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| Traveler Title | P1 Thermal Shield and Spaceframe Assembly |
| Traveler Abstract | This traveler details the assembly and in-process quality control inspection (testing) of the P1 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. |
| Traveler ID | P1-CMAWS3-SFR-ASSY |
| Traveler Revision  | R1 |
| Traveler Author | J. Fischer |
| Traveler Date | 3-Sep-20 |
| NCR Informative Emails | areilly,drury |
| NCR Dispositioners | fischer,worland |
| D3 Emails | areilly,drury,fischer,worland |
| Approval Names | J. Fischer | K. Worland | A. Reilly | D.Hamlette |
| Approval Signatures |  |  |  |  |
| Approval Dates |  |  |  |  |
| Approval Title | Author | Reviewer | Project Manager | RADCON Review |

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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. |
| CRM-102-7044-0000CRM-102-7014-0017CRM-102-7042-1000CRM-102-7030-1001CRM-100-7014-0002CRM-100-7050-0000 CRM-100-7014-0001 | [JLAB Specification 11141S0029, Rev. A](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-61657/JLAB_SPEC_11141S0029_Rev%20A.pdf)Small item Leak Check Procedure | [JLAB specification 11141S0035](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-61659/JLAB_SPEC_11141S0035.pdf)General Cleaning Procedure | American Society of Mechanical Engineers (ASME) B31.3 "Process Piping", 2006 Edition. | Weld Map/ Inspection Procedure**Shield Dwgs**- 115650-1059 shts 1-3**Spaceframe Dwgs**- 115630-1001 shts 1-2 |
| [JLAB Specification](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-61660/JLAB_SPEC_11141S0034.pdf)[11141S0034](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-61660/JLAB_SPEC_11141S0034.pdf)S/S Cleaning and Handling | [JLAB Specification](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-61661/JLAB_SPEC_11141S0033_Rev%20A.pdf)[11141S0033 Rev A](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-61661/JLAB_SPEC_11141S0033_Rev%20A.pdf)Leak Check of Large Items | Frequency Measurement/Tracking ProcedureP1-CM-FREQ-TRK | [11141S0030](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-61662/JLAB_SPEC_11141S0030.pdf) revAGTAW Specification S/S | **MLI Dwgs**- 115650-1090 -2K and 50 K**Outer Mag Shield**- 115650-0200 shts 1-2 |

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

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| Step No. | Instructions | Data Input |
| 1 | Verify P1 Cold Mass Assembly Traveler is complete.Record Serial Numbers.  | [[LeadTechnician1]] <<SRF>>[[TravComplete]] <<YESNO>>[[Date1]] <<TIMESTAMP>>[[SFRSN]] <<SFRSN>>[[THRMSN]] <<THRMSN>> |
| 2 | Install thermal shield* Prior to installation, ensure that .010" indium layer is placed between heat station blocks, all braided thermal straps, and shield outer surface.
* Identify, match mark shield sections and disassemble for reassembly around cavity string
* Reassemble one section at a time around the cavity string, shim to mock the real location. Adjust rotation as well.
* Attach thermal straps to all (64) radial rods and axial (4) rods - all straps and blocks must be inside the shield
* Attach tuner and waveguide thermal straps - Extreme care is needed so as NOT to put any load on the waveguide.
* Repeat process for all shield sections.
* Verify location of shields.
 | [[Technician2]] <<SRF>>[[Date2]] <<TIMESTAMP>>[[Comment2]] <<COMMENT>>[[ShieldsPositioned2]] <<YESNO>> |
| 3 | Weld bellows between each shield section and weld triple pass shield line end connectors (field fit)* Install fire blanket around weld area
* Designate and institute Firewatch
* Install and weld bellows between shield sections, using ASME B31.3 "Process Piping" as the standard.
 | [[Welder3]] <<SRF>>[[FitupGood3]] <<YESNO>>[[WeldMapAndInspectionUpload3]] <<FILEUPLOAD>>[[Date3]] <<TIMESTAMP>>[[Comment3]] <<COMMENT>>[[PicsOfShield]] <<FILEUPLOAD>> |
| 4 | * Leak check 50 K thermal shield helium circuit.
* Bag all joints.

 JLAB Specification 1114S0029 Rev A, and 1114S0033 Rev A. | [[Technician4]] <<SRF>>[[Date4]] <<TIMESTAMP>>[[LeakRate4]] <<TEXT>>[[UploadStripChartFile4]] <<FILEUPLOAD>> |
| 5 | * Install multi-layer-insulation (MLI) blankets around thermal shield. There are sixty layers divided into four blankets of fifteen layers each.
* At waveguide locations, blankets should be separated by support ribs on waveguide - one blanket inserted between ribs.
* Wear gloves and employ MLI installation procedures.
 | [[LeadTechnician5]] <<SRF>>[[Date5]] <<TIMESTAMP>>[[Comment5]] <<COMMENT>> |
| 6 | Install space frame - \*Perform test fitup of spaceframe inside vacuum vessel, adjust wheels if necessary. * Drill and pin (tack weld) wheels to spaceframe, for ease of later alignment.

**\*\* Rigging of Spaceframe to be done by trained personnel only\*\**** Identify, match, mark each section and disassemble for reassembly around cavity string
* Stage tooling on rails - double check direction of tooling
* Beginning with the center sections, assemble one section at a time onto tooling carts, insert Nitronic rods into spaceframe during buildup.
* Bolt sections together as they are installed. Ensure that sections remain level during installation.
* Once the spaceframe is reassembled and bolted together around the string, raise the quarter point supports, lifting the Spaceframe, set to correct height
* Remove center and outboard support carts
* Fasten and align wheels
* Check all fasteners for tightness.

Refer to CRM-100-7001-0002 for dimensions to locate spaceframe relative to vacuum vessel. | [[LeadTechnician6]] <<SRF>>[[Date6]] <<TIMESTAMP>>[[Comment6]] <<COMMENT>> |

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| **Step No.** | **Instructions** | **Data Input** |
| 7 | Attach thermal shield to space frame* Raise one section at a time and bolt in place with G-10/SST brackets.

**\*\*Ensure there are NO thermal shorts to the 2 K cold mass\*\*****(It may be necessary to tack weld shield hangers to spaceframe to achieve clearance)** | [[Technician7]] <<SRF>>[[Date7]] <<TIMESTAMP>>[[Comment7]] <<COMMENT>> |
| 8 | * Anchor HOM and FPC cables to 50 K thermal shield intercept blocks.
* Install .010" Indium foil between cables and 50K heat intercept blocks.
* Route to the appropriate tophat.
 | [[Technician8]] <<SRF>>[[Date8]] <<TIMESTAMP>>[[Comment8]] <<COMMENT>> |
| 9 | Transfer the cavity string to the space frame* Connect all (64 radial, 4 axial) nitronic rods to the space frame.
* Initially torque all rods to 20 in-lbs, top first- alternating side to side to minimize roll.
 | [[Technician9]] <<SRF>>[[Date9]] <<TIMESTAMP>>[[Comment9]] <<COMMENT>> |
| 10 | Remove the cleanroom cavity string assembly supports * Beam line vacuum shall be checked before, during and after each support is removed to ensure reliability and integrity of all vacuum seals.

**\*\*MONITOR CAVTY STRING ELEVATION AT SEVERAL LOCATIONS WHILE REMOVING LOLLIPOP SUPPORTS. (Dial Indicators)\*\*** | [[BeamlineVacBefore10]] <<SCINOT>>[[BeamlineVacAfter10]] <<SCINOT>>[[ElevationSEC10]] <<FLOAT>>[[ElevationCenter10]] <<FLOAT>>[[ElevationREC10]] <<FLOAT>>[[Technician10]] <<SRF>>[[Date10]] <<TIMESTAMP>> |
| 11 | * Align cavity string to +/- 0.010 inches with respect to the monuments.
* Use the single alignment arm with leveling rod fixture, measure and record cold valve flange positions at each end. This information will be used after spaceframe is installed in vacuum vessel.
* Use the alignment spreadsheet to record all values. Refer to "**P1 Alignment Procedure**"
 | [[Technician11]] <<SRF>>[[Date11]] <<TIMESTAMP>>[[Comment11]] <<COMMENT>>[[UploadFile11]] <<FILEUPLOAD>> |
| 12 | Measure cavity frequencies (passband) and record values. Note any significant variance. | [[CAV1\_Freq12]] <<FLOAT>>Mhz[[CAV2\_Freq12]] <<FLOAT>>Mhz[[CAV3\_Freq12]] <<FLOAT>>Mhz[[CAV4\_Freq12]] <<FLOAT>>Mhz[[CAV5\_Freq12]] <<FLOAT>>Mhz[[CAV6\_Freq12]] <<FLOAT>>Mhz[[CAV7\_Freq12]] <<FLOAT>>Mhz[[CAV8\_Freq12]] <<FLOAT>>Mhz[[RFTechnician12]] <<SRF>>[[Date12]] <<TIMESTAMP>>[[Comment12]] <<COMMENT>> |

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| **Step No.** | **Instructions** | **Data Input** |
| 13 | Route and heat station interior instrumentation to 50K shield, place at appropriate tophat. | [[ElectricalTechnician13]] <<SRF>>[[Date13]] <<TIMESTAMP>>[[Comment13]] <<COMMENT>> |
| 14 | Perform wire check, verifying values and readback. | [[ElectricalTechnician14]] <<SRF>>[[Date14]] <<TIMESTAMP>>[[WireValues14]] <<FILEUPLOAD>>[[Comment14]] <<COMMENT>> |
| 15 | Perform TDR measurements and record data.  | [[Technician15]] <<SRF>>[[Date15]] <<TIMESTAMP>>[[UploadTDR15]] <<FILEUPLOAD>>  |
| 16 | Install magnetic shielding around exterior of space frame. * Band clamp shielding prior to installing fasteners for secure fit to space frame.
 | [[Technician16]] <<SRF>>[[Date16]] <<TIMESTAMP>> |
| 17 | Preparation for Fiducialization* Survey and Alignment group shall measure and record space frame tooling markers and cold valve locations.
 | [[Technician17]] <<SRF>>[[Date17]] <<TIMESTAMP>>[[Comment17]] <<COMMENT>> |
| 18 | P1 Spaceframe and Shield Traveler complete. | [[LeadTechnician18]] <<SRF>>[[Date18]] <<TIMESTAMP>>[[Comment18]] <<COMMENT>> |