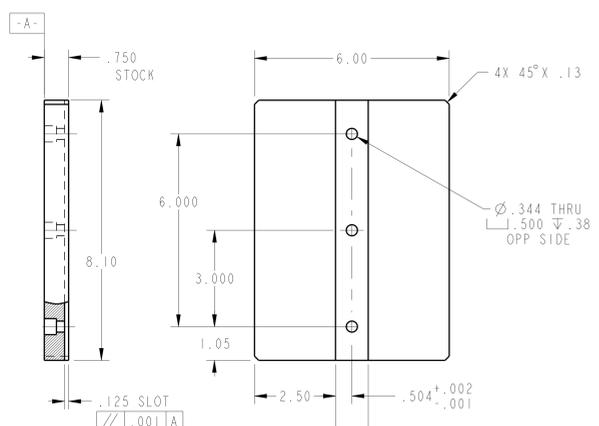
WELDING ENGINEER
APPROV: N/A DATE: _____

COMPUTER GENERATED DRAWING MANUAL CHANGES NOT PERMITTED Pro E	CENTRAL FILES: UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES MACHINE SURFACES BREAK SHARP EDGES .055/.020	PRINCETON PLASMA PHYSICS LABORATORY PRINCETON UNIVERSITY NATIONAL SPHERICAL TORUS EXPERIMENT CENTER STACK UPGRADE MPTS COLLECTION OPTICS LABORATORY TEST FIXTURE
DO NOT VERIFY INFORMATION BY SCALING DRAWING	TOLERANCES - NON-CUMULATIVE DECIMAL-INCH FRACTIONS ± .010 ± .005 ANGULAR ±0°-15'	DIV: MECH. ENG. DATE: 8-27-12 ENG: G LABIK DSN: H FEDER CHK: L MORRIS APPROVER: G LABIK
SCALE:	NEXT ASSEMBLY	E-9D11228 SHEET 1 OF 2 REV 0

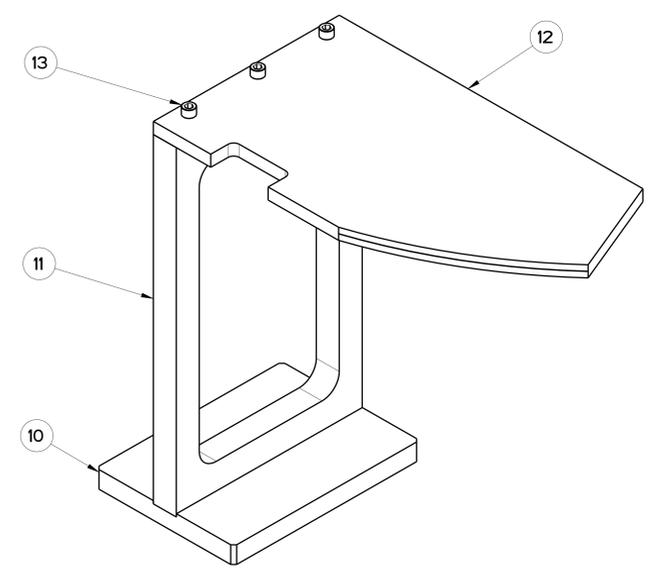
NO.	REVISION	BY	CH	SUP	APPROVED	DATE



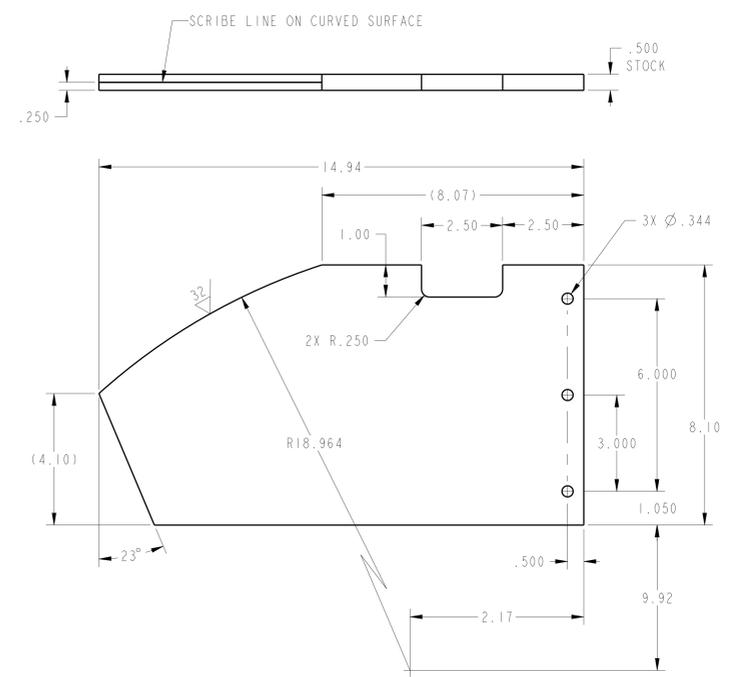
11
SCALE = 0.500



10
SCALE = 0.500



SCALE = 0.500



12
SCALE = 0.500

PART NO.	DRAWING NO	NOMENCLATURE OR DESCRIPTION	MATERIAL	QTY REQD
13	150732	5/16-18 UNC x 1 LG HEX SOC HD CAP SCREW	STN STL	6
12	E-9D11228-6	FIBER OPTICS ARRAY DUMMY	ALUM TOOLING PLATE	1
11	E-9D11228-5	VERTICLE SUPPORT, OPTICS ARRAY DUMMY	ALUM TOOLING PLATE	1
10	E-9D11228-4	SUPPORT BASE, OPTICS ARRAY DUMMY	ALUM TOOLING PLATE	1

E-9D11228-01 PARTS LIST

GENERAL NOTES

- PPPL APPROVED DRAWINGS TAKE PRECEDENCE OVER MODEL DIMENSIONS.
- WHEN MODELS ARE PROVIDED, VENDOR MUST VERIFY THAT MODEL DIMENSIONS CONFORM WITH PPPL APPROVED DRAWINGS PRIOR TO FABRICATION.

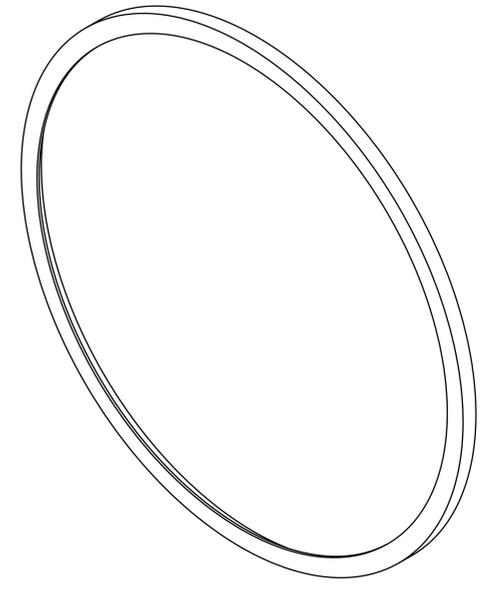
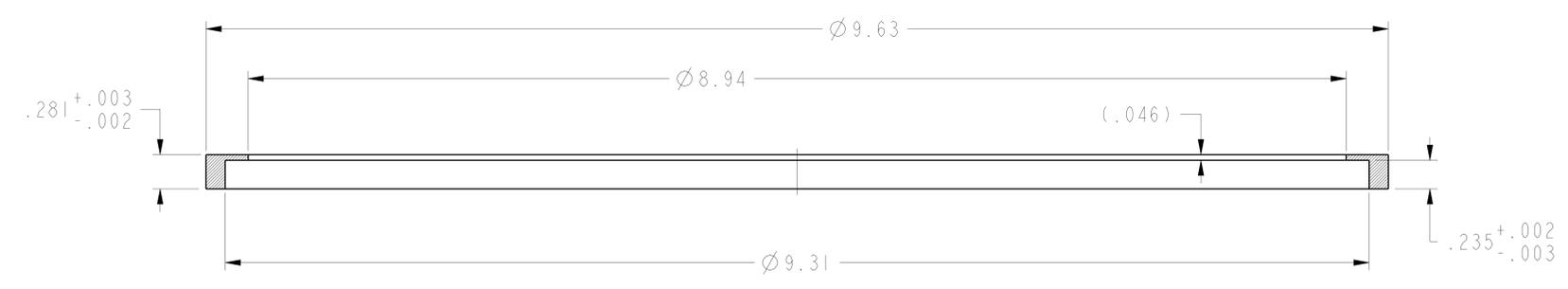
RELEASED FOR FABRICATION/INSTALLATION
PPPL Drafting

RELEASE LEVEL: Fabrication
DWG VERSION NO: 0.2

WELDING ENGINEER
APPVD: _____ DATE: _____

COMPUTER GENERATED DRAWING MANUAL CHANGES NOT PERMITTED Pro E	CENTRAL FILES: UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES MACHINE SURFACES BREAK SHARP EDGES .055/.020	PRINCETON PLASMA PHYSICS LABORATORY PRINCETON UNIVERSITY NATIONAL SPHERICAL TORUS EXPERIMENT CENTER STACK UPGRADE MPTS COLLECTION OPTICS LABORATORY TEST FIXTURE
DO NOT VERIFY INFORMATION BY SCALING DRAWING	TOLERANCES - NON-CUMULATIVE DECIMAL - INCH FRACTIONS ± .010 0" - 12" ±.010 ± .005 12" - 20" ±.010 ANGULAR ±0°-15' 0000-120° ±0.02	DIV: MECH. ENG. DATE: 6-27-12 ENG: G LABIK DSN: H FEDER CHK: L MORRIS
SCALE:	NEXT ASSEMBLY	APPROVED G LABIK E-9D11228
SHEET 2 OF 2		REV 0

NO.	REVISION	BY	CH	SUP	APPROVED	DATE



NOTES:

1. UNLESS OTHERWISE SPECIFIED 2 PLACE DECIMAL DIMENSIONS TO BE $\pm .01$.
2. MATERIAL - 316 SS.
3. REFERENCE PERMEABILITY USING A SEVERN GAGE SHALL NOT EXCEED
 BASE MATERIAL - 1.2
 FABRICATED PART - 1.4

GENERAL NOTES
 1. PPPL APPROVED DRAWINGS TAKE PRECEDENCE OVER MODEL DIMENSIONS.
 2. WHEN MODELS ARE PROVIDED, VENDOR MUST VERIFY THAT MODEL DIMENSIONS CONFORM WITH PPPL APPROVED DRAWINGS PRIOR TO FABRICATION.

MAGNETIC PERMEABILITY REQUIREMENT (SEE NOTES)			
YES	X		NO

RELEASED FOR FABRICATION/INSTALLATION
PPPL Drafting

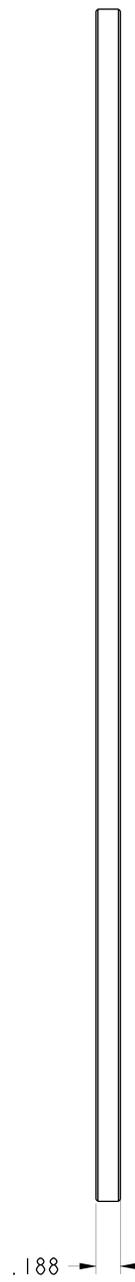
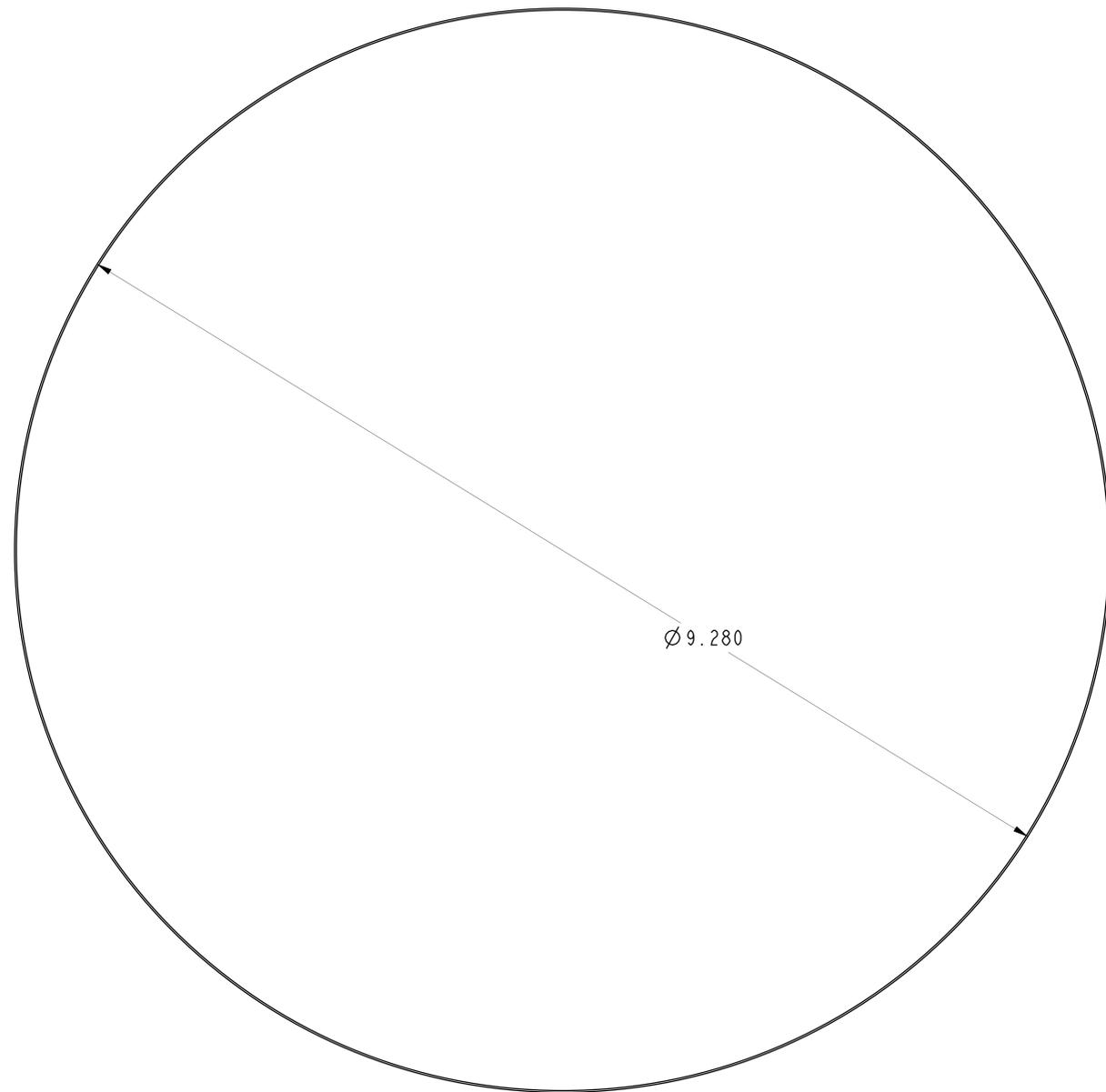
RELEASE LEVEL: Fabrication
 DWG VERSION NO: 0.2

WELDING ENGINEER
 APPVD: *NZA* DATE: */ /*

COMPUTER GENERATED DRAWING MANUAL CHANGES NOT PERMITTED Pro E	CENTRAL FILES: UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES MACHINE SURFACES BREAK SHARP EDGES .055/.020	PRINCETON PLASMA PHYSICS LABORATORY PRINCETON UNIVERSITY NATIONAL SPHERICAL TORUS EXPERIMENT CENTER STACK UPGRADE MPTS - COLLECTION OPTICS BOX BEZEL, WINDOW
DO NOT VERIFY INFORMATION BY SCALING DRAWING SCALE: 2.00	TOLERANCES - NON-CUMULATIVE DECIMAL - INCH FRACTIONS ± .010 04"12" ±.010 ±.010 12"12" ±.010 ANGULAR ±0°15' 00°120' ±.010	DIV: MECH. ENG. DATE: 9-21-12 ENG: G LABIK APPROVED DSN: H FEDER G LABIK CHK: L MORRIS
NEXT ASSEMBLY		E-9D11234 SHEET 1 OF 1 REV 0

NSTX-E-9D11234

NO.	REVISION	BY	CH	SUP	APPROVED	DATE



NOTES:

1. UNLESS OTHERWISE SPECIFIED 2 PLACE DECIMAL DIMENSIONS TO BE $\pm .01$.
2. SPECIFICATIONS

MATERIAL - FUSED QUARTZ.
 DIAMETER TOLERANCE; $\pm .01$ in [.25mm].
 THICKNESS TOLERANCE; $\pm .005$ in [.125mm].
 SURFACE ACCURACY: ~5 PER INCH.
 SURFACE QUALITY: 60-40 SCRATCH-DIG OR BETTER.
 PARALLELISM; $< 15'$
 EDGES; FINE GROUND AND BEVELED.

GENERAL NOTES
 1. PPPL APPROVED DRAWINGS TAKE PRECEDENCE OVER MODEL DIMENSIONS.
 2. WHEN MODELS ARE PROVIDED, VENDOR MUST VERIFY THAT MODEL DIMENSIONS CONFORM WITH PPPL APPROVED DRAWINGS PRIOR TO FABRICATION.

MAGNETIC PERMEABILITY REQUIREMENT (SEE NOTES)	
YES	NO

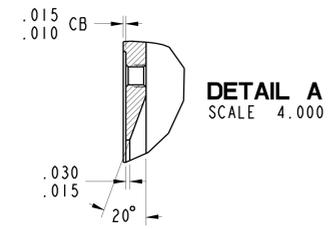
RELEASED FOR FABRICATION/INSTALLATION
PPPL Drawing

RELEASE LEVEL: WIP
 DWG VERSION NO: 0.0

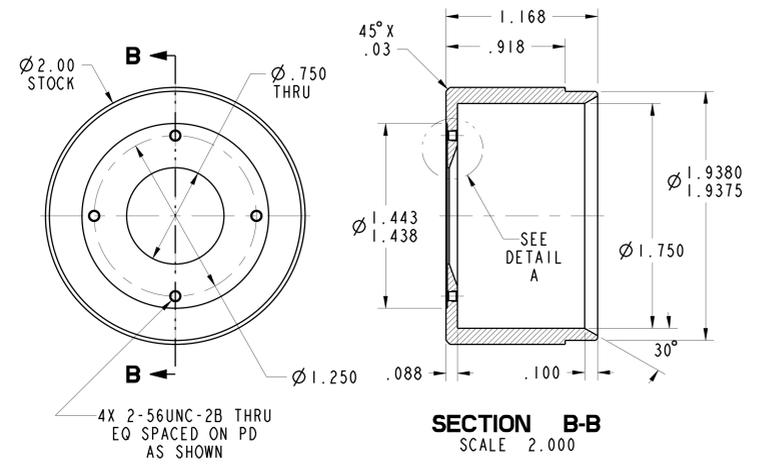
WELDING ENGINEER
 APPVD: N/A DATE: / /

COMPUTER GENERATED DRAWING MANUAL CHANGES NOT PERMITTED Pro E	CENTRAL FILES: UNLESS OTHERWISE SPECIFIED	PRINCETON PLASMA PHYSICS LABORATORY PRINCETON UNIVERSITY NATIONAL SPHERICAL TORUS EXPERIMENT	
DO NOT VERIFY INFORMATION BY SCALING DRAWING	BREAK SHARP EDGES .005/.020	CENTER STACK UPGRADE MPTS - COLLECTION OPTICS BOX WINDOW	
SCALE: 2.00	TOLERANCES NON-CUMULATIVE	DIV: MECH. ENG.	DATE: 9-21-12
NEXT ASSEMBLY	DECIMAL-INCH FRACTIONS	ENG: G LABIK	APPROVED
	.5 .0100 0'-12" 8/16	DSN: H FEDER	G LABIK
	.XXX .010 12'-120" 8/16	CHK: L MORRIS	CHK SUPV
	ANGULAR 20'-15" OVER 120" 8/12	CHK LW	DATE
			E-9D11235
			SHEET 1 OF 1 REV 0

NSTX-E-9D11235



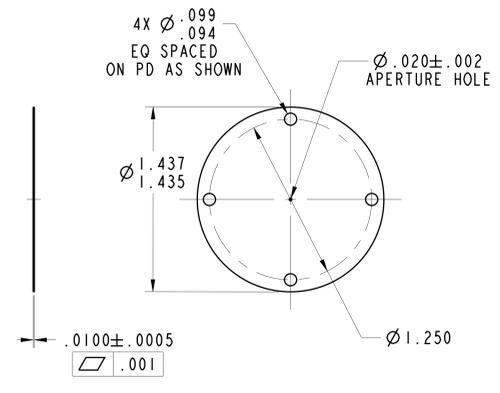
DETAIL A
SCALE 4.000



SECTION B-B
SCALE 2.000

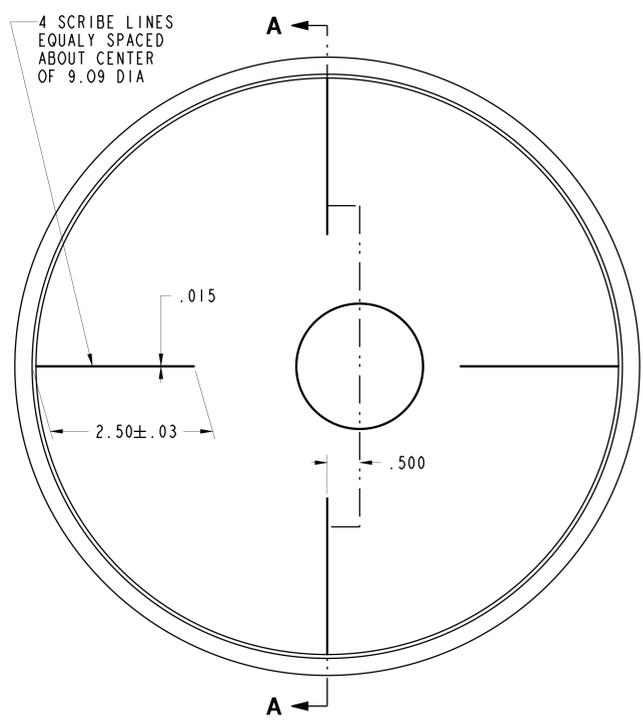
2

SCALE 2.000



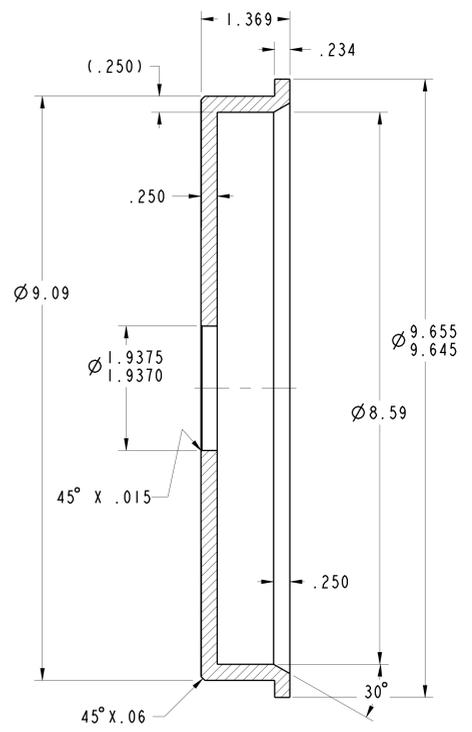
3

SCALE 2.000

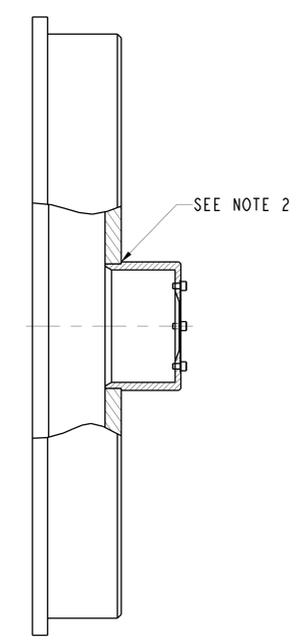


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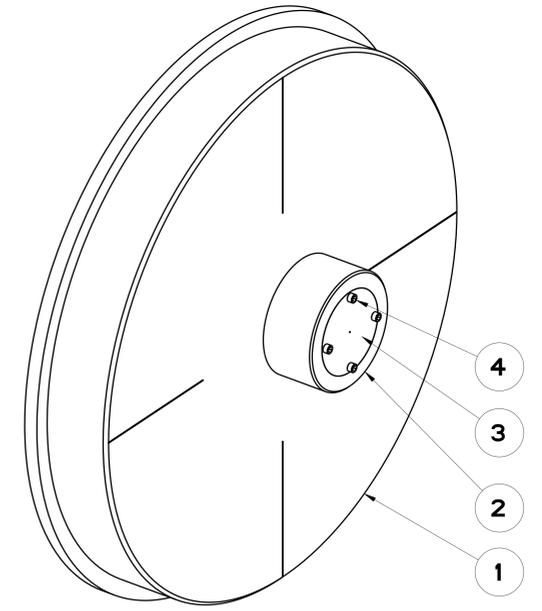
SCALE 1.500



SECTION A-A
SCALE 1.000



PARTIAL SECTION C-C



SCALE 1.000

GENERAL NOTES

- PPPL APPROVED DRAWINGS TAKE PRECEDENCE OVER MODEL DIMENSIONS.
- WHEN MODELS ARE PROVIDED, VENDOR MUST VERIFY THAT MODEL DIMENSIONS CONFORM WITH PPPL APPROVED DRAWINGS PRIOR TO FABRICATION.

MAGNETIC PERMEABILITY REQUIREMENT (SEE NOTES)	
YES	NO
<input type="checkbox"/>	<input checked="" type="checkbox"/>

- NOTES:**
- UNLESS OTHERWISE SPECIFIED 2 PLACE DECIMAL DIMENSIONS TO BE ±.01.
 - PRESS ITEM 2 INTO ITEM 1 AGAINST SHOULDER AND TO APPROX ANGULAR POSITION AS SHOWN.

RELEASED FOR FABRICATION/INSTALLATION
PPPL Drawing

ITEM NO.	DRAWING NO	NOMENCLATURE OR DESCRIPTION	MATERIAL	QTY	RECD
4	150667	# 2-56 UNC x 1/8 LG HEX SOC HD CAP SCREW	STN STL	4	
3	E-9D11236-3	APERTURE DISC	302/304 SS	1	
2	E-9D11236-2	MOUNTING, APERTURE DISC	ALUMINUM	1	
1	E-9D11236-1	HOUSING, APERTURE DISC MTG	ALUMINUM	1	

PARTS LIST

COMPUTER GENERATED DRAWING MANUAL CHANGES NOT PERMITTED Pro E	CENTRAL FILES: UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES MACHINE SURFACES UNLESS SHOWN OTHERWISE BREAK SHARP EDGES .005/.020	PRINCETON PLASMA PHYSICS LABORATORY PRINCETON UNIVERSITY NATIONAL SPHERICAL TORUS EXPERIMENT CENTER STACK UPGRADE MPTS - COLLECTION OPTICS BOX MIRROR ALIGNMENT JIG
DO NOT VERIFY INFORMATION BY SCALING DRAWING	TOLERANCES NON-CUMULATIVE DECIMAL-INCH FRACTIONS ±.0000 ±.0001 ±.0002 ±.0003 ±.0004 ±.0005 ±.0006 ±.0007 ±.0008 ±.0009 ±.0010 ±.0015 ±.0020 ±.0030 ±.0040 ±.0050 ±.0060 ±.0070 ±.0080 ±.0090 ±.0010 ±.0015 ±.0020 ±.0030 ±.0040 ±.0050 ±.0060 ±.0070 ±.0080 ±.0090 ±.0010 ±.0015 ±.0020 ±.0030 ±.0040 ±.0050 ±.0060 ±.0070 ±.0080 ±.0090	DIV: MECH. ENG. DATE: 11-19-12 ENG: G LABIK DSN: H FEDER CHK: L MORRIS
SCALE:	NEXT ASSEMBLY	APPROVED G LABIK DATE: 11-19-12

E-9D11236

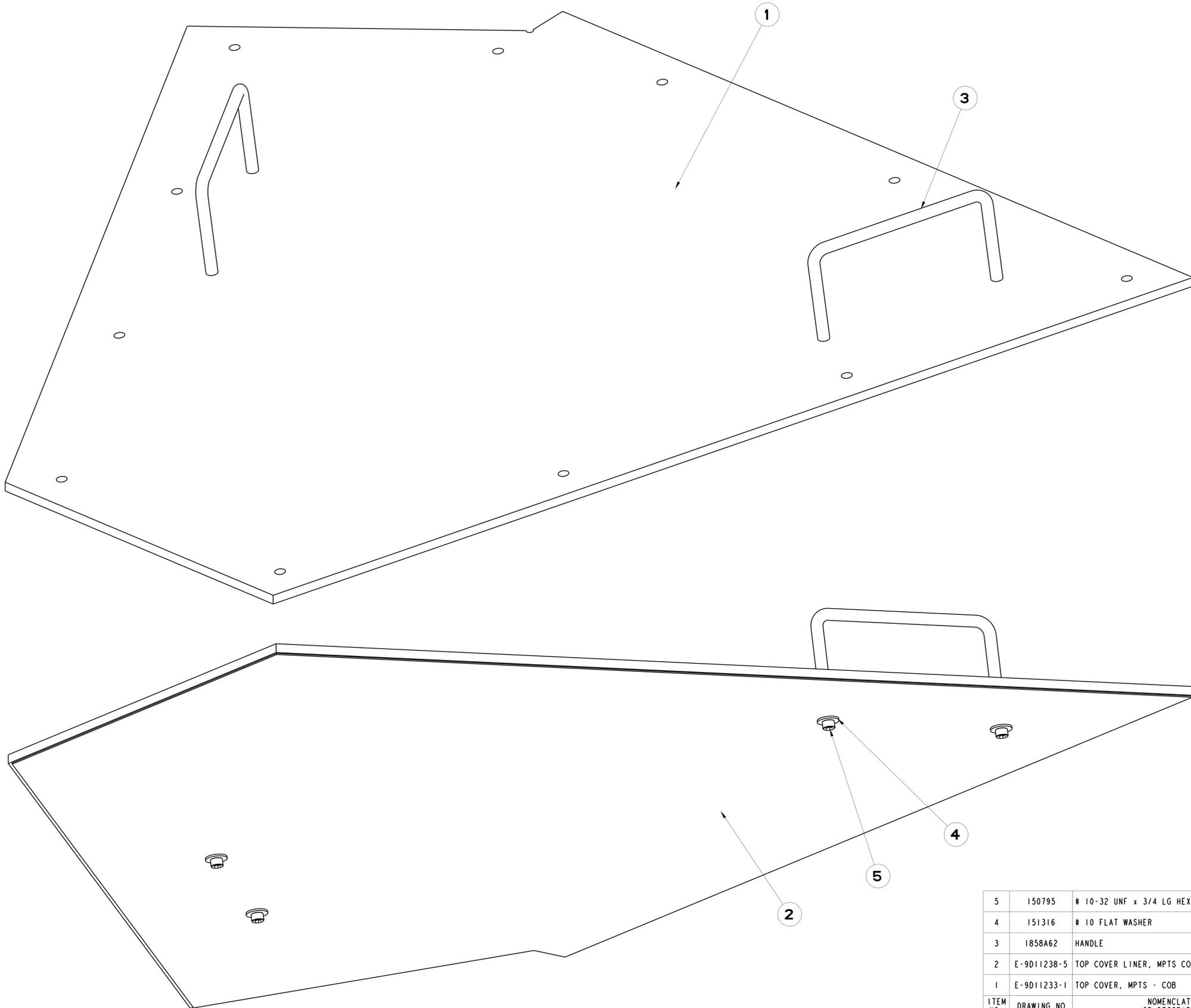
SHEET 1 OF 1 REV 0

RELEASE LEVEL: FABRICATION
DWG VERSION NO: 0.4

WELDING ENGINEER
APPVD: N/A DATE: 11-19-12

INST X-E-9D11236

NO.	REVISION	BY	CH	SUP	APPROVED	DATE
1	REVISED PER ECN 7125	HF	LM	LM	G. LABIK	10-8-13
2	REVISED PER ECN 7147	HF	LM	LM	G. LABIK	11-5-13



ITEM NO.	DRAWING NO	NOMENCLATURE OR DESCRIPTION	MATERIAL	QTY RECD
5	150795	# 10-32 UNF x 3/4 LG HEX SOC HD CAP SCREW	STN STL	4
4	151316	# 10 FLAT WASHER	316 S/S	4
3	1858A62	HANDLE (MCMASTER-CARR)	304 SS	2
2	E-9D11238-5	TOP COVER LINER, MPTS COB	BLK DELRIN 1/32	1
1	E-9D11233-1	TOP COVER, MPTS - COB	G-11	1

COMPUTER GENERATED DRAWING		CENTRAL FILES:	PRINCETON PLASMA PHYSICS LABORATORY	
MANUAL CHANGES NOT PERMITTED		UNLESS OTHERWISE SPECIFIED	PRINCETON UNIVERSITY	
Pro E		DIMENSIONS ARE IN INCHES	NATIONAL SPHERICAL TORUS EXPERIMENT	
DO NOT VERIFY INFORMATION BY SCALING DRAWING		BREAK SHARP EDGES .005/.020	CENTER STACK UPGRADE	
SCALE: 1:000		TOLERANCES NON-CUMULATIVE	MPTS- COLLECTION OPTICS BOX	
NEXT ASSEMBLY		DECIMAL-INCH FRACTIONS	TOP COVER ASSY	
		.X .100 0'-12" 01/16	DIV: MECH. ENG.	DATE: 9-21-12
		.XX .030 12'-12" 01/8	ENG: G. LABIK	APPROVED
		.XXX .010 12'-120" 01/4	DSN: H. FEDER	G. LABIK
		ANGULAR 20'-15" OVER 120" 01/2	CHK: L. MORRIS	CHK: L.M.
			DATE: _____	

GENERAL NOTES

- PPPL APPROVED DRAWINGS TAKE PRECEDENCE OVER MODEL DIMENSIONS.
- WHEN MODELS ARE PROVIDED, VENDOR MUST VERIFY THAT MODEL DIMENSIONS CONFORM WITH PPPL APPROVED DRAWINGS PRIOR TO FABRICATION.

MAGNETIC PERMEABILITY REQUIREMENT (SEE NOTES)	
YES	NO <input checked="" type="checkbox"/>

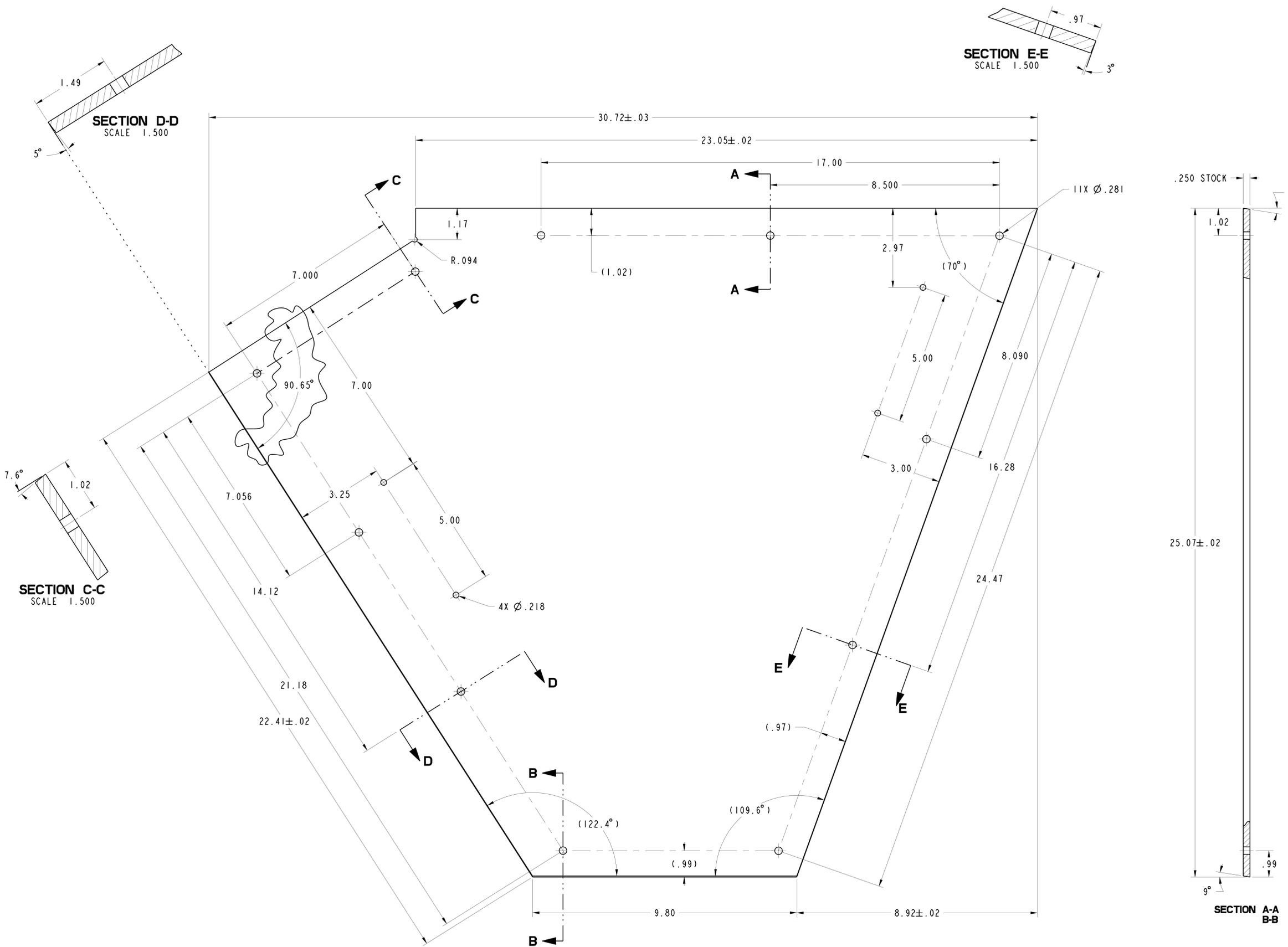
RELEASE LEVEL: Fabrication
 DWG VERSION NO: 2.1
 WELDING ENGINEER
 APPVD: N/A DATE: _____

RELEASED FOR FABRICATION/INSTALLATION
 PPPL Drafting

INSTX-E-9D11233

SHEET 1 OF 2 REV 2

NO.	REVISION	BY	CH	SUP	APPROVED	DATE



1	E-9D11233-1	TOP COVER, MPTS - COB	G-11
	DRAWING NUMBER	DESCRIPTION	MATERIAL

NOTES:
1. UNLESS OTHERWISE SPECIFIED 2 PLACE DECIMAL DIMENSIONS TO BE ±.01

GENERAL NOTES
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2. WHEN MODELS ARE PROVIDED, VENDOR MUST VERIFY THAT MODEL DIMENSIONS CONFORM WITH PPPL APPROVED DRAWINGS PRIOR TO FABRICATION.

MAGNETIC PERMEABILITY REQUIREMENT (SEE NOTES)	
YES	NO <input checked="" type="checkbox"/>

RELEASE LEVEL: Fabrication
DWG VERSION NO: 2.1
WELDING ENGINEER
APPV: _____ DATE: _____

COMPUTER GENERATED DRAWING MANUAL CHANGES NOT PERMITTED Pro E DO NOT VERIFY INFORMATION BY SCALING DRAWING SCALE: .750 NEXT ASSEMBLY	CENTRAL FILES: UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES MACHINE SURFACES UNLESS OTHERWISE SPECIFIED BREAK SHARP EDGES .005/.020 TOLERANCES NON-CUMULATIVE DECIMAL-INCH FRACTIONS .1 .100 0'-12" 8/100 .005 .005 12"-12" 8/100 .010 .010 72"-120" 8/100 ANGULAR 20'-15" OVER 120" 8/100	PRINCETON PLASMA PHYSICS LABORATORY PRINCETON UNIVERSITY NATIONAL SPHERICAL TORUS EXPERIMENT CENTER STACK UPGRADE MPTS- COLLECTION OPTICS BOX TOP COVER ASSY DIV: MECH. ENG. DATE: 9-21-12 ENG: G LABIK DSN: H FEDER G LABIK CHK: L MORRIS APPROVED E-9D11233
SHEET 2 OF 2		REV 2

RELEASED FOR FABRICATION/INSTALLATION
PPPL Drafting

INSTX-E-9D11233