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| Traveler Title | LCLS2 Production Cryomodule Final Assembly Traveler | | | |
| Traveler Abstract | This traveler details the assembly and in-process quality control inspections of the LCLS2 Final Assembly. All work will be completed in the Cryomodule Assembly areas. The scope of work begins with a completed Vacuum Vessel Assembly on the cantilevered tooling and ending with a Cryomodule ready to enter the CMTF. | | | |
| Traveler ID | L2HE-CMA-CM-ASSYF | | | |
| Traveler Revision | R1 | | | |
| Traveler Author | John Fischer | | | |
| Traveler Date | 28-Sep-21 | | | |
| NCR Informative Emails | areilly,edaly,fischer,rlegg,kwilson | | | |
| NCR Dispositioners |  | | | |
| D3 Emails |  | | | |
| Approval Names | John Fischer | Ed Daly | Katherine Wilson | Bob Legg |
| Approval Signatures |  |  |  |  |
| Approval Dates |  |  |  |  |
| Approval Title | Author | Project Manager | Project Engineer | CM Group Lead |

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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. | | | |
| [F10026610-Rev B- Vacuum Vessel](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-126308/F10026610_B_DWG1.pdf) | [F10009950-Cold Mass Assy](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-125861/F10009950_-_PDF_1-Cold%20Mass%20Assy%20Dwg.pdf) | [F10009954 Rev L- Cold Mass Upper](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-134881/F10009954_L_DWG1-Cold%20Mass%20Upper.pdf) | [F10009945-Cryomodule Top Assy](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-125863/F10009945_-_PDF_1-Cryomodule%20Top%20Assy.pdf) | [F10041120 Rev-C - Production Cold Mass](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-134880/F10041120_C_PDF_1-Production%20Cold%20Mass.pdf) |
| [F10026609-Rev B- Vacuum Vessel](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-126307/F10026609_B_DWG1.pdf) | [Master Fastener Installation and Torque Chart](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-154981/Cryomodule_Threaded_Fasteners_20180406.xlsx) | [MLI Installation Procedure](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-115267/MLI%20Installation-CP-C100-CM-INST-MLI.docx) | [11141S0033-Rev A- Large Leak Check Procedure](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-115262/11141S0033%20REV%20A%20(%20LARGE%20LEAK%20CHECK).docx) | [CP-L2PRO-FPCW-AC, Warm Coupler Installation Procedure](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-132229/CP-L2PRO-FPCW-AC%20-Warm%20Coupler%20Installation%20Procedure.pdf) |
| [F10010308- Rev C-Sliding Support Post](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-126306/F10010308_C_DWG1%20SLIDING%20COLD%20MASS%20ASSY.pdf) | [F10010030- Rev D- Fixed Support Post](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-126305/F10010030_D_DWG1-fixed%20cold%20mass%20support.pdf) | [Final Work Station Draft-JF](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-132301/LCLS%20Final%20Work%20Station.docx) | [High Pressure Test PS-7](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-132234/Pressure%20Test%20Doc.pdf) | [Low Pressure Test PS-7](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-132233/Pressure%20Test%20Doc-%20GHRP.pdf) |
| [Demag LCLSII VV OSP](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-132241/operational_safety_procedure_form_60897-%20Demag%20LCLSII%20VV.pdf) | [LCLSII Pressure Testing OSP](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-132242/operational_safety_procedure_form_63238-LCLSII%20Pressure%20Testing.pdf) | [F10041183 Rev B- Cyomodule Top Assy](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-134882/F10041183_B_PDF_1-%20Production%20CM%20Top%20Assy.pdf) | [16000lb Spreader Bar Lift Plan](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-136442/16000lb%20spreader%20bar%20lift%20plan.pdf) | [Gasguard installation procedure](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-150903/Welding%20Gas%20Guard%20CD%20and%20JT%20Valves-1.pdf) |
| [WS5 Fastener Checklist](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-155038/station%205%20signoff.docx) | [WS5 Fastener Torque spreadsheet](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-155039/Torque%20spreadsheet%205.xlsx) |  |  |  |

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

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| Step No. | Instructions | Data Input |
| 1 | Record the Cryomodule and Vacuum Vessel serial number, L2HE-CMA-CM-ASSY-VV | [[CryoVacTech]] <<SRF>>  [[CryoVacDate]] <<TIMESTAMP>>  [[CryoVacComment]] <<COMMENT>>  [[CMSN]] <<CMSN>>  [[VVSN]] <<VVSN>> |
| 2 | Verify the Vacuum Vessel Traveler is complete | [[VacCompTech]] <<SRF>>  [[VacCompDate]] <<TIMESTAMP>>  [[VacCompComment]] <<COMMENT>> |
| 3 | Record version of F10041183 drawing is used | [[DwgTech]] <<SRF>>  [[DwgDate]] <<TIMESTAMP>>  [[DwgRev]] <<COMMENT>> |
| 4 | Use the WS5 Fastener Spreadsheet and sign off to complete the steps in the traveler.  [WS5 Fastener Checklist](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-155038/station%205%20signoff.docx), [WS5 Fastener Torque spreadsheet](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-155039/Torque%20spreadsheet%205.xlsx) | [[SpreadsheetSignTech]] <<SRFCMP>>  [[SpreadsheetSignDate]] <<TIMESTAMP>>  [[SpreadsheetSignComment]] <<COMMENT>> |
| 5 | Move the Cryomodule to the final work station near the CMTF. Position on the concrete blocks. Level and set roll using center fixed support post flange. | [[WS5MoveTech]] <<SRF>>  [[WS5MoveDate]] <<TIMESTAMP>>  [[WS5Comment]] <<COMMENT>> |

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| Step No. | Instructions | Data Input |
| 6 | Record serial numbers of Gas Guard valves | [[ValveNum\_SRF]]<<SRF>>  [[ValveNumDate]]<<TIMESTAMP>>  [[JTVSN]]<<JTVSN>>  [[CDVSN]]<<CDVSN>> |
| 7 | Weld the gas guard valves into position according to [Gasguard installation procedure](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-150903/Welding%20Gas%20Guard%20CD%20and%20JT%20Valves-1.pdf)  **\*\*Welding ground to be as close as reasonably possible during welding activities\*\*\***  Use LCLS-II pCM Welding JT Piping, Ground Strap Locations | [[WeldJTTech]] <<SRF>>  [[WeldJTDate]] <<TIMESTAMP>>  [[WeldJTComment]] <<COMMENT>> |
| 8 | Complete all but final closure weld for the JT pipe welding according to attached documentation, page 9 of [Gasguard installation procedure](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-150903/Welding%20Gas%20Guard%20CD%20and%20JT%20Valves-1.pdf). | [[JTWelder]] <<SRF>>  [[JTWeldDate]] <<TIMESTAMP>>  [[JTWeldComment]] <<COMMENT>> |
| 9 | Remove stems and use rubber plugs to seal lines. Leak check the line A welds. See page 12 of [Gasguard installation procedure](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-150903/Welding%20Gas%20Guard%20CD%20and%20JT%20Valves-1.pdf) for details. | [[LkChckTech]] <<SRF>>  [[LkChckDate]] <<TIMESTAMP>>  [[LkChckComment]] <<COMMENT>>  [[LkChckResults]] <<FILEUPLOAD>> |
| 10 | Replace the stems and pipe caps on cool down line. Weld a plug on the pipe at the position of weld 5 for the high pressure test of line A. | [[StemWelder]] <<SRF>>  [[StemWeldDate]] <<TIMESTAMP>>  [[StemWeldComment]] <<COMMENT>> |
| 11 | Using the PS7 form, pressure test the "A" line to high pressure as shown on page 10 of the [Gasguard installation procedure](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-150903/Welding%20Gas%20Guard%20CD%20and%20JT%20Valves-1.pdf). Do not plug the GHRP to ensure high pressure is not applied to cavities.  Upload the worksheets. Details can be found in the attached documentation. [High Pressure Worksheet](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-132234/Pressure%20Test%20Doc.pdf), [LCLSII P&ID](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-132232/P&ID%20LCLSII.pdf), | [[PressTestTech]] <<SRF>>  [[PressTestDate]] <<TIMESTAMP>>  [[PressTestComment]] <<COMMENT>>  [[HighPressTestResult]] <<FILEUPLOAD>> |
| 12 | Complete final closure weld on CD valves and upload the Weld Map. [JT Weld Map](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-132246/JT%20Weld%20Map.jpg) | [[CDValveWelder]] <<SRF>>  [[CDValveDate]] <<TIMESTAMP>>  [[CDValveComment]] <<COMMENT>>  [[CDValveWeldMap]] <<FILEUPLOAD>> |
| 13 | RT welds on the low pressure piping, record findings. Generate the TATL, see ex. [RT TATL](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-132235/TATL%20for%20RT.docx) Upload the final RT results.  Reference Documentation- [RT THA](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-132236/RT%20THA.docx), [RADCON Work Permit](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-132237/Radiological-%20WORK%20PERMIT.pdf), [RT Procedure](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-132238/Document-122639-%20RT.pdf) | [[RTTech]] <<SRF>>  [[RTDate]] <<TIMESTAMP>>  [[RTComment]] <<COMMENT>>  [[RTResults]] <<FILEUPLOAD>> |
| 14 | Pressure test the CM piping circuits. Upload the worksheets. Details can be found in the attached documentation. Generate the TATL, Use [PT THA](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-132231/CM%20Pressure%20Test%20THA.pdf), [LCLSII P&ID](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-132232/P&ID%20LCLSII.pdf), [Low Pressure Worksheet](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-132233/Pressure%20Test%20Doc-%20GHRP.pdf), [High Pressure Worksheet](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-132234/Pressure%20Test%20Doc.pdf), [Pressure Testing OSP](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-132242/operational_safety_procedure_form_63238-LCLSII%20Pressure%20Testing.pdf), [Bayonet Box Dwg](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-132239/Bayonet%20Box%20Piping%20Pneumatic%20Test%20Pressures_Jan%2020%202016-1.pdf) | [[CMPipePressTestTech]] <<SRF>>  [[CMPipePressTestDate]] <<TIMESTAMP>>  [[CMPipePressTestComment]] <<COMMENT>>  [[LowPTResults]] <<FILEUPLOAD>>  [[HighPTResults]] <<FILEUPLOAD>> |

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| Step No. | Instructions | | Data Input |
| 15 | Install the Warm Couplers and MC pumping line, using the attached procedure. Record vendor and S/N's. Use [CP-L2PRO-FPCW-AC, Warm Coupler Installation Procedure](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-132229/CP-L2PRO-FPCW-AC%20-Warm%20Coupler%20Installation%20Procedure.pdf)  [CP-L2PRD-FPCW-AC](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-137024/CP-L2PRD-repair%20FPCW-AC%207%20Feb%202017.docx)    \*\*Verify the Ion Pump support bracket is in place prior to MC line installation.\*\* | | [[FPCWTech]] <<SRF>>  [[FPCWDate]] <<TIMESTAMP>>  [[FPCWComment]] <<COMMENT>>  [[CouplerMap]] <<FILEUPLOAD>>  [[MCLineLC]] <<FILEUPLOAD>>  [[IP75SDSN]] <<IP75SDSN>> |
|  | [[FPCWSN1]] <<FPCWSN>> | [[Coupler1LC]] <<FILEUPLOAD>> | [[Coupler1QC]] <<FILEUPLOAD>> |
|  | [[FPCWSN2]] <<FPCWSN>> | [[Coupler2LC]] <<FILEUPLOAD>> | [[Coupler2QC]] <<FILEUPLOAD>> |
|  | [[FPCWSN3]] <<FPCWSN>> | [[Coupler3LC]] <<FILEUPLOAD>> | [[Coupler3QC]] <<FILEUPLOAD>> |
|  | [[FPCWSN4]] <<FPCWSN>> | [[Coupler4LC]] <<FILEUPLOAD>> | [[Coupler4QC]] <<FILEUPLOAD>> |
|  | [[FPCWSN5]] <<FPCWSN>> | [[Coupler5LC]] <<FILEUPLOAD>> | [[Coupler5QC]] <<FILEUPLOAD>> |
|  | [[FPCWSN6]] <<FPCWSN>> | [[Coupler6LC]] <<FILEUPLOAD>> | [[Coupler6QC]] <<FILEUPLOAD>> |
|  | [[FPCWSN7]] <<FPCWSN>> | [[Coupler7LC]] <<FILEUPLOAD>> | [[Coupler7QC]] <<FILEUPLOAD>> |
|  | [[FPCWSN8]] <<FPCWSN>> | [[Coupler8LC]] <<FILEUPLOAD>> | [[Coupler8QC]] <<FILEUPLOAD>> |
| 16 | Install the vacuum vessel instrumentation flanges including the Magnet lead flange.  The double flange stack will require an intermediate leak check performed later in this traveler prior to installing the top half.  Install the siphon tube G-10 support brackets  Record instrumentation test results. | | [[VVINSTRTech]] <<SRF>>  [[ElectricalTech]] <<SRF>>  [[VVINSTRDate]] <<TIMESTAMP>>  [[VVINSTRComment]] <<COMMENT>>  [[VVINSTRTestResults]] <<FILEUPLOAD>> |
| 17 | Install the End Cap beampipe and 50K clamp.  \*\* **Continually monitor the beam line vacuum during bleed up.\*\***  Leak check after the installation is completed. Record findings.  **\*\*Protect the beampipe with a metal shroud after good leak check.\*\***  [**DS Beampipe Installation Procedure**](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-132300/DS%20beampipe%20draft-1.docx)  **During beam line work employ CLEAN practices, slow bleed up and pump down manifolds to be used.** | | [[BPLkChckTech]] <<SRF>>  [[BPLkChck Date]] <<TIMESTAMP>>  [[BPLkChck Comment]] <<COMMENT>>  [[BPLkChck]] <<FILEUPLOAD>>  [[ParticulateData]] <<FILEUPLOAD>> |
| 18 | Install the GHRP testing cap with 3.5mm indium gasket. Torque the hardware to 150 in/lbs. | | [[CapInstTech]] <<SRF>>  [[CapInstDate]] <<TIMESTAMP>>  [[CapInstComment]] <<COMMENT>> |
| 19 | Install the jumper flex lines on the ends of all pipes  Leak check all the jumper connections and the GHRP cap, record the findings. | | [[FlexLineInstTech]] <<SRF>>  [[FlexLineLkChckDate]] <<TIMESTAMP>>  [[FlexLineLkChckComment]] <<COMMENT>>  [[LkChck]] <<FILEUPLOAD>> |
| 20 | Add the instrumentation, gate valve guide, pipe thermal strapping, and MLI to the End Cap area. | | [[EndCapAddTech]] <<SRF>>  [[ElectricalTechnician]] <<SRF>>  [[EndCapAddDate]] <<TIMESTAMP>>  [[EndCapAddComment]] <<COMMENT>> |

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| Step No. | Instructions | Data Input |
| 21 | Install the top half of the 50K shield, complete the thermal stapping connections, then add the lower section of the shield and the beam pipe G-10 support strap.  Install 30 layers of MLI to the Shield cap. | [[Top50kTech]] <<SRF>>  [[Top50kDate]] <<TIMESTAMP>>  [[Top50kComment]] <<COMMENT>> |
| 22 | Install the End Cap, secure with clamps. Install the hardware to support the beampipe flange. Remove the G-10 supporting strap hardware | [[EndCap]] <<SRF>>  [[EndCapDate]] <<TIMESTAMP>>  [[EndCapComment]] <<COMMENT>> |
| 23 | Install the "T" and Ion pump assembly to the previously install beam pipe. Leak check the connections, record findings. Start I.P.  [DS Ion Pump Installation Procedure](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-132299/DS%20IP%20Tee%20Installation%20Procedure.docx)  **During beam line work employ CLEAN practices, slow bleed up and pump down manifolds to be used.** | [[PumpInstTech]] <<SRF>>  [[PumpInstDate]] <<TIMESTAMP>>  [[PumpInstComment]] <<COMMENT>>  [[LeakCheckResults]] <<FILEUPLOAD>>  [[ParticulateData]] <<FILEUPLOAD>> |