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| **L2HE Warm Coupler Disassembly Procedure** |
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| Document Owner: | M.Weihl | Department Owner: | SRF Operations |

# Purpose

The purpose of this document is to provide instructions for disassembling the warm coupler assemblies, removing them from a completed Cryomodule that requires rework.

# Scope

This procedure applies to L2HE Cryomodule disassembly actions to be taken by trained and knowledgeable Assembly Technicians to cleanly and specifically remove the warm coupler assemblies which is required for rebuild. Details are contained in the attached process steps.

# Terms and Definitions

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| Term | Definition |
| Warm Coupler Assembly (FPCW) | Assembly that is typically installed at WS5 and attached to the cold coupler following a specific assembly traveler and is performed by trained Technical Staff. |
| MC Line | Master Coupler pumping line assembly which is attached to each warm coupler with a centralized Ion pump. |
| Berry bolts | An assembly of specific hardware that supports the cold coupler that is installed at various stages of assembly a disassembly. Require correct installation to prevent hardware from galling. |

# Roles and Responsibilities

The following roles have responsibilities described in this document.

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| Role | Responsibility |
| Supervisor | Will address and monitor work actions are done correctly, to Procedure |
| Cryomodule Assembly Technician | Technician that has been trained and qualified for warm coupler assembly work. Individual shall also be familiar with specialized tooling and appropriate procedures and techniques. |

# Procedure

1. **Waveguide Removal**

**Note:** All hardware to be placed in plastic bag or plastic cups with cap and labeled with size and material i.e. M4 x 1 x 10 SS shcs. Personnel must wear nitrile glove during removal of waveguide.

* 1. Remove the knob protective cover and the rubber gasket with the 4 screws still in their slots within the cover.
	2. Remove the manual actuator knob.
	3. Remove the waveguide protective cover.
	4. Remove Stainless Steel rings and place in plastic bag
	5. Remove copper ring and place in plastic bag.
	6. Install kapton sleeve over the ceramic.
	7. Remove the split rings from the back of the waveguide.
	8. Remove the mounting rods from the waveguide.
	9. Carefully remove waveguide from over the ceramic of the FPCW.
	10. Install protective cup over the ceramic.
	11. Remove waveguide support arms.
	12. Clean support arm hardware of the Loctite. This can be performed after all waveguides and couplers have been removed.
1. **Removing Frisbee Flanges**
	1. All Hardware must be bagged; RAV and bellows must be capped off and placed in plastic bags
	2. Remove hardware from RAV on FPCW, then gently remove RAV.
	3. Remove hardware from MC line bellows, then remove and safely store bellows on shelf in SRF shelf in parts/coupler storage area.
	4. Install FPCW Support tooling, ensure the arms are tight and saddle is in place.
	5. Loosen all screws on the Frisbee flange and split rings.
	6. Remove split rings, bag the split rings and hardware.
	7. With one technician holding the Frisbee flange, the other technician shall remove the M8 bolts.
	8. With one technician holding the Frisbee flange, the other technician shall install the suspension links ensuring that they are tight.
	9. Remove the support tooling.
	10. Carefully remove the Frisbee flange over the FPCW.
	11. Remove rubber gasket on FPCW.
	12. Wrap the Frisbee flange and gaskets in aluminum foil.
	13. Install nitrogen valve on FPCW and backfill with nitrogen leaving nitrogen flowing through entire disassembly.
2. **Open MLI and removing Field Probe Wire.**
	1. Carefully remove field probe cable from the field probe and roll up at bottom of flange opening.
	2. Carefully cut MLI where the wedge-shaped pieces meet.
	3. Tape back each wedge-shaped piece.
	4. Remove MLI from over 6” flange between Warm and Cold couplers and around FPCW.
3. **Removing FPCW**
	1. Install upper and lower support tooling (rails). Reserve the 2 lower M8 bolts for installing the brass sled with the lower support tooling.
	2. Remove tuner actuator and store with knob removed during waveguide installation.
	3. Remove Ceramic protection cup.
	4. Using strain relief tool, remove M4 SHCS bolts on push rod. Store bolts.
	5. Install t-handle push rod tool.
	6. While pushing in on push rod tool turn push rod ¼ turn counterclockwise.
	7. Slowly, pull push rod out of coupler and place in push rod holder.
	8. Reinstall ceramic protection cup.
	9. Remove M8 bolts from coupler flange.
	10. Remove antenna screw (vented bolt) using long t-handle, attempting to bring screw with it.
	11. While the nitrogen is still on, slowly pull Warm Coupler out using brass sled.
4. **Storing Coupler**
	1. Turn the coupler ceramic side down to retrieve vented bolt if it did not come out with the t-handle. This requires two people, one to hold the coupler and one to catch the bolt. Using the t-handled tool put the vented bolt into the coupler.
	2. Turn the coupler over ceramic side up. Again, this requires two people, one holding the coupler and the other keeping the vented bolt in place. Place the coupler on the shipping flange ensuring that the vented bolt aligns with the copper post. Screw the vented into post, do not tighten.
	3. Install 6 M8 screws removed from flange on shipping coupler, and two M8 screws to install the bellows restrains. The other end of the bellows restraints will have two M6 screws. Tighten all screws and vented bolt.
	4. Remove ceramic protection cup.
	5. Using the t-handle push rod tool, install the push rod with a 2-1/8 gasket and the pin at the end oriented horizontally. While pushing on the t-handle, turn the push rod 90 degrees clockwise.
	6. Install four M5 SHCS on the push rod flange. Tighten using strain relief tool.
	7. Install ceramic protection cup.
	8. Close nitrogen valve and remove nitrogen line.
5. **Protecting Cold Coupler Ceramic**
	1. Install 4 guides for top hat installation.
	2. Place top hat on brass sled and push into place over ceramic.
	3. Install four M8 N60 or brass HHCS and remove guides.
	4. Tighten the M8 bolts.
6. **Install Berry Bolts**
	1. Install 4 berry bolts through cold coupler flange with roughly ½ inch engagement.
	2. Install 4 berry bolt sleeves until they bottom out onto the berry bolts. May have to double nut to facilitate installation.
	3. Install 4 M8 nuts on to berry bolt sleeves hand tight.
	4. Install 4 M4 nuts on to berry bolts.
7. **MC Line Removal**
	1. This step can be done before Coupler removal.
	2. MC line removal must be performed under an LFH. Personnel must wear appropriate cleanroom garb and PPE. All parts other than the 4” MC line must have protective covers installed and bagged.
	3. Start from the downstream end (by cavity 8) by removing the RAV. Put a cap on the MC line 2-3/4 flange. Cap and bag RAV.
	4. Install pipe stands to support pipe, remove pipe support bracket.
	5. If bellows and RAV on coupler have not previously been removed
		1. Remove screws from 2-3/4 flanges on RAV on first cavity. Put screws, nuts and washers in a plastic bag.
		2. Carefully remove RAV. Cap and bag.
		3. Install Nitrogen valve onto coupler and backfill with nitrogen.
		4. Remove nitrogen line.
		5. Remove bellows. Put screws, nuts and washers in a plastic bag.
	6. Remove M8 bolts from 6” flange. Put screws, nut and washers in a plastic bag.
	7. Lower and remove pipe. Cover flanges with plastic covers and tape.
	8. Move LFH to next sections of pipe repeat 8.2 through 8.7
	9. Move to Ion pump and tees.
		1. Remove Blank on bottom of the upstream tee. Bag all hardware.
		2. Remove Magnet from Ion pump and remove ion pump housing. Bag all hardware
		3. Replace magnet and place blank on ion pump using a new gasket.
		4. Remove tees and install plastic caps on flanges. Bag all hardware.
	10. Move LFH to next section of pipe repeat 8.2 through 8.7
	11. Move LFH to last section of pipe.
	12. Remove instrumentation and 2-3/4 tee. Cap and bag and bag all hardware.
	13. Repeat steps 8.2 through 8.7

# References

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| Document No. | Title |
|  | [L2HE-PR-ASSY-FPCW-R1](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-262590/L2HE-PR-ASSY-FPCW-R1.pdf) |
|  | [JL0029137-Berry Bolt Assy Dwg](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-278207/JL0029137-Berry%20Bolt%20Assembly.pdf) |
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# Release and Revision History

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| Rev # | Major Changes | Effective Date: |
| 1 | Initial version | 24 March 2025 |

# Approvals

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