	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	
2.02	interface. Measure tooling balls Remove Type-A coil from stand and move to holding area.	
		The acceptance criterion is .005" RMS deviation in alignment to the set of conical
2.04	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.
	Remove Type-B coil from stand and store coil.	Flange measurement is needed for the A side (only) for the Type-B coil.
	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
2.01	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.
	Remove Type-C coil from stand and store coil.	
	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.
	Pre-Installation Station 2 set-up	Metrology procedure covering Station 2:
	Install MCHP fixtures and metrology equipment.  Perform metrology set-up and checks per section 2.3 of the	
4.02	TPerform metrology set-up and checks per section 2.3 of the	
	Dimensional Control Plan.	THIS STEP HAS REEN ELIMINATED
5.00	Dimensional Control Plan.  Pre-assemble A-A	THIS STEP HAS BEEN ELIMINATED See MCHP component designation in Table 1 of this document.
5.00	Dimensional Control Plan.	See MCHP component designation in Table 1 of this document.
5.00	Dimensional Control Plan.  Pre-assemble A-A	See MCHP component designation in Table 1 of this document. MCHP Assembly Dimensional Control Plan: NCSX-PLAN-HPADC-00
5.00	Dimensional Control Plan.  Pre-assemble A-A  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
5.00	Dimensional Control Plan.  Pre-assemble A-A  A-B modular coil assembly	See MCHP component designation in Table 1 of this document. MCHP Assembly Dimensional Control Plan: NCSX-PLAN-HPADC-00
5.00	Dimensional Control Plan.  Pre-assemble A-A  A-B modular coil assembly  Follow the steps defined in Section 2 of the Metrology Plan for	See MCHP component designation in Table 1 of this document. MCHP Assembly Dimensional Control Plan: NCSX-PLAN-HPADC-00 Reference Drawings: SE140-003 a The acceptance criterion is .003" RMS deviation in alignment to the set of tooling
5.00	Dimensional Control Plan.  Pre-assemble A-A  A-B modular coil assembly  Follow the steps defined in Section 2 of the Metrology Plan for racking coils, lower the Type-A modular coil onto the jacks,	See MCHP component designation in Table 1 of this document.  MCHP Assembly Dimensional Control Plan: NCSX-PLAN-HPADC-00  Reference Drawings: SE140-003 a  The acceptance criterion is .003" RMS deviation in alignment to the set of tooling balls. With a successful alignment a set of global fiducial monuments will have
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6.00 6.01 6.02 6.03 6.04 6.05 6.051 6.06 6.07	Pre-assemble A-A  A-B modular coil assembly  Follow the steps defined in Section 2 of the Metrology Plan for racking coils, lower the Type-A modular coil onto the jacks, "A" flange (datum "D") down and rack the "A" coil into its proper shape.  Using the Type-A (B-flange) inboard shim template mark the nose shim locations and puck locations. Remove the template.  Place an initial set of alumina shims (4-8) on the Type-A coil Place unfilled shim bags in the wing areas Lower the mating "B" coil into position.  Perform an alignment to the "B" coil tooling balls to verify that it has not changed shape. Do not accept the alignment.  Install the jack screws and dial indicators for horizontal positioning.  Using three selected monuments on the "B" coil, position the coil within ±.002" normal to the mating flanges and within ±.060" horizontally.  Install the remaining alumina coated shims; install studs, supernuts, and torque to 50% of final value.  Make a hand "wiggle" test (rotate on bolt) on all shims to	See MCHP component designation in Table 1 of this document.  MCHP Assembly Dimensional Control Plan: NCSX-PLAN-HPADC-00  Reference Drawings: SE140-003 a  The acceptance criterion is .003" RMS deviation in alignment to the set of tooling balls. With a successful alignment a set of global fiducial monuments will have been established. Subsequent alignments of the laser tracker will be to the global monument, and the criterion of .002" RMS deviation will apply  Use a thin equivalent washer of the puck diameter (or some other method) to provide a positional "feel" to allow measuring puck height in the A -B installed position.  See document XXXXX for shim size and location.  If the alignment fails to meet the .003"RMS criterion, add additional shims to the initial set, or adjust shim thicknesses as necessary, until the "B" coil meets the
6.00 6.01 6.02 6.03 6.04 6.05 6.051 6.06 6.07	Pre-assemble A-A  A-B modular coil assembly  Follow the steps defined in Section 2 of the Metrology Plan for racking coils, lower the Type-A modular coil onto the jacks, "A" flange (datum "D") down and rack the "A" coil into its proper shape.  Using the Type-A (B-flange) inboard shim template mark the nose shim locations and puck locations. Remove the template.  Place an initial set of alumina shims (4-8) on the Type-A coil Place unfilled shim bags in the wing areas Lower the mating "B" coil into position.  Perform an alignment to the "B" coil tooling balls to verify that it has not changed shape. Do not accept the alignment.  Install the jack screws and dial indicators for horizontal positioning.  Using three selected monuments on the "B" coil, position the coil within ±.002" normal to the mating flanges and within ±.060" horizontally.  Install the remaining alumina coated shims; install studs, supernuts, and torque to 50% of final value.  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	See MCHP component designation in Table 1 of this document.  MCHP Assembly Dimensional Control Plan: NCSX-PLAN-HPADC-00  Reference Drawings: SE140-003 a  The acceptance criterion is .003" RMS deviation in alignment to the set of tooling balls. With a successful alignment a set of global fiducial monuments will have been established. Subsequent alignments of the laser tracker will be to the global monument, and the criterion of .002" RMS deviation will apply  Use a thin equivalent washer of the puck diameter (or some other method) to provide a positional "feel" to allow measuring puck height in the A -B installed position.  See document XXXXX for shim size and location.  If the alignment fails to meet the .003"RMS criterion, add additional shims to the initial set, or adjust shim thicknesses as necessary, until the "B" coil meets the
6.00 6.01 6.02 6.03 6.04 6.05 6.051 6.06 6.07	Pre-assemble A-A  A-B modular coil assembly  Follow the steps defined in Section 2 of the Metrology Plan for racking coils, lower the Type-A modular coil onto the jacks, "A" flange (datum "D") down and rack the "A" coil into its proper shape.  Using the Type-A (B-flange) inboard shim template mark the nose shim locations and puck locations. Remove the template.  Place an initial set of alumina shims (4-8) on the Type-A coil Place unfilled shim bags in the wing areas Lower the mating "B" coil into position.  Perform an alignment to the "B" coil tooling balls to verify that it has not changed shape. Do not accept the alignment.  Install the jack screws and dial indicators for horizontal positioning.  Using three selected monuments on the "B" coil, position the coil within ±.002" normal to the mating flanges and within ±.060" horizontally.  Install the remaining alumina coated shims; install studs, supernuts, and torque to 50% of final value.  Make a hand "wiggle" test (rotate on bolt) on all shims to	See MCHP component designation in Table 1 of this document.  MCHP Assembly Dimensional Control Plan: NCSX-PLAN-HPADC-00  Reference Drawings: SE140-003 a  The acceptance criterion is .003" RMS deviation in alignment to the set of tooling balls. With a successful alignment a set of global fiducial monuments will have been established. Subsequent alignments of the laser tracker will be to the global monument, and the criterion of .002" RMS deviation will apply  Use a thin equivalent washer of the puck diameter (or some other method) to provide a positional "feel" to allow measuring puck height in the A -B installed position.  See document XXXXX for shim size and location.  If the alignment fails to meet the .003"RMS criterion, add additional shims to the initial set, or adjust shim thicknesses as necessary, until the "B" coil meets the

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	Station 2 - 1st Article (Half Period Assembly)	See last page for Rev changes
NO.	ASSEMBLY STEP	COMMENTS
	After tightening, measure the position of all monuments per the Dimensional Control Plan, following steps 2.3.3 through	All monuments shall be within .007" (true distance) of their desired position. Adjust shims until this criterion is met.
6.11	2.3.7.  Measure the shim puck height (at a number of points around the puck surface) at each of the nose shim puck locations.	
6 12	Use the data to define each puck height. 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 shims.	
	"Lightly" tack weld the nose flex shims to the perspective "A" and "B" coils.	
6.14	Unfasten all bolts and remove the "B" coil and place it on a separate fixture, with the Type-B coil side "A" flange (datum	
	"D") facing up.	
6.15	Recheck the part alignment of the "A" coil to make sure it is still within alignment.	Verify that it still meets the .003" RMS criterion. Do not accept alignment. If the .003" criterion is not met, re-rack the "A" coil .
6.151	Weld all Type-A flex shims to the plasma side, following the	
6.16	weld sequence plan.  After welding the "A" coil nose shims recheck alignment to	The acceptance criterion is .003" RMS deviation in alignment to the set of tooling
	determine if the part still meets the metrology acceptance criterion.	balls.
6.17	Time needs to be allocated for a back office assessment of the part after welding.	If Control Plan acceptance criterion is not met project input is needed to determine how to proceed.
	On the separate fixture measure the "B" fiducials to establish a reference coordinate system prior to welding the "B" coil	
	nose shims. 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 determine if it still meets the metrology acceptance criterion.	Align to measurements of 6.18. Acceptance criterion is RMS .le004". Project 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
6.22	the part after welding.  Remove alumina shims as necessary except for the (4-8)	how to proceed.
	initial locating shims on the Type-A coil in designated	
	locations for the initial alignment of the mating coil.  Lower the mating "B" coil into position.	
	Perform an alignment to the "B" coil tooling balls to verify that it has not changed shape.	Do not accept the alignment if the alignment fails to meet the .003"RMS criterion, add additional shims to the initial set, or adjust shim thicknesses as necessary, until the "B" coil meets the alignment criterion.
	Using three selected monuments on the "B" coil, position the coil accurately in the x, y, and z directions.	An accuracy of ±.002" or better in each direction is expected and required for this step.
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.	осър.
	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	All monuments should be within .007" (true distance) of their desired position.
	the Dimensional Control Plan, following steps 2.3.3 through 2.3.7.	
	Unfasten the bolts, lift the "B" coil enough to remove the Fuji 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	
6.00	adequate load s	
	If a revised set of shims is required, install the new shims and Fuji paper. Lower and reposition the "B" coil. Repeat steps 6.26 thru 6.28.	
6.30	With a successful Fuji load pattern, unfasten the bolts, lift the "B" coil enough to remove the Fuji paper and initial shims.	Send the Fuji paper test shims out to be cleaned.
	Install an equivalent set of alumina coated shims without Fuji	
	paper, install studs, supernuts, and torque to 50% of final value. Recheck alignment.	
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Station 2 - 1st Article	(Half Period Assembly	y	See last	pa	ge for Rev changes	i
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	Station 2 - 1st Article (Half Period Assembly)	See last page for Rev changes
NO.	ASSEMBLY STEP	COMMENTS
	If the above step does not fall within .007" or less then loosen all studs, adjust shims locally. Re-torque all studs to 50%.	All monuments shall be within .007" (true distance) of their desired position. Adjust shims until this criterion is met.
	One hole at a time, remove the supernut. Using the eccentric gage slid onto the stud define the hole eccentricity. Select bushing and machine to match required eccentricity. Install bushing. Replace nut and tighten back to 50% and measure the position of all monuments per the Dimensional Control Plan, following steps 2.3.3 through 2.3.7.	This operation can be done concurrently at different locations if in so doing the part does not move.
	After super bolt tightening, measure the position of all monuments per the Dimensional Control Plan, following steps 2.3.3 through 2.3.7.	All monuments shall be within .007" (true distance) of their desired position.
6.34	Install wing support hardware	Assume three welded chair supports with nut-plates on each wing
6.35	Load the wing support hardware to pre-weld condition.	
	Tighten all bolts to their final torque.	
	After tightening hardware, measure the position of all monuments per the Dimensional Control Plan, following steps 2.3.3 through 2.3.7.	All monuments shall be within .009" (true distance) of their desired position.
	Weld the A / B nose region solenoid side following the weld procedure.	
	Measure the positions of all monuments per the process defined in the Metrology Plan, steps 2.3.3 through 2.3.7.	All monuments shall be within .012" (true distance) of their desired position.
	Review the above results with Back Office. Adjust wing supports if needed to meet alignment requirements	
	Identify, if possible, a set of monuments that have moved less 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.	
	Fill all lose bushings with Stycast 2850FT	
	Scan the "B" flange (datum "E") of the "B" coil, for the purpose	
0.43	of defining the shim thickness for the mating to the "C" coil.	
	Save the measurement file and back it up.	
6 4 4	· · · · · · · · · · · · · · · · · · ·	This is a back office calculation where shim thickness is predetermined based on
0.44	coil and the earlier "A" flange (datum "E") measurement of the Type-C coil, define all B/C flange shim thickness.	·
6.45	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 B/C interface.	contamination conditions.
	(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 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 horizontal. Bolt the fixtures together.	
	Select a subset of monuments identified in step 6.41 that will be used for the initial alignment in this next phase of half	
	Align to the set of monuments selected in 7.02.	The acceptance criterion is .005" RMS deviation in alignment to the set of tooling balls.
	Establish a set of global monuments, on the fixture and on the building.	Subsequent alignments to these monuments must meet the .002"RMS criterion.
7.05	Using the Type-B (B-flange) inboard shim template mark the nose shim locations and puck locations. Remove the template.	Use a thin equivalent washer of the puck diameter (or some other method) to provide a positional "feel" to allow measuring puck height in the A -B installed position.
	Place an initial set of alumina shims (4-8) on the Type-B coil in designated locations for the initial alignment of the mating coil.	See document XXXX for shim size and location.
7.07	Place unfilled shim bags in the wing areas	
7.08	Lower the mating "C" coil into position.	
		If the alignment fails to meet the .003"RMS criterion, add additional shims to the
	it has not changed shape. Do not accept the alignment.	initial set, or adjust shim thicknesses as necessary, until the "C" coil meets the alignment criterion.
	Install the jack screws and dial indicators for horizontal positioning.	

	Station 2 - 1st Article (Half Period Assembly)	See last page for Rev changes
NO.	ASSEMBLY STEP	COMMENTS
7.10	Using three selected monuments on the "C" coil, position the	
	coil within ±.002" normal to the plane of the mating flanges	
	and within ±.060" in the plane of the mating flanges.	
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	
	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.	
7.13	After tightening, measure the position of all monuments per	All monuments shall be within .015" (true distance) of their desired position.The
	the Dimensional Control Plan, following steps 2.3.3 through	component of the deviations of monuments on the "C" coil that is normal to the
	2.3.7.	flange faces shall be less than .010". Adjust shims until this criterion is met.
7.14	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.	
7.15	Unfasten bolts and raise the "C" 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-C flex	
	shims.	
7.16	"Lightly" tack weld the nose flex shims to the respective "B"	
	and "C" 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.	
	Recheck the part alignment of the "A / B" coil to make sure it	RMS deviation .005" or less is the acceptance criterion. Consult Dimensional
	is still within alignment and then weld all Type-B flex shims to	Control if this criterion is not met.
	the plasma side, following the weld sequence plan.	
7.19	After welding the "B" coil nose shims recheck alignment to	RMS deviation .005" or less is the acceptance criterion. Consult Dimensional
	determine if the part still meets the metrology acceptance	Control if this criterion is not met.
	criterion.	
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	RMS deviation .004" or less is the acceptance criterion. Consult Dimensional
	determine if it still meets the metrology acceptance criterion.	Control if this criterion is not met.
	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.
7.25	Remove alumina shims as necessary except for the (4-8)	
	initial locating shims on the Type-B coil in designated	
	locations for the initial alignment of the mating coil.	
7.26	Lower the mating "C" coil into position.	
		Do not accept the alignment. If the alignment fails to meet the .003"RMS criterion,
	it has not changed shape.	add additional shims to the initial set, or adjust shim thicknesses as necessary,
		until the "C" coil meets the alignment criterion.
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.
	coil accurately in the x, y, and z directions.	
7.28	Raise the "C" 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.	
	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.	
	After tightening, measure the position of all monuments per	All monuments shall be within .015" (true distance) of their desired position.
	the Dimensional Control Plan, following steps 2.3.3 through	
1	2.3.7.	

	Station 2 - 1st Article (Half Period Assembly)	See last page for Rev changes
NO.	ASSEMBLY STEP	COMMENTS
7.31	Unfasten the bolts, lift the "C" coil enough to remove the Fuji	
	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 sharing and dimensional accuracy, will be	
	generated if required.	
	If a revised set of shims is required, install the new shims and	
	Fuji paper. Lower and reposition the "C" coil. Repeat steps	
	7.29 thru 7.31.	
7.33	With a successful Fuji load pattern, unfasten 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	
	paper, install studs, supernuts, and torque to 50% of final	
	value. Recheck alignment.	
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%.	
7.35		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	F
	bushing. Replace nut and tighten back to 50% and recheck	
	alignment.	
7 36		All monuments shall be within .015" (true distance) of their desired position.
7.50	of all monuments per the Dimensional Control Plan, following	This monuments shall be within .010 (true distance) of their desired position.
	, ,	
7 27	steps 2.3.3 through 2.3.7.	Accume three wolded chair supports with put pletes on each wing
	Install wing support hardware	Assume three welded chair supports with nut-plates on each wing
	Load support hardware to pre-weld condition.	
7.39	Tighten all bolts to their final torque.	All responses to the library state in OAZII (two and distance) of the indepind manifely
7.40	After tightening hardware, measure the position of all	All monuments shall be within .017" (true distance) of their desired position.
	monuments per the Dimensional Control Plan, following steps	
7 44	2.3.3 through 2.3.7.	
7.41	Weld the B / C nose region solenoid side following the weld	
7.40	procedure.	
7.42	Measure the positions of all monuments per the process	All monuments shall be within .020" (true distance) of their desired position.
	defined in the Metrology Plan, steps 2.3.3 through 2.3.7.	
7.43	Back office of above results and adjust wing supports if	
	needed to meet alignment requirements	
	Fill all lose bushings with Stycast 2850FT	
	Inflate all wing shim bags	CHANGED FROM TACK WELD INBD WELDED SHIMS
	Fill all wing bladders and cure	
	Install trim coil	MOVED TO STATION 5
	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
1	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.
	Remove from stand and measure weight of completed	<u>0</u>
154	assembly	
11.05	Move to holding area.	
11.00	imoro to notaling area.	<u> </u>

# 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

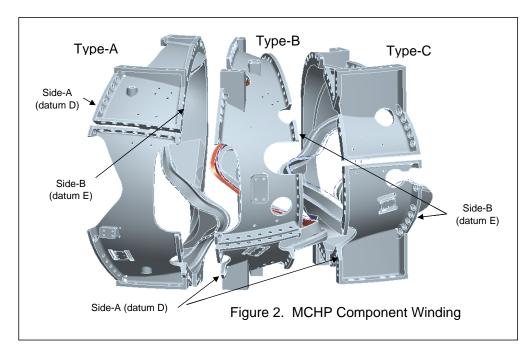
Station 2 - 1st Article (Half Period Assembly)

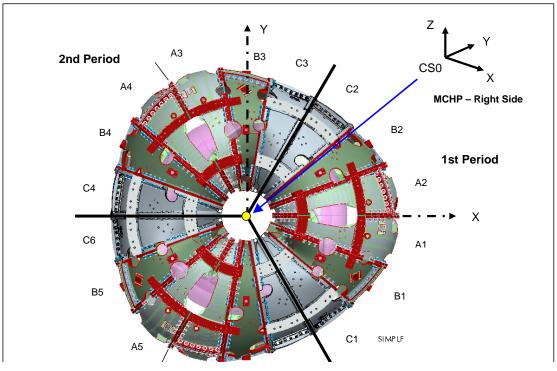
ASSEMBLY STEP

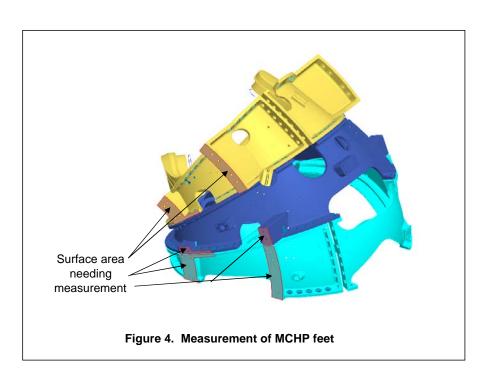
Period 2: MCHP – Left Side NO. COMMENTS

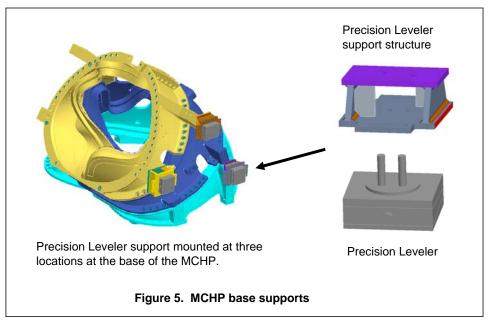
C3 / B3 / A3 Period 3: MCHP - Left Side C6 / B5 / A5

MCHP - Right Side A4/B4/C4 MCHP - Right Side A6/B6/C5









### Station 2 - 1st Article (Half Period Assembly)

See last page for Rev changes

NO. ASSEMBLY STEP COMMENTS

## Change in 9.4

- 1 Updated plan to match changes made in Dimensional Control Plan NCSX-PLAN-HPADC-00-dE.(highlighted in red)
- 2 Corrected typos at Steps 6.29, 7.02 and 7.03. (highlighted in red)
- Incorporated Ellis commnets (9.4\_RAE ) to synchronize with Dimensional control plan NCSX-PLAN-HPADC-00-dF(highlighted in blue)
  - 6.24 "in the horizontal plane" --> "x, y, z directions"
  - 6.30 "Recheck Alignment" -> measure the position of all monuments per the Dimensional Control Plan, following steps 2.3.3 through 2.3.7.
  - 7.04 "including three positions..." -->"on the fixture and on the building"
    - Subsequent alignments to these monuments must meet the .002"RMS criterion.
  - 7.10 deleted "an accuracy of..."
  - 7.16 "perspective" --> "respective"
  - 7.261 Punctuation in right column
  - 7.27 "x-y plane" --> "x, y, and z directions"

#### Change in 9.3

1 Includes Bob Ellis's final dimensional control inputs (highlighted in red).

#### 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.

110	Station 2 - Production Article (Half Period Assem	
NO.	ASSEMBLY STEP	COMMENTS
	MC fit-up pre-check and surface insulation	The full accembly layout of the mating MC's can be found in Table 1 and Figure 2
1.01		The full assembly layout of the mating MC's can be found in Table 1 and Figure 3 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.
	Type-o con with its interfacing Feriod Type-o con.	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
		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
	Scan the "B" flange (datum E) and the MC shell VV boss	
	interface. Measure tooling balls	
	Remove Type-A coil from stand and move to holding area.	The acceptance criterion is 005" DMC deviction in clienment to the set of conicel
2.04	Follow the steps defined in Section 2 of the Metrology Plan for racking coils and lower the Type-B modular coil onto the	The acceptance criterion is .005" RMS deviation in alignment to the set of conical 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.
	Remove Type-B coil from stand and store coil.	
	Follow the steps defined in Section 2 of the Metrology Plan for	
	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
	Scan the "A" flange (datum D). Measure tooling balls.	Flange measurement is needed for the A side (only) for the Type-C coil.
	Remove Type-C coil from stand and store coil.	Matralagy propedure covering Station 2:
	Shim sizing / preparations Using flange measurement of the coils, define the A/B shim	Metrology procedure covering Station 2: This is a back office calculation where shim thickness is predetermined based on
3.01	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:
	Install MCHP fixtures and metrology equipment.	• • • • • • • • • • • • • • • • • • • •
4.02	Perform metrology set-up and checks per section 2.3 of the	
	Dimensional Control Plan.	
	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
6.01	Follow the stone defined in Costion 2 of the Metrology Plan for	Reference Drawings: SE140-003 a The acceptance criterion is .003" RMS deviation in alignment to the set of tooling
0.01		
1	racking coils, lower the Type-A modular coil onto the jacks,	balls. With a successful alignment a set of global fiducial monuments will have
	racking coils, lower the Type-A modular coil onto the jacks, "A" flange (datum "D") down and rack the "A" coil into its	balls. With a successful alignment a set of global fiducial monuments will have been established. Subsequent alignments of the laser tracker will be to the global
	racking coils, lower the Type-A modular coil onto the jacks, "A" flange (datum "D") down and rack the "A" coil into its proper shape.	balls. With a successful alignment a set of global fiducial monuments will have been established. Subsequent alignments of the laser tracker will be to the global monument, and the criterion of .002" RMS deviation will apply
6.02	racking coils, lower the Type-A modular coil onto the jacks, "A" flange (datum "D") down and rack the "A" coil into its proper shape.  Using the Type-A (B-flange) inboard shim template mark the nose shim locations and puck locations. Remove the template.	balls. With a successful alignment a set of global fiducial monuments will have been established. Subsequent alignments of the laser tracker will be to the global monument, and the criterion of .002" RMS deviation will apply  Use a thin equivalent washer of the puck diameter (or some other method) to provide a positional "feel" to allow measuring puck height in the A -B installed position.
6.02	racking coils, lower the Type-A modular coil onto the jacks, "A" flange (datum "D") down and rack the "A" coil into its proper shape.  Using the Type-A (B-flange) inboard shim template mark the nose shim locations and puck locations. Remove the template.  Place an initial set of alumina shims (4-8) on the Type-A coil	balls. With a successful alignment a set of global fiducial monuments will have been established. Subsequent alignments of the laser tracker will be to the global monument, and the criterion of .002" RMS deviation will apply  Use a thin equivalent washer of the puck diameter (or some other method) to provide a positional "feel" to allow measuring puck height in the A -B installed
6.02	racking coils, lower the Type-A modular coil onto the jacks,  "A" flange (datum "D") down and rack the "A" coil into its  proper shape.  Using the Type-A (B-flange) inboard shim template mark the  nose shim locations and puck locations. Remove the  template.  Place an initial set of alumina shims (4-8) on the Type-A coil  in designated locations for the initial alignment of the mating	balls. With a successful alignment a set of global fiducial monuments will have been established. Subsequent alignments of the laser tracker will be to the global monument, and the criterion of .002" RMS deviation will apply  Use a thin equivalent washer of the puck diameter (or some other method) to provide a positional "feel" to allow measuring puck height in the A -B installed position.
6.02 6.03 6.04	racking coils, lower the Type-A modular coil onto the jacks,  "A" flange (datum "D") down and rack the "A" coil into its  proper shape.  Using the Type-A (B-flange) inboard shim template mark the  nose shim locations and puck locations. Remove the  template.  Place an initial set of alumina shims (4-8) on the Type-A coil  in designated locations for the initial alignment of the mating  Place unfilled shim bags in the wing areas	balls. With a successful alignment a set of global fiducial monuments will have been established. Subsequent alignments of the laser tracker will be to the global monument, and the criterion of .002" RMS deviation will apply  Use a thin equivalent washer of the puck diameter (or some other method) to provide a positional "feel" to allow measuring puck height in the A -B installed position.
6.02 6.03 6.04 6.05	racking coils, lower the Type-A modular coil onto the jacks, "A" flange (datum "D") down and rack the "A" coil into its proper shape.  Using the Type-A (B-flange) inboard shim template mark the nose shim locations and puck locations. Remove the template.  Place an initial set of alumina shims (4-8) on the Type-A coil in designated locations for the initial alignment of the mating Place unfilled shim bags in the wing areas  Lower the mating "B" coil into position.	balls. With a successful alignment a set of global fiducial monuments will have been established. Subsequent alignments of the laser tracker will be to the global monument, and the criterion of .002" RMS deviation will apply  Use a thin equivalent washer of the puck diameter (or some other method) to provide a positional "feel" to allow measuring puck height in the A -B installed position.  See document XXXX for shim size and location.
6.02 6.03 6.04 6.05	racking coils, lower the Type-A modular coil onto the jacks, "A" flange (datum "D") down and rack the "A" coil into its proper shape.  Using the Type-A (B-flange) inboard shim template mark the nose shim locations and puck locations. Remove the template.  Place an initial set of alumina shims (4-8) on the Type-A coil in designated locations for the initial alignment of the mating Place unfilled shim bags in the wing areas  Lower the mating "B" coil into position.  Perform an alignment to the "B" coil tooling balls to verify that	balls. With a successful alignment a set of global fiducial monuments will have been established. Subsequent alignments of the laser tracker will be to the global monument, and the criterion of .002" RMS deviation will apply  Use a thin equivalent washer of the puck diameter (or some other method) to provide a positional "feel" to allow measuring puck height in the A -B installed position.  See document XXXX for shim size and location.  If the alignment fails to meet the .003"RMS criterion, add additional shims to the
6.02 6.03 6.04 6.05	racking coils, lower the Type-A modular coil onto the jacks, "A" flange (datum "D") down and rack the "A" coil into its proper shape.  Using the Type-A (B-flange) inboard shim template mark the nose shim locations and puck locations. Remove the template.  Place an initial set of alumina shims (4-8) on the Type-A coil in designated locations for the initial alignment of the mating Place unfilled shim bags in the wing areas  Lower the mating "B" coil into position.	balls. With a successful alignment a set of global fiducial monuments will have been established. Subsequent alignments of the laser tracker will be to the global monument, and the criterion of .002" RMS deviation will apply  Use a thin equivalent washer of the puck diameter (or some other method) to provide a positional "feel" to allow measuring puck height in the A -B installed position.  See document XXXX for shim size and location.  If the alignment fails to meet the .003"RMS criterion, add additional shims to the initial set, or adjust shim thicknesses as necessary, until the "B" coil meets the
6.02 6.03 6.04 6.05 6.051	racking coils, lower the Type-A modular coil onto the jacks,  "A" flange (datum "D") down and rack the "A" coil into its  proper shape.  Using the Type-A (B-flange) inboard shim template mark the  nose shim locations and puck locations. Remove the  template.  Place an initial set of alumina shims (4-8) on the Type-A coil  in designated locations for the initial alignment of the mating  Place unfilled shim bags in the wing areas  Lower the mating "B" coil into position.  Perform an alignment to the "B" coil tooling balls to verify that  it has not changed shape. Do not accept the alignment.	balls. With a successful alignment a set of global fiducial monuments will have been established. Subsequent alignments of the laser tracker will be to the global monument, and the criterion of .002" RMS deviation will apply  Use a thin equivalent washer of the puck diameter (or some other method) to provide a positional "feel" to allow measuring puck height in the A -B installed position.  See document XXXX for shim size and location.  If the alignment fails to meet the .003"RMS criterion, add additional shims to the
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6.02 6.03 6.04 6.05 6.051 6.06 6.07	racking coils, lower the Type-A modular coil onto the jacks, "A" flange (datum "D") down and rack the "A" coil into its proper shape.  Using the Type-A (B-flange) inboard shim template mark the nose shim locations and puck locations. Remove the template.  Place an initial set of alumina shims (4-8) on the Type-A coil in designated locations for the initial alignment of the mating Place unfilled shim bags in the wing areas  Lower the mating "B" coil into position.  Perform an alignment to the "B" coil tooling balls to verify that it has not changed shape. Do not accept the alignment.  Install the jack screws and dial indicators for horizontal positioning.  Using three selected monuments on the "B" coil, position the coil within ±.002" normal to the plane of the mating flanges and within ±.060" in the plane of the mating flanges.	balls. With a successful alignment a set of global fiducial monuments will have been established. Subsequent alignments of the laser tracker will be to the global monument, and the criterion of .002" RMS deviation will apply  Use a thin equivalent washer of the puck diameter (or some other method) to provide a positional "feel" to allow measuring puck height in the A -B installed position.  See document XXXX for shim size and location.  If the alignment fails to meet the .003"RMS criterion, add additional shims to the initial set, or adjust shim thicknesses as necessary, until the "B" coil meets the alignment criterion.
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6.02 6.03 6.04 6.05 6.051 6.06 6.07	racking coils, lower the Type-A modular coil onto the jacks, "A" flange (datum "D") down and rack the "A" coil into its proper shape.  Using the Type-A (B-flange) inboard shim template mark the nose shim locations and puck locations. Remove the template.  Place an initial set of alumina shims (4-8) on the Type-A coil in designated locations for the initial alignment of the mating Place unfilled shim bags in the wing areas  Lower the mating "B" coil into position.  Perform an alignment to the "B" coil tooling balls to verify that it has not changed shape. Do not accept the alignment.  Install the jack screws and dial indicators for horizontal positioning.  Using three selected monuments on the "B" coil, position the coil within ±.002" normal to the plane of the mating flanges and within ±.060" in the plane of the mating flanges.  Install the remaining alumina coated shims; install studs, supernuts, and torque to 50% of final value.  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	balls. With a successful alignment a set of global fiducial monuments will have been established. Subsequent alignments of the laser tracker will be to the global monument, and the criterion of .002" RMS deviation will apply  Use a thin equivalent washer of the puck diameter (or some other method) to provide a positional "feel" to allow measuring puck height in the A -B installed position.  See document XXXX for shim size and location.  If the alignment fails to meet the .003"RMS criterion, add additional shims to the initial set, or adjust shim thicknesses as necessary, until the "B" coil meets the alignment criterion.  An accuracy of .002" RMS is expected and required.
6.02 6.03 6.04 6.05 6.051 6.06 6.07	racking coils, lower the Type-A modular coil onto the jacks, "A" flange (datum "D") down and rack the "A" coil into its proper shape.  Using the Type-A (B-flange) inboard shim template mark the nose shim locations and puck locations. Remove the template.  Place an initial set of alumina shims (4-8) on the Type-A coil in designated locations for the initial alignment of the mating Place unfilled shim bags in the wing areas  Lower the mating "B" coil into position.  Perform an alignment to the "B" coil tooling balls to verify that it has not changed shape. Do not accept the alignment.  Install the jack screws and dial indicators for horizontal positioning.  Using three selected monuments on the "B" coil, position the coil within ±.002" normal to the plane of the mating flanges and within ±.060" in the plane of the mating flanges.  Install the remaining alumina coated shims; install studs, supernuts, and torque to 50% of final value.  Make a hand "wiggle" test (rotate on bolt) on all shims to	balls. With a successful alignment a set of global fiducial monuments will have been established. Subsequent alignments of the laser tracker will be to the global monument, and the criterion of .002" RMS deviation will apply  Use a thin equivalent washer of the puck diameter (or some other method) to provide a positional "feel" to allow measuring puck height in the A -B installed position.  See document XXXX for shim size and location.  If the alignment fails to meet the .003"RMS criterion, add additional shims to the initial set, or adjust shim thicknesses as necessary, until the "B" coil meets the alignment criterion.  An accuracy of .002" RMS is expected and required.

	Station 2 - Production Article (Half Period Assem	See last page for Rev changes
NO.	ASSEMBLY STEP	COMMENTS
	After tightening, measure the position of all monuments per the Dimensional Control Plan, following steps 2.3.3 through	All monuments shall be within .007" (true distance) of their desired position.
	2.3.7.	
	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.	
	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 shims.	
6.13	"Lightly" tack weld the nose flex shims to the perspective "A" and "B" coils.	
6.14	Unfasten all bolts and remove the "B" coil and place it on a	
	separate fixture, with the Type-B coil side "A" flange (datum "D") facing up.	
6.15	Recheck the part alignment of the "A" coil to make sure it is still within alignment.	Verify that it still meets the .003" RMS criterion. Do not accept alignment. If the .003" criterion is not met, re-rack the "A" coil .
6.151	Weld all Type-A flex shims to the plasma side, following the	1.000 Gitterior is not met, re-rack the A coil.
	weld sequence plan.	
6.16	After welding the "A" coil nose shims recheck alignment to determine if the part still meets the metrology acceptance	The acceptance criterion is .003" RMS deviation in alignment to the set of tooling balls.
	criterion.	
6.17	Time needs to be allocated for a back office assessment of the part after welding.	If Control Plan acceptance criterion is not met project input is needed to determine how to proceed.
6.18	On the separate fixture measure the "B" fiducials to establish	now to proceed.
	a reference coordinate system prior to welding the "B" coil	
6.19	nose shims. With the successful "A" coil weld operation, weld all Type-B (A	
	flange) flex shims to the plasma side, following the weld	
6.20	sequence plan.	Alian to macourements of 6.19. The acceptance criterian is 20.4" DMC deviction in
6.20	After welding the "B" coil nose shims recheck the part to determine if it still meets the metrology acceptance criterion.	Align to measurements of 6.18. The acceptance criterion is .004" RMS deviation in alignment to the set of tooling balls.
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	the part after welding.  Remove alumina shims as necessary except for the (4-8)	how to proceed.
	initial locating shims on the Type-A coil in designated	
	locations for the initial alignment of the mating coil.  Lower the mating "B" coil into position.	
6.231	Perform an alignment to the "B" coil tooling balls to verify that	Do not accept the alignment if the alignment fails to meet the .003"RMS criterion,
	it has not changed shape.	add additional shims to the initial set, or adjust shim thicknesses as necessary, until the "B" coil meets the alignment criterion.
	Using three selected monuments on the "B" coil, position the coil within ±.002" in the x, y, and z directions.	An accuracy of .002" or better is expected and required for this step.
	Raise the "B" coil slightly and install the remaining alumina coated shims; install studs, supernuts, and torque to 50% of	
6.26	final value.  Make a hand "wiggle" test (rotate on bolt) on all shims to	
3.20	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.  After tightening, measure the position of all monuments per	All monuments shall be within .007" (true distance) of their desired position.
	the Dimensional Control Plan, following steps 2.3.3 through	
	2.3.7.  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		This operation can be done concurrently at different locations if in so doing the
	gage slid onto the stud define the hole eccentricity. Select bushing and machine to match required eccentricity. Install	part does not move.
	bushing. Replace nut and tighten back to 50% and recheck	
0.00	alignment.	All many manufactures at all the widthin 00711 (true distance) of the decimal at 101
6.30	After super bolt tightening, measure the position of all monuments per the Dimensional Control Plan, following steps	All monuments shall be within .007" (true distance) of their desired position.
	2.3.3 through 2.3.7.	
	Install wing support hardware	Assume three welded chair supports with nut-plates on each wing
	Load the wing support hardware to pre-weld condition.  Tighten all bolts to their final torque.	
5.55	gc.r an botto to tron iniai torque.	ı

	Station 2 - Production Article (Half Period Assem	dee last page for itev changes
NO.	ASSEMBLY STEP	COMMENTS
6.34	After tightening hardware, measure the position of all	All monuments shall be within .009" (true distance) of their desired position.
	monuments per the Dimensional Control Plan, following steps	(**************************************
0.05	2.3.3 through 2.3.7.	
6.35	Weld the A / B nose region solenoid side following the weld	
	procedure.	
6.36	Measure the positions of all monuments per the process	All monuments shall be within .012" (true distance) of their desired position.
	defined in the Metrology Plan, steps 2.3.3 through 2.3.7.	
6.37	Back office of above results and adjust wing supports if	
0.07	needed to meet alignment requirements	
0.00		
	Identify, if possible, a set of monuments that have moved less	
	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.	
6.39	Fill all lose bushings with Stycast 2850FT	
	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	This 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.	
	Compress alumina coated shims and sort by thickness the	
0.72	shim set that will be installed on the B/C interface.	
7.00		0 110110
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
		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 horizontal. Bolt the fixtures together.	
	degrees from nonzonial. Boil the fixtures together.	
7.02	Select a subset of monuments identified in step 6.38 that will	
	be used for the initial alignment in this next phase of half	
	period assembly.	
	Align to the set of monuments selected in 7.02.	The acceptance criterion is .005" RMS deviation in alignment to the set of tooling
1.00	Aligh to the set of monuments selected in 7.02.	The acceptance chieffor is .000 Trivio deviation in alignment to the set of tooling
		halla
		balls.
7.04	Establish a set of global monuments, on the fixture and on the	balls.  Subsequent alignments to these monuments must meet the .002"RMS criterion.
	Establish a set of global monuments, on the fixture and on the building.	
	building.	Subsequent alignments to these monuments must meet the .002"RMS criterion.
	building. Using the Type-B (B-flange) inboard shim template mark the	Subsequent alignments to these monuments must meet the .002"RMS criterion.  Use a thin equivalent washer of the puck diameter (or some other method) to
	building. Using the Type-B (B-flange) inboard shim template mark the nose shim locations and puck locations. Remove the	Subsequent alignments to these monuments must meet the .002"RMS criterion.  Use a thin equivalent washer of the puck diameter (or some other method) to provide a positional "feel" to allow measuring puck height in the A -B installed
7.05	building. Using the Type-B (B-flange) inboard shim template mark the nose shim locations and puck locations. Remove the template.	Subsequent alignments to these monuments must meet the .002"RMS criterion.  Use a thin equivalent washer of the puck diameter (or some other method) to provide a positional "feel" to allow measuring puck height in the A -B installed position.
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7.05 7.06 7.07 7.08 7.081 7.09 7.10 7.11 7.12 7.13 7.14	building.  Using the Type-B (B-flange) inboard shim template mark the nose shim locations and puck locations. Remove the template.  Place an initial set of alumina shims (4-8) on the Type-B coil in designated locations for the initial alignment of the mating coil.  Place unfilled shim bags in the wing areas  Lower the mating "C" coil into position.  Perform an alignment to the "C" coil tooling balls to verify that it has not changed shape. Do not accept the alignment.  Install the jack screws and dial indicators for horizontal positioning.  Using three selected monuments on the "C" coil, position the coil within ±.002" normal to the plane of the mating flanges and within ±.060" in the plane of the mating flanges.  Install the remaining alumina coated shims; install studs, supernuts, and torque to 50% of final value.  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.  After tightening, measure the position of all monuments per the Dimensional Control Plan, following steps 2.3.3 through 2.3.7.  Measure the shim puck height (at a number of points around the puck surface) at each of the nose shim puck locations.	Subsequent alignments to these monuments must meet the .002"RMS criterion.  Use a thin equivalent washer of the puck diameter (or some other method) to provide a positional "feel" to allow measuring puck height in the A -B installed position.  See document XXXX for shim size and location.  If the alignment fails to meet the .003"RMS criterion, add additional shims to the initial set, or adjust shim thicknesses as necessary, until the "C" coil meets the alignment criterion.  All monuments shall be within .015" (true distance) of their desired position. The component of the deviations of monuments on the "C" coil that is normal to the
7.05 7.06 7.07 7.08 7.081 7.09 7.10 7.11 7.12 7.13	building.  Using the Type-B (B-flange) inboard shim template mark the nose shim locations and puck locations. Remove the template.  Place an initial set of alumina shims (4-8) on the Type-B coil in designated locations for the initial alignment of the mating coil.  Place unfilled shim bags in the wing areas  Lower the mating "C" coil into position.  Perform an alignment to the "C" coil tooling balls to verify that it has not changed shape. Do not accept the alignment.  Install the jack screws and dial indicators for horizontal positioning.  Using three selected monuments on the "C" coil, position the coil within ±.002" normal to the plane of the mating flanges and within ±.060" in the plane of the mating flanges.  Install the remaining alumina coated shims; install studs, supernuts, and torque to 50% of final value.  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.  After tightening, measure the position of all monuments per the Dimensional Control Plan, following steps 2.3.3 through 2.3.7.  Measure the shim puck height (at a number of points around	Subsequent alignments to these monuments must meet the .002"RMS criterion.  Use a thin equivalent washer of the puck diameter (or some other method) to provide a positional "feel" to allow measuring puck height in the A -B installed position.  See document XXXX for shim size and location.  If the alignment fails to meet the .003"RMS criterion, add additional shims to the initial set, or adjust shim thicknesses as necessary, until the "C" coil meets the alignment criterion.  All monuments shall be within .015" (true distance) of their desired position. The component of the deviations of monuments on the "C" coil that is normal to the

	Station 2 - Production Article (Half Period Assem	
NO.	ASSEMBLY STEP	COMMENTS
7.15	Unfasten bolts and raise the "C" 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-C flex	
_	shims.	
7.16	,	
	and "C" 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.	
7.18	Recheck the part alignment of the "A / B" coil to make sure it	The acceptance criterion is .005" RMS deviation in alignment to the set of tooling
	is still within alignment and then weld all Type-B flex shims to	balls. Consult Dimensionl Control if this criterion is not met.
	the plasma side, following the weld sequence plan.	
7.19	After welding the "B" coil nose shims recheck alignment to	The acceptance criterion is .005" RMS deviation in alignment to the set of tooling
	determine if the part still meets the metrology acceptance	balls. Consult Dimensionl Control if this criterion is not met.
	criterion.	
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	
7.55	sequence plan.	TI COMPINE COMPINE
7.23	After welding the "C" coil nose shims recheck the part to	The acceptance criterion is .004" RMS deviation in alignment to the set of tooling
	determine if it still meets the metrology acceptance criterion.	balls. Consult Dimensionl Control if this criterion is not met.
70.	The second to be allowed the second to second the second the second to second the second to second the second the second to second the second the second the second the second to second the s	K O anti- I Dian a constant a salitaria di anti-
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
7.05	the part after welding.	how to proceed.
7.25	Remove alumina shims as necessary except for the (4-8)	
	initial locating shims on the Type-B coil in designated	
	locations for the initial alignment of the mating coil.	
	Lower the mating "C" coil into position.	
7.261		Do not accept the alignment. If the alignment fails to meet the .003"RMS criterion,
	it has not changed shape.	add additional shims to the initial set, or adjust shim thicknesses as necessary,
		until the "C" coil meets the alignment criterion.
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.
	coil within ±.002" in the x, y, and z directions.	
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	
7.55	inserted. Tighten bolt and recheck.	All the state of t
	After tightening, measure the position of all monuments per	All monuments shall be within .015" (true distance) of their desired position.
1	the Dimensional Control Plan, following steps 2.3.3 through	
7.01	2.3.7.	Deposit and the desired telegraphy
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%.	
7.00	One hale at a time warrant the company that are the	This appearing any hardens appearing the state of the second seco
7.32		This operation can be done concurrently at different locations if in so doing the
1	gage slid onto the stud define the hole eccentricity. Select	part does not move.
	bushing and machine to match required eccentricity. Install	
	bushing. Replace nut and tighten back to 50% and recheck	
7.00	alignment.	All manufactures about his middle OAF!! (Among distance) of the in-decised in 197
7.33	After super bolt tightening, measure the position of all	All monuments shall be within .015" (true distance) of their desired position.
	monuments per the Dimensional Control Plan, following steps	
<b></b>	2.3.3 through 2.3.7.	
	Install wing support hardware	Assume three welded chair supports with nut-plates on each wing
	Load support hardware to pre-weld condition.	
	Tighten all bolts to their final torque.	All and a constant of all the collision of the collision
7.37	After tightening hardware, measure the position of all	All monuments shall be within .017" (true distance) of their desired position.
	monuments per the Dimensional Control Plan, following steps	
7.00	2.3.3 through 2.3.7.	
7.38	Weld the B / C nose region solenoid side following the weld	
1	procedure.	

	Station 2 - Production Article (Hall Period Assen	
NO.	ASSEMBLY STEP	COMMENTS
7.39	Measure the positions of all monuments per the process	All monuments shall be within .020" (true distance) of their desired position.
	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	
10.01	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	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	
	Move to holding area.	

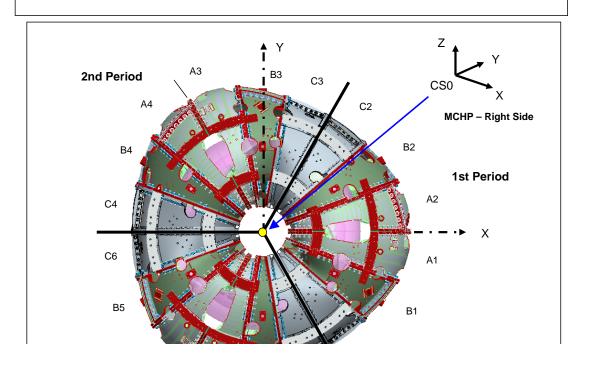
# Table 1.0 Period Assembly Make-up

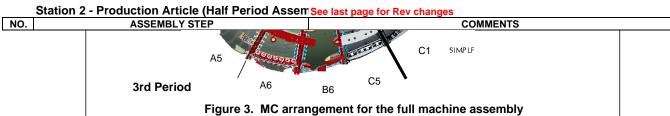
Period 1: MCHP – Left Side MCHP – Right Side

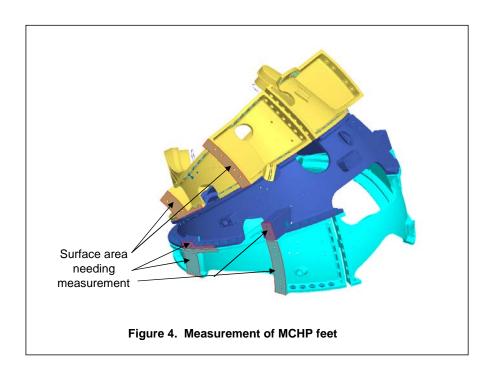
 $\begin{array}{cccc} & & & & & & & & & \\ \text{C1 / B1 / A1} & & & & & & \\ \text{Period 2:} & \text{MCHP} - \text{Left Side} & & & & \\ \text{MCHP} - \text{Right Side} & & & \\ \end{array}$ 

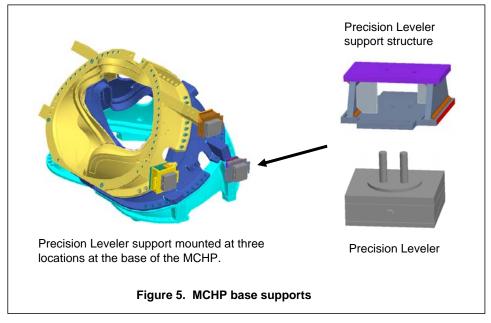
eriod 3: MCHP – Left Side MCHP – Right Side C6 / B5 / A5 A6 / B6 / C5

COMMENTS









Change in 9.4

NO. ASSEMBLY STEP COMMENTS

- 1 Updated plan to match changes made in Dimensional Control Plan NCSX-PLAN-HPADC-00-dE.(highlighted in red)
- 2 Corrected typos at Steps 6.20, 7.02, 7.03 and 7.27. (highlighted in red)
- 3 Incorporated Ellis commnets (9.4\_RAE) to synchronize with Dimensional control plan NCSX-PLAN-HPADC-00-dF(highlighted in blue)
  - 6.24 "in the horizontal plane" --> "x, y, z directions"
  - 6.30 "Recheck Alignment" -> measure the position of all monuments per the Dimensional Control Plan, following steps 2.3.3 through 2.3.7.
  - 7.04 "including three positions..." -->"on the fixture and on the building"
    - Subsequent alignments to these monuments must meet the .002"RMS criterion.
  - 7.10 deleted "an accuracy of..."
  - 7.16 "perspective" --> "respective"
  - 7.261 Punctuation in right column
  - 7.27 "x-y plane" --> "x, y, and z directions"

#### Change in 9.3

1 Includes Bob Ellis's final dimensional control inputs (highlighted in red).

#### 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 Assembly tolerance increase to .010" from .007" in (A-B) to C fit-up.