

<b>f</b>	<b>Fermi National Accelerator Laboratory Batavia, IL 60510</b>	
<b>LARP 90mm Quadrupole Coil Assembly Impregnation Traveler</b>		
<b>Reference Drawing(s): Cured Quarter Coil Assembly ME-411785</b>		
<b>High Field Quadrupole Reaction/Impregnation Fixture ME-411729</b>		
<b>Project # Task #:</b> 31/31.2.2.1.2		<b>Job #:</b> 387
<b>Released by:</b> Sharon Austin		<b>Magnet/Device Series:</b> TQ
<b>Date:</b> 4/10/2006 11:13:50 AM		<b>Scan Pages:</b>
<b>Prepared by:</b> S. Austin		
<b>Title</b>	<b>Signature</b>	<b>Date</b>
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XXXX Traveler Title Here XXXX

Serial No.: TQ  
Note(s)

Revision Page

<b>Revision</b>	<b>Step No.</b>	<b>Revision Description</b>	<b>TRR No.</b>	<b>Date</b>
None			1791	

**Note(s):**

**Ensure appropriate memos and specific instructions are placed with the traveler before issuing the sub traveler binder to production.**

1.0 General Notes

- 1.1 White (Lint Free) Gloves (Fermi stock 2250-1800) or Surgical Latex Gloves (Fermi stock 2250-2494) shall be worn by all personnel when handling all product parts after the parts have been prepared/cleaned.
- 1.2 All steps that require a sign-off shall include the Technician/Inspectors first initial and full last name.
- 1.3 No erasures or white out will be permitted to any documentation. All incorrectly entered data shall be corrected by placing a single line through the error, initial and date the error before adding the correct data.
- 1.4 All Discrepancy Reports issued shall be recorded in the left margin next to the applicable step.
- 1.5 Personnel shall perform all tasks in accordance with current applicable ES&H guidelines and those specified within the step.
- 1.6 Cover the Main Coil Assembly with green Herculite (Fermi stock 1740-0100) when not being serviced or assembled.

2.0 Parts Kit List

- 2.1 Record the Coils being impregnated.

LARP 90mm Quadrupole Coil A Serial Number \_\_\_\_\_

LARP 90mm Quadrupole Coil B Serial Number \_\_\_\_\_

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Technician(s)

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3.0 Preparing the Reaction Fixtures

3.1 Clean the Reaction Fixture Assembly (ME-411729) using Isopropyl Alcohol (Fermi stock 1920-0300) and Heavy Disposable Wipers (Fermi stock 1660-2600) or equivalent.

<b>Item Description: Quadrupole Reaction/Impregnation Fixture</b>	<b>Quantity</b>	<b>Part Number ME-411729</b>	<b>Completed</b>
Base	1	MD-411730_A	
End Mold Block	2	MD-411731	
Second End Mold Block	3	MD-411732_A	
Inner Mold Block	9	MD-411733	
Stripe	2	MB-411734	
Long Mandrel Block	10	MB-411735	
Foil Shell	1	MB-411737	
Coil Spacer	1	MD-411738_B	
RE Cover	1	MD-411740	
Cable Holder	4	MB-411741	
Pusher	2	MB-411742	
Splice Block Holder Left for Impregnation	8	MB-411805	
Splice Block Holder Right for Impregnation	8	MB-411806	
Short Mandrel Block for Impregnation	10	MB-411736	
LE Cover for Impregnation	1	MD-411739	

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 Technician(s)

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4.0 Setup for Splicing

4.1 Place and secure on a clean, flat and strong work surface.

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Technician(s) Date

4.2 Remove any materials around the Leads on the Lead End Cover.

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Technician(s) Date

4.3 Clean the whole fixture with alcohol wipes.

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Technician(s) Date

4.4 Remove the Return End Cover (MD-411740), the Lead End Cover (MD-411739), and the three 3/8" shoulder screws from Mold Block #2, #7 and #13.

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Technician(s) Date

Mandrel Blocks are Stainless Steel (MB-411735) during the splicing.



Impregnation Fixture is right side up with the Mold Blocks and Stripes still installed and the End Covers removed.

4.5 Remove the two Mold Block Alignment Bars (MB-411734) (Stripes) using the 1/2-13 Bolts as screw jacks.

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4.6 Loosen all the large Mold Block bolts.

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4.7 Remove F14 and F13 Mold Blocks from the Lead End of the Reaction Fixture.

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Technician(s)

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4.8 Remove the 10 mil Stainless Steel Section of Foil Shell (MB-411737) from the Lead End of the Reaction Fixture.

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Technician(s)

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- 4.9 Cut off all 4 Coil Leads so they are flush with the Lead End edge of the Reaction Fixture Base Plate (MD-411730)



Mandrel Blocks are Stainless Steel (MB-411735) during the splicing.

Leads ready for Splicing Fixture. Insulation on Leads removed in step 5.1

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Technician(s)

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- 4.10 Remove the remaining bolts holding the Mold Blocks F12 to F1 and remove the Mold Blocks. Proceed to remove the exposed 10 mil S. S. Foil Shell (MB-411737) and the 10 mil ceramic or S-2 glass insulation coil coverings. Clean carefully the reacted coils and the surfaces around.

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4.11 Inspect and photograph the Outer Coils.

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Technician(s) Date

4.12 Carefully remove the mica covering for the voltage taps. Uae a vacuum to remove any residue from the coils.

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Technician(s) Date

4.13 Gaps between the Outer Layer Pole Spacers, as measured before Splicing the Leads.

Coil # \_\_\_\_\_ Coil # \_\_\_\_\_

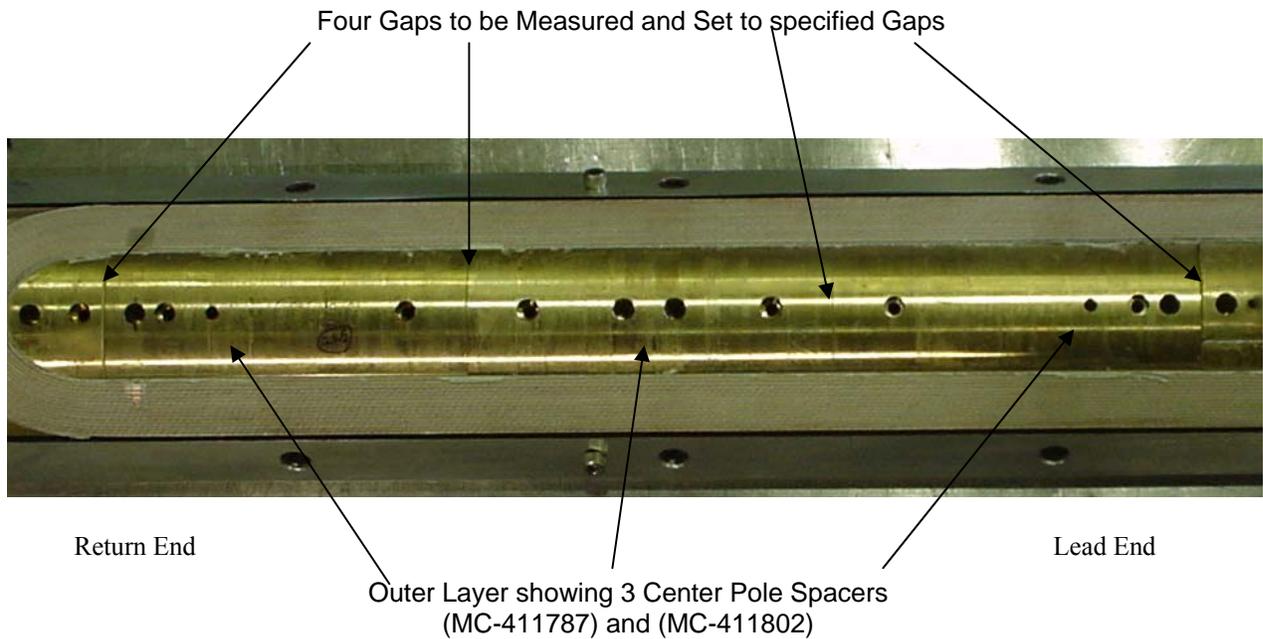
Gap 1 Lead End Pole to Lead End Pole Spacer (MC-411787) \_\_\_\_\_

Gap 2 Lead End Pole Spacer to Center Spacer (MC-411802) \_\_\_\_\_

Gap 3 Center Spacer to Return End Pole Spacer (MC-411787) \_\_\_\_\_

Gap 4 Return End Pole to Return End Pole Spacer (MC-411787) \_\_\_\_\_

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Technician(s) Date





- 5.4 Coat the bare conductor with Kester Rosin Paste Flux and lay Kester 10 mil Ribbon Solder on the Ni3Sn Leads or tin the clean leads, be careful to not overheat.



Mandrel Blocks are Stainless Steel (MB-411735) during the splicing.

Prepping the cable with Flux before splicing

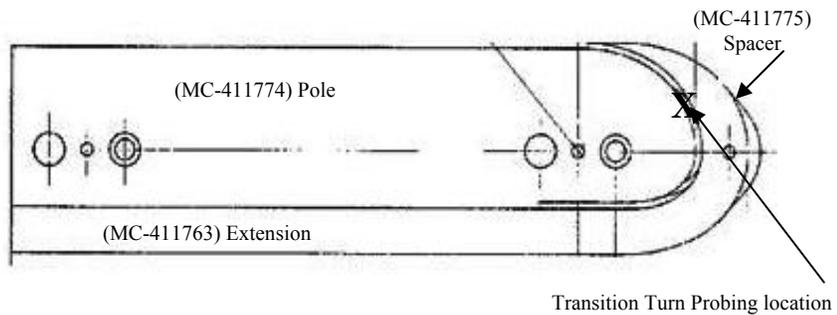
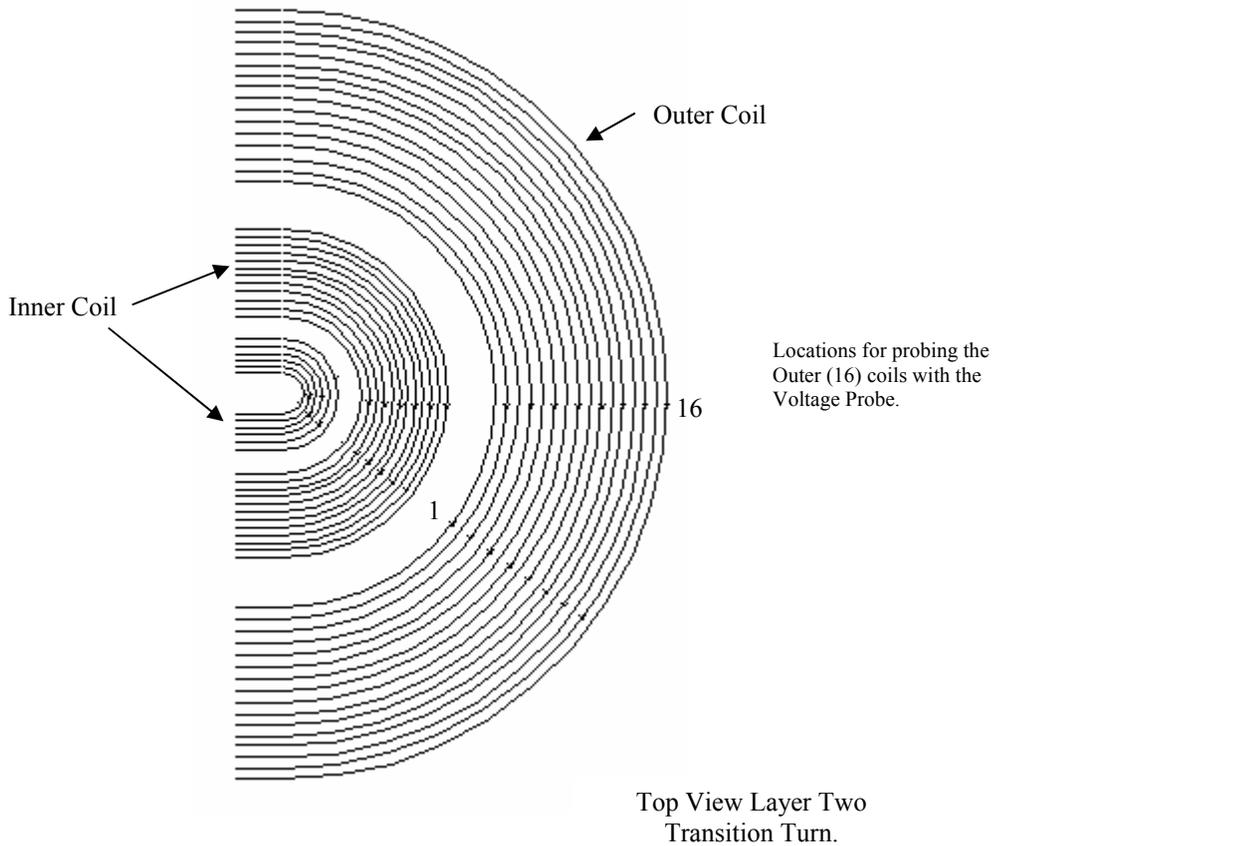
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5.5 Perform turn to turn Electrical tests. Check all the turns in the Outer Coil (16). Be sure the Leads are electrically isolated.

**Notes: Record the results for the Outer Coil in the Turn toTurn Voltage Check Excel Spreadsheet.**

**Record** the measurements. **Graph** the results, print the graph and attach the graph to the traveler



Review the Turn to Turn measurements. Continue readiness for Impregnation Yes  No

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Responsible Authority

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Date

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Serial No.: TQ  
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- 5.6 Prepare the Epoxy Impregnation Coil Spacer (MD-411738). Clean thoroughly with Ethyl Alcohol. Coat the entire Coil Spacer with Mold Release (MA-351557). The three 3/8" X .750" dowel pins are coated with a thin film of high temperature grease.

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- 5.7 Remove the two stainless coil shims from the coil spacer spline. Gently slide the Reaction Coil Spacer out and slide the clean and mold released (MA-351557) Epoxy Impregnation Coil Spacer into position flush with the Lead End.

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Technician(s)

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- 5.8 Prep the Outer Layer traces and fit them to the coil. Trim the traces carefully to avoid the traces hanging over onto the tooling. Cut the traces for voltage taps and pre-tin, as required.

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- 5.9 Make four .005" G-10 shims, .84" wide x 4.13875" long, for replacing the stainless steel ones used for reaction.

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Technician(s)

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- 5.10 Prepare the four 1.5 meter NbTi Extension Cables. These will be spliced to the 4 reacted Nb3Sn Coil Leads, after cleaning and pre-tinning. Use Kester Rosin Paste Flux and Kester 10 mil Ribbon solder (Sn30/PB70) for the tinning of the cables. Place the two inner layer, tinned, NbTi, Extension Cables into position for splicing and secure with the Lead Supports. Double check that the two Cables have opposing keystone positions.

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Technician(s)

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- 5.11 Make up four twisted pairs of wires for the splice taps. These are 8' long and 28AWG wire with .010" TFE insulation. For the splices the colors are black and brown.

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Technician(s)

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Mandrel Blocks are Stainless Steel (MB-411735) during the splicing.



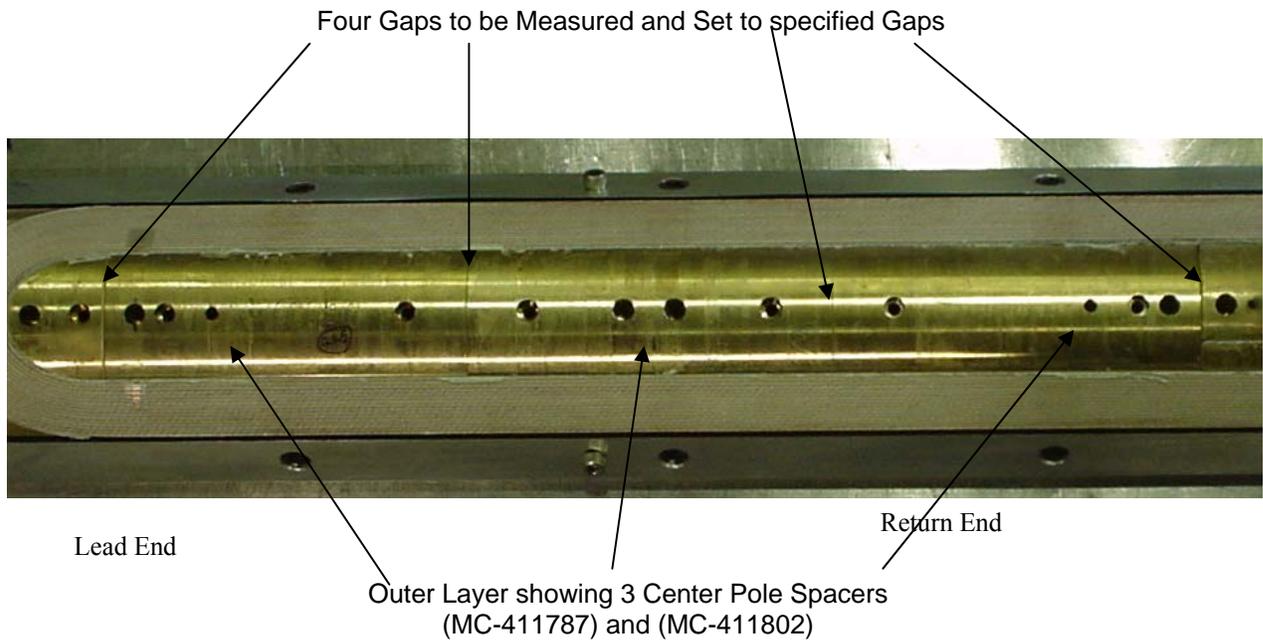
Two Reacted Coils with NbTi Leads ready to splice to the Nb3Sn Coil Leads

- 5.12 While splicing both Inner and Outer Layer Leads for the two Coils check that the keystone angle of the NiTi Extension Cables is opposed to the keystone of the Ni3Sn Coil Leads. Place the twisted pairs of wires correctly into the prepared joints, the twisted wires should be dressed along the center of the cable. Then attach the Splicing Fixture with Heaters and flow the solder to attach the Extension Lead to the main conductor cable. Be sure the splices do not cause any clearance difficulties. Remove excess solder and clean the Splices with Ethyl Alcohol.

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Technician(s)

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- 5.13 Push the island pieces together to make one gap at the lead end. Make and place the coil shims in the island gaps to take up the space.



Coil # \_\_\_\_\_

Gaps set to \_\_\_\_\_

G-10 Spacer thickness \_\_\_\_\_

Coil # \_\_\_\_\_

Gaps set to \_\_\_\_\_

G-10 Spacer thickness \_\_\_\_\_

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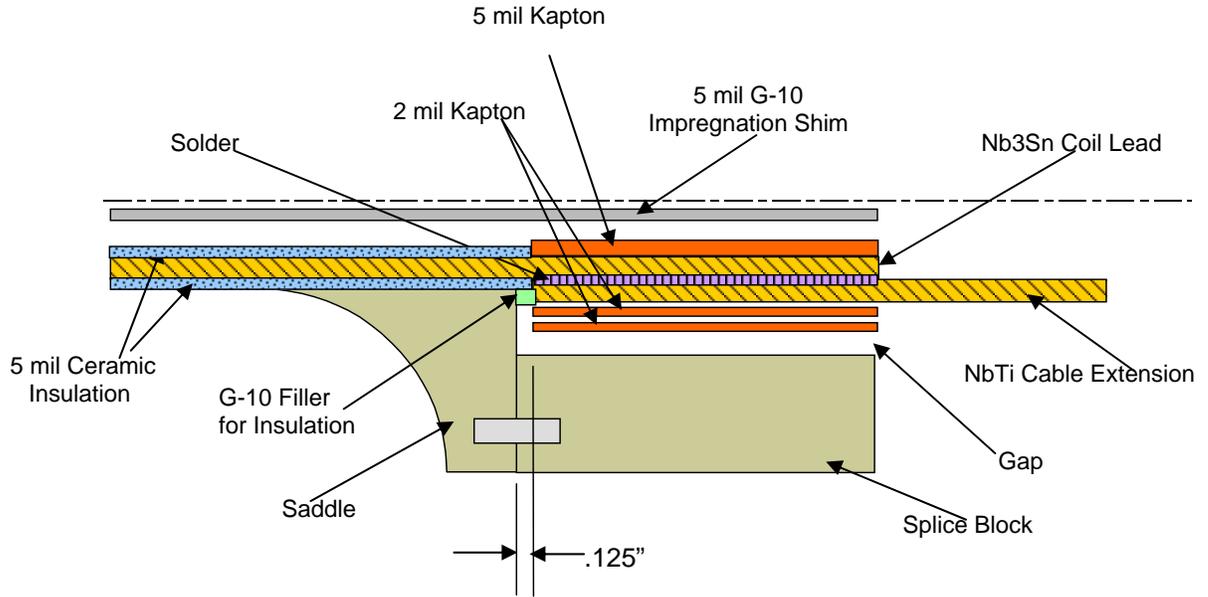
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- 5.14 Strain relief the splice tap wires with waxed string.

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- 5.15 Install the G-10 insulation filler in the .125" space between the Saddles and the splices. The size should be the same as the width and height of the cable. Use crazy glue to hold the small shim in place.



Cross section view showing the layers of the finished Cable Splice

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Technician(s)

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6.0 Preparation for Impregnation

6.1 Wrap the four spliced areas with 5 mil Kapton. Construct a **Box** shape around the splice and seal the open end with 1 mil Kapton sticky tape. Assure that the twisted wires are not inside the Kapton wrap.

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Technician(s) Date

6.2 Mold release all 10-24 holes in the coil spacer piece. Use O-ring pieces to fill holes.

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Technician(s) Date

6.3 Install the four lead end splice saddles. Measure the longest one and note how much needs to come off so both layers of the coil are the same length. Remove both saddles.

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Technician(s) Date

6.4 Machine the longest splice saddles of both coils to match the other layer.

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Technician(s) Date

6.5 Prepare and install the inner layer splice saddles:

- a) Stamp the coil # on the outside.
- b) Machine for instrumentation per LBNL drawing #411793A.
- c) Mold release the inside of the two screw holes and the outside surface.
- d) Place .001" kapton tape on the contact surface with the splice.
- e) Install with screws and pins. Verify it bottoms against the end shoe.
- f) Place the removed layer of .010" ceramic back over the block.
- g) Push the Teflon sticks down into the screw holes.

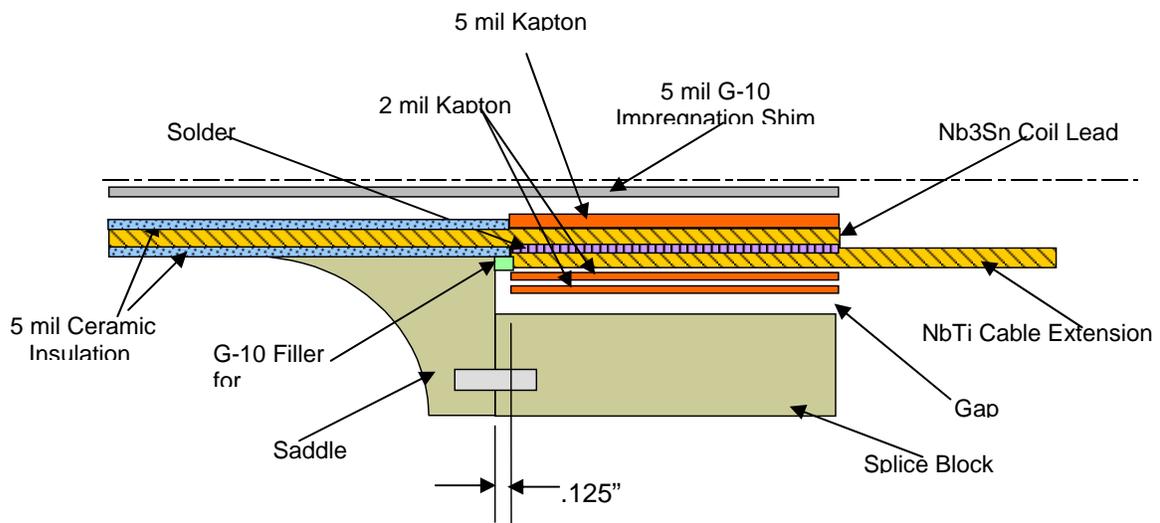
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Technician(s) Date

- 6.6 Prepare and install the outer layer splice saddles:
- a) Stamp the coil # on the outside.
  - b) Machine for instrumentation per LBNL drawing #411794QA3.
  - c) Mold release the inside of the two screw holes and the outside surface.
  - d) Place .001" kapton tape on the contact surface with the splice.
  - e) Install with screws and pins. Verify it bottoms against the end shoe.
  - f) Push the Teflon sticks down into the screw holes.

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 Technician(s) \_\_\_\_\_  
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- 6.7 Install G-10 potting shims onto the coil spacer. Tape in place with .001" kapton tape. Spacer size is .005" thick by .84" x 41.875".

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Cross section view showing the layers of the finished Cable Splice

- 6.8 Put the cleaned and mold released (MA-351557) Splice Holder Blocks (MB-411805) (MB-411806) into position.

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 Technician(s) \_\_\_\_\_  
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- 6.12 Put the 3 small o-rings in the o-ring groove around the three 3/8" shoulder screw holes in the Coil Spacer (MD-411738).

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- 6.13 The 10 mil Foil Shell (MB-411737) should be cleaned and then coated with Mold Release (MA-351557). Install and use dowel pins in the 3/8" holes in the Coil Spacer to align the Foil Shell.

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Technician(s)

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- 6.14 Place two Inner Mold Blocks (MD-411733) temporarily at 2 locations to support the Quad Coils and Retainers. Use these temporary blocks to trap two .050" x 1/2" x 41.75" temporary Metal shims between the Base and the Mold Blocks.

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Technician(s)

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- 6.15 Remove the temporary Mold Blocks and the temporary dowel pins as the correct installation of the Mold Blocks proceeds. Beginning with the Return End set the first (F1) End Mold Block (MD-411731) in place, carefully align so it is square with the Return End of the Base (MD-411730) and rests firmly on the .050” metal shim. Then add the Second End Mold Block (MD-4117320, and the remaining Mold Blocks in their correct order. Constantly check the Foil Spacer as the Impregnation Fixture is assembled. Make sure the threaded holes on the Mold Block face the Return End. Firmly tighten these blocks until there is a zero gap between the Mold Block and the .050” temporary shim.. The Mold Blocks are numbered from the Return End (F1) to the Lead End (F-14)



Assembling the Impregnation Fixture, inserting the O-ring along the S.S. Foil Spacer, while placing the Mold Blocks

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- 6.16 Put the three 3/8 shoulder screws through the Mold Blocks for final securing of the Mold Blocks and the Foil Shell as the Blocks are installed.

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- 6.17 Place the remaining Mold Blocks and align against the first Mold Block. Each Mold Block should rest on the .050" metal shim and then be bolted to the Base. Keep the Mold Blocks aligned and level while tightening. Position and tighten the same as (F1) (the first Mold Block) to a zero gap.



Assembling the Impregnation Fixture,  
showing the spliced leads

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- 6.18 Insert the side Mold Alignment Bars, (MB-411734) (Stripes) and tap into place. The center of the Bars should be at the center of the Mold Block Assembly. If the Bar is binding, tighten the bolts to ease the fit. Check that the Mold Blocks and Bars are all square and level. Insert screws and tighten, then back off the Bars mounting screws to leave slightly loose.

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- 6.19 Loosen the Mold Block Assembly (3/4-10X6” bolts) and remove the 50 mil Base Plate shim from on top of the Mold Blocks. Then evenly tighten the 3/4” bolts until the Mold Blocks are snug against the Base Plate.

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- 6.25 Measure the 3 Layer One gaps between the Pole Spacers and the Poles. Record the gaps, move the Pole Spacers so there is only one gap at the Lead End.

Coil # \_\_\_\_\_  
 Lead End Pole to Pole Spacer \_\_\_\_\_  
 Pole Spacer to Pole Spacer \_\_\_\_\_  
 Pole Spacer to Return End Pole \_\_\_\_\_

Coil # \_\_\_\_\_  
 Lead End Pole to Pole Spacer \_\_\_\_\_  
 Pole Spacer to Pole Spacer \_\_\_\_\_  
 Pole Spacer to Return End Pole \_\_\_\_\_

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- 6.26 Make hard G-10 shims to take up the island gap. Record the sizes. Install and verify that they are flush or below the island surface.

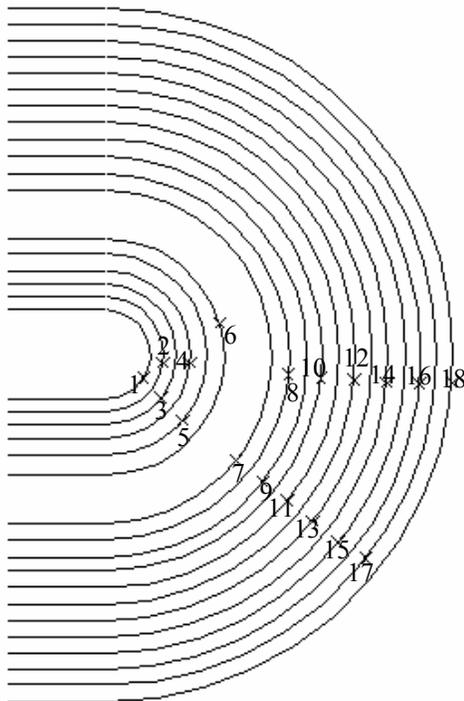
Coil # \_\_\_\_\_ Shim Size \_\_\_\_\_  
 Coil # \_\_\_\_\_ Shim Size \_\_\_\_\_

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 Technician(s) Date

- 6.27 Perform turn to turn Electrical tests. Check all the turns in the Inner Coil (18). Be sure the Leads are electrically isolated.

**Notes: Record the results for the Inner Coil in the Turn toTurn Voltage Check Excel Spreadsheet.**

**Record** the measurements. **Graph** the results, print the graph and attach the graph to the traveler



Locations (18) to probe the coil with the Voltage Probe.

Review the Turn to Turn measurements. Continue Yes \_\_\_\_\_ No \_\_\_\_\_

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Responsible Authority

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7.0 Preparing the Inner Coil for Impregnation

7.1 Prepare the Inner Coil Traces

1. Mark, trim and process the traces. Tin the pads and the traces on the lead ends.
2. Mold release the first half inch on the traces where the taps come out.
3. Install strain gauges into the traces.
4. Install traces and solder the taps. Place Kapton over the joints and on the trace to hold it into the coil.
5. Glue the strain gauges down to the island. Use the Teflon mandrel blocks and weight to hold the gauges down while curing.

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7.2 Apply Mold Release to the ends of both the Return and Lead End Saddles (MC-411767) (MC-411771)

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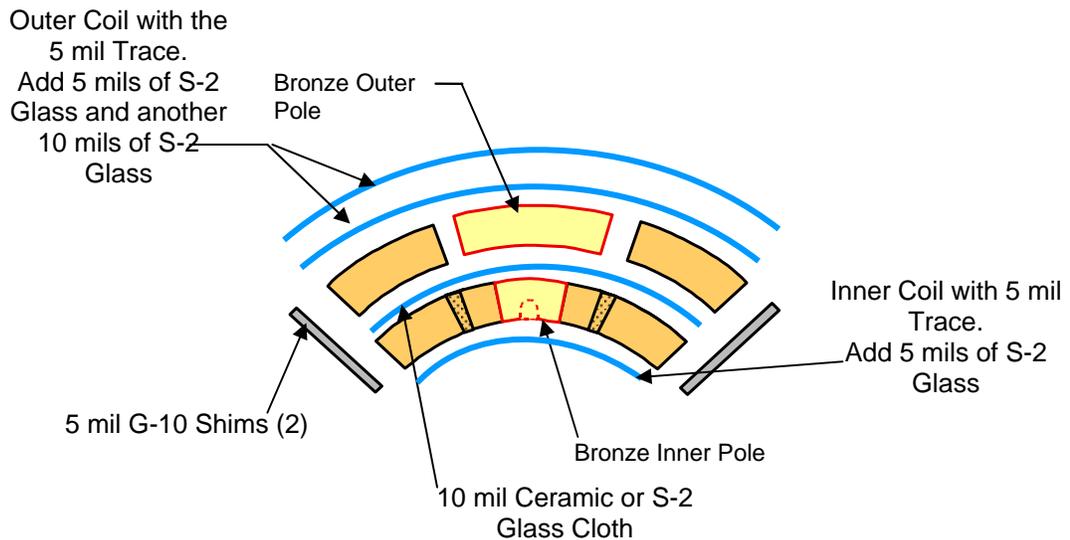
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7.3 Measure and cut out windows in the inner glass cover sheet so the strain gauges have clearance. Place .001" kapton tape over the strain gauges themselves.

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7.4 Install the .005" X 2.75" wide S-2 Glass sheet over the Inner Coil Traces.



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- 7.5 Prepare the clean and Mold Released Stainless Steel Mandrel Blocks (MB-411736) for Impregnation by inserting the Aluminum Filler Rod through the Mandrel Blocks. Then carefully place the Mandrel Block Assembly centered on the Inner Coil.

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- 7.6 Place the two .005" X .84" X 39" G-10 shims along the Coil Edges, replacing the Stainless Steel Coil Shims that were removed. Do not cover the Stainless Steel Splice Block Holders.

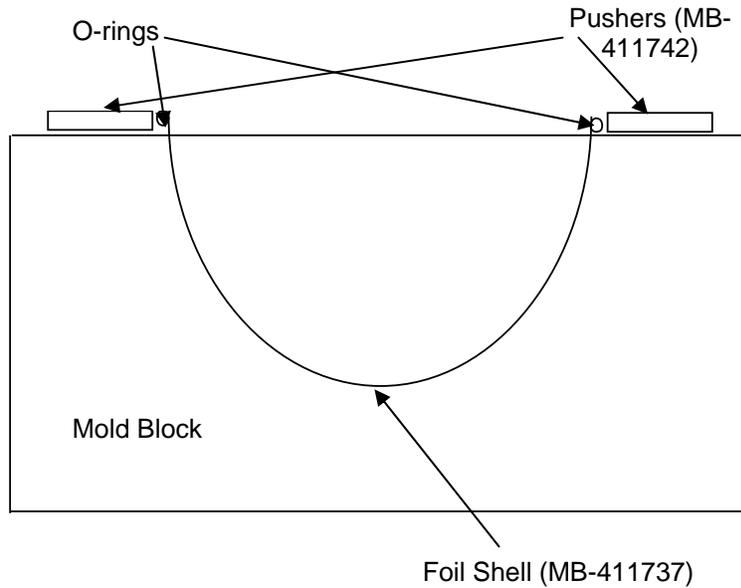
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- 7.7 Place the large .210" silicon o-ring lengths on each side of the shell. Vacuum grease them before placing. Let them hang out on either side of the tooling.

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 Technician(s) \_\_\_\_\_  
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- 7.8 Install the two o-ring pusher bars to hold the two lengths of O-ring along the Foil Shell.

O-rings and Pusher Bars (MB-411742) on the Mold

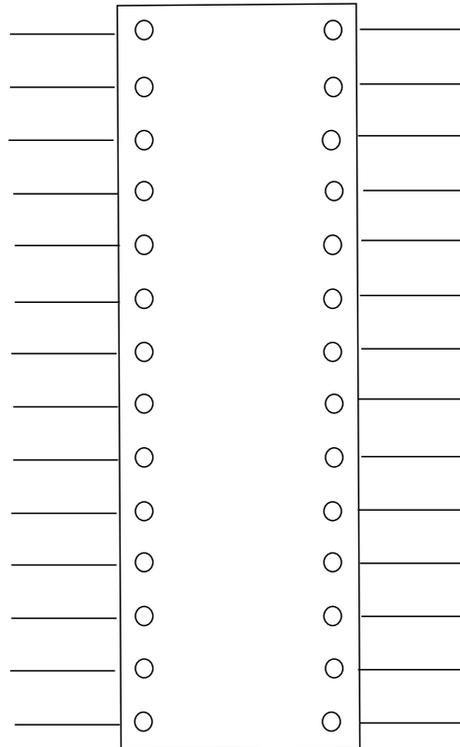


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- 7.12 Install the 3/4--10 nuts and washers and tighten the bolts equally and evenly until there is a zero gap at all bolt locations. Perform total of (28) Gap measurements on the Reaction Fixture Assembly (ME-411729).

Gap Measurement



Lead End  
Top View

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Technician(s)

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- 7.13 Use the thumb screws to push the Pushers (MB-411742) evenly into the o-rings sealing against the Foil Shell.

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- 7.14 Put the Teflon Return End spacers in place.

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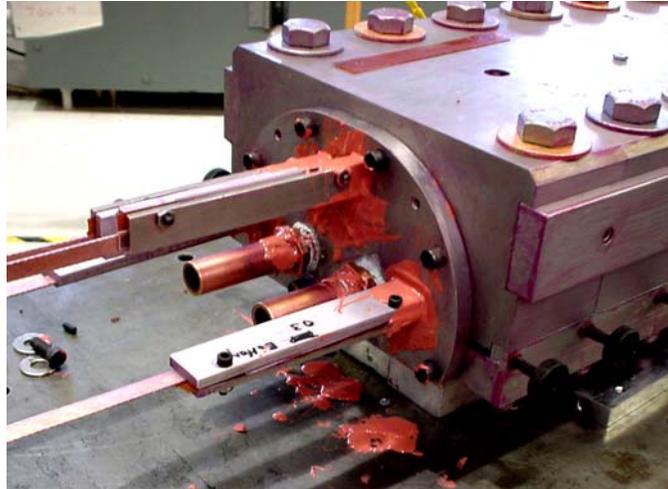
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- 7.15 Clean the Return End cover (MD-411740), install the o-ring and use RTV to seal during installation. Watch that the Foil Shell is inside the o-ring.

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- 7.16 Clean the Lead End Cover for Impregnation (MD-411739) and the Return End Cover (MD-411740) then coat with Mold Release. Install the O-rings in each End Cover.



Two Quad Coils sealed in the Impregnation Fixture showing the Lead End.

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- 7.17 Place the Return End Cover on the Impregnation Fixture and seal with RTV.

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- 7.18 Install the feed barb and the length of feed tubing into the return end plate.

7.19 Seal the leads with RTV. Use 8" of shrink tubing and fill it then shrink it working from the coil outward.

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Technician(s)

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7.20 Install the mold released 1" hose barbs into the lead end plate. Seal with Teflon tape.

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Technician(s)

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7.21 Seal the plate with RTV and place it on the lead end.

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8.0 Inspections before Impregnation

8.1 Perform a Pre-Impregnation Electrical Inspection for the full Coil. Coil Name \_\_\_\_\_

**Note(s):**

**The Cured Quadrupole in the Reaction Fixture Assembly should be isolated from Ground.**

**Support the Lead End at all times.**

**Record the measurements in the TQ Pre-Pot Electrical Checks from the TQ Volt Check excel spreadsheets. Attach the printout to the Traveler.**

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Inspector

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Date

8.2 Perform a Pre-Impregnation Electrical Inspection for the full Coil. Coil Name \_\_\_\_\_

**Note(s):**

**The Cured Quadrupole in the Reaction Fixture Assembly should be isolated from Ground.**

**Support the Lead End at all times.**

**Record the measurements in the TQ Pre-Pot Electrical Checks from the TQ Volt Check excel spreadsheets. Attach the printout to the Traveler.**

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Inspector

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8.3 Lift the mold assembly and place it into the potting stand.

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Technician(s)

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8.4 Work the silicone rubber seals over the lead ends.

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Technician(s)

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Date

8.5 Place the lead reservoir blocks and tighten them down. Use RTV to seal them.

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Technician(s)

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Date

8.6 Tie down and secure the leads for potting.

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Technician(s)

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Date

8.7 Fill the lead reservoirs with RTV.

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Technician(s)

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Date

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Serial No.: TQ  
Note(s)

8.8 Let it cure and install a 15” clear tube fastened in a loop to both hose barbs.

\_\_\_\_\_  
Technician(s) Date

8.9 Perform a leak back check. Pressurize to 2 psi.

\_\_\_\_\_  
Technician(s) Date

8.10 Cut off the reservoir leak test tube leaving one side 12” long.

\_\_\_\_\_  
Technician(s) Date

8.11 Install the other reservoir tube. Mark them off in one inch increments for epoxy level.

\_\_\_\_\_  
Technician(s) Date

8.12 Place the mold in the potting vessel.

\_\_\_\_\_  
Technician(s) Date

9.0 Impregnation Procedures

- 9.1 When mixing the epoxy CTD 101K, ensure that enough epoxy is mixed to complete the impregnation process. See the included (after the LBL Potting Procedures) Technical Data Sheet from Composite Technology Development, Inc.

100 parts Resin, or part A  
90 parts Hardener, or part B  
1.5 parts Accelerator, or part C

Close the Mixing vessel.  
Mix, Heat to 60°C and pump down to 30 - 40 µm Hg.  
40 min or when bubbles evolve infrequently.

\_\_\_\_\_  
Technician(s)

\_\_\_\_\_  
Date

9.2 Follow the included Fabrication (Potting) Procedures from LBL

**FABRICATION PROCEDURES**

Potting Procedures

Lawrence Berkeley Laboratory

Coil No. \_\_\_\_\_ and \_\_\_\_\_

**Superconducting Group**

**September 29, 2004**

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1.  Clean potting fixture and all related parts; use Dynabrade with medium to fine wheel to remove epoxy from prior potting. Mold release all parts to be removed with Krytox DF.
2.  Clean epoxy reservoir and lube all thru sliding fittings with vacuum grease.
3.  Clean and lube all o-rings. Clean out and inspect all o-ring sealing surfaces.
4.  Connect epoxy feed hose from the vacuum vessel to the epoxy reservoir. Take care to seal the barb fittings well. Pinch off the hose with a clamp.
5.  Hook up the heaters and epoxy tubing. Connect the thermocouples to the coil. Refer to the binder for the proper locations. Close up and seal the vacuum vessel.
6.  Verify that all the manual vacuum valves are closed and turn on the pump cart.
7.  Start up and set the data logger. Refer to the procedure in the binder.
8.  Start up the heater controllers and check the heaters. Refer to the procedure in the binder. Verify that the recorder is printing.
9.  Hook up the LN tank and turn the LN controller to AUTO. Open the tank valve and the LN trap will now fill automatically.
10.  Open the main valve at the LN trap. Turn on the vacuum gauge box. Open the valve at the vacuum vessel to begin pumping down. (The vacuum should be better than 100 m Torr)
11.  Follow the written instructions to start Profile "A" and start controller for the 3-hr. ramp to 55 C and hold at 55 C for 16 to 24 hr. This is the pre-heat pumping phase.

12.  To proceed, the vacuum must be better than 100 m Torr. Now the epoxy can be carefully measured, mixed and poured into the epoxy pot. Verify that the epoxy siphon tube is above the liquid.
13.  Clamp the epoxy pot lid in place for safety. Valve off the main vessel and open the vacuum line to the epoxy pot. Pump on the epoxy for 30 min or until the mix is pumped down to 200 – 300 m Torr.
14.  Turn on the epoxy mixer and heaters. Heat should not be over 60C.
15.  Keep the vacuum on the potting fixture @ 1 Torr. Lower the fill tube into the epoxy all the way to the bottom of the pot. Now the epoxy pot can be let up to atmosphere. As the pot is let up the epoxy will fill the hose up to the clamp or valve that isolates it from the coil.
16.  Remove the vacuum hose from the epoxy pot. This allows the introduction of the depth sensor.
17.  The coil is now ready to be filled. Slowly open the clamp to allow the epoxy to start filling the coil. Establish a fill rate by measuring the epoxy level in the pot. The fill rate should be 13 to 18 mm per hr. Fill rate should be monitored at all times during the fill. Hold the vacuum on the potting fixture @ 1 Torr.
18.  Monitor the level of epoxy in the pot and enter data every 10 minutes on “Vacuum Potting Log Sheets”.
19.  After the epoxy reaches the reservoir and fills to the desired level, close the clamp at the bottom fill line and let the vacuum vessel slowly up to atmosphere.
20.  Pump the vessel down to 1 Torr. Let the vessel back to atmosphere. Repeat this process.
21.  Check the reservoir, if not at the desired level, add more epoxy.
22.  Cover the mold with a blanket (If needed) and start the cure cycle Profile “B”. Refer to controller procedure to move the controller into Profile B.
23.  Clean all epoxy feed parts with alcohol before they can set.
24.  When cured, remove coil from the potting fixture.

\_\_\_\_\_  
Technician(s)

\_\_\_\_\_  
Date

# CTD-101K

CTD-101K is a modified anhydride cured epoxy system with excellent performance at cryogenic temperatures, and excellent radiation resistance. It is formulated with a very long pot life to enhance vacuum impregnation and RTM processing. Quoted performance properties are obtained by using the following procedure for mixing and curing the system.

MATERIALS	DESIGNATION	PARTS BY Weight
RESIN:	PART A	100.0
HARDENER:	PART B	90.0
ACCELERATOR:	PART C	1.5

**MIXING TEMPERATURE:**     **40-60°C**

**MIXING PROCEDURE:** Combine the weighed components into a container equipped with heating and mechanical stirring. Heat and stir the mixture until a clear solution at 40-60C is obtained. Degas the mix at 27 in. Hg for approximately 20 to 40 minutes until bubbles evolve infrequently from the mixture. The system is now ready for application.

**POT LIFE:**

<u>Temperature (°C)</u>	<u>Pot Life (Hr)</u>	<u>Viscosity (Cp)</u>
25	145	1300
40	60	400
60	20	100

<b>CURE:</b>	<u>Standard</u> 5 Hrs. @ 110°C	<u>Accelerated</u> 1.5 Hrs. @ 135°C
<b>POST CURE:</b>	16 Hrs. @ 125°C	None

**Composite Technology Development, Inc.**  
 1505 COAL CREEK DRIVE, LAFAYETTE, COLORADO 80026  
 Ph: (303)664-0394 / Fax: (303)664-0392

10.0 Magnet Curing

10.1 Cure the Magnet by maintaining 110°C for 5 hours

Start Time \_\_\_\_\_

End Time \_\_\_\_\_

\_\_\_\_\_  
Technician(s) Date

10.2 Post Cure the Magnet by maintaining 125°C for 16 hours

Start Time \_\_\_\_\_

End Time \_\_\_\_\_

\_\_\_\_\_  
Technician(s) Date

10.3 Attach the temperature chart to this traveler. Ensure that the magnet serial number and date cured is written on the temperature chart.

\_\_\_\_\_  
Technician(s) Date

11.0 Magnet Clean Up and Preparation

11.1 Remove the Impregnation Fixture carefully clean and remove the RTV as the Impregnated Coils are exposed.

\_\_\_\_\_  
Technician(s) Date

11.2 Remove the RTV from the magnet. Clean the magnet with KPC 820N (Fermi stock 1920-0700) or equivalent and Heavy Disposable Wipers (Fermi stock 1660-2600) or equivalent.

\_\_\_\_\_  
Technician(s) Date

11.3 Perform a post Impregnation Electrical Inspection for the full Coil. Coil Name \_\_\_\_\_

**Note(s):**

**The Cured Quadrupole in the Reaction Fixture Assembly should be isolated from Ground Support the Lead End at all times.**

**Record the measurements in the TQ Post-Pot Electrical Checks from the TQ Volt Check excel spreadsheets. Attach the printout to the Traveler.**

\_\_\_\_\_  
Inspector

\_\_\_\_\_  
Date

11.4 Perform a post Impregnation Electrical Inspection for the full Coil. Coil Name \_\_\_\_\_

**Note(s):**

**The Cured Quadrupole in the Reaction Fixture Assembly should be isolated from Ground. Support the Lead End at all times.**

**Record the measurements in the TQ Post-Pot Electrical Checks from the TQ Volt Check excel spreadsheets. Attach the printout to the Traveler.**

\_\_\_\_\_  
Inspector

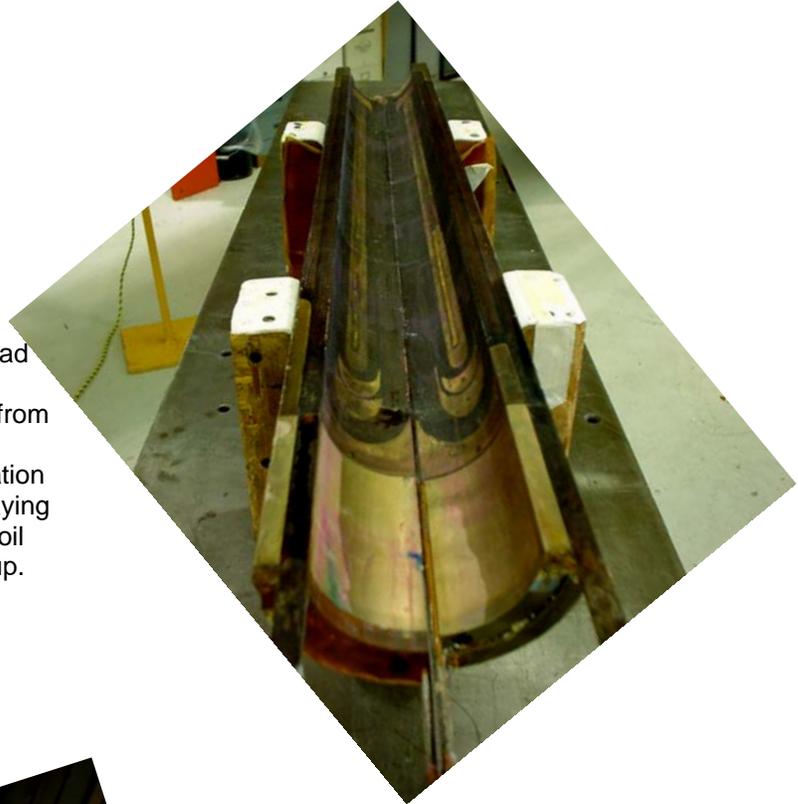
\_\_\_\_\_  
Date

12.0 After Impregnation

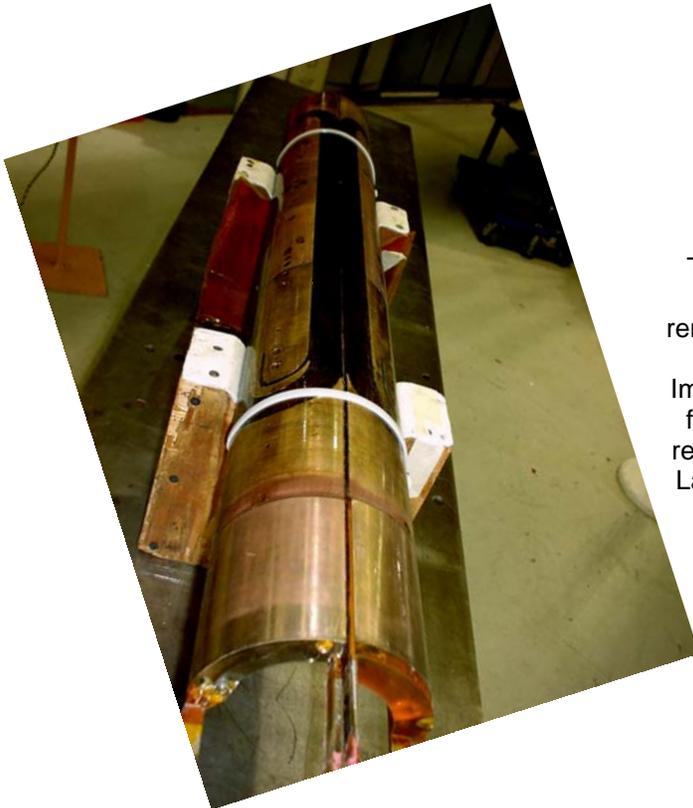


Two Epoxy Impregnated Quad Coils on the Impregnation Fixture Base Plate with the Coil Spacer.

Two Quad  
Coils  
removed from  
the  
Impregnation  
Fixture, laying  
Inner Coil  
facing up.



Two Quad  
Coils  
removed from  
the  
Impregnation  
fixture and  
resting Outer  
Layer facing  
up.



13.0 Production Complete

Process Engineering verifies that the Traveler is accurate and complete. This shall include a review of all steps to ensure that all operations have been completed and signed off. Ensure that all Discrepancy Reports and dispositions have been reviewed by the Responsible Authority for conformance before being approved.

Comments:

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\_\_\_\_\_  
Process Engineering/Designee

\_\_\_\_\_  
Date

13.1 Location of Impregnated Coils, either stay at LBL or are shipped to FNAL

Coil Serial Number      Location \_\_\_\_\_

Date \_\_\_\_\_

Coil Serial Number      Location \_\_\_\_\_

Date \_\_\_\_\_

\_\_\_\_\_  
Crew Chief

\_\_\_\_\_  
Date