

Princeton Plasma Physics Laboratory Procedure			
NSTX-U MIDPLANE FLANGE BAYS I, H, & F WIRE-SEAL VACUUM FLANGE REMOVAL PROCEDURE			
Number: D-NSTXU-IP-DIAG-4074		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-12)	√	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. Repair of original Design. 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
HP – Jessica Malo			
IH – Neil Gerrish			
RE Diagnostics – Brent Stratton			
RE VVIH – Steve Raftopoulos			
TA Vacuum Systems – Dang Cai			
NSTX-U Construction Supervisor – Joe Winston			

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)		√	
NSTX-U Construction Supervisor	√		
QA/QC Representative		√	
Field Supervisor		√	
Industrial Hygiene		√	
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:

- 1.1 This procedure provides instructions for the removal of the Mid-plane Flange Bays I, H, & F Male Wire-Seal flanges within the National Spherical Torus eXperiment (NSTX) that require replacement to eliminate sources of Vacuum Leaks.

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 the area around the Midplane Flange bay being worked on.
 - 2.2.2 Preparing the Midplane Flange Removal Fixture for use.
 - 2.2.3 Removing the respective Midplane male wire-seal flange.
 - 2.2.4 Staging the removed male flange for Health Physics evaluation and disposal.

3.0 References:

- 3.1 Drawing No. E-DB1001: Vacuum Vessel Center Section Weldment Plan view
- 3.2 Drawing No. E-DB1002: Vacuum Vessel Center Section Weldment Views A-A, B-B, D-D, Sections C-C, E-E and details.
- 3.3 Sketch No. SK20-0037: Midplane Flange Bay's I, H, F Removal Fixture

Note: SK20-0037 is attached to the end of this document.

4.0 Precautions:

- 4.1 Individuals are not permitted to lift more than 50 lbs. at any one time. If an object weights 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. This includes any cutting dust which must be collected and surveyed by HP prior to disposal.

5.0 Prerequisites:

- 5.1 If working on Midplane Flange Bay F, the Optics Collection Box and MPTS fiber bundle have been moved and protected from damage (N/A if not applicable).

Lead Tech: _____

- 5.2 For the Flange Bay being worked on, the mating female diagnostic flange, and all associated diagnostics, have been moved and the Bay is accessible for work.

Lead Tech: _____

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

Lead Tech: _____ Permit No.: _____

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

Lead Tech: _____

- 5.5** 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 folder from the WCC.

Lead Tech: _____

- 5.6** A Confined Space Entry Permit must be in place prior to work starting.

Lead Tech: _____ Permit No.: _____

- 5.7** A Hot Work Permit must be obtained from ES&H prior to work starting.

Lead Tech: _____ Permit No.: _____

- 5.8** A Fire Watch must be established and available to oversee the cutting process.

Lead Tech: _____

- 5.9** A Pre-job Briefing must be completed prior to work starting, including a review of the JHA, RWP, and confined space permit requirements to assure they are being implemented. The only personnel allowed to work under this procedure are those that attend this briefing.

Lead Tech: _____

- 5.10** All Prerequisites Completed:

COG Signoff: _____ Date: _____

6.0 Removal Procedure:

6.1 Preparations:

- 6.1.1 Prepare the working area around the respective flange bay for the work to be conducted at the direction of the field supervisor.

6.1.1.1 Remove any guard-rails obstructing the working area and install any fall protection measures as needed at the direction of the field supervisor.

6.1.1.2 Caution tape off the working area.

6.1.1.3 Shield fragile systems in the working area from damage as needed at the direction of the field supervisor.

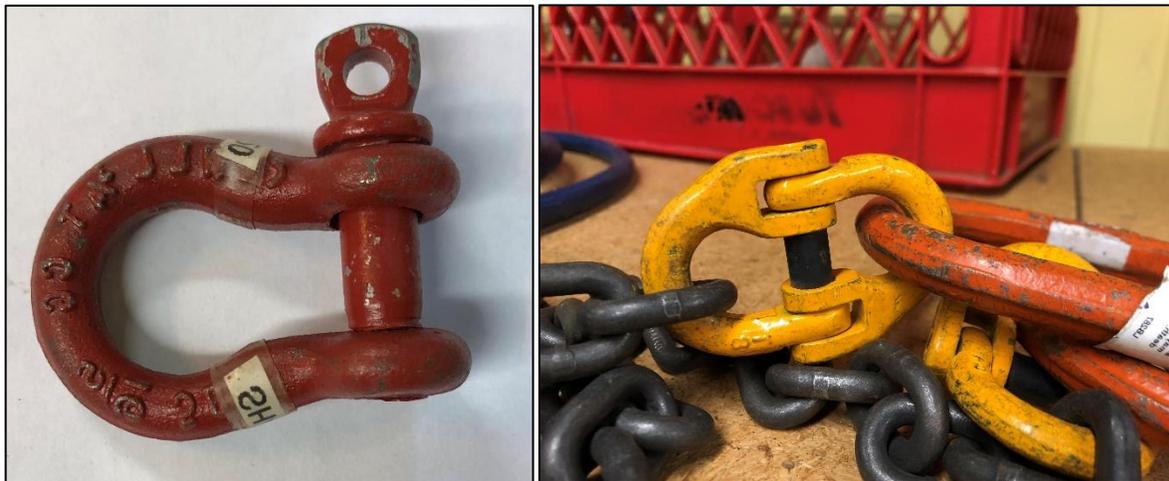
- 6.1.2 Install the safety table platform below the flange bay as shown in Figure 3.

6.1.3 To prevent cutting dust from entering the inside of the vessel, insert the inner Nozzle cover with vacuum port into the nozzle tube. Then, tape the edges of the inner Nozzle

cover dust-tight at the direction of the field supervisor. This must be done prior to bolting the fixture to the flange.

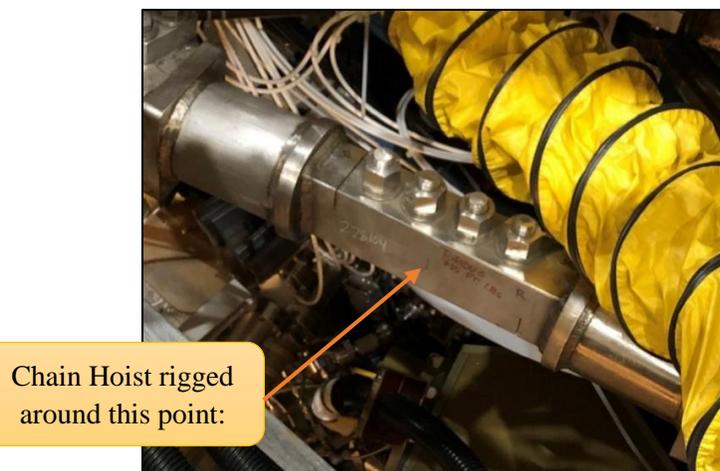
- 6.1.4 Install the aluminum spacer ring and two (2) studs at the 4 and 8 o'clock positions on the flange. Insert the keepers and spacers to hold the aluminum spacer ring in place.
- 6.1.5 Install the flange dust cover by sliding its edge into the lip between the 4 & 8 o'clock spacers and keepers, then install an additional stud with spacers and keepers into the 12 o'clock position holding the flange dust cover flat against the face of the flange.
 - 6.1.5.1 When installing the 12 o'clock stud, ensure to pass it through an appropriately sized shackle or chain connector (as shown in Figure 1) so the flange can be held by the chain hoist at the 12 o'clock stud. Ensure to check that the shackle or chain connector fits the chain used with the chain hoist.

Figure 1: Example Shackle or Chain Connector for 12 o'clock Stud



- 6.1.6 Install 2 more studs with spacers and keepers at the 10 and 2 o'clock positions.
- 6.1.7 Rig a manual chain hoist (rated 1/2 ton at minimum) to the overhead TF coil supporting structure as shown in Figure 2. All flange bays have this same configuration.

Figure 2: TF Coil Supporting Structure



- 6.1.8 Rig the flange and fixture assembly to the overhead TF magnet supporting structure using the 12 o'clock stud (as shown in Figure 2) and install the guiding ring onto the five studs with washers and nuts.
- 6.1.9 Install five (5) more studs with keepers and spacers and tighten all the studs with washers and nuts for a total of ten (10) studs, keepers, washers, and nuts.
- 6.1.10 Run the die grinder (while off) around the inner-track of the guiding ring to ensure the fixture is snug against the flange and will not move during cutting. Additional studs can be added and tightened at the direction of the field supervisor as necessary. All studs require spacers, keepers, washers, and nuts to hold the flange dust cover against the flange face.
- 6.1.11 Install a strip of two (2") inch wide flame resistant tape around the circumference of the Male midplane flange and guiding ring to capture any stray sparks or debris that may escape from between the dust covers.
- 6.1.12 Install the vacuum hose into the vacuum port in the inner Nozzle dust cover and tape the vacuum tube to the dust cover dust-tight.

Note: Installation of the vacuum hose into the vacuum port shall be done from inside the vessel. Use appropriate in-vessel PPE.

Figure 3: Example of Properly Setup Removal Fixture



Note: Figure 3 displays the proper setup for the removal fixture minus the vacuum hose attachment and additional Herculite dust collection. Note the usage of a sling through the 12 o'clock stud as a rigging point to the above TF coil structure, all 10 studs that would typically be used are not shown.

6.1.13 Install additional Herculite dust collection as needed at the direction of the field supervisor.

Approval of dust collection measures require Health Physics approval prior to proceeding.

HP Approval: _____ Date: _____

Approval of Section 6.1 preparations require QC and COG Engineer approval prior to proceeding.

QC Approval: _____ Date: _____

COG Approval: _____ Date: _____

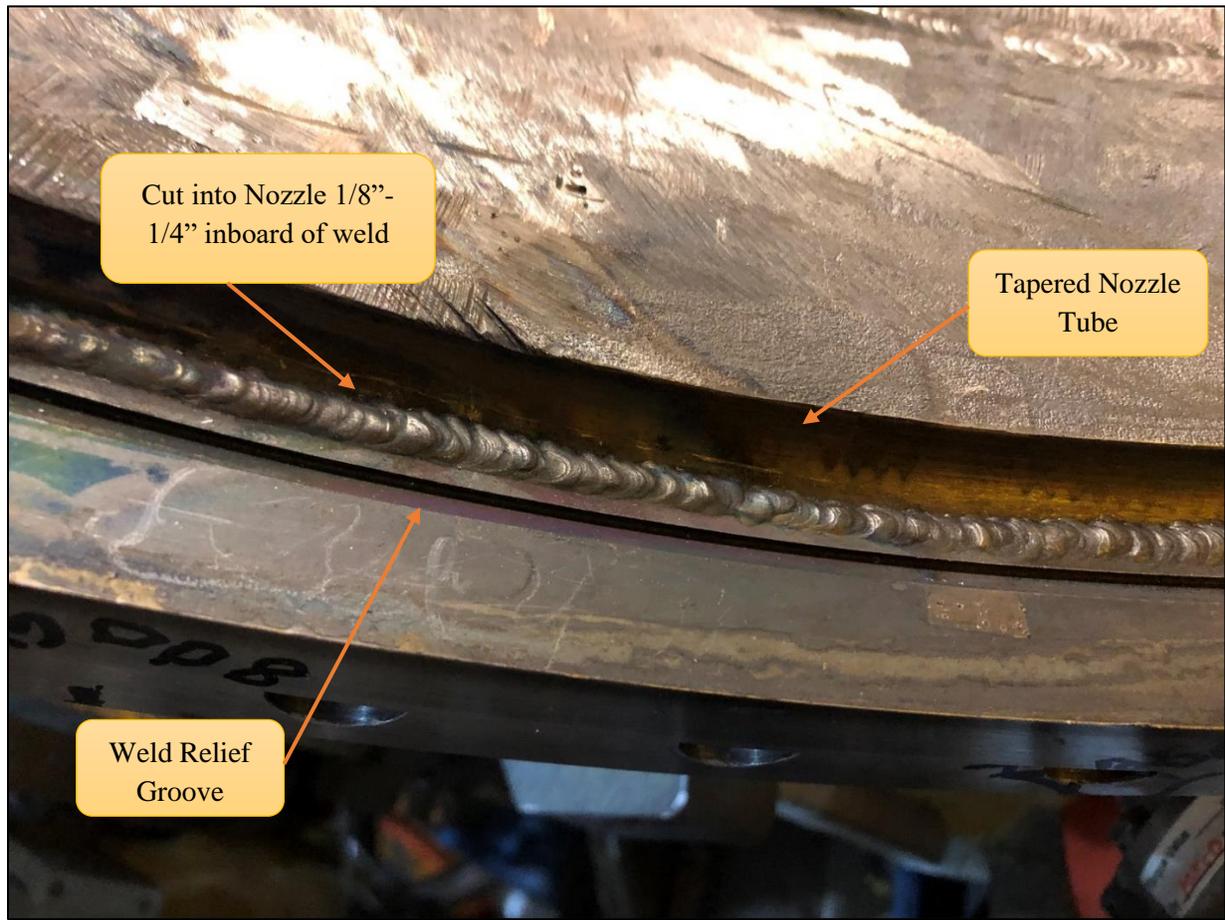
6.2 Cutting:

6.2.1 A Fire Watch must be present during all stages of cutting and for 60 minutes post welding activities. The use of welding blankets and screens should be used as necessary.

Lead Tech: _____ Fire Watch: _____

6.2.2 Positively identify the 1/4" GTAW vacuum weld to be cut per drawing E-DB1002 – “Weld Detail G”. The weld will be located between the existing weld relief groove and the tapering of the mating nozzle tube as shown in Figure 4.

Figure 4: In-Vessel Weld



- 6.2.3 Select the proper thickness and size of cutting disc to remove the ¼” GTAW weld at the direction of the field supervisor.
- 6.2.4 Check and adjust the position of the cutting wheel as necessary to cut 1/8” inboard of the flange weld to be cut; Tighten the locking nut on the die grinder for cutting once positioned.
- 6.2.5 Using proper PPE, cut off the male flange using the die grinder and cutting wheel at the direction of the field supervisor, ensuring to remove at most ¼” but no less than 1/8” of the Nozzle tube inboard of the ¼” GTAW weld.

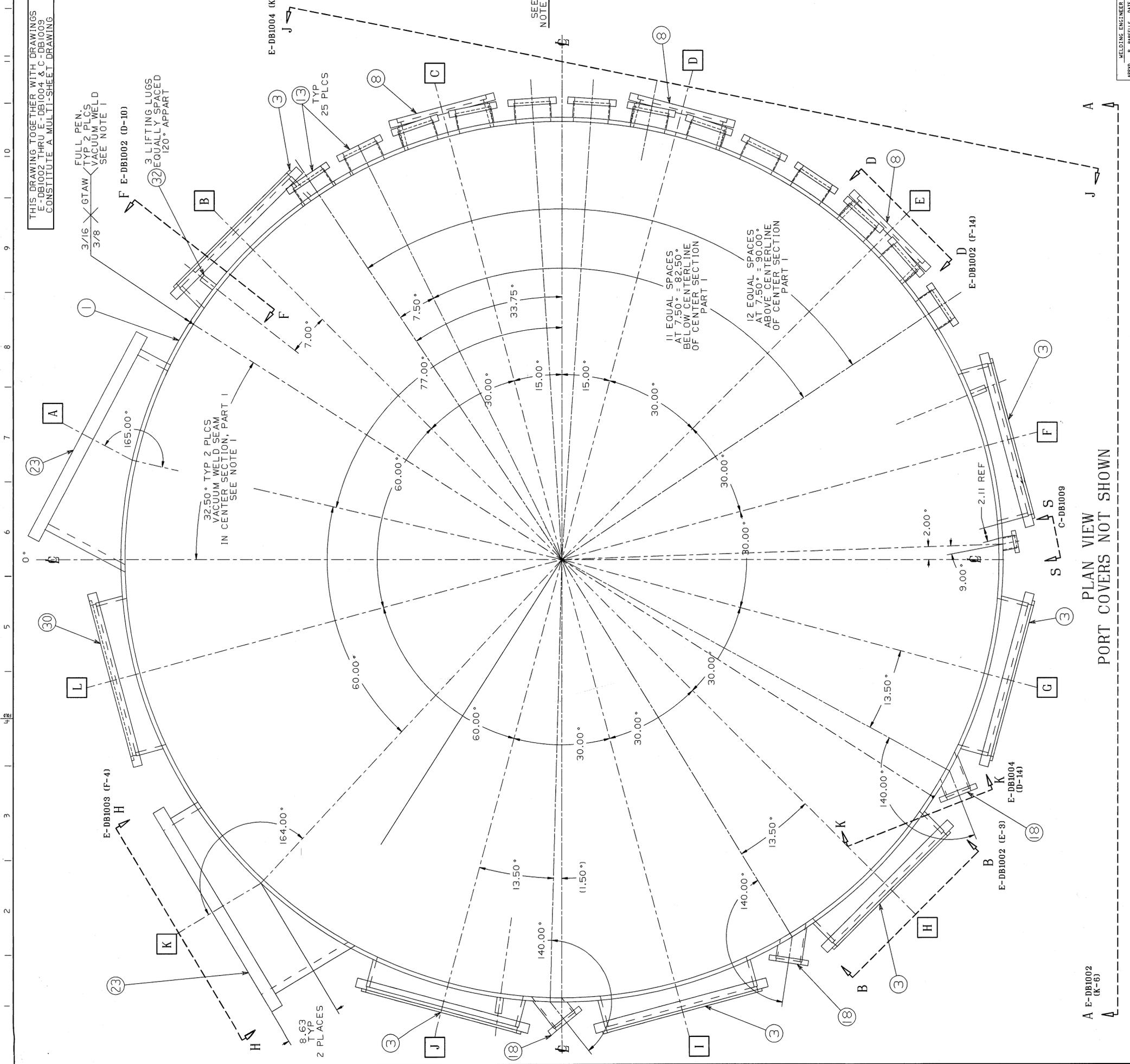
6.3 Staging:

Note: Steel toed or Safety Shoes are required for all personnel during any lifts.

- 6.3.1 Once the flange being worked on has been cut off the respective Midplane Vessel Nozzle, remove all Herculite sheeting and dust collection measures to clear space for safe lifting.
- 6.3.2 Using a minimum of two (2) people, one technician shall work the chain hoist, while the other holds the flange as it is hoisted away from the flange bay. The removed flange and attached fixture will weigh approximately 110lbs.
- 6.3.3 Once the flange is sufficient distance away from any fragile systems within the flange bay, load the removed flange onto a temporary cart, and un-rig it from the chain hoist.
- 6.3.4 Lift the flange and fixture into the South High Bay through the open area above Bay I.
 - 6.3.4.1 While on the temporary cart or table, rig the flange and fixture to the overhead crane using the shackle or chain connector in the 12 o’clock stud.
 - 6.3.4.2 Regardless of the midplane flange being removed, all flanges are to be lifted from the open area above Bay I.
- 6.3.5 Un-rig the flange and fixture and stage the removed male flange in the South High Bay for Health Physics evaluation and disposal.
- 6.3.6 Deburr the end of the Nozzle Tube post removal to prevent personnel from cutting themselves on the burrs.
- 6.3.7 Remove all tools and equipment, including any dust collection measures, used in the completion of this procedure from the NSTX Test-Cell.
- 6.3.8 Dispose of all Herculite sheeting at the direction of Health Physics.

7.0 Final Conditions:

- 7.1 The Mid-plane Male Flange being worked on has been removed and staged for Health Physics evaluation and disposal in the South High Bay.
- 7.2 The Mid-Plane Nozzle tube has been Deburred.
- 7.3 All equipment and dust collection measures have been removed from the NSTX Test-Cell and properly stored or disposed.



THIS DRAWING TOGETHER WITH DRAWINGS E-DB1002 THRU E-DB1004 & C-DB1009 CONSTITUTE A MULTI-SHEET DRAWING

NOTES

- ALL ASPECTS OF FABRICATION OF THIS ASSEMBLY (MATERIALS, WELDING, FINISHING, ETC.) SHALL BE PERFORMED IN ACCORD. WITH PPPL SPECIFICATION NO. NSTX-SPEC-12-044.
- BAY DESIGNATIONS ARE GIVEN BY A = BAY "A"
- DEAD WEIGHT OF VACUUM VESSEL CENTER SECTION INCLUDING PORT AND NB COVERS IS 14,500 LBS.
- MATCHED TOOLS SHALL BE USED TO ENSURE INTER-CHANGEABILITY OF ALL BOLT AND PIN HOLES AT THE INTERFACE OF THE NEUTRAL BEAM DUCT FLANGE, PART 23, AND THE NEUTRAL BEAM DUCT COVER PART 25.
- MAXIMUM MISMATCH BETWEEN CENTERLINES OF BOLT HOLES IN NEUTRAL BEAM DUCT FLANGE, PART 23, AND THE NEUTRAL BEAM DUCT COVER, PART 25, IS NOT TO EXCEED .003.
- MACHINE SEALING SURFACE TO 32 RMS. STRIATE SURFACE TO BE COLL INEAR AND PARALLEL TO FLANGE CONTOUR, PART 23, AND COVER CONTOUR, PART 25, WITH NO TRANSVERSE SCRATCH MARKS.
- ALL ROUND FLANGES TO BE ORIENTED SUCH THAT (1) HOLE IS IN THE 12 O'CLOCK POSITION.
- GASKET (NEUTRAL BEAM DUCT), PART 26, IS A HELICO FLEX SEAL. THESE SEALS TO BE PROVIDED BY PPPL FROM IN-HOUSE SPARES.
- 1/2-18UNC X 3 5/8" LG. HEX. HD. BOLTS, PART 27 FOR NEUTRAL BEAM FLANGES ARE TO BE SILVER PLATED.
- ALL FLANGE FACES ARE TO BE PERPENDICULAR TO HORIZ. & VERTICAL CENTER LINES WITHIN ± 1°
- FULL PENETRATION JOINTS WELDED FROM BOTH SIDES SHALL HAVE THE VACUUM SIDE WELDED USING THE GTAW PROCESS FOLLOWED BY THE NON-VACUUM SIDE PRIOR TO COMPLETION OF THE JOINT.

EXAMPLE : A = BAY "A"

NO.	REVISION	BY	CH	DATE
1	REVISED PER CROSS	BP	J5	11-17-98
2	REVISED PER CROSS	BP	J5	11-25-98
3	REVISED PER CROSS	BP	J6	11-25-98
4	REVISED PER CROSS	BP	J6	11-25-98

NO.	DESCRIPTION	QTY	UNIT	REF.
2	BOLT KITS (REG., 5/16-24 X 1 3/4) HUNTINGTON #B-337 OR EQ.	37	COMM	SS
2	OFHC COPPER GASKET HUNTINGTON #G-337 OR EQ.	36	COMM	OFHC
2	VAC-U-FLAT-FLANGE 3.37" OD BLANK NON-ROTATABLE HUNTINGTON #337-000 OR EQ.	35	COMM	304 SS
2	TUBING 2" OD X .13 THK X LG AS REQ'D	34	THIS DWG.	304 SS
2	VAC-U-FLAT-FLANGE 3.37" OD NON-ROTATABLE HUNTINGTON #337-200 OR EQ.	33	COMM	304 SS
3	LIFTING LUGS 4" X 2 3/8" X 1" THK	32	THIS DWG	304 SS
1	SOLID BOLT-TYPE WIRE SEAL FL. 24.00 TUBE HUNTINGTON #WSB-27-24-MS OR EQUAL	31	COMM	304 SS
1	BOLT-TYPE WIRE SEAL FLANGE 24.00 TUBE HUNTINGTON #WSB-27-24-F OR EQUAL	30	COMM	304 SS
2	DIAMOND PIN (NEUTRAL BEAM DUCT)	29	THIS DWG	304 SS
2	ROUND PIN (NEUTRAL BEAM DUCT)	28	THIS DWG	304 SS
164	1/2-18UNC X 3 5/8" LG. HEX HD BOLTS W/FLAT WASHER .54 10 X 1.25 00 X .25 THK	27	COMM	304 SS
2	GASKET (NEUTRAL BEAM DUCT) SEE NOTE 8	26	COMM	304 SS
2	COVER (NEUTRAL BEAM DUCT)	25	THIS DWG	304 SS
2	NEUTRAL BEAM DUCT	24	THIS DWG	304 SS
2	FLANGE (NEUTRAL BEAM DUCT)	23	THIS DWG	304 SS
3	BOLT KITS (REG. 5/16-24 X 2 1/4) HUNTINGTON #B-600 OR EQ.	22	COMM	SS
3	OFHC COPPER GASKET HUNTINGTON #G5-600 OR EQ.	21	COMM	OFHC
3	VAC-U-FLAT-FLANGE 6" OD BLANK NON-ROTATABLE HUNTINGTON #600-000 OR EQ.	20	COMM	304 SS
3	TUBING 4" OD X .19 THK X LG AS REQ'D	19	THIS DWG.	304 SS
3	VAC-U-FLAT-FLANGE 6" OD NON-ROTATABLE HUNTINGTON #600-400 OR EQ.	18	COMM	304 SS
500	5/16-18UNC X 2 1/2" LG. HEX HD BOLT WITH NUTS	17	COMM	SA453 GR. 660
25	HELICO FLEX SEAL #H-15062, NON-MAGNETIC SILVER SEAL, INCO 600, NIMONIC 90	16	COMM	—
25	RF ANTENNA FLANGE COVER .75 THK REF. 7.375 O.D. REF. 1" THK REF.	15	THIS DWG.	304 SS
25	5" SCH 10 SEAMLESS PIPE	14	ASTM A312	TP304
25	RF ANTENNA FLANGE HUNTINGTON #B-1650 OR EQ.	13	THIS DWG.	304 SS
3	BOLT KITS (REG. 3/8-24 X 2 3/4) HUNTINGTON #B-1650 OR EQ.	12	COMM	SS
3	OFHC COPPER GASKET HUNTINGTON #G-1650-1 OR EQ.	11	COMM	OFHC
3	VAC-U-FLAT-FLANGE 16.50" OD BLANK NON-ROTATABLE HUNTINGTON #1650-000 OR EQ.	10	COMM	304 SS
3	TUBING 14" OD X .50 THK X LG AS REQ'D	9	THIS DWG.	304 SS
3	VAC-U-FLAT-FLANGE 16.50" OD NON-ROTATABLE HUNTINGTON #1650-1400 OR EQ.	8	COMM	304 SS
7	BOLT KIT HUNTINGTON #BW-240 OR EQUAL	7	COMM	SS
7	COPPER GASKET FOR 24.00 FLANGE HUNTINGTON #GC-240 OR EQUAL	6	COMM	OFHC
6	SOLID BOLT-TYPE WIRE SEAL FL. 24.00 TUBE HUNTINGTON #WSB-27-24-MS OR EQUAL	5	COMM	304 SS
7	TUBING 24" OD X .50 THK X LG AS REQ'D	4	THIS DWG	304 SS
6	BOLT-TYPE WIRE SEAL FLANGE 24.00 TUBE HUNTINGTON #WSB-27-24-M OR EQUAL	3	COMM	304 SS
2	VACUUM VESSEL FLANGE	2	THIS DWG	304 SS
1	CENTER SECTION	1	THIS DWG	304 SS

PLAN VIEW
PORT COVERS NOT SHOWN

A E-DB1002 (K-6)

WELDING ENGINEER
APPROV. B. PARSELLS. DATE 11-18-98

RELEASED CAT: A3
PPPL CAD: Thankam Jacob

K+E 10 X 10 TO THE CENTIMETER 18 X 25 CM. KEUFFEL & ESSER CO. MADE IN U.S.A.

46 1512
Digitally signed by William Gattoni
Date: 2019.10.30 15:04:42 -04'00'

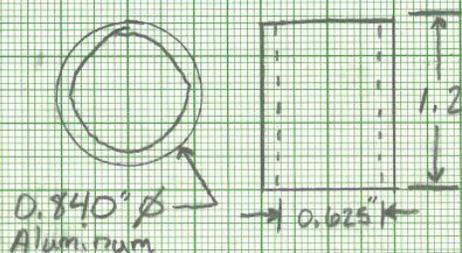
Robert Ellis

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Date: 2019.10.30 14:53:07 -04'00'

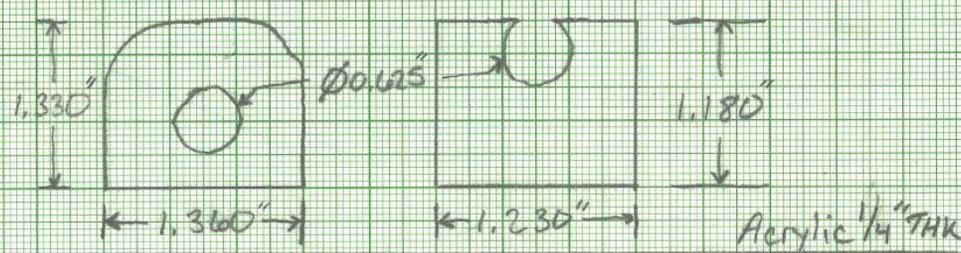
Sketch#: SK20-0037, Sheet 1

Bay's I, H, F Removal Fixture

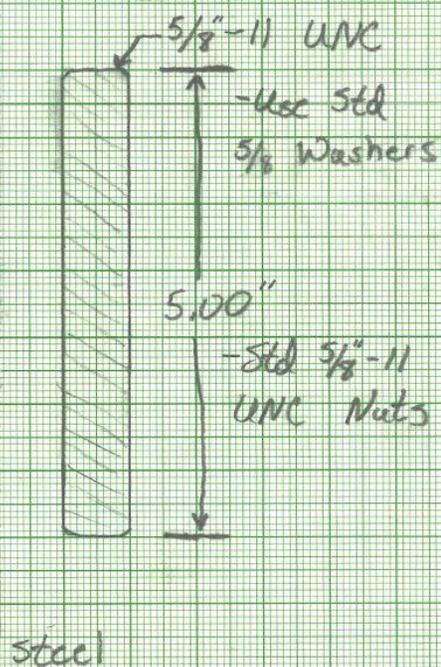
Flange Guide Spacer:



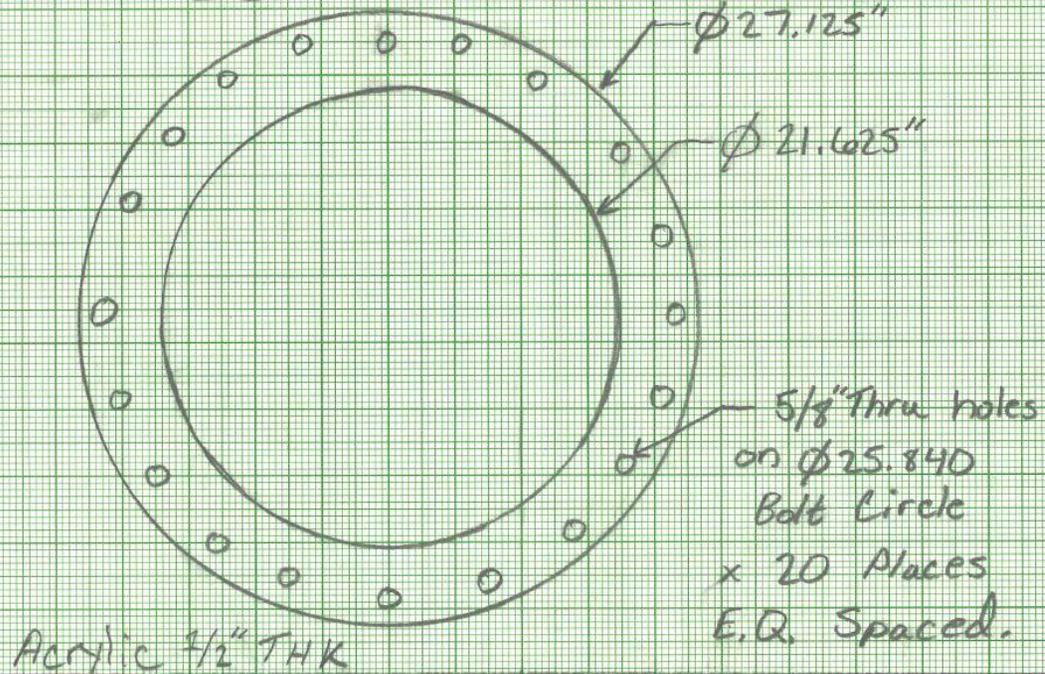
Dust Cover Retainers:



Studs, Washers, Nuts:



Guide Flanges:



Sketch#: SK20-0037, Sheet 2

