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| Traveler Title | C50R FEL Helium Vessel Assembly Traveler |
| Traveler Abstract | This traveler outlines the necessary steps and checkpoints to install and assemble the cavity pair into the helium vessel assembly. Work within this Traveler is to be performed by trained and authorized Assembly Technicians ONLY. All Cryomodule materials shall be kept inside the established RADCON barrier until they have been surveyed and released. **\*\* Radiation surveys shall be performed and information recorded at traveler hold points.\*\******\*\* Radiological controls are a critical component of the cryomodule rework disassembly and assembly process. Dose rate, as well as contamination surveys (where indium gaskets or seals are present) shall be performed and analyzed, with information communicated to all involved personnel. Results will be recorded at traveler hold points. RW-II training will be required where contamination is identified\*\**** |
| Traveler ID | ER5C-CMACU-HELV-ASSYF |
| Traveler Revision  | R2 |
| Traveler Author | John Fischer |
| Traveler Date | 4-Jun-2024 |
| NCR Informative Emails | areilly |
| NCR Dispositioners | areilly,fischer,weaksmc |
| D3 Emails | areilly,fischer |
| Approval Names | John Fischer | Jeff Campbell | John Fischer | Tony Reilly |
| Approval Signatures |  |  |  |  |
| Approval Dates |  |  |  |  |
| Approval Title | Author | Reviewer | CMA Group Lead | Project Representative |

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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.**All materials linked below and throughout this traveler are for reference only and should be verified for latest version at time of use.** |
| [Helium Vessel Dwg](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-71970/CU-HVESSEL.pdf) | [Tuner Assy Dwg](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-71972/CU-TUNER%20ASSY.pdf) | [Small Leak Check Procedure 11141S0029](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-73238/11141S0029REV_A-SMALL%20LEAK%20CHECK.pdf) | [Large Leak Check Procedure 11141S0033](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-73239/11141S0033%20REV%20A%20%28%20LARGE%20LEAK%20CHECK%29.docx) | [C50R Tuner in HV dwg](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-73237/HV%20w%20Cavity%20dwg.pdf) |
| [HV SMA dwg](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-73236/hv%20instrumentation%20SMA%20dwg.pdf) | [C50R HV Instrumentation dwg](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-73235/hv%20instrumentation%20dwg.pdf) |  | [Magnetic Hygiene Procedure](https://jlabdoc.jlab.org/docushare/dsweb/View/Collection-27795/Document-113014) |  |

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| Revision Note |  |
| R1 | Initial release of this Traveler. |
| R2 | Modified Approvers, 8 pin feedthru step 18, and abstract. |

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| Step No. | Instructions | Data Input |
| 1 | Record the Cryounit serial number which is being built. | [[CUSN]] <<CUSN>> |
| 2 | Verify the Tuner assembly traveler is complete and signed off. | [[Technician2]] <<SRF>>[[Date2]] <<TIMESTAMP>>[[Comment2]] <<COMMENT>> |
| 3 | Using the [Magnetic Hygiene Procedure](https://jlabdoc.jlab.org/docushare/dsweb/View/Collection-27795/Document-113014), degauss the Helium Vessel and Hardware Kit. Verify all parts meet the specification. | [[Technician3]] <<SRF>>[[Date3]] <<TIMESTAMP>>[[Comment3]] <<COMMENT>>[[MagneticHygieneOK]] <<YESNO>>[[HVHygieneUpload]] <<FILEUPLOAD>> |
| 4 | Prepare the helium vessel for use. Install the rotary feedthrus, wire retaining clips, and washers. Prefit the helium vessel heads, bent the ends of helium vessel to minimize the amount of weld fillet. | [[Technician4]] <<SRF>>[[Date4]] <<TIMESTAMP>>[[Comment4]] <<COMMENT>>[[HeliumVesselSN4]] <<HESSN>> |
| 5 | Verify the flatness of the helium vessel feedthru plate. Inspect the indium sealing surfaces for defects. Polish if necessary. Record findings | [[Technician5]] <<SRF>>[[Date5]] <<TIMESTAMP>>[[Comment5]] <<COMMENT>>[[Right]] <<FLOAT>>[[Left]] <<FLOAT>> |

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| **Step No** | **Instructions** | **Data Inputs** |
| 6 | Attach the .06" d. indium seals to the helium vessel feedthru plate. | [[Technician6]] <<SRF>>[[Date6]] <<TIMESTAMP>>[[Comment6]] <<COMMENT>> |
| 7 | Secure the helium vessel shell into the shell holding fixture. Be sure feedthrough flange is level and facing up.**\*\*\*\*\*Minimize or eliminate direct contact between the magnetic tooling and the degaussed items.\*\*\*\*\*** | [[Technician7]] <<SRF>>[[Date7]] <<TIMESTAMP>>[[Comment7]] <<COMMENT>> |

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| **Step No** | **Instructions** | **Data Inputs** |
| 8 | Install the Thompson block insertion fixtures on both ends of scissor table, then insert extension bars into blocks and level the blocks andbars. | [[Technician8]] <<SRF>>[[Date8]] <<TIMESTAMP>>[[Comment8]] <<COMMENT>> |
| 9 | Engage the 4' Thompson rail extension shafts into the bottom rail of theCavity Assembly tooling. Slowly transfer the cavity pair into the heliumvessel. **\*\*CAUTION\*\***Do Not Force. Find the Obstruction and Move It! | [[Technician9]] <<SRF>>[[Date9]] <<TIMESTAMP>>[[Comment9]] <<COMMENT>> |

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| **Step No** | **Instructions** | **Data Inputs** |
| 10 | Once in position, insert the locator pins through the corner holes in the helium vesselfeedthrough flange, then thread into the cavity pair FPC flange holes. | [[Technician10]] <<SRF>>[[Date10]] <<TIMESTAMP>>[[Comment10]] <<COMMENT>> |

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| **Step No** | **Instructions** | **Data Inputs** |
| 11 | Using dial indicators, raise the cavity to the feedthru flange and install the hardware.Procedure:* Starting with an 1/8" shim, slowly raise the cavity pair, check the gap (between the HV feedthrough plate and FPC face) frequently. Repeat the process with a .06" shim, all 8 corners should be equal. Mount the dial indicators, zero out (will be measuring the final move of the cavity fixture relative to the Cryounit cart). Raise the cavity pair the last .055" evenly.

 | [[Technician11]] <<SRF>>[[Date11]] <<TIMESTAMP>>[[Comment11]] <<COMMENT>> |

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| **Step No** | **Instructions** | **Data Inputs** |
| 12 | Install the torque the bolts in the shown sequence to 40,60,and finally, 70 in/lbs.(+/5 in/lbs)**REPEAT THIS PROCESS A MINIMUM OF 3 TIMES!!!!** | [[Technician12]] <<SRF>>[[Date12]] <<TIMESTAMP>>[[Comment12]] <<COMMENT>> |

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| **Step No** | **Instructions** | **Data Inputs** |
| 13 | Leak check the FPC to HV flange indium seals. Record Findings. | [[Technician13]] <<SRF>>[[Date13]] <<TIMESTAMP>>[[Comment13]] <<COMMENT>>[[HVFlangeLeakCheck13]] <<FILEUPLOAD>> |
| 14 | Adjust the HOM cans if necessary. Install and tack the HOM assembliesto the helium vessel. | [[Technician14]] <<SRF>>[[Welder14]] <<SRF>>[[Date14]] <<TIMESTAMP>>[[Comment14]] <<COMMENT>> |
| 15 | Install the 4 Ti cavity support hangers, shim if necessary. Drill two 1/8"holes and install roll pins to secure. Torque the 1/4"-28 SHCS to 90 in/lbs. | [[Technician15]] <<SRF>>[[Date15]] <<TIMESTAMP>>[[Comment15]] <<COMMENT>> |
| 16 | Remove the cavity pair installation fixture. Be careful not to disturb the cavity pair alignment.**Procedure**:* Verfiy all Cavity hangers are installed and pinned.
* Remove tooling caps from all three cavity supports.
* Lower the cavity assembly fixture evenly.
* Remove all the thumb screws, aluminum cavity support uprights, and rail end plate.
* Slide the cavity fixture out of the helium vessel, reassemble, then return to the Clean Room
 | [[Technician16]] <<SRF>>[[Date16]] <<TIMESTAMP>>[[Comment16]] <<COMMENT>> |
| 17 | Rotate the helium vessel to 90˚, plumb and lock down. | [[Technician17]] <<SRF>>[[Date17]] <<TIMESTAMP>> |

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| **Step No** | **Instructions** | **Data Inputs** |
| 18 | Install wiring and instrumentation in accordance with drawings11126D0015 and 11126D0018, then test wiring and instrumentationcircuits. Record the manufacturer and S/N for the new qualified 8 pincryogenic feedthrus. | [[ElectricalTechnician18]] <<SRF>>[[Date18]] <<TIMESTAMP>>[[Comment18]] <<COMMENT>>[[ElectricalData18]] <<FILEUPLOAD>>[[FTManufacturer]] <<FILEUPLOAD>>[[FT08PSN]] <<FT08PSN>>[[FT08PSN]] <<FT08PSN>>[[FT08PSN]] <<FT08PSN>>[[FT08PSN]] <<FT08PSN>> |
| 19 | Install co-axial cables and supports. Perform a TDR check on allconnections. Record findings. | [[Technician19]] <<SRF>>[[Date19]] <<TIMESTAMP>>[[Comment19]] <<COMMENT>>[[TDRLeft19]] <<FILEUPLOAD>>[[TDRRight19]] <<FILEUPLOAD>> |
| 20 | Assemble the tuner drive shaft components (from drawing11161E0001) (x2) | [[Technician20]] <<SRF>>[[Date20]] <<TIMESTAMP>>[[Comment20]] <<COMMENT>> |
| 21 | Install the Heater on 2 studs located at bottom of He vessel using (4) 1/4-28 nuts, one on top and one on bottom of the heater card on eachstud. | [[Technician21]] <<SRF>>[[Date21]] <<TIMESTAMP>>[[Comment21]] <<COMMENT>> |

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| **Step No** | **Instructions** | **Data Inputs** |
| 22 | At this time, if helium vessel gets liquid level probe, install it on rightend and run wires to left end. Brackets should be facing inboard and probe should be centered vertically in vessel. | [[Technician22]] <<SRF>>[[Date22]] <<TIMESTAMP>>[[Comment22]] <<COMMENT>> |
| 23 | Tighten the instrumentation feed thru hardware on the HV saddle to 30in/lb. | [[Technician23]] <<SRF>>[[Date23]] <<TIMESTAMP>>[[Comment23]] <<COMMENT>> |
| 24 | Hold-point for supervisor's inspection, before the helium vessel isclosed up. | [[Technician24]] <<SRF>>[[Date24]] <<TIMESTAMP>>[[Comment24]] <<COMMENT>> |

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| **Step No** | **Instructions** | **Data Inputs** |
| 25 | Position the Helium vessel heads on the shell as shown on assemblyDrawing 11126E0001.Make sure that the 4 inch diameter inlet/outlet isoriented at the top of the helium vessel using the head orientationfixture. Weld heads to shell (2 places).Weld the 4 outer HOM support assemblies. **\*\*CAUTION\*\***Minimize heat transfer to bellows during welding; finish welding dish to head. | [[Welder25]] <<SRF>>[[Technician25]] <<SRF>>[[Date25]] <<TIMESTAMP>>[[Comment25]] <<COMMENT>>[[WeldMap25]] <<FILEUPLOAD>> |
| 26 | Leak check the helium vessel in accordance with Specification11141S0033. Bag both heads, both dishes, both bellows, saddle, HOMassemblies, and all 4 helium ports. | [[Technician26]] <<SRF>>[[Date26]] <<TIMESTAMP>>[[Comment26]] <<COMMENT>>[[UploadFile26]] <<FILEUPLOAD>> |
| 27 | Hold-point for supervisor's inspection. | [[Technician27]] <<SRF>>[[Date27]] <<TIMESTAMP>>[[Comment27]] <<COMMENT>> |