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| Traveler Title | CRYOMODULE TUNNEL INSTALLATION |
| Traveler Abstract | This traveler details the cryomodule tunnel installation process, starting from the Test Lab and ending with the cryomodule installed in the designated North or South linac zone. This traveler covers C50, C75 and C100 style cryomodules. |
| Traveler ID | C100R-INSTA-CM |
| Traveler Revision  | R1 |
| Traveler Author | F. Humphry |
| Traveler Date | 1-Apr-22 |
| NCR Informative Emails | areilly,fischer,edaly |
| NCR Dispositioners | drury,fhumphry,fischer |
| D3 Emails | areilly,fischer,edaly,drury,fhumphry |
| Approval Names | F. Humphry | J. Fischer | M. Drury | A Reilly |
| Approval Signatures |  |  |  |  |
| Approval Dates |  |  |  |  |
| Approval Title | Author | Reviewer | SME/WCLead | Project Manager |

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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. |
|  | [Cryomodule Installation OSP](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-254532/Cryomodule%20Installation%20OSP.pdf) | [Cryomodule Lift Plan](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-254533/cryomodule%20lift%20plan%202020.pdf) |  |  |
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| Revision Note |  |
| R1 | Initial release of this Traveler. |

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| Step No. | Instructions | Data Input |
| **Day before transporting cryomodule to accelerator** |
| 1 | **Coordinate with Radiation Control Group**. All refurbished cryomodule are typically radioactive/activated.Identify the Ram Tag Number and associated dose rates.Identify all rope boundaries prior to the move including the North & South accesses building off-loading area. | [[RadConControlTech]] <<USERNAME>>[[RadConControlDate]] <<TIMESTAMP>>[[RAMTagNumber]] <<TEXT>>[[DoseRates]] <<FLOAT>>[[RadConComments]] <<COMMENT>> |
| 2 | Cryomodule Serial Number and Location of Cryomodule Install | [[CMSN]] <<CMSN>>[[LinacZone]] <<TEXT>> |

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| **Step No** | **Instructions** | **Data Inputs** |
| **Loading Cryomodule onto flatbed transport trailer** |
| 3 | Enter the Date of the Move and user name of the Cryomodule Move Coordinator | [[CMMoveCoordinator]] <<USERNAME>>[[CMMoveStartTime]] <<TIMESTAMP>> |
| 4 | Back the flatbed transport trailer into the test lab North rollup door access area. Be sure the flatbed trailer is far enough into the loading zone to allow for overhead crane access. | [[FlatbedBackupTech]] <<USERNAME>>[[FlatbedBackupTimeComplete]] <<TIMESTAMP>> |
| 5 | Retrieve the cryomodule spreader bar located above the CMTF entrance. Lower and align the beam over the cryomodule being transported to the linac. | [[SpreaderTech]] <<SRF>>[[SpreaderTimeComplete]] <<TIMESTAMP>> |
| 6 | Rig the load using shackles & lifting slings **specified in the Cryomodule Lift Plan. See References for link to Lift Plan.** Use the *RED C100* or *YELLOW C50* spreader bar lifting eye location appropriately. Record which lifting eye locations were chosen. | [[LiftTech]] <<SRF>>[[SpreaderLiftEyeOption]] {{Red C100,Yellow C50 }} <<RADIO>> |
| 7 | **Note**: The return end can side of the cryomodule is heavier than the supply end. Position the slings accordingly taking into account for the additional return end can weight. | [[SlingTech]] <<SRF>>[[SlingPositionComments]] <<COMMENT>> |
| 8 | Use crane to hoist up and put tension on the slings. Walk around the module checking for sling interferences / twisted slings. Upload photos to document sling positioning. | [[WalkaroundTech]] <<SRF>>[[InterferencesChecked]] <<CHECKBOX>>[[SlingTensioningChecked]] <<CHECKBOX>>[[TensionedSlingComments]] <<COMMENT>>[[TensionedSlingPositionPhotos]] <<FILEUPLOAD>> |
| 9 | Use Crane to hoist cryomodule up off of the floor. Reposition/shift slings appropriately achieving a level cryomodule.Upload more photos as necessary to document sling positions | [[HoistTech]] <<SRF>>[[CryomoduleLeveled]] <<CHECKBOX>>[[LeveledCMSlingPositionPhotos]] <<FILEUPLOAD>> |
| 10 | Disconnect any ion pump power supplies at this time. **Note:** log pressure before turning off. | [[DisconnectTech]] <<SRF>>[[DisconnectDate]] <<TIMESTAMP>>[[PressureReading]] <<SCINOT>>[[IonPumpComments]] <<COMMENT>> |
| 11 | Orientation of cryomodule on the trailer: Return End Can must always face towards the cab of the transport truck. The Supply End Can with the ion pump will face the back end of the trailer. | [[CMOrientationTech]] <<SRF>>[[CorrectOrientationCheck]] <<CHECKBOX>> |
| 12 | Lower the cryomodule onto the transport truck trailer. Align the cryomodule over the transport truck saddles. The crane operator should be standing on the floor front side between the two center saddles for the best vantage point during the alignment phase. The crane operator should reposition himself to the back of the trailer / beamline ion pump end when finally lowering the cryomodule into the saddles.**Note**: Pay close attention to possible ion pump interference when lowering the cryomodule into the saddles.**Note:** Return saddle outer feet may catch beam when lowering into saddles.**Note:** C100 style cryomodule. Use 4&5 waveguides as a centering reference.**Note:** C50 style cryomodule. Use bridging ring flanges as a reference.Upload photos of Cryomodule in place on trailer. | [[CraneOperator]] <<SRF>>[[CMLoadedOnTruckTime]] <<TIMESTAMP>>[[CMLoadingComments]] <<COMMENT>>[[CMLoadingPhotos]] <<FILEUPLOAD>> |

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| **Step No** | **Instructions** | **Data Inputs** |
| 13 | Unhook sling shackles and put the spreader bar on the floor or put it back over the test cave storage area. | [[SlingUnhookTech]] <<SRF>>[[UnhookComment]] <<COMMENT>> |
| 14 | Tie the cryomodule down utilizing the transport trailer tie down straps.  | [[TieDownTech]] <<SRF>>[[TiedownComments]] <<COMMENT>> |
| 15 | Cryomodule Move Coordinator inspects Cryomodule placement, orientation and tie downs prior to move | [[CMMoveCoordinatorINSP]] <<SRF>>[[InspectionTime]] <<TIMESTAMP>> |
| 16 | Transport the cryomodule to either the North or South Access Buildings to be offloaded. | [[CMTransportSupervisor]] <<SRF>>[[CMLeavesTestLabTime]] <<TIMESTAMP>>[[CMArrivesAccessBldgTime]] <<TIMESTAMP>>[[CMTransportComments]] <<COMMENT>> |

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| **Step No** | **Instructions** | **Data Inputs** |
| **Unloading Cryomodule from flatbed transport trailer** |
| 17 | Rig the cryomodule using the two dedicated lifting slings at designated lifting points as **specified in theCryomodule Lift Plan. See link in References.**Upload photos to document correct rigging | [[CMRiggingTech]] <<SRF>>[[CMRiggingTime]] <<TIMESTAMP>>[[CMRiggingPhotos]] <<FILEUPLOAD>> |
| 18 | Lift the cryomodule high enough to allow the trailer to pull out of the building. | [[TrailerAccessBldgCraneOperator]] <<SRF>>[[CMLiftTime]] <<TIMESTAMP>> |
| 19 | Lower the cryomodule down close to floor allowing for the orange transport wheel installation.Install wheels at appropriate TOW / TRAIL end of the cryomodule. **Note:** The 1 1/2" x 1 1/2" holed ears attached to the wheel assemblies always point outboard. | [[WheelAccessBldgCraneOperator]] <<SRF>>[[TransWheelTech]] <<SRF>>[[TransWheelComments]] <<COMMENT>> |

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| **Step No** | **Instructions** | **Data Inputs** |
| **Moving Cryomodule into Tunnel** |
| 20 | Lower the cryomodule into the tunnel.Turn wheels assemblies in the correct direction before final touchdown on floor. | [[TunnelAccessBldgCraneOperator]] <<SRF>>[[CMLowerCompleteTime]] <<TIMESTAMP>> |
| 21 | Unhook slings from trolley 1 and 2. | [[UnhookTech]] <<SRF>> |
| 22 | Move the cryomodule into the stub area making the transition into the linac area. | [[CMMovementSupervisor]] <<SRF>> |
| 23 | Install towing and trailing hardware.  | [[InstallTowTech]] <<SRF>> |
| 24 | Attach tow hook to electric cart. Designate trailing bar rear steering person as well as lead person up front that will be directly communicating with the driver. | [[CMTunnelMovementLead]] <<SRF>>[[TowCartDriver]] <<SRF>>[[CMSteeringTech]] <<SRF>>[[CMMovePrepComment]] <<TIMESTAMP>> |
| 25 | Pull cryomodule to designated zone. Designate spotters at each end of the cryomodule to ensure cryomodule does not make contact with wall or other equipment. | [[CMTunnelMoveStartTime]] <<TIMESTAMP>>[[CMTunnelMoveEndTime]] <<TIMESTAMP>>[[CryomoduleTunnelMoveComments]] <<COMMENT>> |

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| **Step No** | **Instructions** | **Data Inputs** |
| **Positioning Cryomodule in Zone** |
| 26 | When the cryomodule arrives at the designated location, disconnect and remove all towing and trailing hardware. | [[TowDisconnectTech]] <<SRF>> |
| 27 | Rotate the eight installation wheels 90 degrees to allow the module to move easily in the zone. | [[WheelRotateTech]] <<SRF>> |
| 28 | Rotate the upstream and downstream saddle feet upwards to prevent contact with the zone floor plates. | [[SaddleFeetTech]] <<SRF>> |
| 29 | Position the cryomodule into place over the floor plates. This typically requires 3 to 4 people at each end of the cryomodule. | [[PositioningTech]] <<SRF>>[[ZonePositionTime]] <<TIMESTAMP>> |
| 30 | **Remove the installation wheels.** Remove the downstream / Return End Can end first. The larger outer saddle feet act as outriggers for **stability** when you’re removing the upstream wheels**.** | [[WheelRemoveTech]] <<SRF>> |
| 31 | **Upstream/downstream positioning**. Center the cryomodule in the zone by using the adjacent cryomodules as a reference. Use the floor jack & portable power to adjust the upstream/downstream position. Alignment group would like to see the cryomodule position within a 1/4" of final alignment. | [[UpDownTech]] <<SRF>> |
| 32 | **Cryomodule height/plumb in zone**. Adjust saddle feet accordingly to achieve the correct height. Position the floor jack under the end can bridging ring flange. **Note!** Adjust the upstream end first. The downstream end saddle blue feet act as outriggers keeping the module stable when lifting the upstream. **The cryomodule height must be 27 1/4" BL centerline to floor.** | [[CMHeightTech]] <<SRF>> |
| 33 | CM installation is complete | [[CryomoduleMoveCoordinator]] <<SRF>>[[CMMoveCompleteTime]] <<TIMESTAMP>> |