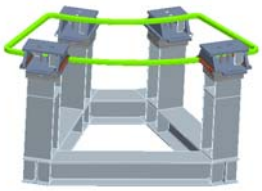
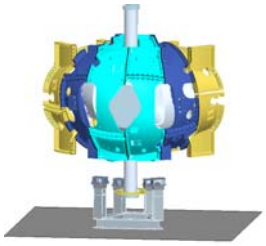
Station 5 (Assembly of VV ports, TF and services) **See last page for Rev changes**

Step	Assembly Step	Comments
1.00	**Component preparations**	
1.01	The short dome port (the one on the top of the dome) needs to cut off near the dome. The longest port can remain.	See drawing: XXXXXXXX The dome (with its long port attached) can be installed after the MCHP is rotated over the VV.
1.02	Install insulation system around all ports.	Drawings: se122-080, -81, -82, -83 This activity can be done before Station 5 begins.
1.03	Install heat tape and theomocouples on all ports.	Drawings: se123-150, -51, -56. This activity can be done before Station 5 begins.
2.00	**Pre-Installation set-up**	**metrology procedure covering Station 5:**
2.01	Install period support fixture	
2.02	Temporarily position/support lower trim coils that surrounds lower vertical port on the FPA support stand	The support stand needs to be reworked to accommodate the lower trim coil.
2.03	Install FPA on support stand with rotation motion to clear horse collar/trim coil interface. Use leveler pad to engage base of MC.	
2.04	Install external working platforms	
2.05	Install internal VV working platforms	

FPA support stand

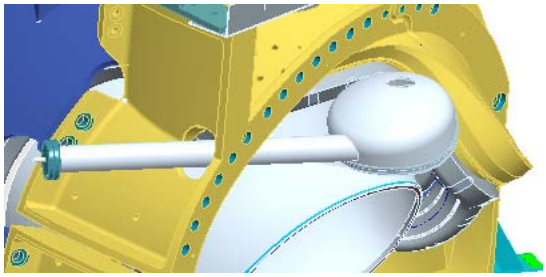


FPA support stand with lower trim coil

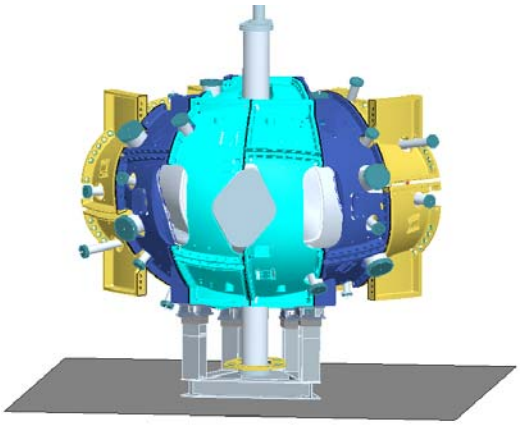


FPA lowered onto support stand

3.00	**VV port installation**	**Reference drawing:**
3.01	Install the domes (left and right side), inserting the long dome port through the MC opening, and weld the dome shell to the VV.	Insulation, heat tape and thermocouples should be on the port.
3.02	Install small dome ports and remaining circular ports. Use a guide tool located at the MC hole opening to help support and center the port. Ports should already have insulation, heater tape and thermocouples on them.	Use a local laser attached to the port cover to define the port trajectory and to aid positioning in port during welding.
3.03	Leak check each port after is welded	



Dome installation

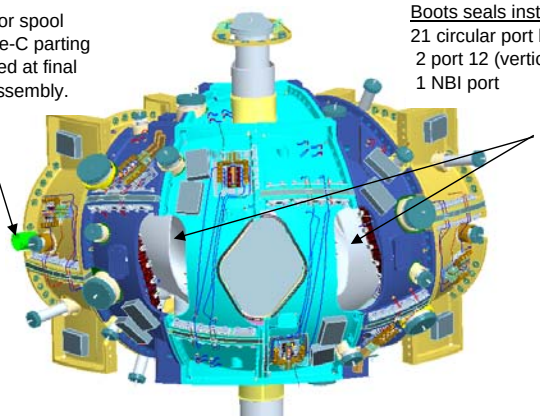


VV ports installation

Station 5 (Assembly of VV ports, TF and services) **See last page for Rev changes**

Step	Assembly Step	Comments
4.00	**Install port boot seal assembly**	**Reference drawing: se122-004 assembly drawing plus many subassembly drawings.**
4.01	Install boots on all ports except for the two port 4's.	25 boot assemblies to be installed at this time (see table below)

Boot seal for spool port at Type-C parting joint installed at final machine assembly.

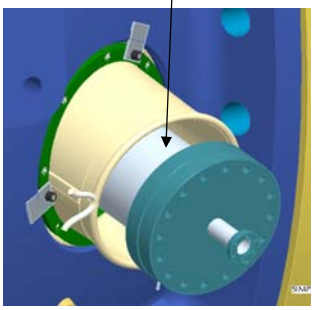


Boot seals on port 4 installed later

Boot seal assemblies

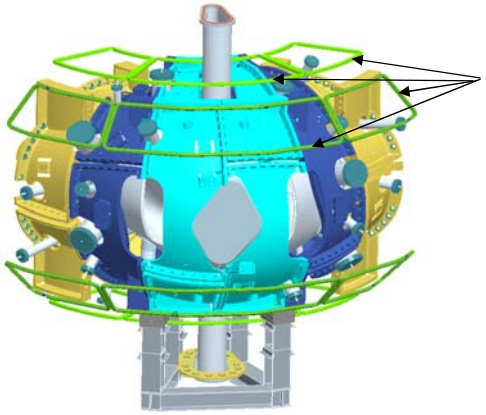
Boots seals installed
21 circular port boots
2 port 12 (vertical ports)
1 NBI port

local port insulation is not shown..



Typical circular port boot assembly.

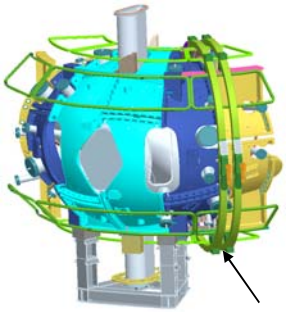
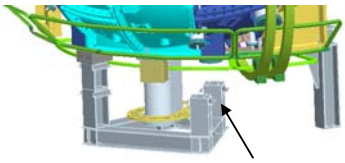
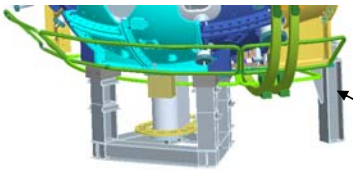
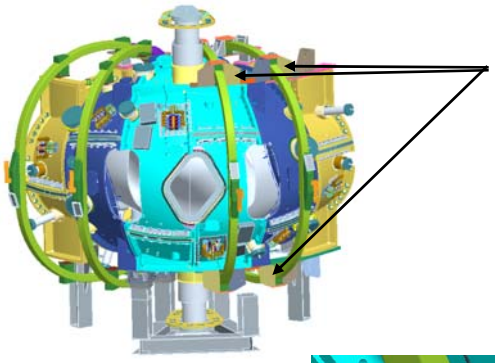
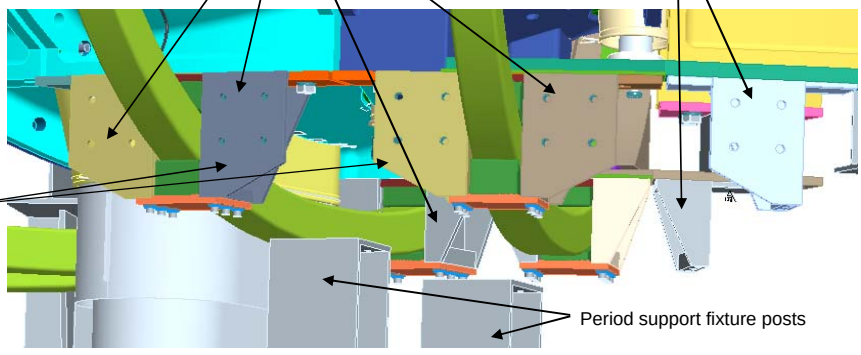
5.00	**Install trim coils**	**Reference drawing:**
5.01	Install six upper and six lower trim coils as shown in the figure below. Note this figure does not show the VV port boots.	The trim coils will be mounted to the MC shells using local support brackets.
5.02	A metrology effert is needed here to measure the location of all the trim coils.	This will be similar to the measurement of the VV loops.



There are four different trim coil sizes at this time.

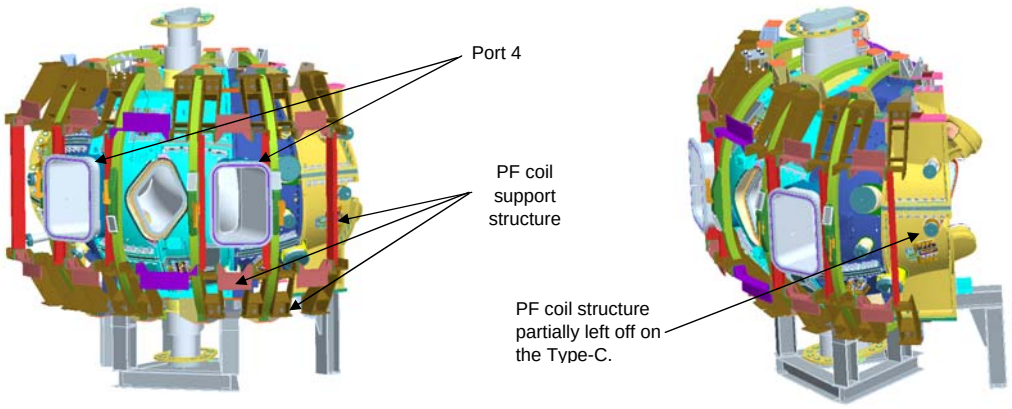
6.00	**MC lead and coolant connections**	**Reference drawing:**
6.01	Install MC lead connections on each of the MC's and temporally position the leads so they will not interfere with the TF coil installation and for routing through the PF structure.	
6.02	Install MC coolant lines on each MC and position them for the TF installation and routing through PF structure.	
6.03	Platforms may need to be altered or moved for the installation of the TF coils.	
7.00	**TF installation - right side**	**Reference drawing:**
7.01	Rotate two individual TF coils over the MC on the right side and temporarily support them off the Type-B and C MC's.	I am assuming that for cost and schedule purposes we do not need to install the third TF coil. My logic is that if we can properly align two (on each side) then we can align all of them.
7.02	Attach the temporary support at the end of the Type-C MC used to unload the a pair of center supports.	
7.03	Lower leveler pad to disengage base of MC on the right side. Remove right side leveler pad and intermediate support.	This allows access to install permanent TF supports and rotate TF coils into their final position.

Station 5 (Assembly of VV ports, TF and services) See last page for Rev changes

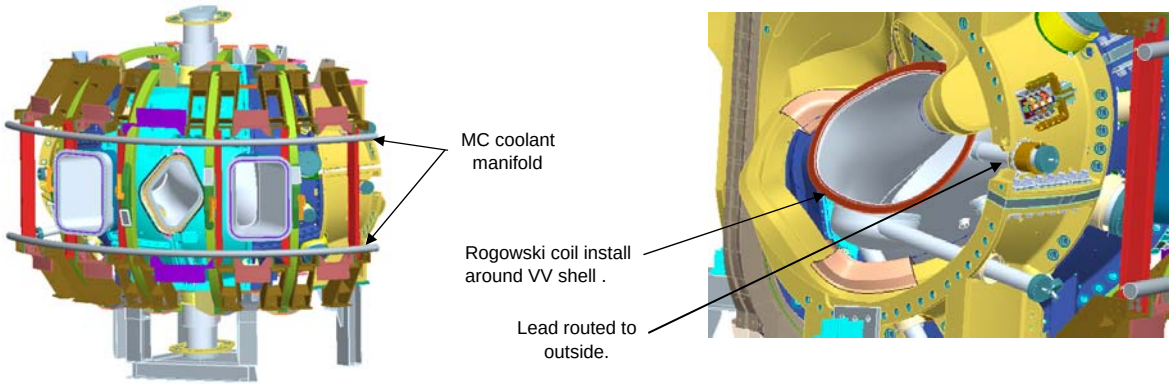
Step	Assembly Step	Comments
	 Two TF coils temporarily supported  Right side leveler pad and intermediate support removed..  Temporary end support	
7.04	Install TF support brackets (top & bottom) to the port 12 side on the Type-A MC (platforms will be needed).	
7.05	Slide the first TF assembly against the TF support bracket and secure in place with the mating support bracket.	
7.06	Install TF support brackets (top & bottom) to the port 12 side on the Type-B MC.	
7.07	Slide the second TF assembly against the support bracket and secure in place with the mating support bracket.	
7.08	Install machine support plates (inboard and outboard) on the bottom, spanning two TF coil support brackets.	The support plates will be used for the machine supports for Stage 5 and 6.
7.09	Reinstall leveler pad to engage base of MC on the right side.	
7.10	Installed one side of the TF support brackets on the Type-C coil (top and bottom) for the TF installation to occur at Station 6.	
	 Install TF support brackets on the sides of the coils, both on the top of the MC and on the bottom. Lower TF support brackets attached to the MC's are shown, inboard and outboard. One side TF brackets attached on Type-C MC's are shown, inboard and outboard.  The lower supports will be modified to allow machine support plates to be attached from which the machine will be supported from the period support fixture. Period support fixture posts	
8.00	**TF installation - left side**	**Reference drawing:**
8.01	The TF installation on the left side will follow the same ten (10) steps that were followed on the right side.	
9.00	**TF fit-up check**	**Reference drawing:**
9.01	Perform a fit-up check of the four TF coils to determine if they can be positioned within tolerances.	We will need to define some external fixture that you can use to pull the coils and wedge them in the nose. This may need to be only done on Period 1.
10.00	**Install Ports 4**	**Reference drawing:**

Station 5 (Assembly of VV ports, TF and services) See last page for Rev changes

Step	Assembly Step	Comments
10.01	Tack weld the left and right port 4's. Use a local laser attached to the port cover to define the port trajectory and to aid positioning in port during welding.	Insulation, heat tape and thermocouples should be on the port.
10.02	Install boots on both port 4's.	
11.00	**Installation of PF structural members and routing of MC coolant and leads.**	**Reference drawing:**
11.01	Install the PF coil support structure that surround the TF coils. In doing this the MC leads and coolant lines need to be routed to the outside of the PF structure. PF structure is only partially installed at the Type-C MC's.	



12.00	**MC header installation and coolant connections**	**Reference drawing:**
12.01	Install the MC coolant manifold outside of the PF structure in the area of PF6.	
12.02	Connect all MC coolant lines to the manifold (40 lines top and bottom)	



13.00	**Diagnostic**	**Reference drawing:**
13.01	Install Rogowski coils on the end of the VV, left side. Route leads through space between port 8 and spool port opening and coil onto shell of MC for future routing (see figure above).	The lead penetration through the shell will need to be sealed at final assembly. (This may be done on Station 1)
14.00	**Final measurements**	**Reference drawing:**
14.01	Obtain a set of Period 1 alignment fiducial positions to use in locating the VV within the MC.	
14.02	Using the laser tracker, align to tooling balls on each MCHP, locking into a minimum of 8 of them.	
14.03	Using monuments on the VV for alignment, bring the VV into proper alignment. Make final adjust in the VV supports to secure VV in place.	A goal would be to bring the VV within positional tolerance with a maximum deviation of maybe .050". ANY COMMENTS HERE?
14.04	Install or identify three primary fiducials that will be used in positioning the Period in Station 6.	
14.05	Make a final measurement of all fiducials, the VV end flanges and the Type-C MC end flanges. Record the results.	
14.06	Perform acceptance test of completed operations	
14.07	Check Assembly (bolts, etc)	
14.08	Check Diagnostics (loops, thermocouples)	

Station 5 (Assembly of VV ports, TF and services) **See last page for Rev changes**

Step	Assembly Step	Comments
14.09	Check manifolds (pressure, flow, etc.	
14.10	Check 6 modular coils (voltage etc)	
14.11	Check trim coils (voltage etc	
14.12	Check TF coils (voltage etc	
15.00	**Transfer Period to final assembly (Station 6)**.	
15.01	Install crane rigging to completed Period assembly	
15.02	Remove platforms	
15.03	Transfer completed Period to Station 5 located in NCSX test cell.	

Change in Rev 9.2:

1 Added lower trim coil onto support stand (Step 2.02) and altered installation of Period onto the stand (Step 2.03).
2 Added full installation of the trim coils as Step 5, increasing the numbering of all following Steps by 1.

Change in Rev 7:

1 Updated sequence plan per Ron's schedule: NCSX Preliminary CP Sched 20070531

Change from Rev 5:

1 Added an acceptance test (13.06) to be performed on all completed systems.