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| Traveler Title | C50R CRYOMODULE ASSEMBLY TRAVELER |
| Traveler Abstract | This Traveler outlines the steps necessary to assemble a C50 Cryomodule, including adding the endcans, completing the bridging areas, and uniting the Cryounits. Work within this Traveler is to be performed by trained and authorized Assembly Technicians. 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-CMA-CM-ASSY-C50R |
| Traveler Revision  | R3 |
| Traveler Author | John Fischer |
| Traveler Date | 01-Sept-24 |
| NCR Informative Emails | areilly |
| NCR Dispositioners | fischer,jjcamp,weakmc |
| 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. |
| [11100-0016 CM Top Assy](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-74930/11100-0016%20CM%20Top%20Assy.pdf) | [11126-0001 CU Top Assy](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-74932/11126-0001%20CU%20Top%20Assy.pdf) | [11131-0081 REC Top Assy](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-74934/11131-0081%20REC%20Top%20Assy.pdf) | [11131-0081 SEC Top Assy](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-74935/11131-0081%20SEC%20Top%20Assy.pdf) | [11171-0001 Bridging Area sh2](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-74939/11171-0001%20Bridging%20Area%20sh%202.pdf) |
| [11108S3704-Alignment Procedure](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-74931/11108S3704-Alignment%20Procedure.doc) | [11141S0029-Rev A Small Leak Check](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-74936/11141S0029-Rev.%20A-Small%20Leak%20Check.pdf) | [11141S0033-Rev A Large Leak Check](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-74937/11141S0033-Rev.%20A-Large%20Leak%20Check.pdf) | [11171-0001 Bridging Area sh1](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-74938/11171-0001%20Bridging%20Area%20sh%201.pdf) | [11171-0001 Bridging Area sh3](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-74940/11171-0001%20Bridging%20Area%20sh%203.pdf) |
| [11171-0001 Bridging Area sh4](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-74941/11171-0001%20Bridging%20Area%20sh%204.pdf) | [CP-C100-CM-CAL-JTAT-JT Set Procedure](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-74942/CP-C100-CM-CAL-JTAT%5B2%5D.pdf) | [CryomoduleEndCanPressureTesting OSP](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-74943/CryomoduleEndCanPressureTesting%20final.docx) | [CryomodulePressureTesting OSP](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-74944/CryomodulePressureTesting%20Final.docx) | [-CP-C100-CM-INST-MLI- mli installation](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-74945/MLI%20Installation-CP-C100-CM-INST-MLI-1.doc) |

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| Revision Note |  |
| R1 | Initial release of this Traveler. |
| R2 | Added CMSN field for tracking and use in status boards – M. McDonald |
| R3 | General review and edit of entire Traveler, added specific direction to use new, qualified 8 pin cryogenic feedthrus in step 27. |

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| Step No. | Instructions | Data Input |
| 1 | Verify all Cryounit travelers are complete. | [[TravCompTech]] <<SRF>>[[TravCompDate]] <<TIMESTAMP>>[[TravCompComm]] <<COMMENT>>[[CMSN]] <<CMSN>>  |
| 2 | Record the serial numbers for Cavities and Cryounits in their respective positions.\*\*NOTE: Cryounits 20 & 50 should have Liquid Level Probe installed.\*\*  | [[CAVSN1]] <<CAVSN>>[[CAVSN2]] <<CAVSN>>[[CAVSN3]] <<CAVSN>>[[CAVSN4]] <<CAVSN>>[[CAVSN5]] <<CAVSN>>[[CAVSN6]] <<CAVSN>>[[CAVSN7]] <<CAVSN>>[[CAVSN8]] <<CAVSN>>[[CUSN20]] <<CUSN>>[[CUSN30]] <<CUSN>>[[CUSN40]] <<CUSN>>[[CUSN50]] <<CUSN>>[[RecordCavTech]] <<SRF>>[[RecordCavDate]] <<TIMESTAMP>>[[RecordCavComm]] <<COMMENT>> |
| 3 | Record serial numbers for End Cans  | [[RECSN]] <<RECSN>>[[SECSN]] <<SECSN>>[[RecordEndCnTech]] <<SRF>>[[RecordEndCnDate]] <<TIMESTAMP>>[[RecordEndCnComm]] <<COMMENT>> |

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|  4 | Receive Cryounit 50, transfer to the Cryomodule Assembly bench.Verify the traveler is signed off and ready for further assembly.**\*\*CAUTION\*\***Make sure the beam pipe and waveguide ion pump valves are opened and pressures is stable before recording. | [[CRYOUNITSN50]] <<CUSN>>[[Cryo50Date]] <<TIMESTAMP>>[[Cryo50WgVac]] <<FLOAT>>[[Cryo50BlVac]] <<FLOAT>>[[Cryo50Tech]] <<SRF>> |
| 5 | Receive Cryounit 40, transfer to the Cryomodule Assembly bench.Verify the traveler is signed off and ready for further assembly.**\*\*CAUTION\*\***Make sure the beam pipe and waveguide ion pump valves are opened and pressures is stable before recording. | [[CRYOUNITSN40]] <<CUSN>>[[Cryo40Date]] <<TIMESTAMP>>[[Cryo40WgVac]] <<FLOAT>>[[Cryo40BlVac]] <<FLOAT>>[[Cryo40Tech]] <<SRF>> |
| 6 | Receive Cryounit 30, transfer to the Cryomodule Assembly bench.Verify the traveler is signed off and ready for further assembly.**\*\*CAUTION\*\***Make sure the beam pipe and waveguide ion pump valves are opened and pressures is stable before recording. | [[CRYOUNITSN30]] <<CUSN>>[[Cryo30Date]] <<TIMESTAMP>>[[Cryo30WgVac]] <<FLOAT>>[[Cryo30BlVac]] <<FLOAT>>[[Cryo30Tech]] <<SRF>> |
| 7 | Receive Cryounit 20, transfer to the Cryomodule Assembly bench.Verify the traveler is signed off and ready for further assembly.**\*\*CAUTION\*\***Make sure the beam pipe and waveguide ion pump valves are opened and pressures is stable before recording. | [[CRYOUNITSN20]] <<CUSN>>[[Cryo20Date]] <<TIMESTAMP>>[[Cryo20WgVac]] <<FLOAT>>[[Cryo20BlVac]] <<FLOAT>>[[Cryo20Tech]] <<SRF>> |
| 8 | Supply End Can Check* Visually inspect for obvious damage
* Visually inspect for thermal shorts.
* Check instrumentation.
* Check seal (conflat and O-ring) surfaces. (Large bridging seal surface can't be checked at this time.)
* Visually inspect insulation.
* Visually inspect for cleanliness and clean inside piping.
 | [[SEndCanTech]] <<SRF>>[[SEndCanDate]] <<TIMESTAMP>>[[SEndCanElecTech]] <<SRF>>[[SEndCanComm]] <<COMMENT>> |

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| 9 | Repeat checks for the Return End Can. | [[REndCanTech]] <<SRF>>[[REndCanDate]] <<TIMESTAMP>>[[REndCanElecTech]] <<SRF>>[[REndCanComm]] <<COMMENT>> |
| 10 | Slide the return end can mounting fixture onto the transfer bench cart (11103D0012). Lift the return end can with the overhead crane and install onto the mounting fixture. Bolt into place and remove the crane.  | [[RECTransferTech]] <<SRF>>[[RECTransferDate]] <<TIMESTAMP>>[[RECTransferComm]] <<COMMENT>> |
| 11 | Slide the supply end can mounting fixture onto the transfer bench cart. Lift the supply end can with the overhead crane and install onto the mounting fixture. Bolt into place and remove the crane.  | [[SECTransferTech]] <<SRF>>[[SECTransferDate]] <<TIMESTAMP>>[[SECTransferComm]] <<COMMENT>> |
| 12 | Slide the return end can onto the north end of cryomodule assembly bench and lockdown. | [[Technician12]] <<SRF>>[[Date12]] <<TIMESTAMP>>[[Comment12]] <<COMMENT>> |

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| 13 | \*\*UNITS 1 AND 4 MUST HAVE LIQUID LEVEL PROBES.\*\* | [[LPTech]] <<SRF>>[[LPDate]] <<TIMESTAMP>>[[Cryounit50LLP]] <<YESNO>>[[Cryounit20LLP]] <<YESNO>>[[LPComm]] <<COMMENT>> |

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| 14 | Align end cans.1. Level bridging seal surface (adjust) and level vent bayonet, using Plumb Bob fixture.
2. Swivel end can so bridging seal surface is square to rail (using reference lines in holding fixture).
3. Bolt on alignment fixture and use scopes to adjust height and left, right.

Double check Step A, B, and then C until no more adjustments need to be made.Remove alignment fixturesVerify dimensions (58 1/2") from top of the bayonets to top of the assembly rail. | [[RECAlignTech]] <<SRF>>[[RECAlignDate]] <<TIMESTAMP>>[[SECAlignTech]] <<SRF>>[[SECAlignDate]] <<TIMESTAMP>>[[RECSECAlignComm]] <<COMMENT>> |
| 15 | Prep the ends of each unit. Ensure the 1/4" bolts are in the copper shield. Insulate the gate valves 2 places. Trim the MLI as necessary. | [[CU50PrepTech]] <<SRF>>[[CU50PrepDate]] <<TIMESTAMP>>[[CU40PrepTech]] <<SRF>>[[CU40PrepDate]] <<TIMESTAMP>>[[CU30PrepTech]] <<SRF>>[[CU30PrepDate]] <<TIMESTAMP>>[[CU20PrepTech]] <<SRF>>[[CU20PrepDate]] <<TIMESTAMP>> |
| 16 | **\*\*CAUTION\*\***Ensure the 3/4" equalizer tubes are capped and Magnetic shield end caps are installed on Cryounits 50 & 20 (outboard ends). | [[EqlTubeTech]] <<SRF>>[[EqlTubeDate]] <<TIMESTAMP>>[[MagTech]] <<SRF>>[[MagTubeDate]] <<TIMESTAMP>> |

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| 17 | **\*\*CAUTION\*\***Check seal surfaces on Bridging Rings.Adjust transfer bench saddles so that beam tubes are aligned to assembly bench rails. Use alignment fixtures and scopes (each end) for rough alignment. See alignment procedure. After unit has been aligned within .020" install the Bridging Ring. Next, double check the alignment and ensure the top hats are plumb.\*\*Check the process piping fitup prior to installing the warm to cold beampippe.\*\*Position the endcan from the end of the Cryounit and lockdown. | Cryounit 20[[CU20Aligned]] <<YESNO>>[[CU20SealSurfaces]] <<YESNO>>[[CU20Oring]] <<YESNO>>[[CU20Tech]] <<SRF>>[[CU20Date]] <<TIMESTAMP>>Cryounit 30[[CU30Aligned]] <<YESNO>>[[CU30SealSurfaces]] <<YESNO>>[[CU30Oring]] <<YESNO>>[[CU30Tech]] <<SRF>>[[CU30Date]] <<TIMESTAMP>>Cryounit 40[[CU40Aligned]] <<YESNO>>[[CU40SealSurfaces]] <<YESNO>>[[CU40Oring]] <<YESNO>>[[CU40Tech]] <<SRF>>[[CU40Date]] <<TIMESTAMP>>Cryounit 50[[CU50Aligned]] <<YESNO>>[[CU50SealSurfaces]] <<YESNO>>[[CU50Oring]] <<YESNO>>[[CU50Tech]] <<SRF>>[[CU50Date]] <<TIMESTAMP>> |

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| 18 | Beam pipe installation.Note: Sequence of assembly will vary depending on where ion pumps are on cavities. In some cases, ion pumps may need to be installed on units to maintain sting pumping.Lock return end can in place using plumb bob fixtures and floor targets.Install the return end beam pipe into end can and bolt in place.**\*\*CAUTION\*\***Don't forget bridging ring O-ring. Make sure o-ring is clean and seal surfaces are not damaged.Using plumb bob fixture on waveguide to set distance, then install locking clamp for CU50.Using beam pipe assembly procedure slide CU50 into position and install beam pipe. Lock CU50 and REC in place. Leak check the beampipe. Beampipe uses a modified pumpdrop support bracket, no shipping fixture used. | [[BPInstTech]] <<SRF>>[[BPInstDate]] <<TIMESTAMP>>[[BPInstLeakCheck]] <<FILEUPLOAD>>[[BPInstComment]] <<COMMENT>> |
| 19 | Install beam pipe between CUs 50 and 40 using plumb bobs and floor targets to locate CU40. Use beam pipe assembly procedure. Lock CU40 in place.Leak check the beampipe.  | [[BP50to40Tech]] <<SRF>>[[BP50to40Date]] <<TIMESTAMP>>[[BP50to40LeakCheck]] <<FILEUPLOAD>>[[BP50to40Comment]] <<COMMENT>> |
| 20 | Install beam pipe between CUs 40 and 30 using plumb bobs and floor targets to locate CU30. Use beam pipe assembly procedure. Lock CU30 in place.Leak check beampipe.  | [[BP40to30Tech]] <<SRF>>[[BP40to30Date]] <<TIMESTAMP>>[[BP40to30LeakCheck]] <<FILEUPLOAD>>[[BP40to30Comment]] <<COMMENT>> |
| 21 | Install beam pipe between CUs 30 and 20 using plumb bobs and floor targets to locate CU20. Use beam pipe assembly procedure. Lock CU20 into place.Leak check beampipe.  | [[BP30to20Tech]] <<SRF>>[[BP30to20Date]] <<TIMESTAMP>>[[BP30to20LeakCheck]] <<FILEUPLOAD>>[[BP30to20Comment]] <<COMMENT>> |
| 22 | Beam pipe installation.Note: Sequence of assembly will vary depending on where ion pumps are on cavities. In some cases, ion pumps may need to be installed on units to maintain sting pumping.Lock supply end can in place using plumb bob fixtures and floor targets.Install the supply end beam pipe into end can and bolt in place.**\*\*CAUTION\*\***Don't forget the O-ring. Make sure the o-ring is clean and seal surfaces are not damaged. Ensure no stress is put on the pump drop assembly.Install restraining fixture onto pump drop assembly.Install pump drop into supply end can and bolt in place. | [[ORingTech]] <<SRF>>[[ORingDate]] <<TIMESTAMP>>[[ORingInstalled]] <<YESNO>>[[ORingComment]] <<COMMENT>> |

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| 23 | Slide end can up to CU20 and install the beam tube. Use beam pipe assembly procedure. Lock supply end can in place. Bag and leak test entire pump drop assembly. \*\*Check the process piping fitup before installing the warm to cold beampipe.\*\* | [[BeamTubeInstTech]] <<SRF>>[[BeamTubeInstDate]] <<TIMESTAMP>>[[BeamTubeInstFile]] <<FILEUPLOAD>>[[BeamTubeInstComment]] <<COMMENT>> |
| 24 | **\*\*CAUTION\*\***Make sure all cavity gate valves are open.All beam pipes are installed. Cavity gate valves should all be open. All cavities are actively being pumped on.Record vacuum of beamline.  | [[BLPressure]] <<FLOAT>>[[AllBPsInstTech]] <<SRF>>[[AllBPsInstDate]] <<TIMESTAMP>>[[AllBPsInstComment]] <<COMMENT>> |
| 25 | Using Assembly Drawing 11100-E-0016, check over all dimensions bayonet to bayonet and top hat to top hat.

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| Return Primary Bayonet to  |
| Waveguide 50  | 50.79 |
| Waveguide 50-40  | 75.22 |
| Waveguide 50-20  | 225.66 |
| Waveguide 40-30  | 75.22 |
| Return Primary Bayonet to Supply |
| Primary Bayonet | 327.24 |
| Drawing Dimensions |

 | [[BayonetDimTech]] <<SRF>>[[BayonetDimDate]] <<TIMESTAMP>>[[WGD50\_50\_79]] <<FLOAT>>[[WGD40\_75\_22]] <<FLOAT>>[[WGD20\_225\_66]] <<FLOAT>>[[WGD30\_75\_22]] <<FLOAT>>[[B327\_24]] <<FLOAT>>[[BayonetDimComment]] <<COMMENT>>[[BayonetDimUpload]] <<FILEUPLOAD>> |
| 26 | Tack weld helium vessel bellows (11126E0001 Item 4) and equalizer tubes (11171E001 Item 19) to helium vessels in bridging areas (three places ea.) Tack weld 4 inch helium tubes (11131E0081 Items 26 and 27) to helium vessels in end can areas (two places).Connect Argon purge to supply end can at helium inlet bayonet. Exhaust from return end can at helium outlet bayonet. Argon purge 2 K system for 15 minutes prior to welding and leave on during welding.Weld 4 inch tubes and 0.75 inch tubes on 2 K system. Weld Inspections are required for in-process and final welds. Will be uploaded in step 28. | [[HVBellowWelder]] <<SRF>>[[HVBellowDate]] <<TIMESTAMP>>[[HVBellowComment]] <<COMMENT>> |

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| 27 | Prior to leak check an Electronics Technician will install a new qualified feed through on the supply and return end can process piping for the Liquid Level Probes. Make sure copper gasket is installed. Tighten feed through conflat. Electronically check | [[ECElectricalTech]] <<SRF>>[[ECElectricalDate]] <<TIMESTAMP>>[[RECElecValues]] <<FLOAT>>[[SECElecValues]] <<FLOAT>>[[ECElectricalComment]] <<COMMENT>> |
| 28 | Visually inspect all 2 K weld joints. Upload the inspection documents. | [[Insp2KBWeldTech]] <<SRF>>[[Insp2KBWeldDate]] <<TIMESTAMP>>[[Insp2KBWeldComment]] <<COMMENT>>[[WeldDocumentation28]] <<FILEUPLOAD>> |
| 29 | Pump and Backfill 2K circuit with N2. Repeat this process 3 times.  | [[VacPump2KTech]] <<SRF>>[[VacPumpDate]] <<TIMESTAMP>>[[VacPumpComment]] <<COMMENT>> |
| 30 | Leak test all 2k piping in accordance with specification 11141S0029. Record findings. | [[2KLeakCheckTech]] <<SRF>>[[2KLeakChckDate]] <<TIMESTAMP>>[[2KLeakCheckFile]] <<FILEUPLOAD>>[[2KLeakCheckComment]] <<COMMENT>> |
| 31 | When no leaks are detected, backfill helium vessels with N2 and close supply and return ball valves to keep helium system clean. | [[BackfillTech]] <<SRF>>[[BackfillDate]] <<TIMESTAMP>>[[BackfillComment]] <<COMMENT>> |
| 32 | Tack weld 50 K braided hoses (11171E0001 Items 18 and 20) to 50 K shield in bridging areas (three places). Be sure to orientate bellows. Tack weld 50 K hoses (11131E0081 Item 49) in end cans to 50 K shield (two places).Connect Argon purge to supply end can at shield inlet bayonet. Exhaust from return end can at shield outlet bayonet. Argon purge 50 K system for 5 minutes prior to welding and leave on during welding.Weld shield joints 8 places. Remove Argon purge.  | [[ShieldWelder]] <<SRF>>[[ShieldWeldDate]] <<TIMESTAMP>>[[ShieldWeldComment]] <<COMMENT>> |
| 33 | Visually inspect all shield weld joints. Upload the weld inspections documents. | [[VisInspWeldTech]] <<SRF>>[[VisInspWeldDate]] <<TIMESTAMP>>[[VisInspWeldComment]] <<COMMENT>>[[Weld Documentation33]] <<FILEUPLOAD>> |

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| 34 | Leak test 50 K piping in accordance with specification 11141S0029. Record findings. | [[LeakTst50KTech]] <<SRF>>[[LeakTst50KDate]] <<TIMESTAMP>>[[LeakTst50KFile]] <<FILEUPLOAD>>[[LeakTst50KComm]] <<COMMENT>> |
| 35 | When no leaks are detected, backfill 50 K system with N2 and close supply and return ball valves to keep system clean. | [[Backfill50KTech]] <<SRF>>[[Backfill50KDate]] <<TIMESTAMP>>[[Backfill50KComm]] <<COMMENT>> |
| 36 | **\*\*CAUTION\*\***Refer back to Step 25 and ensure units have not moved, verify all dimensions. | [[Step25CheckTech]] <<SRF>>[[Step25CheckDate]] <<TIMESTAMP>>[[Step25CheckComment]] <<COMMENT>> |
| 37 | Apply superinsulation to beam tubes, 4 inch tubes, and 0.75 inch equalizer tubes. Spiral wrap 24 layers in three bridging areas and two end can areas. Do not insulate beam tube flanges where alignment fixtures are needed.Note: Make sure there is no interference on conflats for alignment fixture arms. | [[InsulateTech]] <<SRF>>[[InsulateDate]] <<TIMESTAMP>>[[InsulateComment]] <<COMMENT>> |
| 38 | Install helium vessel magnetic shielding (Items 31 - 37) in bridging areas as shown on drawing 11171E001 (3 places).  | [[HVMagShieldTech]] <<SRF>>[[HVMagShieldDate]] <<TIMESTAMP>>[[HVMagShieldComment]] <<COMMENT>> |
| 39 | Install helium vessel superinsulation in three bridging area. Interleave blankets and stagger seams. Slit superinsulation to allow access to beam tubes for alignment (6 places).  | [[HVInsulateTech]] <<SRF>>[[HVInsulateDate]] <<TIMESTAMP>>[[HVInsulateComment]] <<COMMENT>> |
| 40 | Install 50 K shield bridges in bridging areas and in end can areas 5 places.In bridging area and end can areas, check for thermal shorts between 2 K surfaces and 50 K copper shield. Fix as required. Note any problem areas.  | [[Inst50KSBTech]] <<SRF>>[[Inst50KSBDate]] <<TIMESTAMP>>[[Inst50KSBComment]] <<COMMENT>> |
| 41 | Install 50 K shield superinsulation in bridging areas and in end can area 5 places. Interleave blankets and stagger seams. Slit superinsulation to allow access to beam tubes for alignment.  | [[Inst50KInsuTech]] <<SRF>>[[Inst50KInsuDate]] <<TIMESTAMP>>[[Inst50KInsuComment]] <<COMMENT>> |

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| 42 | Install vacuum vessel magnetic shielding in bridging areas (11171E0001 Items 23 - 29), three places, and in end can areas (11131E0081 Items 40, 41 and 58), two places | [[InstVVMagShieldTech]] <<SRF>>[[InstVVMagShieldDate]] <<TIMESTAMP>>[[InstVVMagShieldComm]] <<COMMENT>> |
| 43 | Make bridging connections.In bridging areas, clean areas to be welded and the inside of the vacuum space by wiping with acetone (5 places).In end can areas, clean and inspect o-ring grooves and o-rings (2 places).Grease o-rings with light coat of apiezon type L and reinstall (2 places)  | [[BridgeConnectTech]] <<SRF>>[[BridgeConnectDate]] <<TIMESTAMP>>[[BridgeConnectComm]] <<COMMENT>> |
| 44 |  Slide three bridging rings, and two end can spools in place.**\*\*CAUTION\*\***Make sure all components are still level. Refer back to Step 25 and ensure units have not moved.Bolt end can spools in place, making sure 8 inch blank ports are plumb.Plumb three bridging ring 8 inch blank ports.Check that top hats are still plumb. | [[ECSpoolsTech]] <<SRF>>[[ECSpoolsDate]] <<TIMESTAMP>>[[ECSpoolsComment]] <<COMMENT>> |
| 45 | Tack weld bridging rings. Weld bridging rings.Weld saddle mounting blocks if requiredWeld alignment blocks if requiredWeld waveguide support blocks if required | [[BridgingWelder]] <<SRF>>[[BridgingWeldDate]] <<TIMESTAMP>>[[BridgingWeldComment]] <<COMMENT>> |
| 46 | Visually inspect all bridging welds. There is no documentation with this visual inspection, verifying sufficient weld. | [[InspBridgingWeldTech]] <<SRF>>[[InspBridgingWeldDate]] <<TIMESTAMP>>[[InspBridgngWeldComm]] <<COMMENT>> |
| 47 | Disconnect and lower the end can tooling, lower the support saddle swivel feet. Four swivel feet which duplicate the support areas of the tunnel saddles should remain in contact and support the weight. | [[ToolingTech]] <<SRF>>[[ToolingDate]] <<TIMESTAMP>>[[ToolingComment]] <<COMMENT>> |
| 48 | Perform cavity string alignment including warm to cold beampipes. Use Procedure #11100S0035. Upload the alignment spreadsheet. | [[AlignCMTech]] <<SRF>>[[AlignCMDate]] <<TIMESTAMP>>[[AlignmentSpreadsheet]] <<FILEUPLOAD>>[[AlignCMComment]] <<COMMENT>> |
| 49 | Log dimensions of cryomodule after welding.

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| Return Primary Bayonet to  |
| Waveguide 50  | 50.79 |
| Waveguide 50-40  | 75.22 |
| Waveguide 50-20  | 225.66 |
| Waveguide 40-30  | 75.22 |
| Return Primary Bayonet to Supply |
| Primary Bayonet | 327.24 |
| Drawing Dimensions |

 | [[CMDimTech]] <<SRF>>[[CMDimDate]] <<TIMESTAMP>>[[CMDimComment]] <<COMMENT>>[[WGD50\_50\_79A]] <<FLOAT>>[[WGD40\_75\_22A]] <<FLOAT>>[[WGD20\_225\_66A]] <<FLOAT>>[[WGD30\_75\_22A]] <<FLOAT>>[[B327\_24A]] <<FLOAT>>[[CMDimFile]] <<FILEUPLOAD>> |
| 50 | Complete final instrumentation check and record findings, This will include TDRs of transmission cables. | [[INSTTech]] <<SRF>>[[INSTDate]] <<TIMESTAMP>>[[INSTComment]] <<COMMENT>>[[INSTFile]] <<FILEUPLOAD>>[[TDRFile]] <<FILEUPLOAD>> |
| 51 | Cover the alignment access KF40 ports.Insulate beam pipe conflats.Slide over 2 K magnetic shield and insulate.Cover 50 K shield port and insulate.Close warm shielding.Bolt on cover flanges.**\*\*CAUTION\*\***Make sure all O-ring seal surfaces are clean and not damaged | [[CoverTech]] <<SRF>>[[CoverDate]] <<TIMESTAMP>>[[CoverComment]] <<COMMENT>> |

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| 52 | Fiducialize the Cryomodule. This task is performed by the JLAB Alignment Team. These numbers will be used to set the Cryomodule in the Linac. | [[TunnelAlignTech]] <<SRF>>[[TunnelAlignDate]] <<TIMESTAMP>>[[TunnelAlignComment]] <<COMMENT>> |
| 53 | Move cryomodule to staging area. Prepare for the beam pipe second stage pump drop addition. Set up Flow hood.Cleanly install the second stage beam pipe.Leak check the assemblyRecord findings. | [[MoveTech]] <<SRF>>[[MoveDate]] <<TIMESTAMP>>[[MoveComment]] <<COMMENT>>[[SSBPTech]] <<SRF>>[[SSBPDate]] <<TIMESTAMP>>[[SSBPComment]] <<COMMENT>>[[SSBPLCFile]] <<FILEUPLOAD>> |
| 54 | Transition all beamline vacuum together, activate the NEG assembly. Record all vacuums. | [[TVacTech]] <<SRF>>[[TVacDate]] <<TIMESTAMP>>[[TVacComment]] <<COMMENT>>[[TVBeamlineVacuum]] <<SCINOT>>[[TVWaveguide20Vac1]] <<SCINOT>>[[TVWaveguide30Vac1]] <<SCINOT>>[[TVWaveguide40Vac1]] <<SCINOT>>[[TVWaveguide50Vac1]] <<SCINOT>> |
| 55 | Pumpdown cryomodule vacuum shell to 1 torr and backfill with N2 gas three times. Pump shell down and put on mass spectrometer leak detector. Gross leak test.  | [[PDCMVacShellTech]] <<SRF>>[[PDCMVacShellDate]] <<TIMESTAMP>>[[PDCMVacShellComm]] <<COMMENT>> |
| 56 | Leak test the cryomodule insulating vacuumLeak test in accordance with specification 11141S033.Record Findings | [[LeakTestCMINSVACTech]] <<SRF>>[[LeakTestCMINSVACDate]] <<TIMESTAMP>>[[LeakTestCMINSVACComm]] <<COMMENT>>[[LeakTestCMINSVAC]] <<FILEUPLOAD>> |

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| 57 | Pressure test the internal piping circuits, 2K and 50K, using the pressure testing procedure.Monitor the insulating vacuum leak detector signalRecord findings\*\*Close all ball valves to maintain circuit cleanliness, leave +2psi in circuits, label ball valves for positive pressure.\*\* | [[PTCMTech]] <<SRF>>[[PTCMDate]] <<TIMESTAMP>>[[PTCMComm]] <<COMMENT>>[[PTCMUpload]] <<FILEUPLOAD>> |
| 58 | Prepare the Crymodule for testing in the CMTF or transfer to the AcceleratorRemove all external vacuum pumpsRecord final vacuum readings. | [[FVacTech]] <<SRF>>[[FVacDate]] <<TIMESTAMP>>[[FVacComment]] <<COMMENT>>[[FVBeamlineVacuum]] <<SCINOT>>[[FVWaveguide20Vac1]] <<SCINOT>>[[FVWaveguide30Vac1]] <<SCINOT>>[[FVWaveguide40Vac1]] <<SCINOT>>[[FVWaveguide50Vac1]] <<SCINOT>> |
| 58 | Review the assembly for completionUpload final documentsSupervisor sign off | [[COMPSupervisor]] <<SRF>>[[COMPDate]] <<TIMESTAMP>>[[COMPComm]] <<COMMENT>>[[COMPUpload]] <<FILEUPLOAD>> |