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| Traveler Title | C100 Cryomodule Acceptance Test - Cryocycle |
| Traveler Abstract | *Acceptance Testing of the R100 Cryomodule in the Cryomodule Test Facility (CMTF). This traveler controls and documents the cool down and warm up of the cryomodule during Acceptance Testing* |
| Traveler ID | C100-CM-ACTS-CRYO |
| Traveler Revision  | R1 |
| Traveler Author | M. Drury |
| Traveler Date | 6/21/11 |
| NCR Emails | drury, hogan |
| Approval Names | M. Drury | J. Hogan | M. Wiseman | C. Reece | J. Hogan |
| Approval Signatures |  |  |  |  |  |
| Approval Dates |  |  |  |  |  |
| Approval Title | Author | Reviewer | Reviewer | Reviewer | 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. |
| [A-08-007-OSP](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-20964/A-08-007-OSP.pdf) CMTF Operational Safety Procedure | [Conduct of Operations for the CMTF](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-7460/CMTF%20COO%202008.doc) | CRM-120-7030-1000Cavity String and Instrumentation Flow Schematic | [CRM-120-8020-0040 End Can Wiring Schematic](file:///M%3A%5Casd%5Casddata%5CCMTF%5CC100%20Cryomodule%20Tests%5CCRM1208020-0040-RevA%20EndCanWiring.pdf) |  |
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| Revision Note |  |
| R1 | Initial release of this Traveler. |

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| Part Description: | C100 Cryomodule S/N: [[CMSN]] <<CMSN>> |
| **Table of Contents** |
| **Section** | **Page** |
| Pre Cooldown: Cavity ID's, Cooldown Prep  | 2-4 |
| Cooldown  | 5 |
| Insulating Vacuum Leak Test  | 6 |
| Static Heat Load - Shield Circuit  | 7 |
| Final Vacuum Readings, Cryomodule Warm up  | 8 |

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| **Step No** | **Instructions** | **Data Inputs** |
| 1 | Record the Cavity SN's for each cavity position. (Note: Cavity 1-Supply side, Cavity 8-Return side) | [[Cavity 1 ID]] <<CAVSN>>[[Cavity 2 ID]] <<CAVSN>>[[Cavity 3 ID]] <<CAVSN>>[[Cavity 4 ID]] <<CAVSN>>[[Cavity 5 ID]] <<CAVSN>>[[Cavity 6 ID]] <<CAVSN>>[[Cavity 7 ID]] <<CAVSN>>[[Cavity 8 ID]] <<CAVSN>> |
| 2 | Verify that traveler, C100-CM-ASSY R1, has been completed. | [[FinalAssemblyCheckedBy]] {{drury,kdavis,hogan}} <<HOLDPOINT>>[[FinalAssemblyCheckedComments]] <<COMMENT>> |

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| **Step No** | **Instructions** | **Data Inputs** |
| 3 | Verify that the ground cable is connected to the cryomodule. | [[GroundCableInspector]] <<USERNAME>>[[GroundCableTimeStamp]] <<TIMESTAMP>>[[GroundCableVerified]] <<CHECKBOX>> |
| 4 | Verify that the **Insulating Vacuum** signal is connected to data acquisition systems in the control room and that the readback is correct. Record the Insulating Vacuum pressure (in torr) as displayed by the data acquisition computers. Note any problems in the comment block. | [[WarmInsulateVacInspector]] <<USERNAME>>[[WarmInsulateVacTimeStamp]] <<TIMESTAMP>>[[WarmInsulateVacWarmPressure]] <<SCINOT>> (torr)[[WarmInsulateVacComment]] <<COMMENT>> |
| 5 | Verify that the **Beamline Vacuum** signal is connected to data acquisition systems in the control room and that the readback is correct. Record the Beamline Vacuum pressure (in torr) as displayed by the data acquisition computers. Note any problems in the comment block. | [[WarmBeamlineVacInspector]] <<USERNAME>>[[WarmBeamlineVacTimeStamp]] <<TIMESTAMP>>[[WarmBeamlineVacPressure]] <<SCINOT>> (torr)[[WarmBeamlineVacComment]] <<COMMENT>> |
| 6 | Verify that all eight **Waveguide Guard Vacuum** signals are connected to data acquisition systems in the control room and that each readback is correct. Record each Waveguide Guard Vacuum pressure (in torr) as displayed by the data acquisition computers. Note any problems in the comment block. | [[WarmWaveguideVacInspector]] <<USERNAME>>[[WarmWaveguideVacTimeStamp]] <<TIMESTAMP>>[[WarmWG1VacPressure]] <<SCINOT>> torr[[WarmWG2VacPressure]] <<SCINOT>> torr[[WarmWG3VacPressure]] <<SCINOT>> torr[[WarmWG4VacPressure]] <<SCINOT>> torr[[WarmWG5VacPressure]] <<SCINOT>> torr[[WarmWG6VacPressure]] <<SCINOT>> torr[[WarmWG7VacPressure]] <<SCINOT>> torr[[WarmWG8VacPressure]] <<SCINOT>> torr[[WarmWaveguideVacComment]] <<COMMENT>> |

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| **Step No** | **Instructions** | **Data Inputs** |
| **7** | Verify that all **Cavity Diodes (J6-NN)** are connected to data acquisition in the control room and that each readback is correct. Note any problems in the comment block. | [[CavityDiodeInspector]] <<USERNAME>>[[CavityDiodeTimestamp]] <<TIMESTAMP>>[[CavityDiodesReady?]] <<CHECKBOX>>[[CavityDiodeComment]] <<COMMENT>> |
| **8** | Verify that all **Diagnostic and First Issue Diodes (J7-43)** are connected to data acquisition in the control room and that each readback is correct. Note any problems in the comment block. | [[DiagnosticDiodeInspector]] <<USERNAME>>[[DiagnosticDiodeTimestamp]] <<TIMESTAMP>>[[DiagnosticDiodesReady?]] <<CHECKBOX>>[[DiagnosticDiodeComment]] <<COMMENT>> |
| **9** | Verify that all **End Can Diodes (J1-NN)** are connected to data acquisition in the control room and that each readback is correct. Note any problems in the comment block. | [[EndCanDiodeInspector]] <<USERNAME>>[[EndCanDiodeTimestamp]] <<TIMESTAMP>>[[EndCanDiodesReady?]] <<CHECKBOX>>[[EndCanDiodeComment]] <<COMMENT>> |
| **10** | Verify that **Liquid Level Sensors (J1-NN)** on both Supply and Return end cans are connected to data acquisition in the control room and that each readback is correct. Note any problems in the comment block. | [[LiquidLevelInspector]] <<USERNAME>>[[LiquidLevelTimeStamp]] <<TIMESTAMP>>[[LiquidLevelReady?]] <<CHECKBOX>>[[LiquidLevelComment]] <<COMMENT>> |
| **11** | Verify that all **U-Tube Diodes** are connected to data acquisition in the control room and that each readback is correct. Note any problems in the comment block. | [[UTubeDiodeInspector]] <<USERNAME>>[[UTubeDiodeTimestamp]] <<TIMESTAMP>>[[UTubeDiodesReady?]] <<CHECKBOX>>[[UTubeDiodeComment]] <<COMMENT>> |
| **12** | Verify that **Pressure Transducers** (50 torr and 5000 torr) are connected to data acquisition in the control room and that each readback is correct. Note any problems in the comment block. | [[PressureTransducerInspector]] <<USERNAME>>[[PressureTransducerTimeStamp]] <<TIMESTAMP>>[[PressureTransducersReady?]] <<CHECKBOX>>[[PressureTransducerComment]] <<COMMENT>> |
| **13** | Verify that **JT Valve Actuator** is installed and set up properly. Verify that the LVDT is set up correctly through the epics control system. List set up information and any problems in the comment block. | [[JTValveInspector]] <<USERNAME>>[[JTValveTimestamp]] <<TIMESTAMP>>[[JTValveComment]] <<COMMENT>> |

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| **Step No** | **Instructions** | **Data Inputs** |
| 14 | Verify that Warm Frquency Measurements have been completed. (See C100-CM-ACTS-LPRF). | [[WarmFreqVerifiedBy]] <<USERNAME>>[[FieldName]] <<TIMESTAMP>> |
| 15 | Record date and time of the cool down start. See procedure C100-CMTF-CM-COOL for detailed instructions | [[CoolDownOperator1]] <<USERNAME>>[[CoolDownStartTime]] <<TIMESTAMP>>[[CoolDownStartComments]] <<COMMENT>> |
| 16 | Record the date and time of the completion of the cool down of the primary circuit to 4K.. **Use the diode CTD53 (Cavity 8 upper) as the reference.**Record the **Return End Liquid Level reading** at this time. If unable to complete 4 K cool down, please explain why in comment block**.** | [[CoolDownOperator2]] <<USERNAME>>[[CoolDown4KCompleteTime]] <<TIMESTAMP>>[[ReturnLiqLvl4K]] <<FLOAT>> %[[CTD53Temp]] <<FLOAT>> K[[CoolDownStartComments]] <<COMMENT>> |
| 17 | Record Date and time for beginning of the **primary circuit pump down to 2K**. Record the **Return End Liquid Level reading**. | [[PumpDownOperator1]] <<USERNAME>>[[PumpDownStartTime]] <<TIMESTAMP>>[[ReturnLiqLvlPumpDwnStart]] <<FLOAT>>[[PumpDownStartComments]] <<COMMENT>> |
| 18 | When Helium Liquid Level reaches 20%, verify the operation of the **Helium Vessel Heaters**. Insure that heaters can be turned on at controlled through Labview on CMTF-DAQ computer.  | [[HeaterInspector]] <<USERNAME>>[[HeaterTimeStamp]] <<TIMESTAMP>>[[HeaterComments]] <<COMMENT>> |
| 19 | Record Date and time of completion of the **primary circuit pump down to 2K**. Record the **Return End Liquid Level reading**. | [[PumpDownOperator2]] <<USERNAME>>[[PumpDownCompleteTime]] <<TIMESTAMP>>[[ReturnLiqLvlPumpDwnComplete]] <<FLOAT>>[[PumpDownCompleteComments]] <<COMMENT>> |
| 20 | Verify that guard vacuum pump on sub-atmospheric u-tube is turned on and actively pumping. | [[GuardVacInspector]] <<USERNAME>>[[GuardVacTime]] <<TIMESTAMP>>[[GuardVacComments]] <<COMMENT>>[[GuardVacPumping]] <<CHECKBOX>> |
| 21 | Record Date and time of completion of the final fill at 2K. | [[CoolDownOperator3]] <<USERNAME>>[[CoolDown2KCompleteTime]] <<TIMESTAMP>>[[CoolDown2KComments]] <<COMMENT>> |
| 22 | Upload the logfiles containing the cool down data | [[CoolDownFiles]] <<FILEUPLOAD>> |

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| **Step No** | **Instructions** | **Data Inputs** |
| 23 | Begin the **Integrated Insulating Vacuum Leak Test**: Isolate the insulating vacuum from the pumping station after the cool down is complete and the cryomodule is stable in terms of pressure and liquid level. Monitor the insulating vacuum pressure for at least 1 week. Record start time, completion time and the vacuum pressure (in torr) at start and finish. | [[InsVacLeakTestStartBy]] <<USERNAME>>[[InsVacLeakTestStartTime]] <<TIMESTAMP>>[[InsVacLeakTestStartPressure]] <<SCINOT>> (torr)[[InsVacLeakTestCompleteBy]] <<USERNAME>>[[InsVacLeakTestStopTime]] <<TIMESTAMP>>[[InsVacLeakTestFinalPressure]] <<SCINOT>> (torr)[[Subtract InsVacLeakTestStartTime from InsVacLeakTestStopTime and enter in ElapsedTimeInsVacLeakTest in units of days]] <<NOTE>>[[Subtract InsVacLeakTestStartPressure from InsVacLeakTestFinalPressure and enter result in InsVacuumDelta]] <<NOTE>>[[ElapsedTimeInsVacLeakTest]] <<FLOAT>> (days)[[InsVacuumDelta]] <<SCINOT>>[[InsVacLeakTestComments]] <<COMMENT>> |

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| **Step No** | **Instructions** | **Data Inputs** |
| 24 | Measure the **Shield Static Heat Load**. Complete at least 1 week after pump down to 2K is completed. See the procedure C100-CMTF-CM-SHLD for detailed instructions. Use the Shield Heat Load Spreadsheet Template to calculate and record the data.Enter the Static Heat Load (in Watts) in the appropriate box | [[StaticShldHeatLoad]] <<USERNAME>>[[StaticShldHeatLoadComplete]] <<TIMESTAMP>>[[StaticShldHeatLoadComments]] <<COMMENT>>[[StaticShldHeatLoad]] <<FLOAT>>[[StaticShldHeatLoadFile]] <<FILEUPLOAD>> |

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| **Step No** | **Instructions** | **Data Inputs** |
| 25 | Verify that all low power measurements and tests are complete prior to starting the warm up. See C100-CM-ACTS-LPRF  | [[AcceptanceTestingCompleted]] {{drury,kdavis,hogan}} <<HOLDPOINT>> |
| 26 | Verify that all high power measurements and tests are complete prior to starting the warm up. See C100-CM-ACTS-HPRF. | [[AcceptanceTestingCompleted]] {{drury,kdavis,hogan}} <<HOLDPOINT>> |
| 27 | Record the **beamline vacuum**, all **waveguide guard vacuums,** and the **insulating vacuum** (in torr) prior to beginning warm up. Note any problems in comment block | [[FinalVacInspector]] <<USERNAME>>[[FinalVacCheckComplete]] <<TIMESTAMP>>[[FinalVacCheckComments]] <<COMMENT>>[[FinalInsVac]] <<SCINOT>> (torr)[[FinalBeamLineVac]] <<SCINOT>> (torr)[[FinalWG1Vac]] <<SCINOT>> (torr)[[FinalWG2Vac]] <<SCINOT>> (torr)[[FinalWG3Vac]] <<SCINOT>> (torr)[[FinalWG4Vac]] <<SCINOT>> (torr)[[FinalWG5Vac]] <<SCINOT>> (torr)[[FinalWG6Vac]] <<SCINOT>> (torr)[[FinalWG7Vac]] <<SCINOT>> (torr)[[FinalWG8Vac]] <<SCINOT>> (torr) |
| 28 | Begin the cryomodule warm up procedure. See the procedure, CP-CM-CMTF-WARM for instructions. Record thestart time for the warm up to the right. | [[WarmUpOperator]] <<USERNAME>>[[WarmStartTime]] <<TIMESTAMP>>[[WarmUpComments]] <<COMMENT>> |
| 29 | Verify that all eight mechanical tuners have been tuned back to the original positions as measured directly after completion of the 2K cool down. See C100-CM-ACTS-LPRF. | [[TunerVerifiedBy]] <<USERNAME>>[[TunerComments]] <<COMMENT>> |
| 30 | Complete the U-tube removal procedure. See the procedure, CP-CM-CMTF-WARM for instructions. | [[UTubeRemovalTechnician]] <<USERNAME>>[[UTubeRemovalComplete]] <<TIMESTAMP>>[[UTubeRemovalComments]] <<COMMENT>> |
| 31 | Upload the logfiles containing data on the cryomodule warm up. | [[CMWarmUpFiles]] <<FILEUPLOAD>> |

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| **Step No** | **Instructions** | **Data Inputs** |
| 32 | Record the time of completion of the cryomodule removal procedure | [[CMRemovalTechnician]] <<USERNAME>>[[CMRemovalComplete]] <<TIMESTAMP>>[[CMRemovalComments]] <<COMMENT>> |