Station 2 - 1st Article (Half Period Assembly) See last page for Rev changes

NO.	ASSEMBLY STEP	COMMENTS
1.00	MC fit-up pre-check and surface insulation	
1.01	Verify that mating MC's of a MCHP will come together without	The full assembly layout of the mating MC's can be found in Table 1 and Figure 3
	interferences by pre-fitting mating coils. This will include the	below. Some of this effort may be done before the half period assembly activity
	Type-C coil with its interfacing Period Type-C coil.	begins.
		• _
2.00	Pre-measurement of MCHP Type A, B and C coils flanges	See MCHP component designation in Table 1 of this document.
	plus interfacing Type-A coil flange	MCHP Assembly Dimensional Control Plan: NCSX-PLAN-HPADC-00
2.01	Follow the steps defined in Section 2 of the Metrology Plan for	The acceptance criterion is .005" RMS deviation in alignment to the set of tooling
	racking coils and lower the Type-A modular coil onto the	balls. With a successful alignment a set of global fiducial monuments will have
	jacks, "A" flange (datum "D") down and rack the "A" coil into	been established. Subsequent alignments of the laser tracker will be to the global
	its proper shape.	monument
2.02	Scan the "B" flange (datum E) and the MC shell VV boss	
	interface. Measure tooling balls	
2.03	Remove Type-A coil from stand and move to holding area.	
2.04	Follow the steps defined in Section 2 of the Metrology Plan for	The acceptance criterion is .005" RMS deviation in alignment to the set of conical
	racking coils and lower the Type-B modular coil onto the	seats. With a successful alignment a set of global fiducial monuments will have
	jacks, "B" flange (datum "E") down and rack the "B" coil into	been established. Subsequent alignments of the laser tracker will be to the global
	its proper shape.	monument
2.05	Scan the "A" flange (datum D). Measure Tooling Balls	Flange measurement is needed for the A side (only) for the Type-B coil.
2.06	Remove Type-B coil from stand and store coil.	
2.07	Follow the steps defined in Section 2 of the Metrology Plan for	The acceptance criterion is .005" RMS deviation in alignment to the set of conical
	racking coils and lower the Type-C modular coil onto the	seats. with a successful alignment a set of global fiducial monuments will have
	Jacks, "B" flange (datum "E") down and rack the "C" coll into	been established. Subsequent alignments of the laser tracker will be to the global
2.00	its proper shape.	Figure measurement is peeded for the A side (only) for the Type C soil
2.08	Scan the A flange (datum D). Measure tooling balls.	Frange measurement is needed for the A side (only) for the Type-C coll.
2.09	Shim sizing (proparations	Matrology procedure covering Station 2:
3.00	Using flange measurement of the coils define the A/B shim	This is a back office calculation where shim thickness is predetermined based on
5.01	thickness	the scanned flange surface data
3.02	Compress alumina coated shims and sort by thickness the	Care must be taken when handling alumina shims to mitigate any possible surface
0.02	shim set that will be installed on the MCHP	contamination conditions
4.00	Pre-Installation Station 2 set-up	Metrology procedure covering Station 2:
4.01	Install MCHP fixtures and metrology equipment.	
4.02	Perform metrology set-up and checks	
5.00	Pre-assemble A-A	THIS STEP HAS BEEN ELIMINATED
6.00	A-B modular coil assembly	See MCHP component designation in Table 1 of this document.
		MCHP Assembly Dimensional Control Plan: NCSX-PLAN-HPADC-00
		Reference Drawings: SE140-003 a
6.01	Follow the steps defined in Section 2 of the Metrology Plan for	The acceptance criterion is .005" RMS deviation in alignment to the set of tooling
	racking coils, lower the Type-A modular coil onto the jacks,	balls. With a successful alignment a set of global fiducial monuments will have
	"A" flange (datum "D") down and rack the "A" coll into its	been established. Subsequent alignments of the laser tracker will be to the global
6.02	proper snape.	monument
0.02	Osing the Type-A (B-hange) inboard shift template mark the	ose a triff equivalent washer of the puck diameter (of some other method) to
	tomplato	provide a positional leer to allow measuring puck height in the A -B installed
6.03	Place an initial set of alumina shims (4-8) on the Type-A coil	See document XXXX for shim size and location
6.04	Place unfilled shim bags in the wing areas	
6.05	Lower the mating "B" coil into position.	
6.06	Install the jack screws and dial indicators for horizontal	
	positioning.	
6.07	Using three selected monuments on the "B" coil, position the	
0.01	coil within 002" in the Z-direction and within 060" in the X-Y	
	plane.	
6.08	Install the remaining alumina coated shims; install studs.	
	supernuts, and torque to 50% of final value.	
6.09	Make a hand "wiggle" test (rotate on bolt) on all shims to	
	make sure that they are tight. If a loose shim is found back off	
	on sufficient adjacent bolts to allow a replacement shim to be	
	inserted. Tighten bolt and recheck.	
6.10	After tightening, measure the position of all monuments per	An accuracy of .007" is expected
	the Dimensional Control Plan, following steps 2.3.3 through	
	2.3.7.	
6.11	Measure the shim puck height (at a number of points around	
	the puck surface) at each of the nose shim puck locations.	
1	Use the data to define each puck height.	

	Station 2 - 1st Article (Half Period Assembly)	See last page for Rev changes
NO.	ASSEMBLY STEP	COMMENTS
6.12	Unfasten bolts and raise the "B" coil in height to remove the	
	puck locating rings and install all nose shims with the properly	
	sized pucks. Use temporary shims to support the Type-B flex	
0.40	shims.	
6.13	"Lightly" tack weld the nose flex shims to the perspective "A"	
614	and B colls.	
0.14	separate fixture, with the Type-B coil side "A" flance (datum	
	"D") facing up	
6.15	Recheck the part alignment of the "A" coil to make sure it is	
0.10	still within alignment and then weld all Type-A flex shims to the	
	plasma side, following the weld sequence plan.	
6.16	After welding the "A" coil nose shims recheck alignment to	.005"rms
	determine if the part still meets the metrology acceptance	
	criterion.	
6.17	Time needs to be allocated for a back office assessment of	If Control Plan acceptance criterion is not met project input is needed to determine
0.40	the part after welding.	how to proceed.
6.18	On the separate fixture measure the "B" fiducials to establish	
6.19	With the successful "A" coil weld operation, weld all Type-B (A	
0.10	flange) flex shims to the plasma side, following the weld	
	sequence plan.	
6.20	After welding the "B" coil nose shims recheck the part to	Align to measurements of 6.18. Acceptance criterion is RMS .le004". Project
	determine if it still meets the metrology acceptance criterion.	input is required in the event of failure.
6.21	Time needs to be allocated for a back office assessment of	If Control Plan acceptance criterion is not met project input is needed to determine
0.00	the part after welding.	how to proceed.
6.22	Remove alumina shims as necessary except for the (4-8)	
	Initial locating shifts on the Type-A coll in designated	
6 23	I ower the mating "B" coil into position	
6.24	Using three selected monuments on the "B" coil position the	An accuracy of 002" or better is expected and required for this step
0.24	coil accurately in the X -Y plane.	
6.25	Raise the "B" coil slightly and install the remaining alumina	
	coated shims; install Fuji paper on all outboard shims, install	
	studs, supernuts, and torque to 50% of final value.	
6.26	Make a hand "wiggle" test (rotate on bolt) on all shims to	
	make sure that they are tight. If a loose shim is found back off	
	on sufficient adjacent bolts to allow a replacement shim to be	
0.07	inserted. Tighten bolt and recheck.	
6.27	After tightening, measure the position of all monuments per	I he maximum deviation from the "realigned" points should be .007" or less.
6.28	Unfasten the bolts, lift the "B" coil enough to remove the Fuii	
0.20	paper, and examine the load sharing. At the same time, the	
	"back office" will analyze the measurements of the monument	
	positions. A revised set of shim thicknesses, to provide	
	adequate load s	
6.29	If a revised set of shims is required, install the new shims and	
	Fuji paper. Lower and reposition the "B" coil. Repeat steps	
6.00	4.26 thru 4.28.	Condition Fuil noncritication out to be desired
6.30	"P" coil enough to remove the Euli paper and initial chime	Send the Fuji paper test shims out to be cleaned.
	Install an equivalent set of alumina coated shims without Fuji	
	paper, install study, supernuts, and torque to 50% of final	
	value. Recheck alignment.	
6.31	If the above step does not fall within .007" or less then loosen	Repeat until the desired tolerance is met.
	all studs, adjust shims locally. Re-torque all studs to 50%.	
6.32	One hole at a time, remove the supernut. Using the eccentric	This operation can be done concurrently at different locations if in so doing the
	gage slid onto the stud define the hole eccentricity. Select	part does not move.
	pushing and machine to match required eccentricity. Install	
	alignment	
6.33	After super bolt tightening, measure the position of all	The maximum deviation from the "realigned" points should be 007" or less
	monuments per the Dimensional Control Plan, following steps	
	2.3.3 through 2.3.7.	

	Station 2 - 1st Article (Half Period Assembly)	See last page for Rev changes
NO.	ASSEMBLY STEP	COMMENTS
6 34	Install wing support hardware	Assume three welded chair supports with put-plates on each wing
6.25	Load the wing support hardware to pre weld condition	
0.35	Load the wing support hardware to pre-weid condition.	
6.36	Lighten all bolts to their final torque.	
6.37	After tightening hardware, measure the position of all	The maximum deviation from the "realigned" points should be010" RMS or less.
	monuments per the Dimensional Control Plan, following steps	
	2 3 3 through 2 3 7	
0.00	2.0.0 through 2.0.7.	
0.30	velu the A / B hose region sciencia side following the weld	
	procedure.	
6.39	Measure the positions of all monuments per the process	The maximum deviation from the "realigned" points should be .015" RMS or less.
	defined in the Metrology Plan, steps 2,3,3 through 2,3,7	
0.40	Best office of above results and advetucing suggests if	
6.40	Back office of above results and adjust wing supports if	
	needed to meet alignment requirements	
6.41	Identify, if possible, a set of monuments that have moved less	
6 / 2	Fill all lose bushings with Stycast 2850FT	
0.42	Thi an lose businings with Stycast 20501 T	
6.43	Scan the "B" flange (datum "E") of the "B" coil, for the purpose	
	of defining the shim thickness for the mating to the "C" coil.	
	Save the measurement file and back it up	
6 4 4	Light the "P" florge (detum "F") measurement of the Ture P	This is a back office calculation where shim thickness is predatormined bacad on
6.44	Using the B hange (datum E) measurement of the Type-B	This is a back once calculation where shim thickness is predetermined based on
	coil and the earlier "A" flange (datum "E") measurement of the	the scanned flange surface data.
	Type-C coil, define all B/C flange shim thickness.	
6 4 5	Compress alumina coated shims and sort by thickness the	Care must be taken when handling alumina shims to mitigate any possible surface
0.40	shim not that will be installed on the D/C interface	contamination conditions
	shim set that will be installed on the B/C interface.	contamination conditions.
7.00	(A-B) to C modular coil assembly (MCHP)	See MCHP component designation in Table 1 of this document.
		MCHP Assembly Dimensional Control Plan: NCSX-PLAN-HPADC-00
7.04	Dalt the "A" sail to its first up and lift the (A D) sail plans with	Reference Drawinds: SE140-003 a
7.01	Boil the A coil to its fixture and lift the (A-B) coil, along with	
	the fixture, onto another wedge with its top surface tilted at 20	
7.02	Select a subset of monuments identified in step 4.38 that will	
	be used for the initial alignment in this next phase of half	
7.03	Align to the set of monuments selected in 5.02. Acceptance	
	aritarian is 005" PMS doviation	
7.04	Citterion is 2005 Kivis deviation.	
7.04	Establish a set of global monuments, including three positions	
	on the fixture and five on the building.	
7.05	Using the Type-B (B-flange) inboard shim template mark the	Use a thin equivalent washer of the puck diameter (or some other method) to
7.06	Place an initial set of aluming shime (4.8) on the Type P coil	See designed VVV for shim size and leastion
7.00	Flace all linual set of alumina similis (4-0) of the Type-D con	
7.07	Place unfilled shim bags in the wing areas	
7.08	Lower the mating "C" coil into position.	
7.09	Install the jack screws and dial indicators for horizontal	
	positioning	
740	Using three colorised monuments on the "D" coil position the	An ensurement of 000" is supported and required
7.10	Using three selected monuments on the "B" coll, position the	An accuracy of .002" is expected and required.
	coil accurately in the Z-direction and within .002" in the X - Y	
	plane.	
7 1 1	Install the remaining alumina coated shims: install studs	
1.1.1	superpute, and targue to E^{0} of final value	
7 10	Supernuis, and torque to 50% of final value.	
7.12	Make a hand "wiggle" test (rotate on bolt) on all shims to	
	make sure that they are tight. If a loose shim is found back off	
	on sufficient adjacent bolts to allow a replacement shim to be	
	inserted Tighten bolt and recheck	
7 1 2	After tightening, measure the position of all manuments per	
7.13	After tightening, measure the position of all monuments per	
	the Dimensional Control Plan, following steps 2.3.3 through	
	2.3.7.	
7.14	Measure the shim puck height (at a number of points around	
	the nuck surface) at each of the name chim nuck locations	
745	line puck surface) at each of the nose shift puck locations.	
7.15	Unfasten bolts and raise the "C" coll in height to remove the	
	puck locating rings and install all nose shims with the properly	
	sized pucks. Use temporary shims to support the Type-C flex	
	shims.	
746	"Lightly" took wold the need flow chime to the nerve of the "D"	
1.10	Lightly tack weld the nose nex shifts to the perspective "B"	
	and "U" coils.	
7.17	Unfasten all bolts and remove the "C" coil and place it on a	
	separate fixture, with the Type-C coil side "A" flange (datum	
	"D") facing up	
740	Dechaok the part alignment of the "A / D" soil to make ours it	
1.10		
	is still within alignment and then weld all Type-B flex shims to	
1	the plasma side, following the weld sequence plan.	

Station 2 - 1st Article (Half Period Assembly) See last page for Rev changes

Station 2 - 1st Article	(Half Period Assembly)	See last page for Rev changes
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		dee last page for new changes
NO.	ASSEMBLY STEP	COMMENTS
7 1 0	After welding the "P" soil pass shime resheals alignment to	
7.19	After weiging the B connose shifts recheck alignment to	
	determine if the part still meets the metrology acceptance	
	aritarian	
	chienon.	
7.20	Time needs to be allocated for a back office assessment of	If Control Plan acceptance criterion is not met project input is needed to determine
	the part offer welding	how to proceed
		now to proceed.
7.21	On the separate fixture measure the "C" fiducials to establish	
	a reference coordinate system prior to welding the "C" coil	
	a reference coordinate system phor to weiding the o con	
	nose shims.	
7 22	With the successful "A / B" coil weld operation, weld all Type-	
1.22		
	C (A-flange) flex shims to the plasma side, following the weld	
	sequence plan.	
7 00	After welding the IIOI self as a chieve method the ment to	
1.23	After weiging the C coil nose shifts recheck the part to	
	determine if it still meets the metrology acceptance criterion.	
7.24	Time needs to be allocated for a back office assessment of	If Control Plan acceptance criterion is not met project input is needed to determine
7.25	Remove alumina shims as necessary except for the (4-8)	
	initial la satis s shines en the True Desilie designated	
	Initial locating snims on the Type-B coll in designated	
	locations for the initial alignment of the mating coil.	
7 26	Lower the mating "C" coil into position	
1.20		
7.27	Using three selected monuments on the "C" coil, position the	An accuracy of .002" or better is expected and required for this step.
1	coil accurately in the X -Y plane	
7 00		
7.28	Raise the "C" coil slightly and install the remaining alumina	
1	coated shims: install Fuji paper on all outboard shims install	
1	atude auremente and termine to 500/ of final value	
	studs, supernuts, and torque to 50% of final value.	
7.29	Make a hand "widgle" test (rotate on bolt) on all shims to	
	make sure that they are tight. If a loose shim is found back of	
	on sufficient adjacent bolts to allow a replacement shim to be	
	incorted Tighton holt and recheck	
7.30	After tightening, measure the position of all monuments per	The maximum deviation from the "realigned" points should be 015" or less
	the Dimensional Control Plan following steps 2.3.3 through	C
	2.3.7.	
7.31	I Infasten the holts, lift the "C" coil enough to remove the Fuji	
1.01	enaction are bolle, int are of contendighter terror time, the	
	paper, and examine the load sharing. At the same time, the	
	"back office" will analyze the measurements of the monument	
	positions. A revised act of abim thicknesses, to provide	
	positions. A revised set of shift thicknesses, to provide	
	adequate load s	
7 32	If a revised set of shims is required install the new shims and	
1.02		
	Fuji paper. Lower and reposition the "C" coil. Repeat steps	
	4.29 thru 4.31.	
7 2 2	With a sussessful Eulii load pattern, unfasten the balta, lift the	Sand the Fuji paper test shime out to be alconed
1.33	with a successful Fuji load pattern, unlasten the bolts, lift the	Send the Fuji paper test shims out to be cleaned.
	"C" coil enough to remove the Fuji paper and initial shims.	
	Install an equivalent set of alumina coated shims without Fuji	
	install all equivalent set of alumina coaled shirts without I uji	
1	paper, install studs, supernuts, and torque to 50% of final	
1	value. Recheck alignment	
7.04		Demost until the desired telever is much
7.34	If the above step does not fall within .015" or less then loosen	Repeat until the desired tolerance is met.
	all studs, adjust shims locally. Re-torque all studs to 50%	
1		
1		
7.35	One hole at a time, remove the supernut. Using the eccentric	This operation can be done concurrently at different locations if in so doing the
	gage slid onto the stud define the hole accontricity. Scloot	part does not move
1	gage and onto the stud denne the hole eccenthicity. Select	part does not move.
1	bushing and machine to match required eccentricity. Install	
1	bushing. Replace nut and tighten back to 50% and recheck	
1	olignment	
1	alignment.	
7.36	After super bolt tightening (50 % value), measure the position	The maximum deviation from the "realigned" points should be .015" RMS or less.
	of all monuments par the Dimensional Control Plan, following	
1		
1	steps 2.3.3 through 2.3.7.	
7 37	In stall wing support hardwa re	Assume three welded chair supports with put-plates on each wing
7.07		noourno unoo woldod ondii oupporto witi nutpiateo on edon wing
7.38	Load support hardware to pre-weld condition.	
7.39	Tighten all bolts to their final torque.	
7 40	After tightening bordware, measure the nest-tion of all	The maximum doviation from the "realized" points should be 017" DMC
1.40	Aner ugnitering naroware, measure the position of all	The maximum deviation from the realigned points should be .017" RMS of less.
1	monuments per the Dimensional Control Plan. following steps	
1	2 3 3 through 2 3 7	
1_		
7.41	Weld the B / C nose region solenoid side following the weld	
1	procedure	
		
7.42	Measure the positions of all monuments per the process	I he maximum deviation from the "realigned" points should be .020" RMS or less.
1	defined in the Metrology Plan steps 2.3.3 through 2.3.7	
7 10		
7.43	Back office of above results and adjust wing supports if	
1	needed to meet alignment requirements	
1		

Station 2 - 1st Article (Half Period Assembly)	See last page for Rev changes
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NO.	ASSEMBLY STEP	COMMENTS
7.44	Fill all lose bushings with Stycast 2850FT	
8.00	Inflate all wing shim bags	CHANGED FROM TACK WELD INBD WELDED SHIMS
8.01	Fill all wing bladders and cure	
9.00	Install trim coil	MOVED TO STATION 5
10.00	Complete local service and interface details	
10.01	Install all wing support bladders between wing surfaces (A/B,	This work is now done earlier in the Station 2
	B/C) and on the C wing (MCHP - Right Side only)	
10.02	Make local service runs/connections on the shell of each MC.	Jim Chrzanowski will make service connections across the poloidal breaks. All
		remaining services will be done in Station 5.
10.03	Inject sealant compound to fill in all shim spaces in order to	
	prevent VV/MC insulation from falling out.	
11.00	Final measurements / transfer completed MCHP to	Reference drawing: xxxxxxx
	holding area	
11.01	Using tension tester measure bolt length on all tension	
	fasteners and record the results.	
11.02	Mark part for identification	Part identification should indicate the period and subparts (ex. MCHP - Left Side
		C1/B1/A!)
11.03	Install base supports.	See figure 5 for base supports.
11.04	Remove from stand and measure weight of completed	
	assembly	
11.05	Move to holding area.	











Change in Rev 9.2:

1 Revised Step 6.07 to relax X-Y positioning; eliminated Steps 6.34, 6.35, 7.37 and 7.38 all dealing with the wing supports.

Change in Rev 9.1:

1 Added Steps 6.40, 6.45 and 7.43

Change in Rev 9:

1 Updated sequence plan for Station 2 to meet final welded nose approach

Change in Rev 8:

1 Updated sequence plan for Station 2 to meet welded nose approach and following Dimensional Control Plan: NCSX-PLAN-HPADC-00-dC

Change in Rev 7:

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

Change from Rev 4:

- 1 Developed a Station 2 1st article sequence plan that includes the addition of metal shims and Fuji paper to use for shim qualification test.
- 2 Reintroduced the A A pre-fit up to establish a success oriented full period installation operation.
- 3 Added a shim sizing / preparation step
- 4 Developed a Station 2 Production article sequence plan that excludes Fuji paper and installs all alumina coated shims on the first pass.

Change from Rev 3:

- 1 The Pre-assemble A-A (old step 4.0) has been eliminated in favor of alignment of separate MCHP.
- 2 Fuji paper will no longer be included in the installation process although it may be used on the first MCHP article (separate plan).
- 3 Alumina coated shims with close tolerance bolt hole installed on first pass.
- 4 Assembly tolerance increase to .010" from .007" in (A-B) to C fit-up.

Station 2 - Production Article	(Half Period Assem See last page for Rev changes
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NO.	ASSEMBLY STEP	COMMENTS
1.00	MC fit-up pre-check and surface insulation	
1.01	Verify that mating MC's of a MCHP will come together without	The full assembly layout of the mating MC's can be found in Table 1 and Figure 3
	interferences by pre-fitting mating coils. This will include the	below. Some of this effort may be done before the half period assembly activity
	Type-C coil with its interfacing Period Type-C coil	henins
	Type o con with its interfacing r chod Type o con.	bogino.
2.00	Pre-measurement of MCHP Type A B and C coils flanges	See MCHP component designation in Table 1 of this document
2.00	nus interfacing Type-A coil flange	MCHP Assembly Dimensional Control Plan: NCSY-PLAN-HPADC-00
2.01	Follow the steps defined in Section 2 of the Metrology Plan for	The acceptance criterion is 005" RMS deviation in alignment to the set of tooling
2.01	rollow the steps defined in Section 2 of the Methology Flam of	halls. With a successful alignment a set of global fiducial monuments will have
	iacks. "A" flange (datum "D") down and rack the "A" coil into	been established. Subsequent alignments of the laser tracker will be to the global
	ite proper change (datum D) down and fack the A con into	monumont
2 02	Seen the "P" flange (datum E) and the MC shall /// hose	monument
2.02	interface. Macaura taoling halls	
2.02	Pamovo Type A soil from stand and move to holding area	
2.03	Fellow the stope defined in Section 2 of the Metrology Blan for	The acceptones criterion is OOE" DMC doviation in alignment to the act of conical
2.04	Follow the steps defined in Section 2 of the Methology Flat for	The acceptance chemon is .005 Kivis deviation in alignment to the set of conical
	iacking colls and lower the Type-B modular coll onto the	seals. With a successful alignment a set of global noucial monuments will have
	Jacks, B hange (datum E) down and fack the B con into	
0.05	its proper shape.	monument
2.05	Scan the A hange (datum D). Measure Tooling Bails	Flange measurement is needed for the A side (only) for the Type-B coll.
2.06	Remove Type-B coll from stand and store coll.	The second se
2.07	Follow the steps defined in Section 2 of the Metrology Plan for	I ne acceptance criterion is .005" RMS deviation in alignment to the set of conical
	racking coils and lower the Type-C modular coil onto the	seats. With a successful alignment a set of global fiducial monuments will have
	jacks, "B" flange (datum "E") down and rack the "C" coil into	been established. Subsequent alignments of the laser tracker will be to the global
	its proper shape.	monument
2.08	Scan the "A" flange (datum D). Measure tooling balls.	Flange measurement is needed for the A side (only) for the Type-C coil.
2.09	Remove Type-C coil from stand and store coil.	
3.00	Shim sizing / preparations	Metrology procedure covering Station 2:
3.01	Using flange measurement of the coils, define the A/B shim	This is a back office calculation where shim thickness is predetermined based on
	thickness.	the scanned flange surface data.
3.02	Compress alumina coated shims and sort by thickness the	Care must be taken when handling alumina shims to mitigate any possible surface
	shim set that will be installed on the MCHP.	contamination conditions.
4.00	Pre-Installation Station 2 set-up	Metrology procedure covering Station 2:
4.01	Install MCHP fixtures and metrology equipment.	
4.02	Perform metrology set-up and checks	
5.00	Pre-assemble A-A	THIS STEP HAS BEEN ELIMINATED
6.00	A-B modular coil assembly	See MCHP component designation in Table 1 of this document.
		MCHP Assembly Dimensional Control Plan: NCSX-PLAN-HPADC-00
		Reference Drawings: SE140-003 a
6.01	Follow the steps defined in Section 2 of the Metrology Plan for	The acceptance criterion is .005" RMS deviation in alignment to the set oftooling
	racking coils, lower the Type-A modular coil onto the jacks,	balls. With a successful alignment a set of global fiducial monuments will have
	"A" flange (datum "D") down and rack the "A" coil into its	been established. Subsequent alignments of the laser tracker will be to the global
	proper shape.	monument
6.02	Using the Type-A (B-flange) inboard shim template mark the	Use a thin equivalent washer of the puck diameter (or some other method) to
	nose shim locations and puck locations. Remove the	provide a positional "feel" to allow measuring puck height in the A -B installed
	template.	position.
6.03	Place an initial set of alumina shims (4-8) on the Type-A coil	See document XXXX for shim size and location.
	in designated locations for the initial alignment of the mating	
6.04	Place unfilled shim bags in the wing areas	
6.05	Lower the mating "B" coil into position.	
6.06	Install the jack screws and dial indicators for horizontal	
	positioning.	
6.07	Using three selected monuments on the "B" coil, position the	An accuracy of .002" RMS is expected and required.
	coil within .002" in the Z-direction and within .060" in the X-Y	
	plane.	
6.08	Install the remaining alumina coated shims; install studs,	
	supernuts, and torque to 50% of final value.	
6.09	Make a hand "wiggle" test (rotate on bolt) on all shims to	
	make sure that they are tight. If a loose shim is found back off	
	on sufficient adjacent bolts to allow a replacement shim to be	
	inserted. Tighten bolt and recheck.	
6.10	After tightening, measure the position of all monuments per	An accuracy of .007" RMS is expected.
	the Dimensional Control Plan, following steps 2.3.3 through	
	2.3.7.	
6.11	Measure the shim puck height (at a number of points around	
	the puck surface) at each of the nose shim puck locations.	
	Use the data to define each puck height.	

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NO	ASSEMBLY STEP	COMMENTS
6.12	Unfasten bolts and raise the "B" coil in height to remove the	COMMENTO
0.12	nuck locating rings and install all nose shims with the property	
	cized pucks. Use temporary chims to support the Type-B flex	
	shims	
6 1 3	"I ightly" tack weld the nose flex shims to the perspective "A"	
0.15	and "B" coils	
6 1 4	Infasten all bolts and remove the "B" coil and place it on a	
0.11	separate fixture with the Type-B coil side "A" flange (datum	
	"D") facing up	
6 1 5	Recheck the part alignment of the "A" coil to make sure it is	
0.10	still within alignment and then weld all Type-A flex shims to the	
	plasma side, following the weld sequence plan	
6.16	After welding the "A" coil nose shims recheck alignment to	An accuracy of .005" RMS is expected.
	determine if the part still meets the metrology acceptance	
	criterion.	
6.17	Time needs to be allocated for a back office assessment of	If Control Plan acceptance criterion is not met project input is needed to determine
	the part after welding.	how to proceed.
6.18	On the separate fixture measure the "B" fiducials to establish	
	a reference coordinate system prior to welding the "B" coil	
	nose shims.	
6.19	With the successful "A" coil weld operation, weld all Type-B (A	
	flange) flex shims to the plasma side, following the weld	
	sequence plan.	
6.20	After welding the "B" coil nose shims recheck the part to	Align to measurements of 4.18. Acceptance criterion is RMS .le004". Project
	determine if it still meets the metrology acceptance criterion.	input is required in the event of failure.
0.04	The second to be allocated for a back office according to f	
6.21	Time needs to be allocated for a back office assessment of	If Control Plan acceptance criterion is not met project input is needed to determine
6 22	Personal aluming chime as personal except for the (4.8)	now to proceed.
0.22	initial locating shims on the Type-A coil in designated	
	locations for the initial alignment of the mating coil	
6.22	Lower the meting "P" soil into position	
6.23	Lower the mating B con into position.	An accuracy of 002" or better is expected and required for this step
0.24	coil accurately in the X -Y plane	An accuracy of .002 of better is expected and required for this step.
6 25	Raise the "B" coil slightly and install the remaining alumina	
0.20	coated shims: install stude supernuts and torque to 50% of	
	final value	
6.26	Make a hand "wiggle" test (rotate on bolt) on all shims to	
	make sure that they are tight. If a loose shim is found back off	
	on sufficient adjacent bolts to allow a replacement shim to be	
	inserted. Tighten bolt and recheck.	
6.27	After tightening, measure the position of all monuments per	The maximum deviation from the "realigned" points should be .007" or less.
	the Dimensional Control Plan, following steps 2.3.3 through	
	2.3.7.	
6.28	If the above step does not fall within .007" or less then loosen	Repeat until the desired tolerance is met.
	all studs, adjust shims locally. Re-torque all studs to 50%.	
6.29	One hole at a time, remove the supernut. Using the eccentric	This operation can be done concurrently at different locations if in so doing the
	gage slid onto the stud define the hole eccentricity. Select	part does not move.
	bushing and machine to match required eccentricity. Install	
	pushing. Replace nut and tighten back to 50% and recheck	
6.20	ally limetil.	The maximum doviation from the "realigned" points should be 007" or loss
0.30	monuments per the Dimensional Control Plan following store	The maximum deviation from the realigned points should be .007 OF less.
	2 3 3 through 2 3 7	
6.31	Install wing support bardware	Assume three welded chair supports with put-plates on each wing
6.32	and the wing support hardware to pre-weld condition	a locality and worked on an supporte with the plates of each wing
6 33	Tighten all holts to their final torque	
6.34	After tightening hardware measure the position of all	The maximum deviation from the "realigned" points should be 010" RMS or less
0.04	monuments per the Dimensional Control Plan following steps	The maximum deviation nom the realigned points should be
	2.3.3 through 2.3.7.	
6.35	Weld the A / B nose region solenoid side following the weld	
0.00	procedure.	
6.36	Measure the positions of all monuments per the process	The maximum deviation from the "realigned" points should be .015" RMS or less.
	defined in the Metrology Plan, steps 2.3.3 through 2.3.7.	u
6.37	Back office of above results and adjust wing supports if	
	needed to meet alignment requirements	

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NO.	ASSEMBLY STEP	COMMENTS
6.38	Identify, if possible, a set of monuments that have moved less	
0.00	than 005" from their original positions. The alignment that will	
	than .005 from their original positions. The alignment that will	
	be necessary for mating to the "C" coil will use monuments	
	from among this set.	
6 30	Fill all lose bushings with Stycast 2850ET	
0.39		
6.40	Scan the "B" flange (datum "E") of the "B" coil, for the purpose	
	of defining the shim thickness for the mating to the "C" coil.	
	Save the measurement file and back it up	
6.41	Using the "B" flange (datum "E") measurement of the Type-B	I his is a back office calculation where shim thickness is predetermined based on
	coil and the earlier "A" flange (datum "E") measurement of the	the scanned flange surface data.
	Type-C coil define all B/C flange shim thickness	
C 40	Compress aluming assted alims and part by this was the	
0.4Z	Compress alumina coated shims and sort by thickness the	
	shim set that will be installed on the B/C interface.	
7.00	(A-B) to C modular coil assembly (MCHP)	See MCHP component designation in Table 1 of this document.
		MCHP Assembly Dimensional Central Plan: NCSY-PLAN-HPADC-00
		Reference Drawings: SE140-003 a
7.01	Bolt the "A" coil to its fixture and lift the (A-B) coil, along with	
	the fixture, onto another wedge with its top surface tilted at 20	
	degrees from herizontal. Bolt the fixtures together	
1	degrees nom nonzonital. Doit the fixtures together.	
1		
7.02	Select a subset of monuments identified in step 4.38 that will	
	he used for the initial alignment in this next phase of half	
1		
1	period assembly.	
7.03	Align to the set of monuments selected in 5.02. Acceptance	
1	criterion is 005" RMS deviation	
7 . 4	Establish a set of elabol menure anti- inclusion there	
7.04	Establish a set of global monuments, including three positions	
1	on the fixture and five on the building.	
7.05	Using the Type-B (B-flange) inboard shim template mark the	Use a thin equivalent washer of the puck diameter (or some other method) to
	nose shim leastions and puck leastions. Remove the	provide a positional "fool" to allow magning puck height in the A. P installed
	nose shim locations and puck locations. Remove the	provide a positional reel to allow measuring puck height in the A -b installed
	template.	position.
7.06	Place an initial set of alumina shims (4-8) on the Type-B coil	See document XXXX for shim size and location.
	in designated locations for the initial alignment of the mating	
	COII.	
7.07	Place unfilled shim bags in the wing areas	
7.08	Lower the mating "C" coil into position	
7.00	Lower the mating of contribution position.	
7.09	Install the jack screws and dial indicators for horizontal	
	positioning.	
7.10	Using three selected monuments on the "B" coil, position the	An accuracy of 002" is expected and required
	coil accurately in the 7 direction and within 002 " in the X X	· ··· ································
7.11	Install the remaining alumina coated shims; install studs,	
	supernuts, and torque to 50% of final value.	
7.12	Make a hand "wiggle" test (rotate on bolt) on all shims to	
1	make cure that they are tight. If a loose shim is found hards aff	
1	make sure that they are tight. If a loose shift is found back off	
1	on sufficient adjacent bolts to allow a replacement shim to be	
1	inserted. Tighten bolt and recheck.	
7 1 2	After tightening measure the position of all monuments per	
1.13		
1	the Dimensional Control Plan, following steps 2.3.3 through	
1	2.3.7.	
7.14	Measure the shim puck height (at a number of points around	
1	the nucle surface) at each of the need shim nucle loosting	
1	the puck surface) at each of the nose shim puck locations.	
1	Use the data to define each puck height.	
7.15	Unfasten bolts and raise the "C" coil in height to remove the	
1	nuck locating rings and install all nose shims with the property	
1	letred nucles. Use terms and install all nose shifts with the property	
1	sized pucks. Use temporary snims to support the Type-C flex	
1	shims.	
7.16	"Lightly" tack weld the nose flex shims to the perspective "B"	
1.10	and "C" coile	
1		
7.17	Unfasten all bolts and remove the "C" coil and place it on a	
1	separate fixture, with the Type-C coil side "A" flance (datum	
1	"D") facing up	
7.18	Recheck the part alignment of the "A / B" coil to make sure it	
1	is still within alignment and then weld all Type-B flex shims to	
1	the plasma side following the weld sequence plan	
7 4 0	After welding the "D" acil near phime weld bequeite plan.	
7.19	After weiding the "B" coll nose shims recheck alignment to	
1	determine if the part still meets the metrology acceptance	
1	criterion.	
		4

NO.	ASSEMBLY STEP	COMMENTS
7.20	Time needs to be allocated for a back office assessment of	If Control Plan acceptance criterion is not met project input is needed to determine
	the part after welding.	how to proceed.
7.21	On the separate fixture measure the "C" fiducials to establish	
	a reference coordinate system prior to welding the "C" coil	
	nose shims.	
7.22	With the successful "A / B" coil weld operation, weld all Type-	
	C (A-flange) flex shims to the plasma side, following the weld	
	sequence plan.	
7.23	After welding the "C" coil nose shims recheck the part to	
	determine if it still meets the metrology acceptance criterion	
7 24	Time needs to be allocated for a back office assessment of	If Control Plan acceptance criterion is not met project input is needed to determine
1.24	the part after welding	how to proceed
7 25	Remove alumina shims as necessary except for the $(1-8)$	
1.20	initial locating shims on the Type-B coil in designated	
	locations for the initial alignment of the mating soil	
7.00	locations for the initial alignment of the mating coll.	
7.26	Lower the mating "C" coll into position.	An answer of 000" as he that is summated and as wired for this star.
1.27	Using three selected monuments on the "C" coil, position the	An accuracy of .002" or better is expected and required for this step.
	coil accurately in the X -Y plane.	
7.28	Raise the "C" coil slightly and install the remaining alumina	
	coated shims; install studs, supernuts, and torque to 50% of	
	final value.	
7.29	Make a hand "wiggle" test (rotate on bolt) on all shims to	
	make sure that they are tight. If a loose shim is found back off	
	on sufficient adjacent bolts to allow a replacement shim to be	
	inserted. Tighten bolt and recheck.	
7.30	After tightening, measure the position of all monuments per	The maximum deviation from the "realigned" points should be 015" or less
	the Dimensional Control Plan, following steps 2.3.3 through	
	2.3.7.	
7.31	If the above step does not fall within .015" or less then loosen	Repeat until the desired tolerance is met.
	all studs, adjust shims locally. Re-torque all studs to 50%	
7 3 2	One hole at a time, remove the superput. Using the eccentric	This operation can be done concurrently at different locations if in so doing the
1.52	ages slid onto the stud define the hele accentricity. Select	nort deep not move
	bushing and machine to match required accontricity. Install	pair does not move.
	bushing and machine to match required eccentricity. Install	
	bushing. Replace hut and tighten back to 50% and recheck	
7 22	After ouper helt tightening, measure the position of all	The maximum deviation from the "realized" points abould be Q15" or less
1.55	After super boil lightening, measure the position of all	The maximum deviation from the realigned points should be DTS of less.
	monuments per the Dimensional Control Plan, following steps	
	2.3.3 through 2.3.7.	
7.34	Install wing support hardware	Assume three welded chair supports with nut-plates on each wing
7.35	Load support hardware to pre-weld condition.	
7.36	lighten all bolts to their final torque.	
7.37	After tightening hardware, measure the position of all	The maximum deviation from the "realigned" points should be 017" RMS or less.
	monuments per the Dimensional Control Plan, following steps	
	2.3.3 through 2.3.7.	
7.38	Weld the B / C nose region solenoid side following the weld	
	procedure.	
7.39	Measure the positions of all monuments per the process	The maximum deviation from the "realigned" points should be .020" RMS or less.
	defined in the Metrology Plan, steps 2.3.3 through 2.3.7.	
7.40	Back office of above results and adjust wing supports if	
_	needed to meet alignment requirements	
7.41	Fill all lose bushings with Stycast 2850FT	
8.00	Inflate all wing shim bags	CHANGED FROM TACK WELD INBD WELDED SHIMS
8.01	Fill all wing bladders and cure	
9.00	Install trim coil	MOVED TO STATION 5
10.00	Complete local service and interface details	
10.00	Install all wing support bladders between wing surfaces (A/P	This work is now done earlier in the Station 2
10.01	P(C) and on the C wing (MCHP Diabet Side anti-	THIS WORLIS HOW CONE CANCE III LITE STALLOT Z
10.00	D/C/ and on the C wing (MCHP - Kight Side only).	lim Chronowski will make conside connections across the polaidal baselies. All
10.02	wake local service runs/connections on the shell of each MC.	Jim Unizanowski will make service connections across the poloidal breaks. All
		remaining services will be done in Station 5.
10.03	Inject sealant compound to fill in all shim spaces in order to	
	prevent VV/MC insulation from falling out.	
11.00	Final measurements / transfer completed MCHP to	Reference drawing: xxxxxxx
	holding area	

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NO		COMMENTS	
NO.	ASSEMBLISTEP	CONIMENTS	
11.01	Measure the tooling balls on all coils. Save the data file and	The maximum deviation from the "realigned" points should be .020" or less. If the	
	back it up. Print reports of all alignments used, and	deviation is greater that .020", Project input is needed to determine how to	
	nonconformance reports, and keep with run copies of the	proceed.	
	assembly procedure.		
11.02	Install or identify three primary fiducials that will be used in		
	positioning the Period in Station 3.		
11.03	Scan the "B" flange of Type-C coil as well as the interfacing		
	base support feet (see Figure 4). Record the results.		
11.04	Using tension tester measure bolt length on all tension		
	fasteners and record the results.		
11.05	Mark part for identification	Part identification should indicate the period and subparts (ex. MCHP - Left Side	
		C1/B1/A!)	
11.06	Install base supports.	See figure 5 for base supports.	
11.07	Remove from stand and measure weight of completed		
	assembly		
11.08	Move to holding area.		

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Table 1.0 Period Assembly Make-up

Period 1:	MCHP – Left Side	MCHP – Right Side
	C1 / B1 / A1	A2 / B2 / C2
Period 2:	MCHP – Left Side	MCHP – Right Side
	C3 / B3 / A3	A4 / B4 / C4
Period 3:	MCHP – Left Side	MCHP – Right Side
	C6 / B5 / A5	A6 / B6 / C5



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Change in Rev 9.2:

1 Revised Step 6.07 to relax X-Y positioning; eliminated Steps 6.31, 6.32, 7.34 and 7.35 all dealing with the wing supports.

Change in Rev 9.1:

1 Added Steps 6.37, 6.43 and 7.40

Change in Rev 9:

1 Updated sequence plan for Station 2 to meet final welded nose approach

Change in Rev 8:

1 Updated sequence plan for Station 2 to meet welded nose approach and following Dimensional Control Plan: NCSX-PLAN-HPADC-00-dC

Change in Rev 7:

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

Change from Rev 4:

- 1 Developed a Station 2 1st article sequence plan that includes the addition of metal shims and Fuji paper to use for shim qualification test.
- 2 Reintroduced the A A pre-fit up to establish a success oriented full period installation operation.
- 3 Added a shim sizing / preparation step
- 4 Developed a Station 2 Production article sequence plan that excludes Fuji paper and installs all alumina coated shims on the first pass.

Change from Rev 3:

- 1 The Pre-assemble A-A (old step 4.0) has been eliminated in favor of alignment of separate MCHP.
- 2 Fuji paper will no longer be included in the installation process although it may be used on the first MCHP article (separate plan).
- 3 Alumina coated shims with close tolerance bolt hole installed on first pass.
- $4 \qquad \mbox{Assembly tolerance increase to .010" from .007" in (A-B) to C fit-up.}$