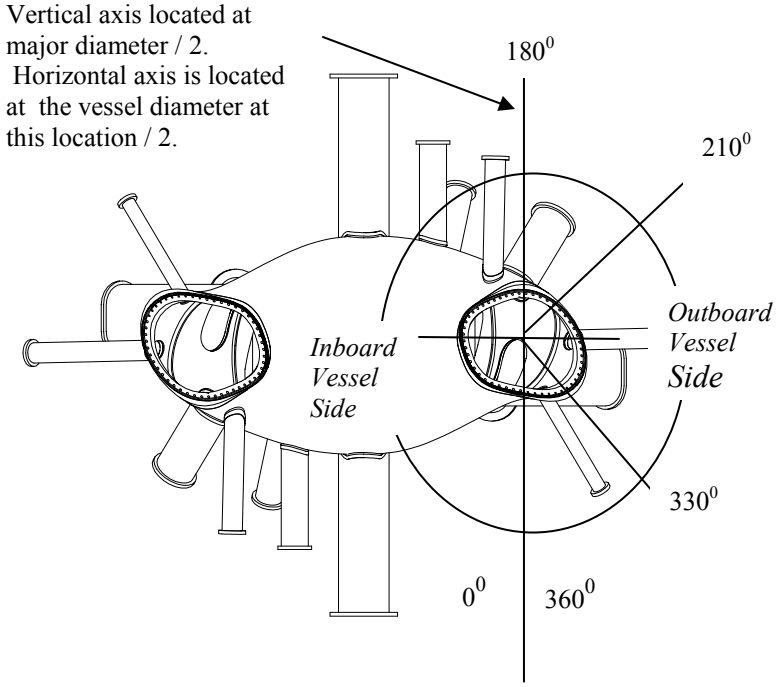
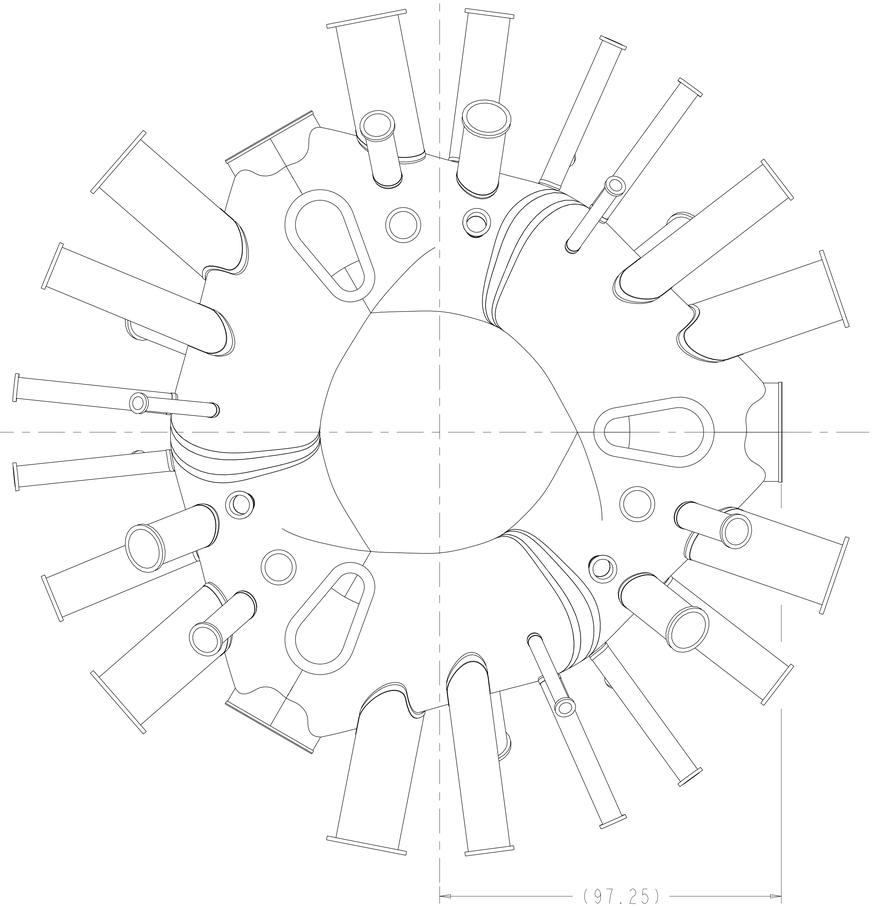
Proposed NCSX Vacuum Vessel Tolerances

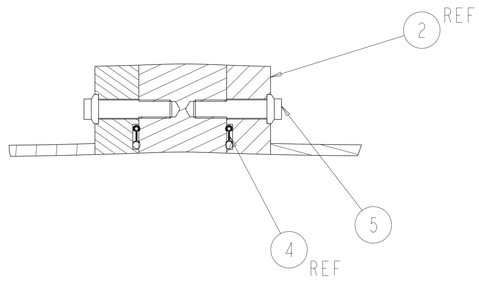
The proposed tolerances below are given as interim information for use in preparation in of your proposal. Comments and recommendations on tolerances (including the way they are defined) that would make the vessel easier to manufacture and inspect or that would reduce costs are encouraged and should be included in your proposal. Updates to the vessel drawings will be made prior to Subcontract awards; these drawings will formally incorporate tolerances which may be revised as a result of comments and recommendations.

Location	**Tolerance**
Inboard vessel wall location (poloidal angle 0-180 ^{0})	+/- 0.188"
Outboard vessel wall tolerance transition regions (poloidal angle 180-210^0 and 330-360^0)	Smooth transition in tolerance from +/- 0.188" to +/- 0.375" over the angular regions indicated.
Outboard vessel wall location (poloidal angle 210-330 ^{0})	+/- 0.375"
Port assembly length "L" (ref. SE 120-002)	+/- 0.125"
Port extension profile location	Within 0.250"
Vessel wall thinning allowance	Local areas <10% of total in any poloidal band: max. -0.060"
Vessel plate thickness tolerance	Per ASTM Standard B443
Port wall thickness tolerance	Per ASTM B443, B444, or B705, as applicable.
Flange flatness after welding (non-circular flanges)	+/- 0.005"
Sector end flange profile location	Within 0.030"

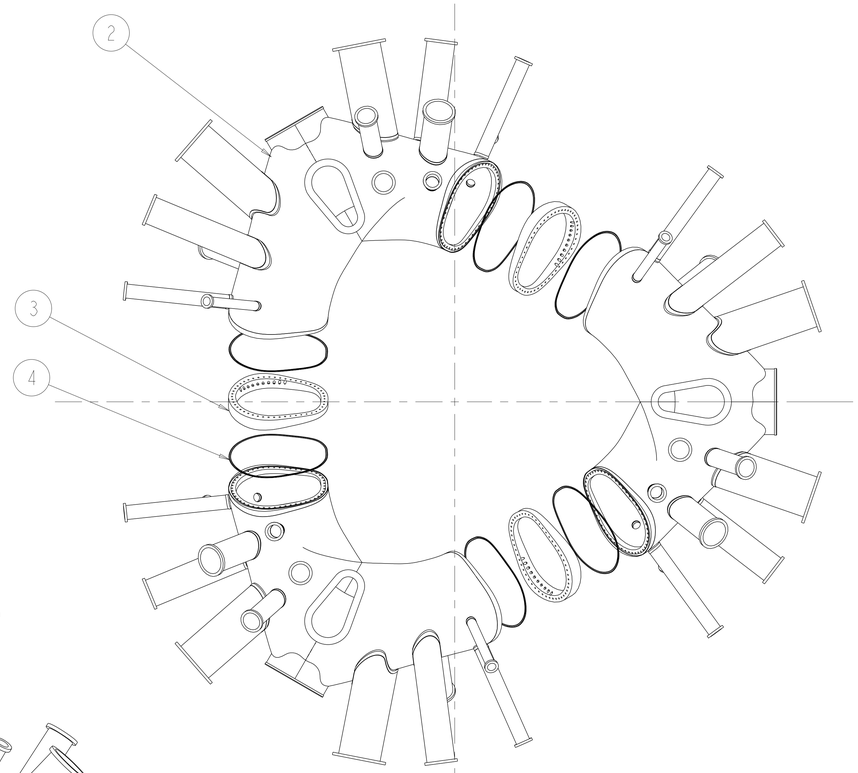


NOTES:
1. INTERPRET DIMENSIONS AND TOLERANCES PER ANSI Y14.5M.
2. DIMENSION ARE IN INCHES.
3. REQUIREMENTS FOR FABRICATING THE VACUUM VESSEL ARE DEFINED IN THE DRAWINGS, MODELS, AND SPECIFICATION.
4. THE VACUUM VESSEL GEOMETRY IS DEFINED IN CAD MODELS/FILES SE120-001.ASM, SE120-002.ASM, AND SE121-019.PRT.
5. ADDITIONAL TOLERANCE LIMITS ARE DEFINED IN DOCUMENT NCSX-12-122002-PH
6. HELIUM LEAK TEST SHALL SHOW NO DETECTABLE LEAK WITH THE DETETECTOR SENSITIVITY SET AT 1.0 X 10^{-9} STD-CC/SEC.

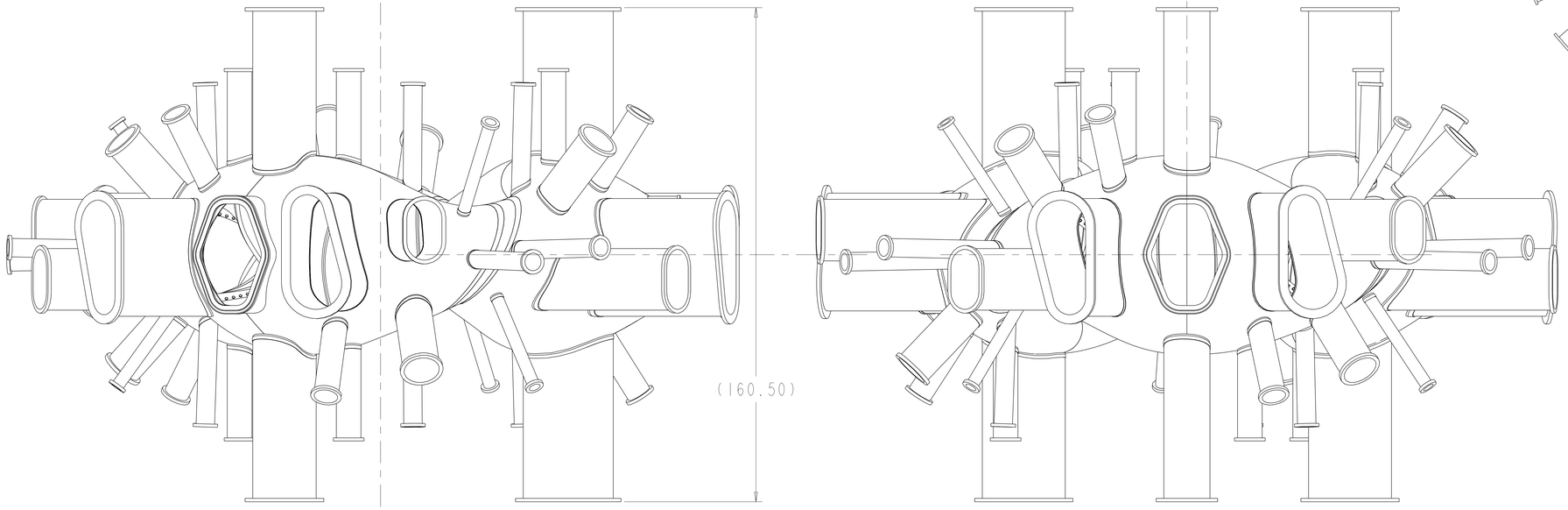




TYPICAL FLANGE/SEAL CONFIGURATION



EXPLODED VIEW
SCALE 0.040



1 SCALE = 0.060

Weight = 18808 lbs

next assy		CAGE CODE	PART OR IDENTIFYING NO	NOMENCLATURE OR DESCRIPTION	MATERIAL	SPECIFICATION	FIND NO
	300		.625-11UNC-2A X 3.0 LG	SOC HD CAP SCREW			5
	6		-4	VACUUM VESSEL SEAL			4
	3		SE121-019	VACUUM VESSEL SPACER			3
	3		SE120-002	VACUUM VESSEL PERIOD ASSEMBLY			2
	X		SE120-001	VACUUM VESSEL ASSEMBLY			1
		← NEXT ASSEMBLY		PARTS LIST			

QUALITY VERIFICATION
MECHANICAL AND STRUCTURAL
REFERENCE ORNL QA-G05

QV CLAUSE	DOCUMENTS REQUIRED	APPLICABLE TO PART NO ▾
303	MATERIAL MILL TEST REPORT	
325	MATERIAL SELLER CERT	X
326	SPECIAL MATERIAL INSPECTION REPORT	
205	MANUFACTURING, INSPECTION, AND TEST PLAN	X
312	FIELD INSPECTION AND TEST PLAN	X
321	WELD AND BRAZE INSPECTION REPORT	X
322	HEAT TREAT REPORT (MICHART)	
310	LEAK TEST REPORT	X
315	CLEANING CERT	X
318	DEVIATION REQUEST	X
319	NONCONFORMANCE REPORT	X
323	DIMENSIONAL REPORT	X
330	FUNCTIONAL TEST REPORT	
100	DOCUMENTTION	X

▾ SYMBOL X INDICATES APPLICABLE TO ALL PARTS OR ITEMS

QA COORDINATOR ..... DATE .....

PRELIMINARY
FOR INFORMATION ONLY

REV	DESCRIPTION	A-E	BY	CHK	SECT	DEPT	DATE	PE	REQ	DATE	ORNL	DATE	DOE	DATE
	REVISION OR ISSUE PURPOSE					REVISION APPROVALS								

QA	CV	EC	EE	EM	IE	M	PD	SE	ST	XAD	PES
SQUAD CHECK											

SCALE NOTED

TOLERANCES UNLESS OTHERWISE SPECIFIED

FRACTIONS	:
XX DECIMALS	±.01
XXX DECIMALS	±.005
ANGLES	±0°15'
BREAK SHARP EDGES	.06 MAX
FINISH	125 UNLESS OTHERWISE SPECIFIED

DRAWING APPROVALS		DATE
DES	P. L. GORANSON	12/02
DRW	M. J. COLE	12/02
CHK	:	:
SECT	:	:
DEPT	:	:
PE	:	:
CR	:	:
PJ	:	:
REQ	:	:

UT-BATTELLE
Oak Ridge National Laboratory
managed for the DEPARTMENT OF ENERGY under
U.S. GOVERNMENT contract DE-AC05-00OR22725
UT-BATTELLE, LLC. Oak Ridge, Tennessee

PROJECT NAME
NATIONAL COMPACT STELLERATOR EXPERIMENT

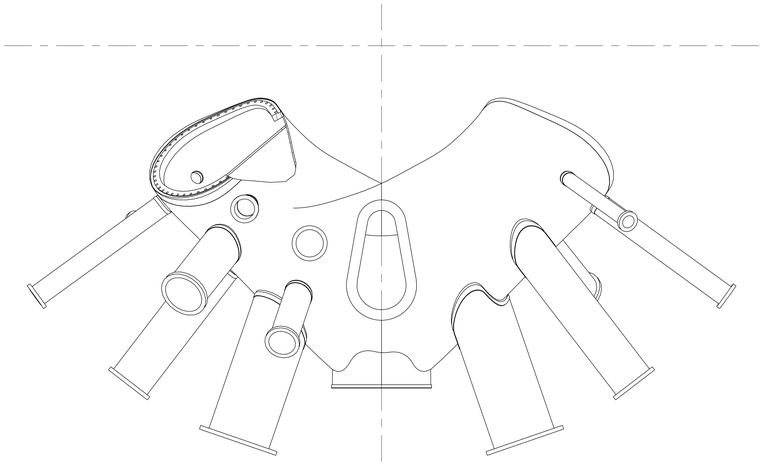
VACUUM VESSEL ASSEMBLY

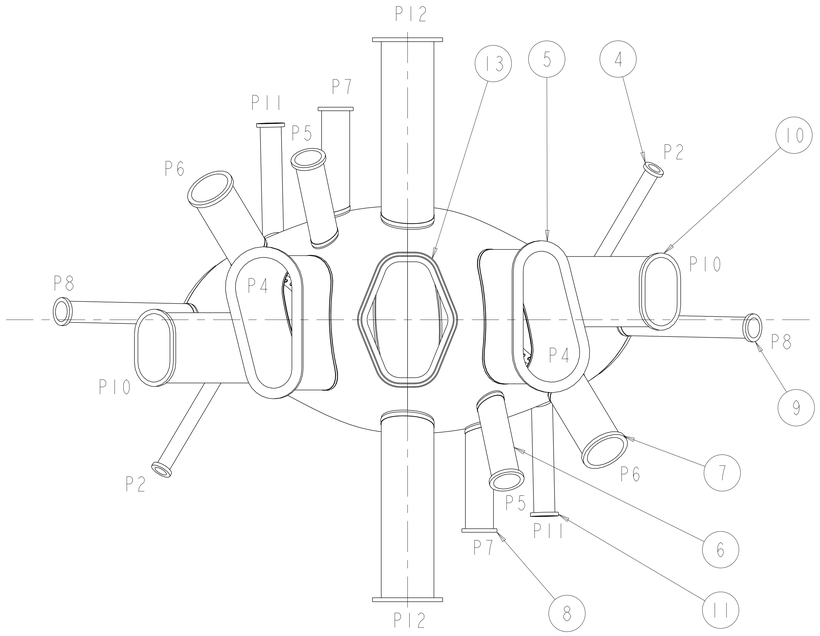
VERSION NO.	PLANT	BLDG	FL	SHT	OF	TYPE	CLASS
4+	XX	XX	X	1	1	X	U

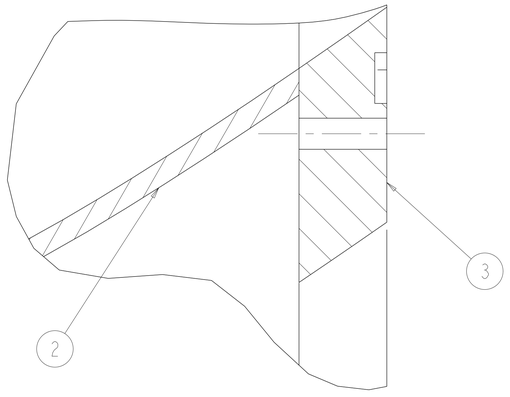
RELEASE LEVEL: WIP

SE120-001 REV 0

P THIS DRAWING PRODUCED ON PRO-ENGINEER



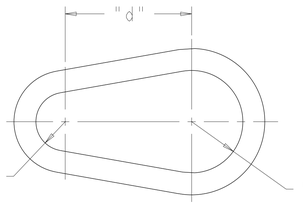




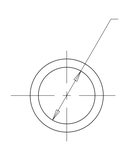
TYPICAL FLANGE CONFIGURATION
SCALE: 1.00

NOTES:
1. INTERPRET DIMENSIONS AND TOLERANCES PER ANSI Y14.5M.
2. DIMENSION ARE IN INCHES.
3. REQUIREMENTS FOR FABRICATING THE VACUUM VESSEL ARE DEFINED IN THE DRAWINGS, MODELS, AND SPECIFICATION.
4. GEOMETRY OF VACUUM VESSEL IS DEFINED IN CAD MODELS/FILES SE120-001.ASM, SE120-002.ASM AND SE121-019.PRT
5. HELIUM LEAK TEST SHALL SHOW NO DETECTABLE LEAK WITH LEAK DETECTOR SENSITIVITY SET AT 1.0×10^{-9} STD-CC/S.
6. ALL MATERIAL EXCEPT FOR CONFLAT FLANGES TO BE UNS N06625. CONFLAT FLANGES TO BE 304 SST.
7. BLANK MATING FLANGES AND ASSOCIATED SEALS AND HARDWARE TO BE FURNISHED FOR ALL PORTS.
8. ADDITIONAL TOLERANCE LIMITS ARE DEFINED IN DOCUMENT NCSX-12-122002-PH.

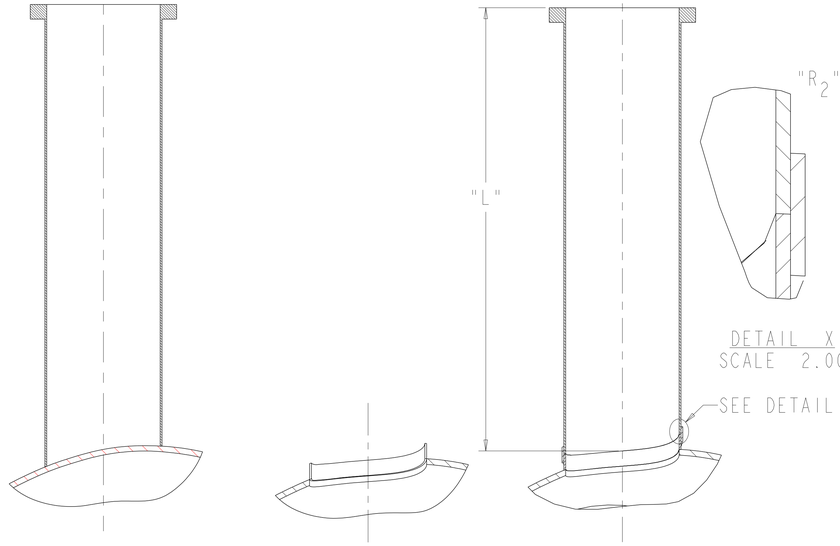
PORT #	QTY	"L" APPROXIMATE	"D" TUBE O.D.	"R_1" TUBE	"R_2" TUBE	"D" TUBE	"T" TUBE THK	FLANGE TYPE
P2	2	35.5	Ø4	--	--	--	.125	Ø6" CONFLATE
P4	2	32.0	--	9.0	6	23.25	.5	O-RING FLANGE
P5	2	26.0	Ø8	--	--	--	.125	Ø10" CONFLATE
P6	2	25.0	Ø12	--	--	--	.25	Ø14" CONFLATE
P7	2	28.5	Ø8	--	--	--	.125	Ø10" CONFLATE
P8	2	44.0	Ø6	--	--	--	.125	Ø8" CONFLATE
P10	2	44.0	--	6	6	8	.25	O-RING FLANGE
P11	2	32.0	Ø6	--	--	--	.125	Ø8" CONFLATE
P12	2	47.0	--	7.5	4.5	17.28	.5	O-RING FLANGE



TYPICAL RACETRACK PORT
SCALE 0.13



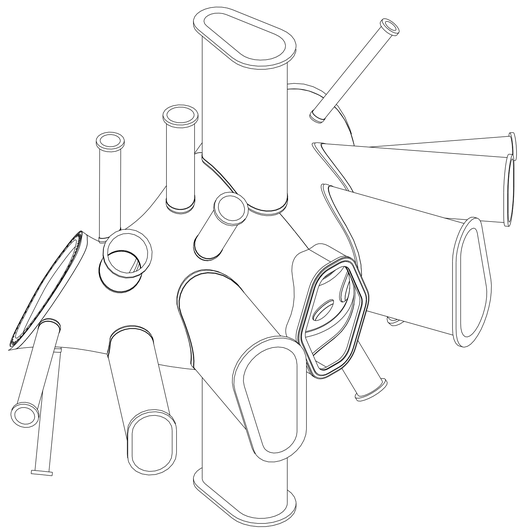
TYPICAL CONFLAT PORT
SCALE 0.13



DETAIL X
SCALE 2.00

TYPICAL PORT CONFIGURATION
SCALE: .25

		1	-13	NEUTRAL BEAM PORT WELDMENT		13
		2	-12	P12 PORT WELDMENT		12
		2	-11	P11 PORT WELDMENT		11
		2	-10	P10 PORT WELDMENT		10
		2	-9	P8 PORT WELDMENT		9
		2	-8	P7 PORT WELDMENT		8
		2	-7	P6 PORT WELDMENT		7
		2	-6	P5 PORT WELDMENT		6
		2	-5	P4 PORT WELDMENT		5
		2	-4	P2 PORT WELDMENT		4
		2	-3	VACUUM VESSEL FLANGE		3
		1	-2	VACUUM VESSEL BODY		2
	AR	X	-1	VACUUM VESSEL PERIOD ASSEMBLY		1
next assy SE120-001	-	CAGE CODE	PART OR IDENTIFYING NO	NOMENCLATURE OR DESCRIPTION	MATERIAL / SPECIFICATION	FIND NO
		← NEXT ASSEMBLY		PARTS LIST		



ISOMETRIC VIEW

(1) SCALE: .06

QUALITY VERIFICATION
MECHANICAL AND STRUCTURAL
REFERENCE ORNL QA-G05

QV CLAUSE	DOCUMENTS REQUIRED	APPLICABLE TO PART NO ♦
303	MATERIAL MILL TEST REPORT	
325	MATERIAL SELLER CERT	X
326	SPECIAL MATERIAL INSPECTION REPORT	
205	MANUFACTURING, INSPECTION, AND TEST PLAN	X
312	FIELD INSPECTION AND TEST PLAN	X
321	WELD AND BRAZE INSPECTION REPORT	X
322	HEAT TREAT REPORT (WECHART)	
310	LEAK TEST REPORT	X
315	CLEANING CERT	X
318	DEVIATION REQUEST	X
319	NONCONFORMANCE REPORT	X
323	DIMENSIONAL REPORT	X
330	FUNCTIONAL TEST REPORT	
100	DOCUMENTION	X

♦ SYMBOL X INDICATES APPLICABLE TO ALL PARTS OR ITEMS

QA COORDINATOR ..... DATE .....

PRELIMINARY
FOR INFORMATION ONLY

REV	DESCRIPTION	A-E	BY	CHK	SECT	DEPT	DATE	PE	REQ	DATE	ORNL	DATE	DOE	DATE	QA	CV	EC	EE	EM	IE	M	PD	SE	ST	XAD	PES
	REVISION OR ISSUE PURPOSE					REVISION APPROVALS									SQUAD CHECK											

SCALE NOTED
TOLERANCES UNLESS OTHERWISE SPECIFIED
FRACTIONS :
XX DECIMALS ±.01
XXX DECIMALS ±.005
ANGLES ±0°15'
BREAK SHARP EDGES .06 MAX
FINISH 125 UNLESS OTHERWISE SPECIFIED

DRAWING APPROVALS	DATE
DES P. L. GORANSON	12/02
DRW M.J.COLE & G.H.JONES	12/02
CHK	
SECT	
DEPT	
PE	
CR	
PJ	
REQ	

UT-BATTELLE
Oak Ridge National Laboratory
managed for the DEPARTMENT OF ENERGY under U.S. GOVERNMENT contract DE-AC05-00OR22725
UT-BATTELLE, LLC. Oak Ridge, Tennessee

PROJECT NAME
NATIONAL COMPACT STELLERATOR EXPERIMENT

VACUUM VESSEL
PERIOD
ASSEMBLY

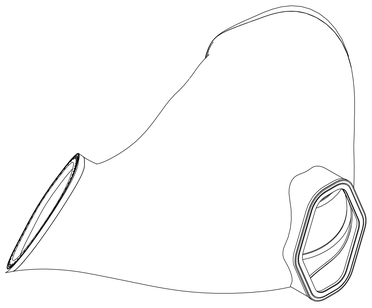
VERSION NO.	PLANT	BLDG	FL	SHT OF	TYPE	CLASS
5+	XX	XX	XX	1 2	XX	U

RELEASE LEVEL: WIP
SE120-002
REV 0

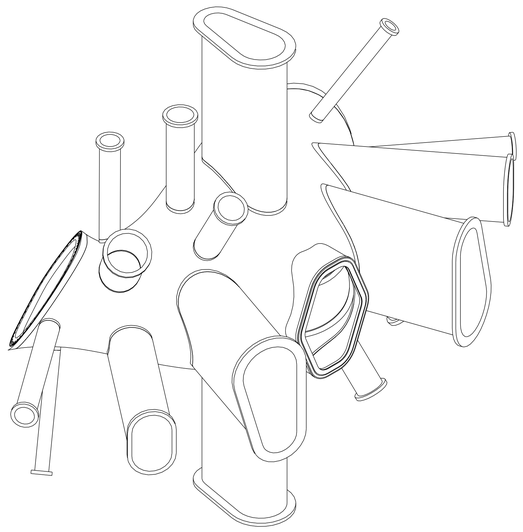
P THIS DRAWING PRODUCED ON PRO-ENGINEER

SE120-002

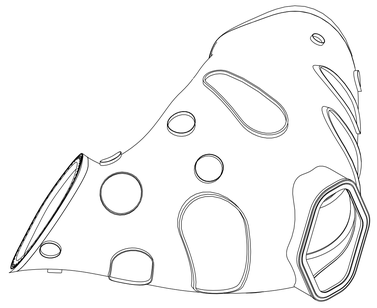
FABRICATION STEPS
(VENDOR RESPONSIBLE FOR STEPS 1 THRU 4)



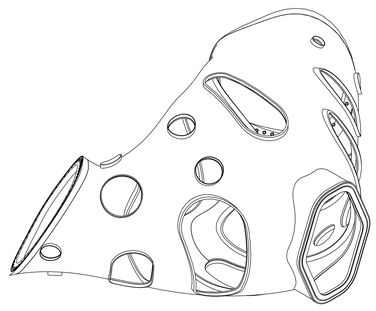
STEP 1
BASIC VESSEL
CONFIGURATION



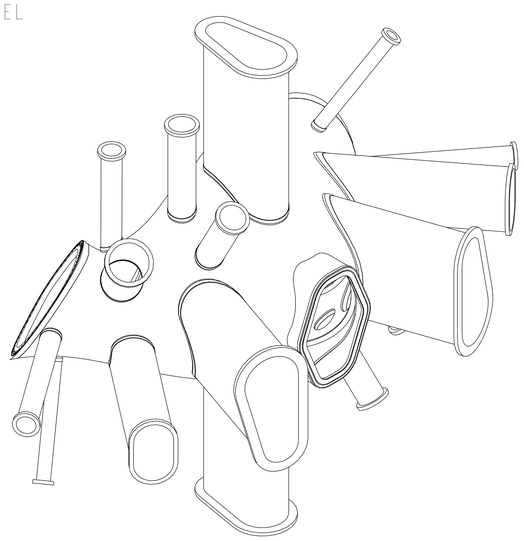
STEP 2
PORTS HAVE BEEN
POSITIONED AND
WELDED TO
VESSEL



STEP 3
PORTS HAVE BEEN CUT
LEAVING A STUB ON THE
VESSEL FOR REATTACHING
PORTS AT PPPL



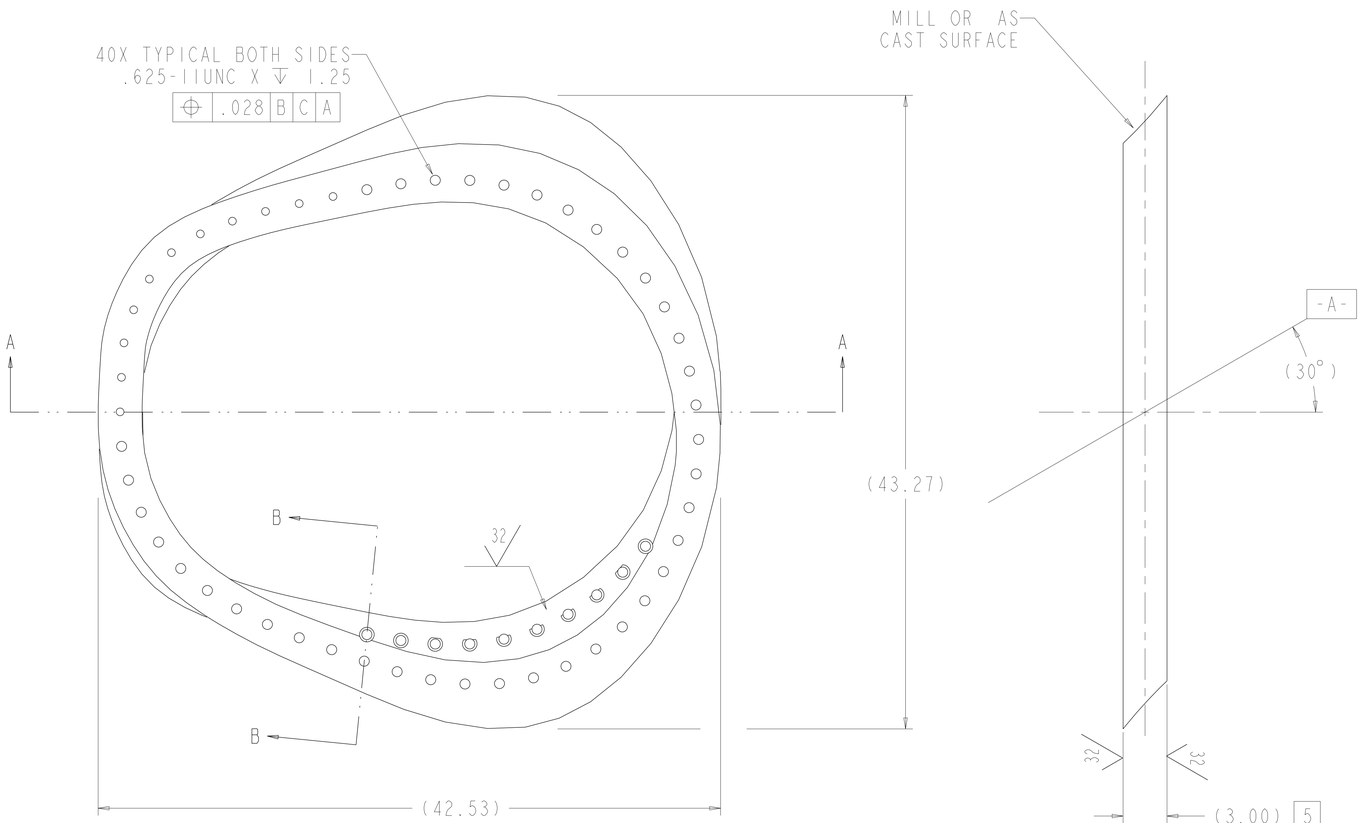
STEP 4
HOLES HAVE BEEN
CUT IN THE VESSEL



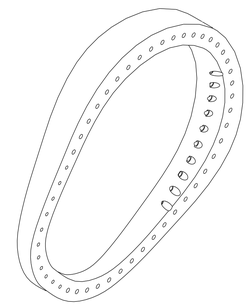
STEP 5
DURING THE DEVICE ASSEMBLY
AT PPPL THE PORTS WILL BE
REATTACHED AS SHOWN.

UT-BATTELLE	Oak Ridge National Laboratory managed for the DEPARTMENT OF ENERGY under U.S. GOVERNMENT contract DE-AC05-000R22725 UT-BATTELLE, LLC Oak Ridge, Tennessee						
PROJECT NAME: NATIONAL COMPACT STELLERATOR EXPERIMENT							
VACUUM VESSEL PERIOD ASSEMBLY							
VERSION NO. 6+	PLANT XX	BLDG XX	FL XX	SHT 2 OF 2	TYPE XX	CLASS U	
RELEASE LEVEL WIP	SE120-002					REV 0	

200-0213

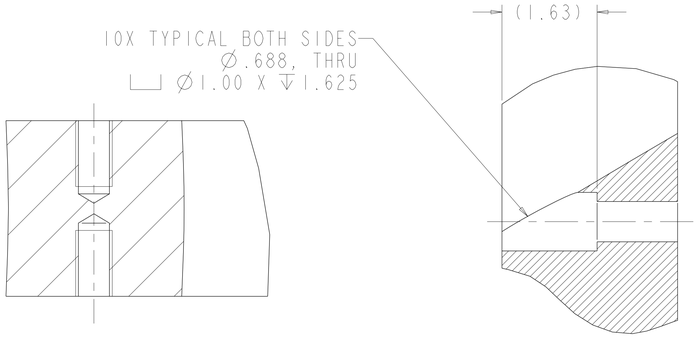


NOTES:
1. INTERPRET DIMENSIONS AND TOLERANCES PER ANSI Y14.5M.
2. DIMENSION ARE IN INCHES.
3. REQUIREMENTS FOR FABRICATING THE VACUUM VESSEL SPACER ARE DEFINED IN THE DRAWINGS, MODELS, AND SPECIFICATION.
4. GEOMETRY OF VACUUM VESSEL SPACER IS DEFINED IN CAD MODELS/FILES SE121-019.PRT.ASM, SE120-001.ASM, AND SE120-002.ASM.
5. MEASURE AND MACHINE TO FIT AT ASSEMBLY, SE120-001.
6. HELIUM LEAK TEST SHALL SHOW NO DETECTABLE LEAK WITH DETECTOR SENSITIVITY SET AT 1.0×10^{-9} STD-CC/SEC.
7. ADDITIONAL TOLERANCE LIMITS ARE DEFINED IN DOCUMENT NCSX-I2-I22002-PH.



SCALE 0.125

SECTION A-A



DETAIL X
SCALE 1.00

SECTION B-B
SCALE 1.00

(1) SCALE: .25

WEIGHT = 362.83 lbs

PRELIMINARY
FOR INFORMATION ONLY

next assy							
SE120-002	AR		-1	VACUUM VESSEL SPACER DETAIL	UNS N06625		1
	CAGE CODE	PART OR IDENTIFYING NO	NOMENCLATURE OR DESCRIPTION	MATERIAL	SPECIFICATION		FIND NO
	← NEXT ASSEMBLY	PARTS LIST					

QUALITY VERIFICATION
MECHANICAL AND STRUCTURAL
REFERENCE ORNL QA-G05

QV CLAUSE	DOCUMENTS REQUIRED	APPLICABLE TO PART NO *
303	MATERIAL MILL TEST REPORT	
325	MATERIAL SELLER CERT	X
326	SPECIAL MATERIAL INSPECTION REPORT	
205	MANUFACTURING, INSPECTION AND TEST PLAN	X
312	FIELD INSPECTION AND TEST PLAN	X
321	WELD AND BRAZE INSPECTION REPORT	X
322	HEAT TREAT REPORT (W/CHART)	
310	LEAK TEST REPORT	X
315	CLEANING CERT	X
318	DEVIATION REQUEST	X
319	NONCONFORMANCE REPORT	X
323	DIMENSIONAL REPORT	X
330	FUNCTIONAL TEST REPORT	
100	DOCUMENTION	X

* SYMBOL X INDICATES APPLICABLE TO ALL PARTS OR ITEMS

QA COORDINATOR ..... DATE .....

REV	DESCRIPTION	A-E	BY	CHK	SECT	DEPT	DATE	PE	REQ	DATE	ORNL	DATE	DOE	DATE	QA	CV	EC	EE	EM	IE	M	PD	SE	ST	XAD	PES
	REVISION OR ISSUE PURPOSE								REVISION APPROVALS						SQUAD CHECK											

SCALE NOTED
TOLERANCES UNLESS OTHERWISE SPECIFIED
FRACTIONS
XX DECIMALS ±.01
XXX DECIMALS ±.005
ANGLES ±0°15'
BREAK SHARP EDGES .06 MAX
FINISH 125 UNLESS OTHERWISE SPECIFIED

DRAWING APPROVALS	DATE
DES P. L. GORANSON	12/02
DRW M.J.COLE & G.H.JONES	12/02
CHK	
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PJ	
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UT-BATTELLE, LLC. Oak Ridge, Tennessee

PROJECT NAME
NATIONAL COMPACT STELLERATOR EXPERIMENT

VACUUM VESSEL SPACER DETAIL

VERSION NO.	PLANT	BLDG	FL	SHT	OF	TYPE	CLASS
3+	XX	XX	XX	1	1	XX	U

RELEASE LEVEL: WIP
SE121-019
REV 0

SE121-019

P THIS DRAWING PRODUCED ON PRO-ENGINEER