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| Traveler Title | SNSPPU Helium vessel welding | | | |
| Traveler Abstract |  | | | |
| Traveler ID | SNSPPU-CAV-ASSY-HELV | | | |
| Traveler Revision | R2 | | | |
| Traveler Author | Kurt Macha | | | |
| Traveler Date | 27-Feb-20 | | | |
| NCR Informative Emails |  | | | |
| NCR Dispositioners |  | | | |
| D3 Emails |  | | | |
| Approval Names | Kurt Macha | John Fischer | Ed Daly | Naeem Huque |
| Approval Signatures |  |  |  |  |
| Approval Dates |  |  |  |  |
| Approval Title | Author | Reviewer | Project Manager | 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. | | | |
| [Calculate Shell Length](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-225234/Calculate%20shell%20length%2007Oct2020.xlsx) | [104211700-M8U-8200-A001 HELIUM VESSEL WITH LIQUID LEVEL PROBES](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-210389/1.%20104211700-M8U-8200-A001%20HELIUM%20VESSEL%20WITH%20LIQUID%20LEVEL%20PROBES.pdf) | [104211700-M8U-8200-A002 HELIUM VESSEL WO LIQUID LEVEL PROBES](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-210390/2.%20104211700-M8U-8200-A002%20HELIUM%20VESSEL%20WO%20LIQUID%20LEVEL%20PROBES.pdf) | [104211700-M8U-8200-A026 HELIUM VESSEL ASSEMBLY](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-210532/1.2%20104211700-M8U-8200-A026%20HELIUM%20VESSEL%20ASSEMBLY.pdf) | [CP-SNSPPU-CAV-ASSY-HELV](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-225235/CP-SNSPPU-CAV-ASSY-HELV-R2.docx) |
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| Revision Note |  |
| R1 | Initial release of this Traveler. |
| R2 | Changed the process slightly to set bellows tention so welding puts bellows at relaxed state after welding. This changes some of the process steps. Also added more detail to instrumentation checkout. KM |

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| Step No. | Instructions | Data Input |
| 1 | Enter cavity serial number ID  Enter Helium vessel serial number ID  One in four cavities will have liquid level probes installed.  Will this be an assembly with liquid level probes? Enter the appropriate check box. | [[CavitySerialNo]] <<SN>>  [[HeliumVesselID]] <<SN>>  [[FieldName]] <<COMMENT>>  [[WithLLProbes]] <<CHECKBOX>>  [[NoLLProbes]] <<CHECKBOX>>  [[Initiate]] <<COMMENT>>  [[Initiate]] <<SRF>> |
| 2 | Ensure the cavity has had all travelers completed and it is ready for helium vessel welding.  Ensure RF measurements have been taken.  **Note: Throughout this traveler reference:** [CP-SNSPPU-CAV-ASSY-HELV](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-225235/CP-SNSPPU-CAV-ASSY-HELV-R2.docx) **This is the procedure used to detail important information needed to properly install the helium vessel.** | [[ReadyForHV]] <<COMMENT>>  [[ReadyForHV]] <<SRF>> |

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| 3 | Measure Cavity, Coupler side head (Bellows) and FP head to calculate shell length.  Use the [Calculate Shell Length](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-225234/Calculate%20shell%20length%2007Oct2020.xlsx) spreadsheet to enter dimensional data. The spreadsheet will calculate the shell length for machining.  Upload entered [Calculate Shell Length](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-225234/Calculate%20shell%20length%2007Oct2020.xlsx) spreadsheet and data fields.  Send out the shell for machining. When the shell comes back from machining measure the shell length using a tape measure to ensure the shell has been machined to proper length. | [[ShellLength.xls]] <<FILEUPLOAD>>  [[CalcShellLength]] <<FLOAT>>  [[ShellLength]] <<COMMENT>>  [[MeasureShellLength]] <<FLOAT>>  [[Shell]] <<TIMESTAMP>>  [[ShellLength]] <<SRF>> |
| 4 | Tack weld the backing rings into both helium vessel heads  Ensure the head with backing ring fits into the shell end. | [[BackingRings]] <<COMMENT>>  [[FPHeadFit]] <<CHECKBOX>>  [[CouplerHeadFit]] <<CHECKBOX>>  [[BackingRings]] <<SRF>> |

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| 5 | Install two rounding fixtures onto the machined shell.  Load the shell onto the shell support tooling.  Load the cavity onto the cavity support tooling.  Install the cavity spider components onto the cavity. Ensure hardware is tightened properly and wire locked.  If applicable, install the liquid level probe assemblies onto the cavity.  Insert the cavity through the shell, install the coupler side head into place.  Support the cavity on the lollipops.  Remove the cavity support tooling.  See: [CP-SNSPPU-CAV-ASSY-HELV](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-225235/CP-SNSPPU-CAV-ASSY-HELV-R2.docx) | [[LoadComponents]] <<COMMENT>>  [[WireLockCenterSupport]] <<YESNO>>  [[LiquidLevelProbes]] <<YESNO>>  [[LoadComponents]] <<SRF>> |

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| 6 | Adjust the coupler head into proper position and tack weld the head to the cavity dish.  **Note: Ensure the cavity end dish is seated properly into the machined head step.** | [[TackCouplerHead]] <<COMMENT>>  [[TackCouplerHead]] <<SRF>> |
| 7 | Adjust the shell support tooling so the shell is set to the proper position.  **Note: See** [CP-SNSPPU-CAV-ASSY-HELV](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-225235/CP-SNSPPU-CAV-ASSY-HELV-R2.docx) **for important details.** | [[AdjustShell]] <<COMMENT>>  [[AdjustShell]] <<SRF>> |
| 8 | Weld the helium vessel support block to the vessel shell.  Tighten the spider to support block with proper hardware and tack weld properly.  Set the root weld gap and tack weld the shell to the coupler helium vessel head.  **Note: See** [CP-SNSPPU-CAV-ASSY-HELV](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-225235/CP-SNSPPU-CAV-ASSY-HELV-R2.docx) **for important details.** | [[WeldSupportBlock]] <<COMMENT>>  [[WeldSupportandTackHead]] <<SRF>> |

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| 9 | Install the heater and properly run all wiring. This includes heater wires and liquid level wires if applicable.  Preform test of all instrumentation and verify they are functioning properly.  Lock wire heater support hardware.  Protect the leads properly to ensure ready for vessel welding. (Tie leads together and insulate over bare wire.) | [[HeaterWiring]] <<COMMENT>>  [[WiringVerification]] <<YESNO>>  [[HeaterLockWire]] <<YESNO>>  [[HeaterWiring]] <<SRF>> |
| 10 | Ensure all steps are complete up to this point.  Verify the cavity spider is secure before the lollipop support can be removed at the next step. | [[SpiderSecure]] <<TIMESTAMP>>  [[SpiderSecureWireOk]] {{worland,fischer,macha}} <<HOLDPOINT>> |
| 11 | Remove the lollipop support holding the cavity field probe beam line flange.  Test fit the field probe end helium vessel head to ensure proper fit.  If the field probe end helium vessel head does not fit properly contact the supervisor to resolve the issue. | [[FPHeadFits]] <<COMMENT>>  [[FPHeadFits]] <<SRF>> |

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| 12 | Install the field probe helium vessel head.  Install the dummy tuner to set the head into proper rotation.  Install the lollipop support back under the beam line flange.  Tack weld the coupler side helium vessel head to the cavity end dish.  **Note:** **Ensure the bellows cuff properly seats into the cavity end dish step.**  Set the 24” shell root to proper 1/16” gap and then tack the shell tube to the head.  **Note: See** [CP-SNSPPU-CAV-ASSY-HELV](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-225235/CP-SNSPPU-CAV-ASSY-HELV-R2.docx) **for important details.**  Put larger tack welds at all helium vessel weld joints to ensure no possible movement or breaking of tack welds while moving the cavity to the next work center.  Remove both lollipop supports.  Transfer the tack welded cavity in helium vessel to the weld station. | [[FinalTackWeld]] <<COMMENT>>  [[FinalTackWeld]] <<SRF>> |
| 13 | Weld the four helium vessel joints.  Ensure proper purge.  Skip weld to control excessive heat. | [[FinalWeld]] <<COMMENT>>  [[FinalWeld]] <<SRF>> |

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| 14 | Preform test of all instrumentation and verify they are functioning properly. | [[FinalWiringVerification]] <<YESNO>>  [[FinalWiring]] <<SRF>> |
| 15 | RF Measure pass band frequency.  Ensure the network analyzer is calibrated properly | [[FinalRFMeasure]] <<COMMENT>>  [[FinalRFMeasure]] <<FILEUPLOAD>>  [[AnalyserCal]] <<TIMESTAMP>>  [[FinalRFMeasure]] <<SRF>> |
| 16 | Leak test the cavity helium vessel and record results.  **Note: Ensure the mock tuner is installed for cavity evacuation and leak test.** | [[HVLeakTight]] <<YESNO>>  [[HVLeakTest]] <<FILEUPLOAD>>  [[HVLeakTest]] <<COMMENT>>  [[HVLeakTest]] <<SRF>> |
| 17 | The helium vessel is fully welded and ready for the next work center | [[Complete]] <<COMMENT>>  [[Complete]] <<SRF>> |