|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Traveler Title | LCLS HE Production Cryomodule Vacuum Vessel Assembly Traveler | | | |
| Traveler Abstract | This traveler details the assembly and in-process quality control inspections of the LCLS HE Vacuum Vessel Assembly. All work will be completed in the Cryomodule Assembly areas. The scope of work begins with a completed Cold Mass Phase 2 under the 4 poster and ends with an assembly ready to move onto the Test Lab High Bay floor WS5. | | | |
| Traveler ID | L2HE-CMA-CM-VV | | | |
| Traveler Revision | R1 | | | |
| Traveler Author | John Fischer | | | |
| Traveler Date | 10-Oct-22 | | | |
| NCR Informative Emails | hannesv | | | |
| NCR Dispositioners | fischer,jjcamp,jared,cheng | | | |
| D3 Emails | adamg,cheng,hannesv | | | |
| Approval Names | John Fischer | Gary Cheng | Tony Reilly | Mike Bevins |
| Approval Signatures |  |  |  |  |
| Approval Dates |  |  |  |  |
| Approval Title | Author/Group Lead | Project Engineer | SRF Dept Head | 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. | | | |
| [F10009945 LCLSII PCM CM Assy dwg](https://jlabdoc.jlab.org/docushare/dsweb/View/Collection-54886/Document-261917) | [F10009950\_LCLSII PCM Cold Mass dwg](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-261909/F10009950_C_DWG1.pdf) | [F10010030\_E\_Fixed Support Post dwg](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-261910/F10010030_E_PDF_1.pdf) | [F10010308\_C Sliding Support Post dwg](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-261911/F10010308_C_DWG1.pdf) | [F10017613\_E Lower 50K Shield dwg](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-261912/F10017613_E_DWG1.pdf) |
| [F10020678 Cavity Rotation Stop Plate dwg](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-261913/F10020678___DWG1.pdf) | [F10026609\_K LCLSII Vacuum Vessel dwg](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-261914/F10026609_K_DWG1.pdf) | [F10026610\_K LCLSII Vacuume Vessel Detail dwg](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-261915/F10026610_K_DWG1.pdf) | [F10127855\_A- LCLS HE Cryomodule Assy dwg](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-261916/F10127855_A_DWG1.pdf) | [F10127864-A-LCLS HE Cold Mass dwg](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-261917/F10127864-A-DWG1.pdf) |
| [WS4 Fastener Checklist](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-155027/station%204%20signoff.docx) |  |  |  |  |

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

|  |  |  |
| --- | --- | --- |
| Step No. | Instructions | Data Input |
| 1 | Record the Vacuum Vessel, UCM, and Cold Mass serial numbers | [[RecordSerial\_SRF]] <<SRF>>  [[RecordSerialDate]] <<TIMESTAMP>>  [[RecordSerialComment]] <<COMMENT>>  [[VVSN]] <<VVSN>>  [[UCMSN]] <<UCMSN>>  [[CMSN]] <<CMSN>> |
| 2 | Verify the Cold Mass Phase 2 Traveler is complete | [[CMPhase2\_SRF]] <<SRF>>  [[CMPhase2Date]] <<TIMESTAMP>>  [[CMPhase2Comment]] <<COMMENT>> |
| 3 | Verify the VV Inspection and CWI I nspection Travelers are complete.  [L2HE-CMA-VV-INSP-R1](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-261921/L2HE-CMA-VV-INSP-R1.docx), [L2HE-CWI-VV-R1](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-261922/L2HE-CWI-VV-R1.docx) | [[VVVerify\_SRF]] <<SRF>>  [[VVDate]] <<TIMESTAMP>>  [[VVComment]] <<COMMENT>>  [[VVCompleted]] <<YESNO>> |
| 4 | Use the WS4 Fastener Spreadsheet and sign off to complete the steps in the traveler.  [WS4 Fastener Checklist](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-155027/station%204%20signoff.docx), [WS4 Fastener Torque Spreadsheet](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-155028/Torque%20spreadsheet%204.xlsx) | [[SRF5]] <<SRFCMP>>  [[Date5]] <<TIMESTAMP>>  [[Comment5]] <<COMMENT>> |
| 5 | Place the Vacuum Vessel onto the blue transfer carts on the cantilevered tooling. Center weldments on carts, align, and lock in place. Use [16000lb Spreader Bar Lift Plan](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-136442/16000lb%20spreader%20bar%20lift%20plan.pdf) | [[PlaceTooling\_SRF]] <<SRF>>  [[PlaceToolingDate]] <<TIMESTAMP>>  [[PlaceToolingComment]] <<COMMENT>> |
| 6 | Roll the assembly towards the fixed end of the catilevered tooling, adjust as required to slide the Vacuum Vessel entirely over the spit. | [[RollTooling\_SRF]] <<SRF>>  [[RollToolingDate]] <<TIMESTAMP>>  [[RollToolingComment]] <<COMMENT>> |
| 7 | Install the completed Cold Mass onto the cantilevered tooling;  Carefully lift the 4 poster spreader bar and cold mass using [8000lb Spreader Bar Lift Plan](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-136441/8%2c000lb%20spreader%20bar%20lift%20plan.pdf)  Position level and centered over the cantilevered tooling rails  Using the OHC, engage the fixed end spit into the end of the GHRP to mark.  **\*\*PROTECT THE GHRP BELLOWS DURING INSERTION, INSTALL BELLOWS PROTECTOR\*\***  Once in position, engage the moveable cantilevered support into the opposite end of the GHRP to mark.  Lower the spreader bar fixture until the GHRP is in contact with the seating pads.  M:\asd\asddata\CryomoduleAssembly\pictures\LCLS\General Assembly\DSC_0780.JPG | [[InstallTooling\_SRF]] <<SRF>>  [[InstallToolingDate]] <<TIMESTAMP>>  [[InstallToolingComment]] <<COMMENT>> |
| 8 | Install the anti-roll bracket to the upstream end moveable cantilevered support to GHRP. This will hold the rotation of the Cold Mass. | [[AntiRoll\_SRF]] <<SRF>>  [[AntiRollDate]] <<TIMESTAMP>>  [[AntiRollComment]] <<COMMENT>> |
| 9 | Remove the 4 poster spreader bar;  Loosen the tophat vertical and horizontal hardware  Remove the spreader bar split ring section  Lower the spreader bar until the tooling disengages  Slowly maneuver the spreader bar away fron the Cold Mass top hats  Place the spreader bar back on the WS3 4 poster supports. | [[SpreaderBar\_SRF]] <<SRF>>  [[SpreaderBarDate]] <<TIMESTAMP>>  [[SpreaderBarComment]] <<COMMENT>> |
| 10 | If the 50k lower shields have not been added at WS3, proceed with a final review of mechanical, instrumentation, and HOM measurements (Retune if required). Upload findings  M:\asd\asddata\CryomoduleAssembly\LCLS\HE\Travelers\VV WS4\CM WO 50K S POSTS.png | [[Final\_SRF]] <<SRF>>  [[FinalDate]] <<TIMESTAMP>>  [[FinalComment]] <<COMMENT>>  [[FinalUpload]] <<FILEUPLOAD>> |
| 11 | Install then weld the 50k lower shields as per [F10017613\_E Lower 50K Shield dwg](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-261912/F10017613_E_DWG1.pdf)  M:\asd\asddata\CryomoduleAssembly\LCLS\HE\Travelers\VV WS4\CM W 50K S.png | [[Shield\_SRF]] <<SRF>>  [[ShieldDate]] <<TIMESTAMP>>  [[ShieldComment]] <<COMMENT>> |
| 12 | Remove the sliding and fixed cold mass supports;  Match mark the supports prior to moving  Remove the hardware and tapered pins  Remove them using the crane  [F10010030\_E\_Fixed Support Post dwg](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-261910/F10010030_E_PDF_1.pdf), [F10010308\_C Sliding Support Post dwg](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-261911/F10010308_C_DWG1.pdf)  M:\asd\asddata\CryomoduleAssembly\LCLS\HE\Travelers\VV WS4\CENTER POST.png  M:\asd\asddata\CryomoduleAssembly\LCLS\HE\Travelers\VV WS4\SLIDING POST.png | [[RmvSupports\_SRF]] <<SRF>>  [[RmvSupportsDate]] <<TIMESTAMP>>  [[RmvSupportsComment]] <<COMMENT>> |
| 13 | Install 30 layers of MLI over the 50K shield assembly;  Radial clearance between Cold Mass and Vaccum vessel is limited, install 5 layer blankets and cinch with Nomex cord as required.  MLI placement; First 10 layers are to be cut even with the shield ends, second 10 layers staggered inward -4”, last 10 layers in -8” from shield edge. Cut/verify all port penetrations as the MLI is being applied. | [[InstallMLI\_SRF]] <<SRF>>  [[InstallMLIDate]] <<TIMESTAMP>>  [[InstallMLIComment]] <<COMMENT>> |
| 14 | Prepare the Vacuum Vessel and Cold Mass for engagement.  Verify the elevation of the Vacuum Vessel so it will roll smoothly over the Cold Mass. Adjust as required.  Ensure all instrumentation and peripherals are within the 50K shield nothing should be outside shield diameter. | [[PrepVV\_SRF]] <<SRF>>  [[PrepVVSRF]] <<TIMESTAMP>>  [[PrepVVComment]] <<COMMENT>> |
| 15 | Slide the Vacuum Vessel over the Cold Mass. Procede slowly, do not tear MLI. Center the Vacuuum Vessel over the Cold Mass. Adjust the position of the VV weldment as required.    M:\asd\asddata\CryomoduleAssembly\LCLS\HE\Travelers\VV WS4\CM IN VV WO POSTS CP SIDE.png | [[SlideVV\_SRF]] <<SRF>>  [[SlideVVDate]] <<TIMESTAMP>>  [[SlideVVComment]] <<COMMENT>> |
| 16 | Install the roller bearings for the sliding support post assemblies  [F10010308\_C Sliding Support Post dwg](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-261911/F10010308_C_DWG1.pdf)  M:\asd\asddata\CryomoduleAssembly\LCLS\HE\Travelers\VV WS4\SLIDING POST.png | [[InstallRollerBear\_SRF]] <<SRF>>  [[InstallRollerBearDate]] <<TIMESTAMP>>  [[InstasllRollerBearComment]] <<COMMENT>> |
| 17 | Install the previously removed sliding and fixed support post assemblies back onto the Cold Mass. Verify all match marking are consistant, tapered pins, MLI, and roller bearings are installed. Locktight and torque all hardware.  **It will be necessary to backoff the support post hardware to install them, return them to their original position post installation, lifting the Cold Mass.**  [F10010030\_E\_Fixed Support Post dwg](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-261910/F10010030_E_PDF_1.pdf), [F10010308\_C Sliding Support Post dwg](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-261911/F10010308_C_DWG1.pdf)  **M:\asd\asddata\CryomoduleAssembly\LCLS\HE\Travelers\VV WS4\CM IN VV W POSTS CP SIDE.png**  **M:\asd\asddata\CryomoduleAssembly\LCLS\HE\Travelers\VV WS4\CM IN VV W POSTS.png** | [[InstallSupport\_SRF]] <<SRF>>  [[InstallSupportDate]] <<TIMESTAMP>>  [[InstallSupportComment]] <<COMMENT>> |
| 18 | Verify the Cold Mass assembly is lifted off of the cantilevered tooling seats. If adjustment is necessary use the hardware on the Support Posts and systematically raise the Cold Mass. | [[VerifyCM\_SRF]] <<SRF>>  [[VerifyCMDate]] <<TIMESTAMP>>  [[VerifyCMComment]] <<COMMENT>> |
| 19 | Disengage the cantilevered tooling from the GRHP ends.  **Monitor the GHRP bellows during spit removal, do not damage.** | [[GHRPTooling\_SRF]] <<SRF>>  [[GHRPToolingDate]] <<TIMESTAMP>>  [[GHRPToolingComment]] <<COMMENT>> |
| 20 | JLAB Alignment group will align the Cold Mass inside the Vacuum Vessel and fiducialize. Record findings.  [VV\_UCM Alignment Procedure](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-261947/VV_UCM%20alignment_Procedure.docx) | [[Align\_SRF]] <<SRF>>  [[AlignDate]] <<TIMESTAMP>>  [[AlignComment]] <<COMMENT>>  [[AlignmentData]] <<FILEUPLOAD>>  [[PipeLocations]] <<FILEUPLOAD>> |
| 21 | Install the G-10 threaded shield support hardware and lockdown.  **Do not install until the Alignment of the cold mass inside the VV has been completed** | [[G10Shield\_SRF]] <<SRF>>  [[G10ShieldDate]] <<TIMESTAMP>>  [[G10ShieldComment]] <<COMMENT>> |
| 22 | Upload the completed [WS4 fastener checklist](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-155027/station%204%20signoff.docx). Note any deviations. | [[SRF28]] <<SRFCMP>>  [[Date28]] <<TIMESTAMP>>  [[Comment28]] <<COMMENT>>  [[FastenerSheet4]] <<FILEUPLOAD>> |
| 23 | Verify all the steps in this traveler have been completed. | [[ResponsibleAuthority]] <<SRF>>  [[ResponsibleAuthoDate]] <<TIMESTAMP>>  [[ResponsibleAuthComment]] <<COMMENT>>  [[COMPLETIONCHECKLIST]] <<FILEUPLOAD>>  [[ResponsibleAuthorityHold]] {{fischer,jjcamp,jared}} <<HOLDPOINT>> |