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| Traveler Title | C100R Thermal Shield and Spaceframe Assembly | | | |
| Traveler Abstract | This traveler details the assembly and in-process quality control inspection of the C100 Spaceframe and Thermal Shield. All work from this section on will be performed in the Cryomodule assembly area. Furthermore, it is assumed the Cold Mass Assembly Traveler has been completed. The scope of work begins with a completed Cold Mass Assembly and ends with a partial assembly of the Cryomodule including Spaceframe, Thermal Shield, and Outer Magnetic shield.  Work within this Traveler is to be performed by trained and authorized Assembly Technicians ONLY.  All Cryomodule RAM materials shall be kept inside the established RADCON barriers, and all protocals outlined in the attached RADCON Control Memorandum will be maintained.  **\*\* Radiation surveys shall be performed and information recorded at traveler hold points.\*\*** | | | |
| Traveler ID | C100R-CM-ASSY-SFR | | | |
| Traveler Revision | R2 | | | |
| Traveler Author | John Fischer | | | |
| Traveler Date | 21-Feb-22 | | | |
| NCR Informative Emails | areilly,drury | | | |
| NCR Dispositioners | fischer,jjcamp | | | |
| D3 Emails | fischer,jjcamp,drury,fhumphry | | | |
| Approval Names | John Fischer | Tony Reilly | Jeff Campbell | Dave Hamlette |
| Approval Signatures |  |  |  |  |
| Approval Dates |  |  |  |  |
| Approval Title | CM Group Lead | SRF Dept. Head | Technical Reviewer | RADCON Rep. |

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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. | | | |
| [CP-C100-CM-ALGN- Cavity String Alignment Procedure](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-252432/CP-C100-CM-ALGN.pdf) | [CP-C100-CM-INST-MLI Procedure for MLI Installation](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-252434/CP-C100-CM-INST-MLI.pdf) | [CP-C100-CM-ASSY-SFR Procedure for Space Frame and Shield Installation](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-252433/CP-C100-CM-ASSY-SFR%5b1%5d.pdf) | [11141S0029- Small Item Leak Check Spec Rev B](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-252428/11141S0029%20Rev%20B%202e-10%20Leak%20Check%20Final.pdf) | [11141S0033- Large Item Leak Check Spec Rev B 1E-9](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-252429/11141S0033%201e9%20Leak%20Check%20Final.pdf) |
| [11141S0034 S/S Cleaning-Handling Spec](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-252430/11141S0034%20Stainless%20handling%20and%20cleaning%20spec.pdf) | [11141S0035-Cleaning- Handling Spec](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-252431/JLAB_SPEC_11141S0035%20Cleaning%20and%20Handling%20Procedure.pdf) | [CRM1207001-0500 Space Frame-Shields Top Assy](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-252421/CRM1207001-0500%20Space%20Frame-50k%20Shields%20Top%20Assy.pdf) | [CRM1207044-0000 Thermal Shield sh1](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-252426/CRM1207044-0000%20sh1.pdf) | [CRM1207044-0000 Thermal Shield sh2](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-252427/CRM1207044-0000%20Shield%20sh2.pdf) |
| [CRM1207095-1000 Space Frame Assy sh1](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-252305/CRM1207095-1000%20Spaceframe%20Assy%20sh1.pdf) | [CRM1207095-1000 Space Frame Assy sh2](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-252306/CRM1207095-1000%20Spaceframe%20Assy%20sh2.pdf) | [CRM1207043-0000 Outer Magnetic Shield sh1](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-252424/CRM1207043-0000%20Outer%20Mag%20Shield%20sh1.pdf) | [CRM1207043-0000 Outer Magnetic Shield sh2](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-252425/CRM1207043-0000%20Outer%20Mag%20Shield%20sh2.pdf) | [CRM1207043-0030 Secondary Outer Magnetic Shield sh1](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-252422/CRM1207043-0000%20Outer%20Mag%20Shield%20Secondary%20sh1.pdf) |
| [CRM1207043-0000 Secondary Outer Magnetic Shield sh2](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-252423/CRM1207043-0000%20Outer%20Mag%20Shield%20Secondary%20sh2.pdf) |  |  |  |  |

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| Revision Note |  |
| R1 | Initial release of this Traveler. |
| R2 | Modified approval names and signatures, changed a few steps |

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| Step No. | Instructions | Data Input |
| 1 | Verify the Cold Mass Assembly Traveler is complete and enter the Cryomodule Assembly serial no. | [[CMSN]] <<CMSN>>  [[UCMLeadTech]] <<SRF>>  [[UCMComplete]] <<YESNO>>  [[CMDate]] <<TIMESTAMP>> |
| 2 | Prepare and Install the 50 k shield, MLI, and Spaceframe. Follow [CP-C100-CM-ASSY-SFR](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-252433/CP-C100-CM-ASSY-SFR%5b1%5d.pdf) to complete this work.  **\*\*\*When working on and around the Cavity String, Space Frame, and 50K Shields be aware of exposed bellows, cryogenic feedthrus, and instrumentation. Consult the Floor Lead if you have questions or concerns\*\*\***   * Ensure that .010" indium layer is placed between heat station blocks, all braided thermal straps, and shield outer surface. * Identify and match mark the removable shield sections and disassemble * Once shield and spaceframe is in it’s final position over the cavity string, proceed below. * Attach the thermal straps to all (64) radial rods and axial (4) rods - all straps and blocks must be inside the shield. * Attach the waveguide thermal straps – be cognizant of wavweguide bellows. | [[SFRSN]] <<SFRSN>>  [[SFRInstallLeadTech]] <<SRF>>  [[SFRInstallDate]] <<TIMESTAMP>>  [[SFRInstallComment]] <<COMMENT>> |
| 3 | Weld the bellows between the shield sections   * Open the MLI accessing the bellows areas * Install fire blanket material around the weld area * Designate and Institute a Firewatch * Install and weld the bellows assemblies between the shield sections, using ASME B31.3 "Process Piping" as the standard. | [[ShieldWelder]] <<SRF>>  [[WeldDocumentation]] <<FILEUPLOAD>>  [[ShieldWeldDate]] <<TIMESTAMP>>  [[ShieldWeldComment]] <<COMMENT>> |
| 4 | Leak check the 50 K thermal shield helium circuit. Bag all joints. JLAB Specification [11141S0029 Rev B 2e-10 Leak Check Final](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-252428/11141S0029%20Rev%20B%202e-10%20Leak%20Check%20Final.pdf) | [[LeakCheckTech]] <<SRF>>  [[LeakCheckDate]] <<TIMESTAMP>>  [[LeakCheckGood]] <<YESNO>>  [[UploadStripChartFile]]  <<FILEUPLOAD>>  [[LeakCheckComment]] <<COMMENT>> |
| 5 | Install, then anchor the HOM and FPC cables to the 50 K thermal shield intercept blocks. Install .010" Indium foil between the cables and the 50K heat intercept blocks. Torque the indium joints a minimum of 3 times at minimum of 12 hour increments. Perform TDR measurements of all cables. Record findings. | [[THRMSN]] <<THRMSN>>  [[AnchorTech]] <<SRF>>  [[AnchorDate]] <<TIMESTAMP>>  [[AnchorComment]] <<COMMENT>>  [[AnchorElectricalTech]] <<SRF>>  [[TDRfiles]] <<FILEUPLOAD>> |
| 6 | Transfer the cavity string to the space frame   * Connect all (64 radial, 4 axial) nitronic rods to the space frame. * Verify the spaceframe is centered, torque the axial rods (4x) to 20 in/lbs. Use dwg.[CRM1207001-0500 Space Frame-50k Shields Top Assy](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-252421/CRM1207001-0500%20Space%20Frame-50k%20Shields%20Top%20Assy.pdf) as a reference. * Torque the remaining 64 rods to 20 in-lbs, tops first - alternating side to side to minimize the roll. | [[TransferLeadTech]] <<SRF>>  [[TransferDate]] <<TIMESTAMP>>  [[TransferComment]] <<COMMENT>> |
| 7 | Remove the cleanroom cavity string assembly supports   * Beam line vacuum shall be monitored during entire process to ensure reliability and integrity of all vacuum seals. Record vacuum before and after.   **Dial indicators can be used to monitor the beam line movement during the tooling weight transfer.** | [[BeamlineVacBefore]] <<SCINOT>>  [[BeamlineVacAfter]] <<SCINOT>>  [[ElevationSEC]] <<FLOAT>>  [[ElevationCenter]] <<FLOAT>>  [[ElevationREC]] <<FLOAT>>  [[BeanlineTech]] <<SRF>>  [[BeamlineDate]] <<TIMESTAMP>>  [[BeamlineComment]] <<COMMENT>> |
| 8 | Install the 50K Shield top panels and related MLI blankets. Stagger the seams as found in [CP-C100-CM-INST-MLI](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-252434/CP-C100-CM-INST-MLI.pdf). Close the 50k lower MLI seams, trim as required. | [[MLITech]] <<SRF>>  [[MLIDate]] <<TIMESTAMP>>  [[MLIComment]] <<COMMENT>> |
| 9 | Align the cavity string to +/- 0.010 inches with respect to the monuments. Using the double arm alignment fixture, measure and record the cold valve flange positions at each end. This information will be used after the spaceframe is installed into the vacuum vessel. Use the alignment spreadsheet to record all values. Refer to [CP-C100-CM-ALGN](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-252432/CP-C100-CM-ALGN.pdf)  Alignment yoke dwgs [CRM1207014-0160](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-252435/alignment%20yoke%201%5b2%5d.pdf), [CRM1207014-0161](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-252436/alignment%20yoke%202%5b2%5d.pdf) | [[AlignTech]] <<SRF>>  [[AlignDate]] <<TIMESTAMP>>  [[AlignComment]] <<COMMENT>>  [[AlignmentSS]] <<FILEUPLOAD>> |
| 10 | Perform RF measurements, record passbands, and upload findings | [[RFTech]] <<SRF>>  [[RFDate]] <<TIMESTAMP>>  [[RFComment]] <<COMMENT>>  [[RFUpload]] <<FILEUPLOAD>> |
| 11 | Perform a wire check, verifying values and read-back. Record findings. | [[WireElectricalTech]] <<SRF>>  [[WireDate]] <<TIMESTAMP>>  [[WireValue]] <<FILEUPLOAD>>  [[WireComment]] <<COMMENT>> |
| 12 | Close 50k shield and MLI   * Install the tuner access shield doors and 50k MLI * Close the 2k waveguide MLI access windows * Install the 50k waveguide shield access panels * Close the 50k waveguide MLI | [[CloseTech]] <<SRF>>  [[CloseDate]] <<TIMESTAMP>>  [[CloseComment]] <<COMMENT>> |
| 13 | Verify all previous steps have been completed. Review the assembly before starting the next step. | [[ReviewTech]] <<SRF>>  [[ReviewDate]] <<TIMESTAMP>>  [[ReviewComment]] <<COMMENT>> |
| 14 | Install the outer magnetic shielding around the exterior of the space frame. Band clamp the shielding prior to installing the fasteners for secure fit to space frame. Verify all clearances for the lockdowns and the alignment fiducial ears.  [CRM1207043-0000 Outer Magnetic Shielding sh1](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-252424/CRM1207043-0000%20Outer%20Mag%20Shield%20sh1.pdf), [CRM1207043-0000 Outer Magnetic Shielding sh2](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-252425/CRM1207043-0000%20Outer%20Mag%20Shield%20sh2.pdf), [CRM1207043-0030 Secondary Outer Magnetic Shieldind sh1](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-252422/CRM1207043-0000%20Outer%20Mag%20Shield%20Secondary%20sh1.pdf), [CRM1207043-0030 Secondary Outer Magnetic Shielding sh2](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-252423/CRM1207043-0000%20Outer%20Mag%20Shield%20Secondary%20sh2.pdf) | [[OMAGSN]] <<OMAGSN>>  [[OMAGTech]] <<SRF>>  [[OMAGDate]] <<TIMESTAMP>>  [[OMAGComment]] <<COMMENT>> |
| 15 | Preparation for Fiducialization   * Survey and Alignment group shall measure and record the space frame tooling markers and cold valve locations. | [[PrepTech]] <<SRF>>  [[PrepDate]] <<TIMESTAMP>>  [[PrepComment]] <<COMMENT>>  [[FiducialData]] <<FILEUPLOAD>> |
| 16 | Complete the Space Frame/Thermal Shield checklist, then upload. | [[CheckSupervisor]] <<SRFCMP>>  [[CheckDate]] <<TIMESTAMP>>  [[CheckComment]] <<COMMENT>>  [[CheckList]] <<FILEUPLOAD>> |
| 17 | C100R Spaceframe and Shield Traveler complete. | [[TravCompleteSupervisor]] <<USERNAME>>  [[TravCompleteDate]] <<TIMESTAMP>>  [[TravCompleteComment]] <<COMMENT>> |