|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Traveler Title | NB3SN CRYOMODULE ASSEMBLY TRAVELER | | | |
| Traveler Abstract | This traveler contains the necessary information to successfully assemble the C75 Cryomodule. | | | |
| Traveler ID | NB3SN-CMA-CM-ASSY | | | |
| Traveler Revision | R2 | | | |
| Traveler Author | John Fischer | | | |
| Traveler Date | 28-Oct-2024 | | | |
| NCR Informative Emails | areilly | | | |
| NCR Dispositioners | fischer,worland | | | |
| D3 Emails | fischer,Worland,areilly | | | |
| Approval Names | John Fischer | Ken Worland | Tony Reilly |  |
| Approval Signatures |  |  |  |  |
| Approval Dates |  |  |  |  |
| Approval Title | Author | Reviewer | Project Manager |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 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://misportal.jlab.org/jlabDocs/documents/versions/6144/download) | [11126-0001 CU Top Assy](https://misportal.jlab.org/jlabDocs/documents/versions/6565/download) | [11131-0081 SEC and REC Top Assy](https://misportal.jlab.org/jlabDocs/documents/versions/109563/download) | [11171-0001 Bridging Area](https://misportal.jlab.org/jlabDocs/documents/versions/102756/download) | [11108S3704-Alignment Procedure](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-74931/11108S3704-Alignment%20Procedure.doc) |
| [11141S0029-Rev A Small Leak Check](https://misportal.jlab.org/jlabDocs/documents/versions/192249/download) | [11141S0033-Rev A Large Leak Check](https://misportal.jlab.org/jlabDocs/documents/versions/192250/download) | [SRF-MSPR-CMA-EVA-INST-R1](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-290611/SRF-MSPR-CMA-EVA-INST-R1.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) |
| [SRF-MSPR-CMA-MLI-INST-R1](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-290609/SRF-MSPR-CMA-MLI-INST-R1.pdf) |  |  |  |  |

|  |  |
| --- | --- |
| Revision Note |  |
| R1 | Initial release of this Traveler. |
| R2 | Converted from ER5C-CMA-CM-ASSY-R1 |

|  |  |  |
| --- | --- | --- |
| 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>> |

|  |  |  |
| --- | --- | --- |
| Step No. | Instructions | Data Input |
| 4 | Receive Cryounit 50, tranfer 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, tranfer 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, tranfer 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, tranfer 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 | 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. * Supply End Can | [[EndCanTech]] <<SRF>>  [[EndCanDate]] <<TIMESTAMP>>  [[EndCanElecTech]] <<SRF>>  [[EndCanComm]] <<COMMENT>> |

|  |  |  |
| --- | --- | --- |
| Step No. | Instructions | Data Input |
| 9 | Repeat checks for the Return End Can. | [[ReptRECTech]] <<SRF>>  [[ReptRECDate]] <<TIMESTAMP>>  [[ReptRECElecTech]] <<SRF>>  [[ReptRECComm]] <<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 (11103D0012). 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. | [[RECNorthTransferTech]] <<SRF>>  [[RECNorthTransferDate]] <<TIMESTAMP>>  [[RECNorthTransferComm]] <<COMMENT>> |

|  |  |  |
| --- | --- | --- |
| Step No. | Instructions | Data Input |
| 13 | \*\*UNITS 1 AND 4 MUST HAVE LIQUID LEVEL PROBES.\*\* | [[LPTech]] <<SRF>>  [[LPDate]] <<TIMESTAMP>>  [[Cryounit50LLP]] <<YESNO>>  [[Cryounit20LLP]] <<YESNO>>  [[LPComm]] <<COMMENT>> |
| Step No. | Instructions | Data Input |
| 14 | Align end cans.  Level bridging seal surface (adjust) and level vent bayonet, using Plumb Bob fixture.  Swivel end can so bridging seal surface is square to rail (using reference lines in holding fixture).  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 fixtures  Verify 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 if 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 (outerboard ends). | [[EqlTubeTechCU50]] <<SRF>>  [[EqlTubeDateCU50]] <<TIMESTAMP>>  [[EqlTubeTechCU20]] <<SRF>>  [[EqlTubeDateCU20]] <<TIMESTAMP>> |

|  |  |  |
| --- | --- | --- |
| Step No. | Instructions | Data Input |
| 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 1  [[CU1Aligned]] <<YESNO>>  [[CU1SealSurfaces]] <<YESNO>>  [[CU1Oring]] <<YESNO>>  [[CU1Tech]] <<SRF>>  [[CU1Date]] <<TIMESTAMP>> |
| Cryounit 2  [[CU2Aligned]] <<YESNO>>  [[CU2SealSurfaces]] <<YESNO>>  [[CU2Oring]] <<YESNO>>  [[CU2Tech]] <<SRF>>  [[CU2Date]] <<TIMESTAMP>> |
| Cryounit 3  [[CU3Aligned]] <<YESNO>>  [[CU3SealSurfaces]] <<YESNO>>  [[CU3Oring]] <<YESNO>>  [[CU3Tech]] <<SRF>>  [[CU3Date]] <<TIMESTAMP>> |
| Cryounit 4  [[CU4Aligned]] <<YESNO>>  [[CU4SealSurfaces]] <<YESNO>>  [[CU4Oring]] <<YESNO>>  [[CU4Tech]] <<SRF>>  [[CU4Date]] <<TIMESTAMP>> |

|  |  |  |
| --- | --- | --- |
| Step No. | Instructions | Data Input |
| 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. See 11 liter ion pump installation procedure.  Lock return end can in place using plumb bob fixtures and floor targets.  Install unvented return end beam pipe into end can and bolt in place.  **\*\*CAUTION\*\***  Don't forget O-ring. Make sure o-ring is clean and seal surfaces are not damaged.  Using plumb bob fixture in waveguide set locking clamp for unit 1.  Using beam pipe assembly procedure slide unit 1 to position and install beam pipe. Lock unit 1 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 units 1 and 2 using plumb bobs and floor targets to locate unit 2. Use beam pipe assembly procedure. Lock unit 2 in place.  Leak check the beampipe. | [[BP1to2Tech]] <<SRF>>  [[BP1to2Date]] <<TIMESTAMP>>  [[BP1to2LeakCheck]] <<FILEUPLOAD>>  [[BP1to2Comment]] <<COMMENT>> |
| 20 | Install beam pipe between units 2 and 3 using plumb bobs and floor targets to  locate unit 3 using beam pipe assembly procedure. Lock unit 3 in place.  Leak check beampipe. | [[BP2to3Tech]] <<SRF>>  [[BP2to3Date]] <<TIMESTAMP>>  [[BP2to3LeakCheck]] <<FILEUPLOAD>>  [[BP2to3Comment]] <<COMMENT>> |
| 21 | Install beam pipe between units 3 and 4 using plumb bobs and floor targets to  locate unit 4. Use beam pipe assembly procedure. Lock unit 4 into place.  Leak check beampipe. | [[BP3to4Tech]] <<SRF>>  [[BP3to4Date]] <<TIMESTAMP>>  [[BP3to4LeakCheck]] <<FILEUPLOAD>>  [[BP3to4Comment]] <<COMMENT>> |
| 22 | **\*\*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 unvented pump drop onto supply end can and bolt in place. | [[ORingTech]] <<SRF>>  [[ORingDate]] <<TIMESTAMP>>  [[ORingInstalled]] <<YESNO>>  [[ORingComment]] <<COMMENT>> |

|  |  |  |
| --- | --- | --- |
| Step No. | Instructions | Data Input |
| 23 | Slide end can up to unit 4 and install 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. Pump on pump drop is now pumping on all 4 sets of cavities and pump on return end is pumping also on all 4 sets of cavities. | [[SupplyPDPressure]] <<FLOAT>>  [[ReturnEndPressure]] <<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.   |  |  | | --- | --- | | 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.  Remove Argon purge. | [[HVBellowWelder]] <<SRF>>  [[HVBellowDate]] <<TIMESTAMP>>  [[HVBellowComment]] <<COMMENT>> |

|  |  |  |
| --- | --- | --- |
| Step No. | Instructions | Data Input |
| 27 | Allow electronic tech to solder wires to feed through at supply and return end  can for LLP. 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 bridging weld joints | [[Insp2KBWeldTech]] <<SRF>>  [[Insp2KBWeldDate]] <<TIMESTAMP>>  [[Insp2KBWeldComment]] <<COMMENT>> |
| 29 | Vacuum pump 2 K system to 200-300Mt. Backfill with N2. Repeat this process 3 times. | [[VacPump2KTech]] <<SRF>>  [[VacPumpDate]] <<TIMESTAMP>>  [[VacPumpComment]] <<COMMENT>> |
| 30 | Bag and leak test joints in accordance with specification 11141S0029. | [[JointLeakCheckTech]] <<SRF>>  [[JointLeakChckDate]] <<TIMESTAMP>>  [[JointLeakCheckFile]] <<FILEUPLOAD>>  [[JointLeakCheckComment]] <<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. | [[VisInspWeldTech]] <<SRF>>  [[VisInspWeldDate]] <<TIMESTAMP>>  [[VisInspWeldComment]] <<COMMENT>> |

|  |  |  |
| --- | --- | --- |
| Step No. | Instructions | Data Input |
| 34 | Leak test 50 K joints in accordance with specification 11141S0029 | [[LeakTst50KJointTech]] <<SRF>>  [[LeakTst50KJointDate]] <<TIMESTAMP>>  [[LeakTst50KJointFile]] <<FILEUPLOAD>>  [[LeakTst50KJointComm]] <<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 11 and assure units have not moved.  Before closing bridging Areas #11, Page 15 overall dimensions need to be double checked. | [[Step11CheckTech]] <<SRF>>  [[Step11CheckDate]] <<TIMESTAMP>>  [[Step11CheckComment]] <<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>> |

|  |  |  |
| --- | --- | --- |
| Step No. | Instructions | Data Input |
| 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 11 and assure 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.  Weld alignment blocks.  Weld waveguide support blocks | [[BridgingWelder]] <<SRF>>  [[BridgingWeldDate]] <<TIMESTAMP>>  [[BridgingWeldComment]] <<COMMENT>> |
| 46 | Visually inspect all bridging welds | [[InspBridgingWeldTech]] <<SRF>>  [[InspBridgingWeldDate]] <<TIMESTAMP>>  [[InspBridgngWeldComm]] <<COMMENT>> |
| 47 | Close the gate valve at position #2 to isolate the 45 liter pump during its alignment.  Final alignment on both end beampipes is done with insulating vacuum established, prior to alignment crew measurements. | [[CloseGV2Tech]] <<SRF>>  [[CloseGV2Date]] <<TIMESTAMP>>  [[CloseGV2Comment]] <<COMMENT>> |
| 48 | **\*\*CAUTION\*\***  When aligning the pump drop, use extreme caution no to put stress on the assembly. Tension on the conflat joints, may cause leaks. | [[AlignPDTech]] <<SRF>>  [[AlignPDDate]] <<TIMESTAMP>>  [[AlignPDComment]] <<COMMENT>> |

|  |  |  |
| --- | --- | --- |
| Step No. | Instructions | Data Input |
| 49 | Using final alignment procedure #11100S0035, align cryomodule. Attach alignment numbers and graph. | [[AlignCMTech]] <<SRF>>  [[AlignCMDate]] <<TIMESTAMP>>  [[AlignmentSpreadsheet]] <<FILEUPLOAD>>  [[AlignCMComment]] <<COMMENT>> |
| 50 | After the 45 liter pump has been aligned, the entire assembly must be leak tested. | [[LeakTestCMTech]] <<SRF>>  [[LeakTestCMDate]] <<TIMESTAMP>>  [[CMLeakCheck]] <<FILEUPLOAD>>  [[CMLeakCheckComment]] <<COMMENT>> |
| 51 | After the leak test of the 45 liter pump drop, ensure the pressure is  reestablished and open the gate valve at position No. 2. | [[OpenGV2Tech]] <<SRF>>  [[OpenGV2Date]] <<TIMESTAMP>>  [[OpenGV2Comment]] <<COMMENT>> |
| 52 | Ensure that all beam tube gate valves are open and insulated. | [[GVsOpenTech]] <<SRF>>  [[GVsOpenDate]] <<TIMESTAMP>>  [[GVsOpenComment]] <<COMMENT>> |
| 53 | Log dimensions of cryomodule after welding.   |  |  | | --- | --- | | 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>> |

|  |  |  |
| --- | --- | --- |
| Step No. | Instructions | Data Input |
| 54 | Cover alignment access 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>> |
| 55 | Remove the 11 liter ion pump on the return end of the beam pipe. | [[RmvIonPumpTech]] <<SRF>>  [[RmvIonPumpDate]] <<TIMESTAMP>>  [[RmvIonPumpComment]] <<COMMENT>> |
| 56 | Allow tunnel alignment people to get their beam pipe reference numbers. | [[TunnelAlignTech]] <<SRF>>  [[TunnelAlignDate]] <<TIMESTAMP>>  [[TunnelAlignComment]] <<COMMENT>> |
| 57 | Move cryomodule to staging area.  Close manual gate valve and disconnect 500 l turbo.  Attach cryomodule transfer cart to end of cryomodule assembly bench and latch in place.  Before moving cryomodule record vacuums. | [[StageCMTech]] <<SRF>>  [[StageCMDate]] <<TIMESTAMP>>  [[BeamlineVacuum]] <<SCINOT>>  [[Waveguide20Vac1]] <<SCINOT>>  [[Waveguide30Vac1]] <<SCINOT>>  [[Waveguide40Vac1]] <<SCINOT>>  [[Waveguide50Vac1]] <<SCINOT>> |
| 58 | Attach clamping locks to transfer cart rails and slide cryomodule onto transfer  cart.  Roll transfer cart to staging area position.  After moving cryomodule record vacuums. | [[TransferCMTech]] <<SRF>>  [[TransferCMDate]] <<TIMESTAMP>>  [[Waveguide20Vac2]] <<SCINOT>>  [[Waveguide30Vac2]] <<SCINOT>>  [[Waveguide40Vac2]] <<SCINOT>>  [[Waveguide50Vac2]] <<SCINOT>>  [[TransferCMComment]] <<COMMENT>> |

|  |  |  |
| --- | --- | --- |
| Step No. | Instructions | Data Input |
| 59 | Install the 500 l turbo pump on the vacuum shell. Cover all KF 40 ports.  Install the cold cathodes. Make sure all the ports are covered and flanges are  tight. | [[InstTurboPumpTech]] <<SRF>>  [[InstTurboPumpDate]] <<TIMESTAMP>>  [[InstTurboPumpComm]] <<COMMENT>> |
| 60 | 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>> |
| 61 | Leak test the cryomodule shell and internal piping, See Document #3.7.3.  Leak test in accordance with specification 11141S033.  Pumpdown 50 K shield circuit, backfill and pressurize to 180 psig with helium. Hold for 5 min.  Pumpdown and backfill 2 K circuit and pressurize with helium to 15 psig. Hold for 10 minutes. | [[LeakTestCMShellTech]] <<SRF>>  [[LeakTestCMShellDate]] <<TIMESTAMP>>  [[UploadLeakCheck11]] <<FILEUPLOAD>>  [[UploadLeakCheck21]] <<FILEUPLOAD>>  [[LeakTestCMShellComm]] <<COMMENT>> |
| 62 | Primary and secondary clean up. See Document # 3.7.3 for procedure.  Document hydrometer reading  Ensure blank off caps on the 3 bayonets are installed. Record the pressure in the helium circuits. | [[CleanupTech]] <<SRF>>  [[CleanupDate]] <<TIMESTAMP>>  [[Hydrometer]] <<FLOAT>>  [[CleanupComment]] <<COMMENT>> |
| 63 | Prepare cryomodule for transport.  Clean the outside of the cryomodule and put plastic covers over all feedthroughs and waveguides.  Make sure that vent bayonet O-rings are in place.  Set LVDT Zero (0), and log digital percentage readings.  Close the gate valve on the shell vacuum and remove the pump (install aluminum cover) document shell vacuum pressure.  Record shell pressure at the Turbo Pump | [[PrepCMTransportTech]] <<SRF>>  [[PrepCMTransportDate]] <<TIMESTAMP>>  [[FullOpen]] <<FLOAT>>  [[FullClosed]] <<FLOAT>>  [[ShellVacuum]] <<SCINOT>>  [[PrepCMTransportComm]] <<COMMENT>> |
| 64 | Review this document to be sure all required assembly steps and file uploads  have been completed. | [[FinalReviewTech]] <<SRF>>  [[FinalReviewDate]] <<TIMESTAMP>>  [[SupervisorSignOff]] <<SRF>>  [[FinalReviewComment]] <<COMMENT>> |