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| Traveler Title | SNSPPU Cryomodule Spaceframe-Thermal Shield Assembly Traveler | | | |
| Traveler Abstract | This traveler specifies the assembly steps for the SNS cryomodule after the cold mass assembly traveler has been completed. These assembly steps include the thermal shield, space frame, outer magnetic shielding, MLI, instrumentation routing and cavity alignment. This work is to be performed by trained and authorized CMA Technicians only. | | | |
| Traveler ID |  | | | |
| Traveler Revision | R1 | | | |
| Traveler Author | Jared Martin | | | |
| Traveler Date | 10-Aug-21 | | | |
| NCR Informative Emails | Areilly,Huque,Marchlik,Daly | | | |
| NCR Dispositioners | Fischer,Jared,JJCamp | | | |
| D3 Emails | Daly,Marchlik | | | |
| Approval Names | Jared Martin | John Fischer | Naeem Huque |  |
| Approval Signatures |  |  |  |  |
| Approval Dates |  |  |  |  |
| Approval Title | Author | CMA Group Lead | CA Manager |  |

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| References | List and Hyperlink all documents related to this traveler. This includes, but is not limited to: safety (THAs, SOPs, etc), drawings, procedures, and facility related documents. | | | |
| [104210200-M8U-8200-A002\_-\_SPACEFRAME THERMAL SHIELD ASSY](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-215861/104210200-M8U-8200-A002_-_SPACEFRAME%20-%20THERMAL%20SHIELD%20ASSY.pdf) | [104210900-M8U-8200-A001--SPACE FRAME ASSY](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-215862/104210900-M8U-8200-A001--Space%20frame.pdf) | [104211100-M8U-8200-A002 THERMAL SHIELD ASSY](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-215863/104211100-M8U-8200-A002%20Rev%20A-1-%20Thermal%20Shield.pdf) | [104211000-M8U-8200-A001 OUTER MAGNETIC SHIELD](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-215864/haysg_104211000-M8U-8200-A001-%20OUTER%20MAGNETIC%20SHIELD.pdf) | [11141S0029 High Sensitivity Vacuum Leak Check Procedure](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-215860/11141S0029%20Rev%20B%202e-10%20Leak%20Check%20Final.pdf) |
| [SNSPPU Cryomodule Alignment Procedure](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-215859/SNSPPU%20Cryomodule%20Alignment%20Procedure_Final.docx) | [CP-Cryomodule MLI Installation Procedure](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-244377/CP-C75-CM-INST-MLI.docx) | [SNS-PPU-TSMLI-INST](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-246252/Mylar%20procedure%20thermal%20shield.docx) | [PPU HB0X Alignment Template](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-246399/H01%20Preliminary%20alignment%20check.xls) |  |

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| Revision Note |  |
| R1 | Initial release of this Traveler. |

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| Step No. | Instructions | Data Input |
| 1 | Record the Spaceframe and Thermal shield serial numbers.  SF-TS | [[SNTech]] <<SRFCMP>>  [[SNDate]] <<TIMESTAMP>>  [[SNComment]] <<COMMENT>>  [[SpaceFrameSN]] <<SFRSN>>  [[ThermalShieldSN]] <<THRMSN>>  [[CryomoduleSN]] <<CMSN>> |
| 2 | Install the Spaceframe/Thermal shield assembly onto the transfer bench (on ¼ point supports). Verify the spaceframe height from the Thompson rails. 49.88” +/- .06” | [[ToolTech]] <<SRFCMP>>  [[ToolDate]] <<TIMESTAMP>>  [[ToolComment]] <<COMMENT>> |
| 3 | Remove the bottom sections of the TS and SF. Label each section and monitor for any deflections during the removal process. | [[RemoveTech]] <<SRFCMP>>  [[RemoveDate]] <<TIMESTAMP>>  [[RemoveComment]] <<COMMENT>> |
| 4 | Leak check the Thermal Shield line and record findings.  Note: Only thermal shields with SN’s, A, C, F, and G require leak testing.  Use [11141S0029 High Sensitivity Vacuum Leak Check Procedure](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-215860/11141S0029%20Rev%20B%202e-10%20Leak%20Check%20Final.pdf) | [[ThermLeakCheckTech]] <<SRFCMP>>  [[ThLCDate]] <<TIMESTAMP>>  [[ThLCComment]] <<COMMENT>>  [[ThLCUpload]] <<FILEUPLOAD>>  [[THLCLeakDetectorSN]] <<SN>>  [[THLCLDCalDate]] <<TEXT>> |
| 5 | Make modifications to the Thermal Shield.   * Remove the shipping bolts, leaving breaks in shield (x2) as shown in dwg 104210200-M8U-8200-A002. Areas shown below in green. * Identify shield line bellows with bellows tape      * Add or verify indium foil under the Field Probe heat stationing blocks (x4) [Note: Shield assemblies 104211100-M8U-8200-A002-A, B, C, D, E and F should already have indium installed. Indium application requires three torque steps with a minimum of 8 hours intervals   indium sink   * Loosen the bellows restraints to obtain 1/8” clearance between the lock nut and the bellows plate   bellows   * Install the MLI blankets over the 50K shields, use [SNS-PPU-TSMLI-INST](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-246252/Mylar%20procedure%20thermal%20shield.docx) to complete.   NOTE: The distance from the outer diameter of the thermal shield to the inner diameter of the spaceframe should nominally be 1.29” +/- 1/8” | [[ThModTech]] <<SRFCMP>>  [[ThModDate]] <<TIMESTAMP>>  [[ThModComment]] <<COMMENT>>  [[ThModHoldpoint]] {{fischer,  jared,marchlik}} <<HOLDPOINT>> |
| 6 | Install the axial restraint rods onto the cavity string. Run the nuts all the way up on threads, except the return 33.5” rod. Leave 1/8” space between the nut and the end of the threaded assembly. | [[AxTech]] <<SRFCMP>>  [[AxDate]] <<TIMESTAMP>>  [[AxComment]] <<COMMENT>> |
| 7 | Install the Spaceframe/thermal shield over string assembly (on assembly bench).   * Ensure the CM string is locked down on the rails * Verify the Cavity string elevation * Ensure nothing from the string is protruding outside the helium vessel Outer Dimension * Ensure no thermal straps are positioned down into the TS Inner diameter * Verify the temporary protective covers are over the coupler bellows * Ensure the coupler cooling exhaust lines are fed between the TS and SF during installation   **NOTE: Carefully roll the SFTS assembly over the CM string paying particular attention to the coupler bellows and coupler cooling exhaust lines as the SF rings roll past them.** | [[InsSFTech]] <<SRFCMP>>  [[InstSFDate]] <<TIMESTAMP>>  [[InstSFComment]] <<COMMENT>> |
| 8 | * Lock the down spaceframe over the CM string ensuring alignment of nitronic rod connection points (as per assembly drawing 104210200-M8U-8200-A002). * Adjust the “Z” dimension (the location of the string in relationship to the spaceframe) as shown below. This is a reference dimension that will be accurately set during the alignment process. | [[AlignSFTech]] <<SRFCMP>>  [[AlignSFDate]] <<TIMESTAMP>>  [[AlignSFComment]] <<COMMENT>> |
| 9 | Install the bottom SF lower ring ties, wheel assemblies, and crossover carriage supports as shown below. Measure the distance from the wheel to the spaceframe, should be ~7/8”. Shim wheels if necessary.  wheel distancecid:8150a5cf-4083-433e-a00f-48b62a6d632f | [[InstWHTech]] <<SRFCMP>>  [[InstWHDate]] <<TIMESTAMP>>  [[InstWHComment]] <<COMMENT>> |
| 10 | Install all nitronic and axial rods and heat stationing straps. Torque all rods to 20 in/lbs using a calibrated torque wrench, mark each rod after torqueing to identify work has been completed, follow [SNSPPU Cryomodule Alignment Procedure](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-215859/SNSPPU%20Cryomodule%20Alignment%20Procedure_Final.docx). | [[InstRodsTech]] <<SRFCMP>>  [[InstRodsDate]] <<TIMESTAMP>>  [[InstRodsComment]] <<COMMENT>>  [[TorqueWrenchSN]] <<SN>>  [[TorqueWrenchCalDate]] <<TEXT>>  [[TorqueHoldpoint]] {{fischer,  jared,  marchlik}} <<HOLDPOINT>> |
| 11 | Remove the clean room string support assemblies (lollipop sticks slide out through bottom).  Label the Ion pump, noting that the support has been removed.  \*\*The ion pump will hang from the beam tube, supported by the bellows protection covers while alignment is being completed.\*\* | [[RemCRToolTech]] <<SRFCMP>>  [[RemCRToolDate]] <<TIMESTAMP>>  [[RemCRToolComment]] <<COMMENT>> |
| 12 | Perform alignment, using procedure [SNSPPU Cryomodule Alignment Procedure](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-215859/SNSPPU%20Cryomodule%20Alignment%20Procedure_Final.docx).  Use alignment spreadsheet [PPU HB0X Alignment Template](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-246399/H01%20Preliminary%20alignment%20check.xls)  \*\*\*It will be necessary to remove the motor and harmonic drives to clear way for the alignment arms as identified in the Alignment Spreadsheet.\*\*\* | [[AlignTech]] <<SRFCMP>>  [[AlignDate]] <<TIMESTAMP>>  [[AlignComment]] <<COMMENT>>  [[AlignFile]] <<FILEUPLOAD>>  [[AlignScope1]] <<SN>>  [[AlignScope1CalDate]] <<TEXT>>  [[AlignScope2]] <<SN>>  [[AlignScope2CalDate]] <<TEXT>>  [[AlignReview]] {{fischer,  jared  ,marchlik}} <<HOLDPOINT>> |
| 13 | Route and heat station all instrumentation to vacuum vessel port locations.   * Route the FP cables, strip off the outer jacket (at grounding points only) and attach to heat station block with indium foil as per 104210200-M8U-8200-A002, torque the indium clamping hardware 3 times with a minmum of 8 hours between torqueing steps * Perform TDR check after final routing * Record cable locations. | [[FPElectTech]] <<SRF>>  [[FPTech]] <<SRFCMP>>  [[FPDate]] <<TIMESTAMP>>  [[FPComment]] <<COMMENT>>  [[FPTDRUpload]] <<FILEUPLOAD>>  [[FPSNCav1]] <<SN>>  [[FPSNCav2]] <<SN>>  [[FPSNCav3]] <<SN>>  [[FPSNCav4]] <<SN>>  [[AnalyzerSN]] <<SN>>  [[AnalyzerCalDate]] <<TEXT>> |
| 14 | Install, then weld the remaining coupler exhaust lines extensions. Upload the completed welding documentation.  C:\Users\fischer\AppData\Local\Microsoft\Windows\INetCache\Content.MSO\6797A156.tmp | [[EXWelder]] <<SRFCMP>>  [[EXDate]] <<TIMESTAMP>>  [[EXComment]] <<COMMENT>>  [[EXWeldUpload]] <<FILEUPLOAD>> |
| 15 | Leak check the extensions added in step 14, using [11141S0029 High Sensitivity Vacuum Leak Check Procedure](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-215860/11141S0029%20Rev%20B%202e-10%20Leak%20Check%20Final.pdf). Record the leak check data, leak detector S/N, and leak rate calibration date. | [[EXLCTech]] <<SRFCMP>>  [[EXLCDate]] <<TIMESTAMP>>  [[EXLCComment]] <<COMMENT>>  [[EXLCUplaod]] <<FILEUPLOAD>>  [[LeakDetectorSN]] <<SN>>  [[LeakRateCalDate]] <<TEXT>> |
| 16 | Install bottom TS panels and MLI patches.   * Remove all bellows protectors prior to closing * Ensure proper clearance all around between coupler and TS, test fit the coupler tophat to verify * Interleave bottom MLI blankets with top blanket * Install MLI patches over helium vessel nitronic rod connections * Review the assembly is complete and ready for the outer magnetic shield   C:\Users\fischer\AppData\Local\Microsoft\Windows\INetCache\Content.MSO\1EC8529.tmp | [[InstPNTech]] <<SRFCMP>>  [[InstPNDate]] <<TIMESTAMP>>  [[InstPNComment]] <<COMMENT>>  [[AssyReviewHold]] {{fischer,  jared,  marchlik}} <<HOLDPOINT>>  [[PNReviewUpload]] <<FILEUPLOAD>> |
| 17 | Install the outer magnetic shielding onto SF as per 104210200-M8U-8200-A002.   * Test fit all SF lock downs to ensure proper clearance between lockdowns and mag shield. Threaded stud of lockdown needs to be unrestricted into spaceframe. * Ensure proper clearance all around and between coupler and mag shielding, Test fit the coupler tophat to verify. | [[OutMGTech]] <<SRFCMP>>  [[OutMGDate]] <<TIMESTAMP>>  [[OutMGComment]] <<COMMENT>>  [[OuterMagSN]] <<OMAGSN>> |
| 18 | * Install the heat stationing clamps on both ends of the cavity string, directly behind the cold gate valve as shown below. Install .01” indium between the heat sink and flange o.d. Torque the indium clamping hardware 3 times with a minmum of 8 hours between torqueing steps. | [[ClampTech]] <<SRFCMP>>  [[ClampDate]] <<TIMESTAMP>>  [[ClampComment]] <<COMMENT>> |
| 19 | Install the surge tank, space frame extensions, ion pump hanger assembly, and corresponding ¼” piping. Upload the completed Welding documentation.  cid:a189f2b2-1149-49dc-990c-41716e176d89 | [[SurgeWelder]] <<SRFCMP>>  [[SurgeTech]] <<SRFCMP>>  [[SurgeDate]] <<TIMESTAMP>>  [[SurgeComment]] <<COMMENT>>  [[SurgeWeldUpload]] <<FILEUPLOAD>> |
| 20 | Leak check the extensions added in step 19, using [11141S0029 High Sensitivity Vacuum Leak Check Procedure](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-215860/11141S0029%20Rev%20B%202e-10%20Leak%20Check%20Final.pdf). Record the leak check data, leak detector S/N, and leak rate calibration date. | [[SurgeLCTech]] <<SRFCMP>>  [[SurgeLCDate]] <<TIMESTAMP>>  [[SurgeLCComment]] <<COMMENT>>  [[SurgeLCUpload]] <<FILEUPLOAD>>  [[LeakDetectorSN]] <<SN>>  [[LeakRateCalDate]] <<TEXT>> |
| 21 | Review and sign off the completed assembly as per 104210200-M8U-8200-A002.  Record the drawing revision number.  Upload the Space frame and Thermal shield work station checklist. | [[SignDate]]: <<Date>>  [[SignMang]]: <<Username>>  [[Traveler Revision number]]: <<Float>>  [[SignComment]]: <<Comment>>  [[SignHoldpoint]] {{fischer,  jared,  marchlik}} <<HOLDPOINT>>  [[FinalChecklistUpload]] <<FILEUPLOAD>> |