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| Traveler Title | P1 Vacuum Vessel and End Can Assembly |
| Traveler Abstract | This traveler details the assembly and in-process quality control inspection (testing) of the P1 Vacuum Vessel and final components. All work from this section on will be performed in the Cryomodule assembly area. Furthermore, it is assumed the Spaceframe and Thermal Shield Assembly Traveler has been completed. The scope of work begins with a completed Spaceframe and Thermal Shield Assembly and ends with a completely assembled P1 Vacuum Vessel and End Can Assembly. |
| Traveler ID | P1-CMAWS3-VV-ASSY |
| Traveler Revision  | R1 |
| Traveler Author | J. Fischer |
| Traveler Date | 26-Jan-21 |
| NCR Informative Emails | areilly,drury |
| NCR Dispositioners | fischer,worland |
| D3 Emails | areilly,drury,fischer,worland |
| Approval Names | J. Fischer | K. Worland | A. Reilly | Dave 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. |
| CRM1027001-0200 Vacuum VesselCRM1027001-0210Vacuum Vessel w/ stackCRM1027001-0001Cryomodule Assy115310-1001 sht 1-3Supply End Can115300-1001 sht 1-3Return End Can | [JLAB Specification 11141S0029, Rev. A](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-61712/JLAB_SPEC_11141S0029_Rev%20A.pdf)Small item Leak Check Procedure | [JLAB specification 11141S0035](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-61713/JLAB_SPEC_11141S0035.pdf)General Cleaning Procedure | American Society of Mechanical Engineers (ASME) BP&V Code Sec 9, "Welding and Brazing Qualification" | Weld Map/ Inspection ProcedureOuter Mag Shield-115650-0200 shts 1-2Vacuum VesselCRM1207090-1000Return EndcanCRM1208020-0000Supply EndcanCRM1208010-0000Cryomodule Top AssyCRM1207001-1000 |
| [JLAB Specification](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-61710/JLAB_SPEC_11141S0034.pdf)[11141S0034](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-61710/JLAB_SPEC_11141S0034.pdf)S/S Cleaning and Handling | [JLAB Specification](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-61711/JLAB_SPEC_11141S0033_Rev%20A.pdf)[11141S0033 Rev A](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-61711/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-61714/JLAB_SPEC_11141S0030.pdf) revAGTAW Specification S/S |  |

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

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| Step No. | Instructions | Data Input |
| 1 | Verify Spaceframe and Thermal Shield Traveler is complete. | [[LeadTechnician1]] <<SRF>>[[TravelerComplete]] <<YESNO>>[[Date1]] <<TIMESTAMP>> |
| 2 | Install vacuum vessel over spaceframe* Pre-align VV utilizing the top rail alignment tooling
* As space frame wheels engage VV, secure the two components from movement, remove tooling and install magnetic shielding patches over holes where tooling was attached.
* Verify center and roll; is grooved wheel setting on transfer rail in vacuum vessel, if not, adjust.
* "Z" Center spaceframe in vacuum vessel, install lockdowns.
 | [[LeadTechnician2]] <<SRF>>[[Date2]] <<TIMESTAMP>>[[Comment2]] <<COMMENT>> |
| 3 | Align vacuum vessel with cavity string back to monuments to within +/- 0.010" using the cold valve locations recorded in Spaceframe and Thermal Shield Traveler. | [[Technician3]] <<SRF>>[[Date3]] <<TIMESTAMP>>[[Comment3]] <<COMMENT>> |
| 4 | Install tophats * Extreme care shall be taken bolting the waveguides to the tophats
* Pre-fit each top hat, weld out, leak check prior to final installation
* Prep O-Ring surfaces
* Install tophats

**\*\*\*Route instrumentation to proper ports during tophat installation\*\*\*** | [[Technician4]] <<SRF>>[[ElectricalTechnician4]] <<SRFCMP>>[[Date4]] <<TIMESTAMP>>[[Welder4]] <<SRF>>[[WeldMapAndInspection4]] <<FILEUPLOAD>>[[LeakCheckTophat1]] <<FILEUPLOAD>>[[LeakCheckTophat2]] <<FILEUPLOAD>>[[LeakCheckTophat3]] <<FILEUPLOAD>>[[LeakCheckTophat4\_5]] <<FILEUPLOAD>>[[LeakCheckTophat6]] <<FILEUPLOAD>>[[LeakCheckTophat7]] <<FILEUPLOAD>>[[LeakCheckTophat8]]<<FILEUPLOAD>>[[Comment4]] <<COMMENT>> |
| 5 | Terminate Instrumentation * Install feedthrus
* Record wire values
* TDR cables to verify, record values.
 | [[Technician5]] <<SRF>>[[Date5]] <<TIMESTAMP>>[[WiringValues5]] <<FILEUPLOAD>>[[TDRFiles5]] <<FILEUPLOAD>>[[ElectricalTechnician5]] <<SRF>>[[Date\_5]] <<TIMESTAMP>>[[Comment5]] <<COMMENT>> |

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| Step No. | Instructions | Data Input |
| 6 | Install Supply End Can (SEC)* Install bridging ring and O-Ring seal onto end of vacuum vessel.
* Align end can, pitch, roll and yaw should not exceed 0.125 inches across bayonets
* Prefit all process piping, modify as needed.
* Install step transitions.
* Prep entire area for CLEAN install of beampipe.
* Install and pre-align beampipe with oring into endcan.
* Install warm-to-cold beamline with ion pump under laminar flow hood using procedure CP-P1-CM-ASSY-BPIP
* Leak check beampipe assembly.
* Once beamline pressure is stable, configure valves as outlined in procedure.
 | [[SECSN]] <<SECSN>>[[Technician6]] <<SRF>>[[Date6]] <<TIMESTAMP>>[[LeakRate6]] <<TEXT>>[[UploadStripChartFile6]] <<FILEUPLOAD>>[[UploadParticleTestData6]] <<FILEUPLOAD>>[[O\_RingsInstalled6]]<<YESNO>>[[ValvesInProperPositions6]]<<YESNO>> |
| 7 | Weld process piping, using (ASME) BP&V Code Sec 9, "Welding and Brazing Qualification" as a guide. | [[Welder7]] <<SRF>>[[WeldMapAndInspection7]] <<FILEUPLOAD>>[[Date7] <<TIMESTAMP>> |
| 8 | Remove Return side 11l/s ion pump* Prep entire area for CLEAN work.
* Using procedure CP-P1-CM-ASSY-BPIP, remove REC ion pump.
* Blank off cold valve with clean flange
 | [[Technician8]] <<SRF>>[[Date8]] <<TIMESTAMP>>[[UploadParticleTestData8]] <<FILEUPLOAD>> |
| 9 | Install Return End Can (REC) * Install bridging ring and O-Ring seal onto end of vacuum vessel.
* Align SEC, Pitch, roll and yaw should not exceed 0.125 inches across bayonets
* Pre-fit process piping, flex lines and fittings.
* Install step transitions.
* Prep entire area for CLEAN install of beampipe.
* Install and pre-align beampipe with oring into endcan.
* Install warm-to-cold beamline with ion pump under laminar flow hood using procedure CP-P1-CM-ASSY-BPIP
* Leak check beampipe assembly.
* Once beamline pressure is stable, configure valves as outlined in procedure.
 | [[Technician9]] <<SRF>>[[Date9]] <<TIMESTAMP>>[[LeakRate9]] <<TEXT>>[[UploadStripChartFile9]] <<FILEUPLOAD>>[[UploadParticleTestData9]] <<FILEUPLOAD>>[[O\_RingsInstalled9]]<<YESNO>>[[ValvesInProperPositions9]]<<YESNO>> |
| 10 | Weld process piping using (ASME) BP&V Code Sec 9, "Welding and Brazing Qualifications" as a guide. | [[Welder10]] <<SRF>>[[WeldMapAndInspection10]] <<FILEUPLOAD>>[[Date10]] <<TIMESTAMP>> |
| 11 | Leak check both 2 K and 50 K piping circuits. Bag all joints for final leak check. | [[Technician11]] <<SRF>>[[Date11]] <<TIMESTAMP>>[[LeakRate11]] <<TEXT>>[[UploadStripChartFile11]] <<FILEUPLOAD>> |
| 12 | Install bridging area components* Complete wiring for beampipe diodes, liquid level and intercept instrumentation. Verify wiring.
* Wrap all 2 K piping with 12-15 layers of MLI
* Install thermal shielding
* Cover thermal shielding with 60 layers MLI and tie in with the 50 K MLI installed over string 50k shield.
* Install outer magnetic shielding
* Slide bridging ring into place with O-Ring and secure for vacuum seal. Ensure that rotation is set such that ports are located at 3 & 9 o'clock.
* Record final overall bayonet to bayonet and beampipe end flange to beampipe end flange dimension.
 | [[Technician12]] <<SRF>>[[Date12]] <<TIMESTAMP>>[[ElectricalTechnician12]] <<SRF>>[[UploadWiringValues12]] <<FILEUPLOAD>>[[Date\_12]] <<TIMESTAMP>>[[BayonetToBayonet12]] <<FLOAT>>[[EndflangeToEndflange12]] <<FLOAT>> |

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| Step No. | Instructions | Data Input |
| 13 | Weld SEC and REC bridging rings, also position and weld outer tuner stacks (2) to vacuum vessel.Tack weld the fiducial blocks to the vacuum vessel in the proper locations. | [[Welder13]] <<SRF>>[[WeldMapAndInspection13]] <<FILEUPLOAD>>[[Date13]] <<TIMESTAMP>>[[Comment13]] <<COMMENT>> |
| 14 | Install Warm Tuner sections. Refer to "**C100 Warm Tuner Installation Procedure**" to complete this work. Record warm tuner, harmonic drive and stepper motor serial numbers | [[Technician14]] <<SRF>>[[Date14]] <<TIMESTAMP>>[[Comment14]] <<COMMENT>> |
| **CAV-ID** | **Harmonic Drive S/N** | **Stepper Motor S/N** |
| P1-1 | [[CAV1\_HMDRSN]] <<HMDRSN>> | [[CAV1\_SMSN]] <<SMSN>> | [[CAV1\_TUNWSN]] <<TUNWSN>> |
| P1-2 | [[CAV2\_HMDRSN]] <<HMDRSN>> | [[CAV2\_SMSN]] <<SMSN>> | [[CAV2\_TUNWSN]] <<TUNWSN>> |
| P1-3 | [[CAV3\_HMDRSN]] <<HMDRSN>> | [[CAV3\_SMSN]] <<SMSN>> | [[CAV3\_TUNWSN]] <<TUNWSN>> |
| P1-4 | [[CAV4\_HMDRSN]] <<HMDRSN>> | [[CAV4\_SMSN]] <<SMSN>> | [[CAV4\_TUNWSN]] <<TUNWSN>> |
| P1-5 | [[CAV5\_HMDRSN]] <<HMDRSN>> | [[CAV5\_SMSN]] <<SMSN>> | [[CAV5\_TUNWSN]] <<TUNWSN>> |
| P1-6 | [[CAV6\_HMDRSN]] <<HMDRSN>> | [[CAV6\_SMSN]] <<SMSN>> | [[CAV6\_TUNWSN]] <<TUNWSN>> |
| P1-7 | [[CAV7\_HMDRSN]] <<HMDRSN>> | [[CAV7\_SMSN]] <<SMSN>> | [[CAV7\_TUNWSN]] <<TUNWSN>> |
| P1-8 | [[CAV8\_HMDRSN]] <<HMDRSN>> | [[CAV8\_SMSN]] <<SMSN>> | [[CAV8\_TUNWSN]] <<TUNWSN>> |
| 15 | While monitoring frequency, locally run stepper motors to verify operation. Record final cavity frequency.  | [[CAV1\_Freq15]] <<FLOAT>>Mhz[[CAV2\_Freq15]] <<FLOAT>>Mhz[[CAV3\_Freq15]] <<FLOAT>>Mhz[[CAV4\_Freq15]] <<FLOAT>>Mhz[[CAV5\_Freq15]] <<FLOAT>>Mhz[[CAV6\_Freq15]] <<FLOAT>>Mhz[[CAV7\_Freq15]] <<FLOAT>>Mhz[[CAV8\_Freq15]] <<FLOAT>>Mhz[[Technician15]] <<SRF>>[[Date15]] <<TIMESTAMP>>[[Comment15]] <<COMMENT>> |
| 16 | Fiducilization* Survey and Alignment group shall measure and record space frame tooling markers.
* Survey and Alignment group shall attach, measure and record tooling ball sockets on vacuum vessel.
* Survey and Alignment group shall measure and record warm valve locations, and roll datums.
 | [[Technician16]] <<SRF>>[[Date16]] <<TIMESTAMP>>[[SurveyData16]] <<FILEUPLOAD>> |
| 17 | Leak check insulating vacuum* Install insulating vacuum roughing gate valve.
* Install pressure relief plates on aisle-side ports on bridging rings.
* Install insulating vacuum gauge manifold.
* Perform leak check and record data.
* Reset warm to cold end flanges to within .010" with respect to the monuments.
 | [[Technician17]] <<SRF>>[[Date17]] <<TIMESTAMP>>[[LeakRate17]] <<TEXT>>[[UploadStripChartFile17]] <<FILEUPLOAD>>[[AlignmentCompleted17]]<<YESNO>> |
| 18 | Pressure test primary and shield circuits using SOP A-05-026, UPCM Pressure Test Procedure.* Upload worksheet taken from Appendix A of SOP.
* Install baratrons, peanut reliefs and 30/30 gauges.
 | [[Technician18]] <<SRF>>[[Date18]] <<TIMESTAMP>>[[UploadPressureTestData18]] <<FILEUPLOAD>>[[UploadScannedResultsSheet18]] <<FILEUPLOAD>> |
| 19 | Vacuum Vessel Assembly complete. | [[CompleteYes]] <<CHECKBOX>>[[Technician19]] <<SRF>>[[Date19]] <<TIMESTAMP>> |