

f	Fermi National Accelerator Laboratory Batavia, IL 60510	
LARP 90mm QUADRUPOLE MODEL INNER COIL and OUTER COIL WINDING and CURING TRAVELER		
Reference Drawing(s) Cured Inner Coil Assembly ME-411783 Cured Outer Coil Assembly ME-411784 Cured Quarter Coil Assembly ME-411785		
Project# / Task #: 30/30.8.2.02.2.2		Job #: 266
Released Jan Szal		Magnet/Device Series: Test
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LARP Quadrupole Inner and Outer Coil
Winding and Curing Traveler

Serial No.: <SerialNo>-<ReworkID>

Note(s): <Notes>

LBNL/HFM Task Manager	Shlomo Caspi / Designee	
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LARP Quadrupole Inner and Outer Coil
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Note(s): «Notes»

Revision Page

Revision	Step No.	Revision Description	TRR No.	Date
None	N/A	Initial Release	N/A	9/16/05
A	4.1	Added picture to illustrate the added slits. Added statement: . Both LBL TQS and Fermi TQC need the end pieces to be slit to ease forming around the cable. Confirm the slit is correctly finished to the curved of the end pieces or hand finish. Done _____	1774	9/21/05
	4.3	Added picture to illustrate the 1.25 mm gap between the poles and the center pole pieces.		
	4.5	Added picture to illustrate the Coil End Clamping Assemblies (MB-376131) and the Roller Guide Support Bar (MC-376105)		
	4.6	Add statement: To introduce a twist in the favorable direction (counter-clockwise), rotate the Inner Coil Reel of Insulated Conductor 360 ⁰ in the clockwise direction. The CCW twist in the conductor should help prevent decabbling. Included picture showing the CCW Twist.		
	5.1	Replaced Winder/Tensioner picture with current setup picture which also shows the full CCW cable twist now used for winding. Also deleted original drawing of cable feed. Added note: The thick edge of the Cable is mounted up Removed phrase “through the pulleys”.		
	5.3	Added statement: See the pictures in step 4.5.		
	6.3	Added picture of installed voltage tap and included the LBL Voltage Tap Installation Procedure		
	6.8	Updated the drawing to show Tensioner #2 in place.		
	6.11 and 6.14	Added statement: The gap should match the gap established at the LE and RE Poles, 1.25 mm. See step 4.3.		
	6.15	Issued DR 4288 because of decabbling problem. To prevent further decabbling a full CCW twist in the favorable direction was added between the Tensioner and the Winder.		
	7.2	Changed ceramic cloth length from 2 3/8” to 7.0” long.		
	7.3	Added this step: Insert Teflon Pipe Tape between the Inner to the Outer Pole Transition and the Lead End of the Coil Curved Surface. This Teflon Tape is temporary during the Curing Process. Remove the Teflon Tape after Curing Layer One.		
	7.6	Added statement: . Roll it counter clockwise, when viewed from the Lead End, onto the coil’s side on the table and attach the lifting eye bolts. Do not allow the cable to twist or have sharp bends while moving the coil. Included a picture to show the coil positioned on the cart.		
	12.1	Added statement: machine Rotate the Outer Layer Cable Spool 360 ⁰ in the Clockwise direction to introduce a full Counter Clockwise Twist in the Favorable direction into the Cable to the Coil.. Included a picture showing the Winder/Tensioner setup.		
	12.6	Added picture to illustrate the 10 mil Ceramic Blanket over the Cured Inner layer.		
	13.1	Add statement: To introduce a twist in the favorable direction (counter-clockwise), rotate the outer Coil Reel of Insulated Conductor 360 ⁰ in the clockwise direction. The CCW twist in the conductor should help prevent decabbling. Included picture showing the CCW Twist.		

LARP Quadrupole Inner and Outer Coil
Winding and Curing Traveler

Serial No.: <<SerialNo>>-<<ReworkID>>

Note(s): <<Notes>>

Revision	Step No.	Revision Description	TRR No.	Date
	14.2	Added statement: See step 4.3 for detailed Voltage Tap Installation Procedures. Included a picture of two Voltage Taps installed on the Outer Layer.		
	14.9	Added statement: Along the Lead End Saddle add a piece of 10 mil Ceramic Cloth that is 7.0" long		
	20.4 and 20.5	Moved these steps after step 21.3 and renumbered to 21.4 and 21.5.		
B	23.1	Added program name: (compactpop 16HFM)	1782	10/21/2005
	23.3	Added To reposition the Coil Sizer <ol style="list-style-type: none"> 1) To raise or lower the Coil Sizer, switch to control to LOCAL and switch the control to RAISE. 2) Raise the Coil Sizer and move it to the location between the Mandrel and the Return End of the Coil 3) Switch the control to OFF to lower the Coil Sizer. 		
	23.9	Added To reposition the Coil Sizer <ol style="list-style-type: none"> 1) To raise or lower the Coil Sizer, switch to control to LOCAL and switch the control to RAISE. 2) Raise the Coil Sizer and move it to the Coil Master. 3) Switch the control to OFF to lower the Coil Sizer. 		
	22.3	Added picture of the Coil Sizer over the Return End of the Coil		
	22.4	Added picture of the Lead End of the Coil on the Sizer Mandrel		
	23.1	Added picture of the Computer with the HFM sizing program running Added statement: To move the Sizer forward and back for positioning, be sure the left knob is pointing at OFF and the right know is pointing at LOCAL		

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 product/assembly with Green Herculite (Fermi stock 1740-0100) when not being serviced or assembled.

2.0 Parts Kit List

- 2.1 Attach the completed Parts Kit List to this traveler. Ensure that the serial number on the Parts Kit List matches the serial number of this traveler. Verify that the Parts Kit received is complete.

Process Engineering/Designee

Date

3.0 Mandrel Preparation:

- 3.1 Prepare two Reels with only one insulated Cable, one Reel for the Inner Coil and the other for the Outer Coil. Inner Coil Reel of cable needs 30.5 m (100.1') of cable which includes 1 m (3.281') for the lead.. Outer Coil Reel of cable needs 25 m (82.02') of cable which includes a 1 m (3.281') leader. Record the Cable Reel Serial No. used.

Reel Serial No. _____

Technician(s)

Date

- 3.2 Using the overhead crane and appropriate lifting device, position the Winding Mandrel Assembly (MC-411727) onto the winding table, and attach them together.

Note(s):

When mounting the Winding Mandrel to the Winding Table ensure that the Lead End (4 Mandrel Blocks) of the Mandrel is at the same end of the fixture as the motor.

Technician(s)

Date

- 3.3 Clean the Winding Table and the Inner Coil Winding Mandrel Assembly using a vacuum, Isopropyl Alcohol (Fermi stock 1920-0300) and Heavy Disposable Wipers (Fermi stock 1660-2600) or equivalent ensuring that all the tooling is clean of dirt, dust and other contaminants.

Technician(s)

Date

- 3.4 Before mounting pole pieces, spacers and transition pieces, place a 5 mil thick kapton tape layer 4 “ wide, on the Mandrel to insulate and protect the cable.

Technician(s)

Date

- 3.5 Use a file, fine round, (Fermi Stock 1246-1760) or equivalent, to deburr all the Retainers and Sizing Bars if required. Once these items have been deburred, clean them using Isopropyl Alcohol (Fermi stock 1920-0300) and Heavy Disposable Wipers (Fermi stock 1660-2600) or equivalent.

Item Description:	Quantity	Part Number	Completed
Quad. Coil Winding Mandrel Assembly		MC-411727	
Mandrel Support Block		MD-344049	
Mandrel Block		MC-411718	
Spacer		MD-411720	
Pusher Inner		MD-411721	
Guiding Spacer		MB-411726	
Sector Inner		MB-411723	
Mold Retainer		MD-344109	
Roller Guide Support		MC-376111	
Teflon Retainers		MC-376115/376116	
Roller Guide Support Bar		MC-376105	

Technician(s)

Date

- 3.6 Mount the Roller Guide Support Bar and the Roller Guide Supports onto the Winding Mandrel.

Technician(s)

Date

4.0 Pre-Coil Winding Preparation for Inner Layer:

- 4.1 Using Heavy Disposable Wipers (Fermi stock 1660-2600) or equivalent, clean the items specified in the table provided. Both LBL TQS and Fermi TQC need the end pieces to be slit to ease forming around the cable. Confirm the slit is correctly finished to the curved of the end pieces or hand finish. Done _____



Layer One, Return End. End Parts with Slits cut in two pieces.



Layer One, Lead End, End Parts with Slit cut in one piece.

Description (Qty) for TQC w/Radius	Part No.	Cleaned
L1_LE_POLE_LARP_90mm	MC-411768	
L1_LE_SPACER1_LARP_90mm	MC-411827	
L1_LE_SPACER2_LARP_90mm	MC-411828	
L1_LE_SADDLE_LARP_90mm	MC-411771	
L1_POLE_SPACER_LARP_90mm	MD-411786	
L1_LE_SPLICE_BLOCK_LARP_90mm	MC-411793	
L1_LE_POLE_EXTENSION Transition Assembly	MD-411764	
L1_RE_POLE_LARP_90mm	MC-411844	
L1_RE_SPACER1_LARP_90mm	MC-411826	
L1_RE_SADDLE_LARP_90mm (1)	MC-411767	
INNER WEDGE	MD-411756	

OR

Description (Qty) for TQS w/o Radius	Part No.	Cleaned
L1_LE_POLE_LARP_90mm (1)	MC-411822	
L1_LE_SPACER1_LARP_90mm (1)	MC-411827	
L1_LE_SPACER2_LARP_90mm (1)	MC-411828	
L1_LE_SADDLE_LARP_90mm (1)	MC-411771	
L1_POLE_SPACER_LARP_90mm (1)	MD-411813	
L1_LE_SPLICE_BLOCK_LARP_90mm (1)	MC-411793	
L1_LE_POLE_EXTENSION (1)	MD-411825	
L1_RE_POLE_LARP_90mm (1)	MC-411765	
L1_RE_SPACER1_LARP_90mm (1)	MC-411826	
L1_RE_SADDLE_LARP_90mm (1)	MC-411767	
INNER WEDGE (2)	MD-411756	

Technician(s)

Date

LARP Quadrupole Inner and Outer Coil
Winding and Curing Traveler

Serial No.: «SerialNo»-«ReworkID»

Note(s): «Notes»

- 4.2 Attach the Inner Pole Spacer (MD-411786 for TQC or MD-411813 for TQS) to the Winding Mandrel with screws.

Technician(s)

Date

- 4.3 Attach the Inner Layer Lead End Pole (MC-411768 for TQC or MD-411822 for TQS) and Inner Layer Return End Pole (MC-3411844 for TQC or MD-411765 for TQS) to the Winding Mandrel. Make sure to align both the Lead End and Return End Poles with the Inner Layer Inner Pole Spacer (MD-411786 for TQC or MD-411813 for TQS). The gaps are to be modified to 1.25 mm on each end. Measure the gap between the Return End and the Lead End Pole and Center Pole Pieces



Gap between Lead End and Return End Poles and the Center Spacers. Gap is to be set at 1.25 mm.

LE Gap _____

RE Gap _____

Technician(s)

Date

- 4.4 Place 5 mils of ceramic tape insulation around the Layer One Lead End Pole (MC-411768 for TQC or MD-411822 for TQS), the Return End Pole (MC-3411844 for TQC or MD-411765 for TQS) and the Layer One Pole Spacers. Be sure the ceramic tape insulation protects the cable from shorting to the metal surfaces.

Technician(s)

Date

- 4.5 Attach the Coil End Clamp Assemblies (MB-376131) to the Winding Mandrel on both the Lead End and Return End.



Coil End Clamping
Assemblies (MB-
376131)

Coil End Clamping
Assemblies (MB-376131)



Roller Guide Support
Bar (MC-376105)

Technician(s)

Date

LARP Quadrupole Inner and Outer Coil
Winding and Curing Traveler

Serial No.: «SerialNo»-«ReworkID»

Note(s): «Notes»

- 4.6 Using the overhead crane and appropriate lifting device, position the Reel of Insulated Conductor for the Inner Coil onto the tensioning machine with the thick edge of the Conductor facing up. To introduce a twist in the favorable direction (counter-clockwise), rotate the **Inner Coil Reel** of Insulated Conductor 360° in the clockwise direction. The CCW twist in the conductor should help prevent decabbling.



Cable from Cable Spool to Coil showing the full CCW Twist in the Favorable direction

Technician(s) Date

- 4.7 Using the overhead crane and appropriate lifting device, position the Reel of Insulated Conductor for the **Outer Coil** above the winding table.

Technician(s) Date

- 4.8 Before insulating the wedges be sure the witness mark will remain visible by adding either scribe marks or marker to the ends of the wedges)

Technician(s) Date

- 4.9 Insulate the Wedges with the cured ceramic sleeve insulation.

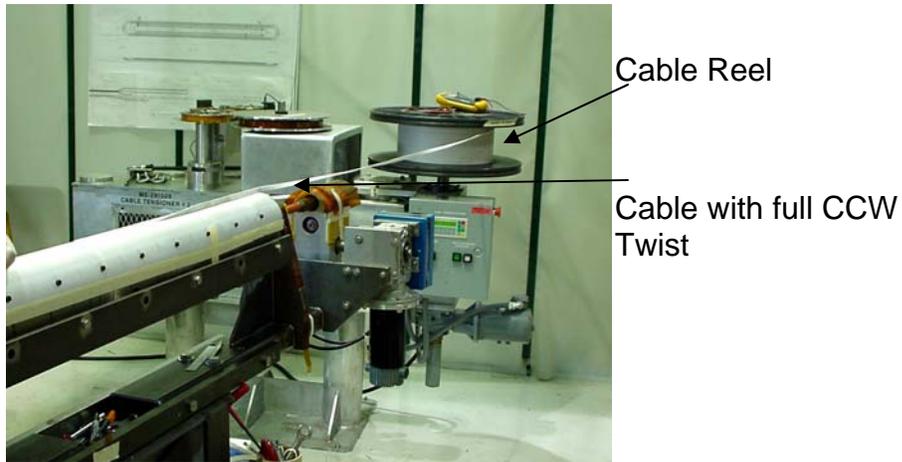
Note:

For all wedges, the witness mark should be closer to the pole side..

Technician(s) Date

5.0 Inner Coil Winding Set-Up

5.1 Thread the cable off the reel on Tensioner #2, as shown below.



Coil Winding and Tensioner System

Note(s):

The thick edge of the Cable is mounted up.

The cable tension is determined by the cross-section of the cable.

Technician(s)

Date

5.2 Attach the Cable to the Coil Lead End Clamp Assembly (MC-376131) on the ramp side of the Lead End.

Technician(s)

Date

5.3 Place Ceramic Insulation tape on both sides of Inner Pole Spacer (MD-411786) as per Cured Inner Layer. Wrap the Ceramic Tape all the way around the Poles and Spacers. See the pictures in step 4.5.

Note:

The two sides of the Lead End Inner Pole are insulated with 5 mil thick ceramic tape insulation.

Technician(s)

Date

6.0 Inner Coil Winding

- 6.1 Position the turntable so that the Conductor lays flat against the Inner Layer Inner Pole (MD-411761). Clamp the straight section against the Inner Layer Inner Pole on the side with the transition. Increase Winding tension to 35 lbs. Winding tension should be kept at 35 lbs. throughout the entire Coil Winding.

Note(s):

Coil is wound Clockwise.

Constantly monitor for a cable to ground short through out the winding process.

Ensure that the Protective (Kapton tape) Insulated Steel Bars are installed between the Clamp and Conductor.

Technician(s)

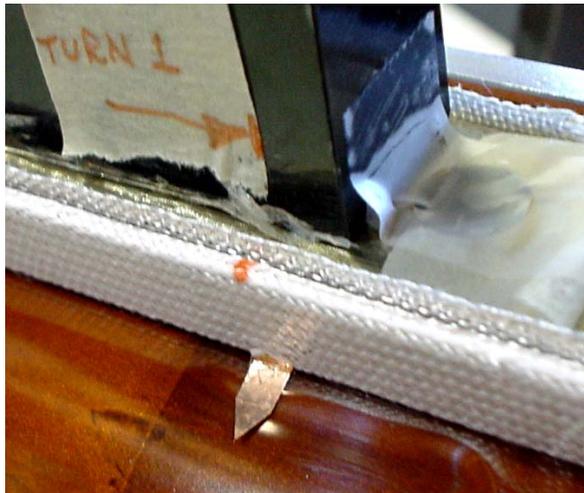
Date

- 6.2 Wind Turn 1 around Inner Layer Return End Pole (MC-411844 for TQC and MC-411765 for TQS), using a combination of Mandrel and Table rotations. Rotate the Table until Conductor lays flat against the Inner Layer Inner Pole (MD-411761), and install the Clamps. Make sure that the cable sits properly against the End Parts Surfaces. Tap slightly, if needed, using a plastic hammer.

Technician(s)

Date

- 6.3 Add the Voltage Taps to the cable for the first turn. See the locations specified in the drawing from LBL
Cable with Ceramic
Insulation



Voltage Tap Installed at the marked location, by curling over the top of cable, passing under the layer of Ceramic Insulation with the voltage connection extending below the cable.

Voltage Tap Installation Procedure, LBL Specifications

1. Burnish the tap with a smooth dowel pin. Push it down in the die with a section of cable to form it.
2. Wind the conductor far enough onto the coil to accurately mark the tap location. Mark only with non-conductive pen such as a colored Sharpie.
3. Unwind the conductor until the tap location clears the winding plates.
4. Use a clip on the insulation to keep the slack from passing the tap location.
5. Squeeze and pull the insulation to move a slack spot up to the tap location.
6. Make a hole in the top of the insulation and widen it to accept the tap.
7. Install the tap with the point going down the side toward the tap pocket. Push the tap until the point comes out the bottom.
8. Seat the tap allowing the short leg to hang over on the other side of the conductor.
9. Close the access hole in the insulation and work the loose insulation back towards the reel.
10. Continue to wind the coil, laying the protruding tap flat.
11. Cut and install two small pieces of mica, sandwiching the voltage tap as it is laying flat
12. Use caution as the other wraps are laid in, verifying that they do not disturb the tap and or mica shielding pieces.

Technician(s)

Date

- 6.4 Reduce the tension to 25 lbs. then wind Turn 1 around the Inner Layer Return End Pole. Then increase the tension to 35 lbs. Clamp turn 1 before winding around the Lead End Pole. Locate the position of the 3rd voltage tap and mark the location with a non-black marker. After locating the 3 Taps make the second turn and trap Mica Sheet pieces placed under and on the Voltage Taps. See LBL Inner Tap locations Rev. B.

Technician(s)

Date

- 6.5 Replacing the Clamps as needed, proceed to the Return End. Continue the Winding process, Clamping as required, until there are 5 turns wound on the Lead End and the cable is exiting the Coil at the Return End. Install the Turn 6 Lead End Voltage Tap. See LBL drawing..

Technician(s)

Date

- 6.6 Install the Inner Layer Lead End Spacer 1 (MC-411827) and Inner Layer Return End Spacer 1 (MC-411826) per the Cured Inner Layer (ME-411182). Slowly engage the winding table, turning the radius sufficiently to capture the Inner Layer Return End Spacer 1 and stop the Table when the Conductor holds the Inner Layer Lead End Spacer 1 firmly in place. Just before trapping the Spacers, be sure to insulate the metal surfaces with 10 mil ceramic tape. The tape protects the cable from abrasion against the metal parts.

Note(s):

Press the Spacer on to the Mandrel using the End Clamp.

Technician(s)

Date

- 6.7 Position the Insulated Inner Layer Wedge (MD-411756) on the **Transition Side** (cable moves from inner coil to outer coil) against Turn 6 of the Coil with the notch of the Wedges located closest to the pole, then Clamp into place.

Note(s):

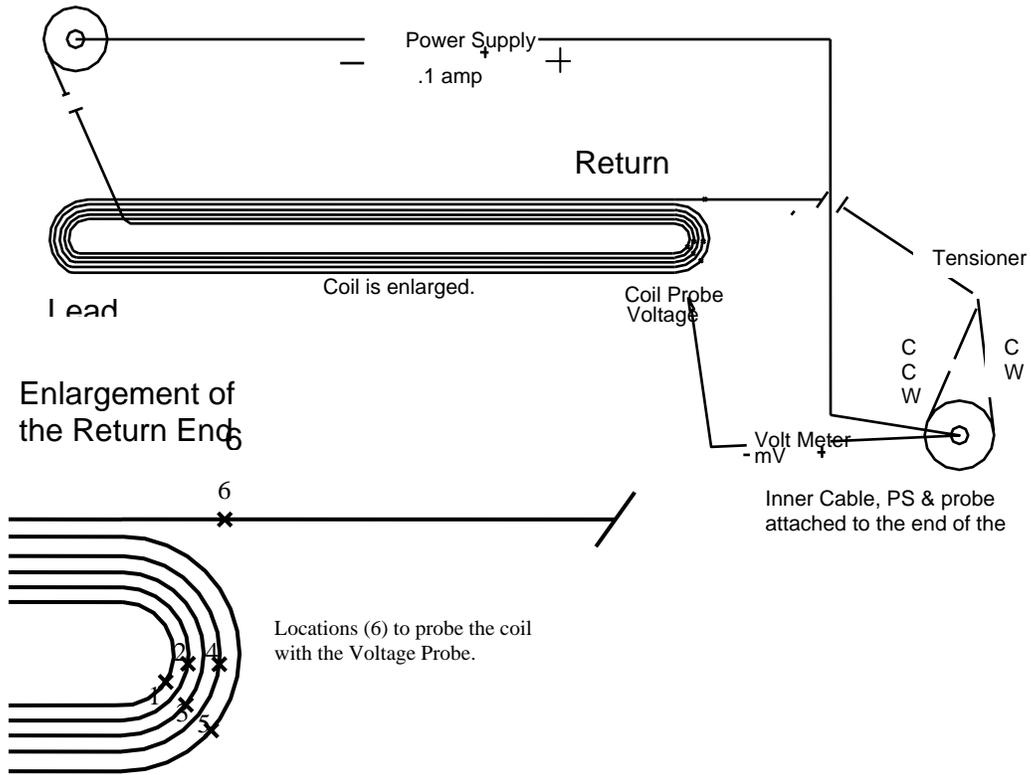
Check that the witness mark on the Wedge is closest to the Inner Layer pole spacer.

Technician(s)

Date

6.8 Perform turn to turn Electrical tests.

Suspended
Outer Coil
Cable Spool.
Power Supply
attached to end



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

Instrument Used	Current Applied	Turn number	Measured Voltage
	1 Amp	1	
		2	
		3	
		4	
		5	
		6	

Review the Turn to Turn measurements. Continue Winding Yes _____ No _____

Responsible Authority

Date

- 6.9 Install the Inner Layer Lead End Spacer 2 (MC-411828). Slowly engage the winding table, turning the radius sufficiently to capture the Inner Layer Lead End Spacer 2.

Note(s):

Press the Spacer on to the Mandrel using the End Clamp.

Use 10 mil ceramic tape over the spacer to protect the cable.

Technician(s)

Date

- 6.10 Continue the winding process, stopping the table when the Conductor holds the Inner Layer Lead End Spacer 2 firmly in place.

Note(s):

Press the Spacer on to the Mandrel using the End Clamp.

Technician(s)

Date

- 6.11 Record the gaps between the Inner Layer Wedge (MD-411756) and the End Spacers in the Table provided. (See Numbers in drawing _____ to check). The gap should match the gap established at the LE and RE Poles, 1.25 mm. See step 4.3.

	Gap Between Lead End Spacer & Wedge	Wedge Length	Gap Between Return End Spacer & Wedge
Transition Side	1		2

Technician(s)

Date

- 6.12 Position the Insulated Inner Layer Wedge (MD-411756) on the **Non transition Side** against Turn 6 of the Coil with the notch of the Wedges located closest to the pole, then Clamp into place.

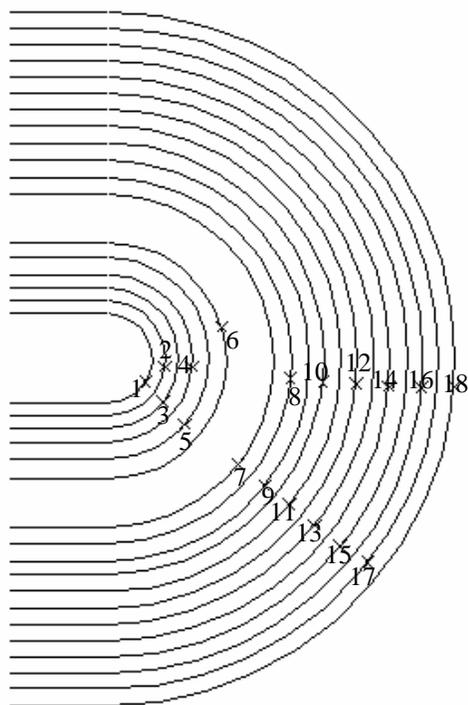
Note(s):

Check that the witness mark on the Wedge is closest to the Inner Layer pole spacer.

Technician(s)

Date

- 6.19 Perform turn to turn Electrical tests. Check all turns, 1 to 18. Record the results in the table that follows.



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

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

Instrument Used	Current Applied	Turn number	Measured voltage
	1 Amp	1	
		2	
		3	
		4	
		5	
		6	
		7	
		8	
		9	
		10	
		11	
		12	
		13	
		14	
		15	
		16	
		17	
		18	

Review the Turn to Turn measurements. Continue Winding Yes _____ No _____

 Responsible Authority

 Date

7.0 Inner Coil Packaging:

7.1 Place shims (currently .050" (1 each side) with added Kapton shimming .010" (each side) with the Inner Layer Sector sections (MD-411723) and attach them on either side of the Mandrel as per Coil Winding Fixture Assembly (MD-411727).

Thickness of Shim Installed _____

Technician(s)

Date

7.2 Along the Lead End Saddle add a piece of 10 mil Ceramic Cloth that is 7.0" long. This protects the Power Lead Cable from the Saddle.

Technician(s)

Date

7.3 Insert Teflon Pipe Tape between the Inner to the Outer Pole Transition and the Lead End of the Coil Curved Surface. This Teflon Tape is temporary during the Curing Process. Remove the Teflon Tape after Curing Layer One.

Technician(s)

Date

7.4 Secure the Inner coil around the coil and mandrel with cable ties. Then remove the Teflon layer retainers and the End Clamp Assemblies.

Technician(s)

Date

7.4 Measure the Coil length from End Saddle to End Saddle.

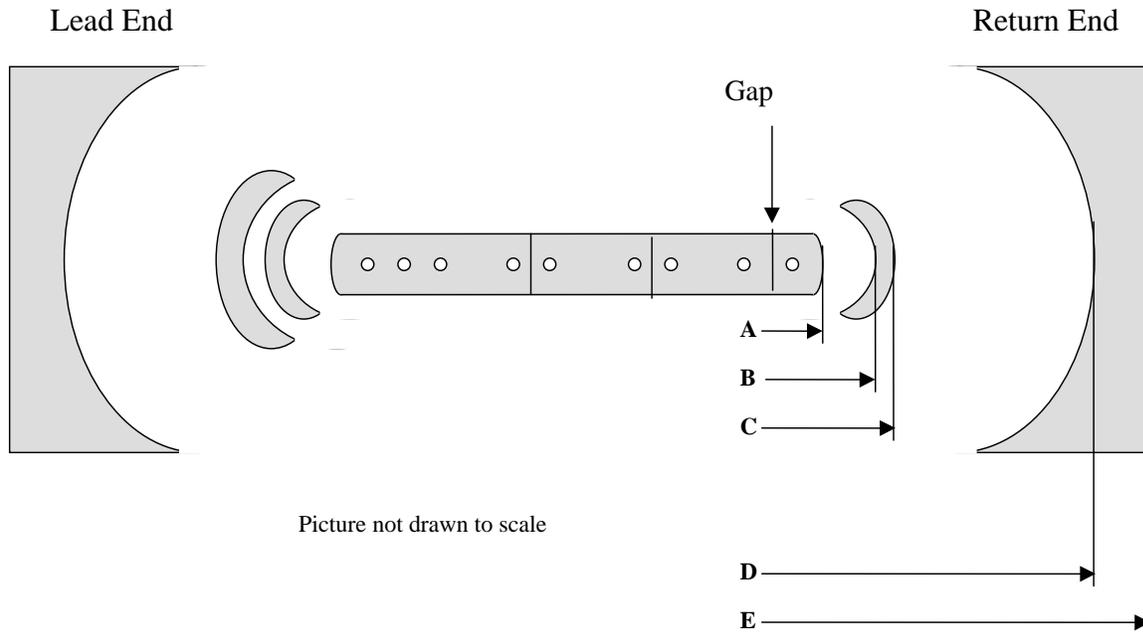
Coil Length _____

Inspector

Date

7.5 Using a caliper or equivalent, measure the Return End of the Coil.

Inner Layer



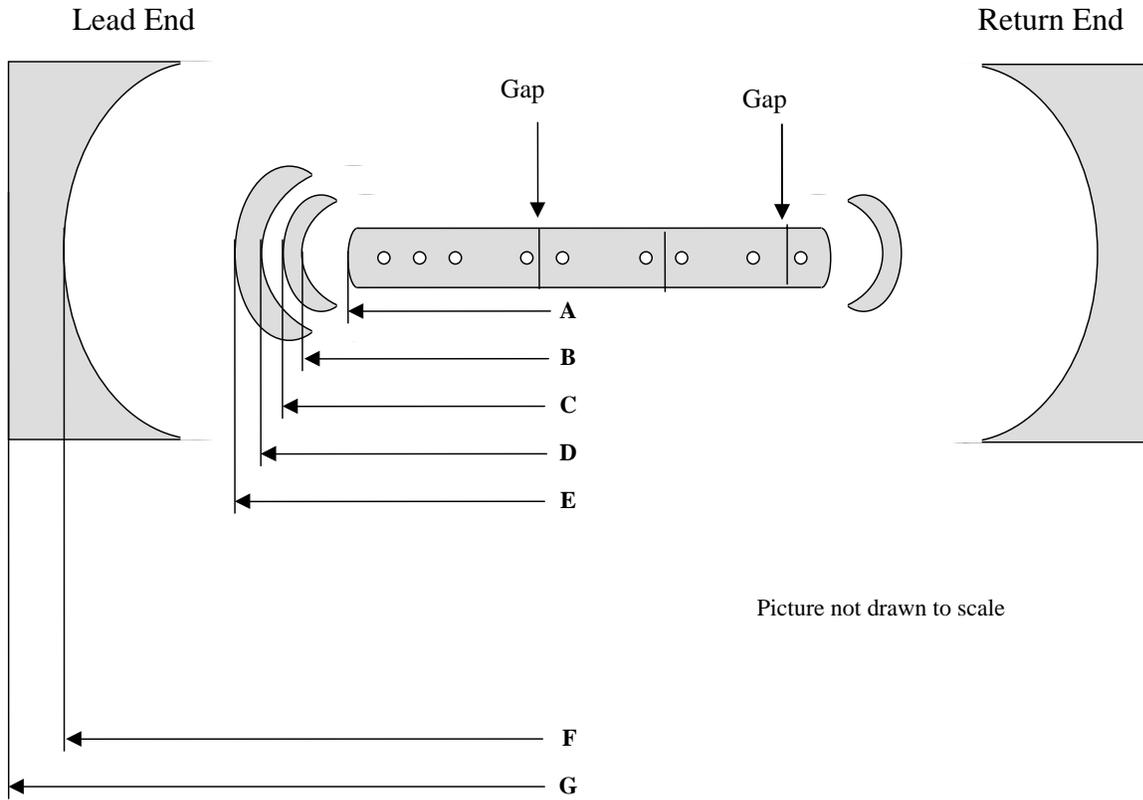
Return End	Nominal (to spacer) mm/in	Measured (to spacer)	Gap between spacer and conductor
A (End of 411761)	60/2.362		
B (Start of 411766)	70.59/2.779		
C (End of 411766)	110/4.331		
D (Start of 411767)	132.51/5.217		
E (End of 411767)	161.42/6.355		

Inspector

Date

7.6 Using a caliper or equivalent, measure the Lead End of the Coil.

Inner Layer



Picture not drawn to scale

Lead End	Nominal (to spacer) mm/in	Measured (to spacer)	Gap between spacer and conductor
A (End of 411768)	217.09/8.547		
B (Start of 411769)	225.91/8.895		
C (End of 411769)	242.09/9.532		
D (Start of 411770)	243.91/9.603		
E (End of 411770)	265.33/10.446		
F (Start of 411771)	285.97/11.259		
G (End of 411771)	309.9/12.201		

Inspector _____

Date _____

LARP Quadrupole Inner and Outer Coil
Winding and Curing Traveler

Serial No.: «SerialNo»-«ReworkID»

Note(s): «Notes»

7.10 Install the Inner Pushers (MD-41721) to each side of the Mandrel. Refer to drawing (MD-411727).

Technician(s) Date

7.11 Install the Outer Pushers (MD-411722) over the Inner Pushers. See Assembly (MD-411727)

Technician(s) Date

7.12 Place the 10 mil thick Stainless Steel shim over the Winding Fixture Assembly. Adjustments to the thickness of the shim applied to the External Shells may be required Record the amount of shimming used.

Actual shims used _____

Responsible Authority/ Date

7.13 The Mold Retainer (MD-344109) is secured over the whole assembly. Be sure to protect the cable from the Retainer with Kapton sheet.

Technician(s) Date

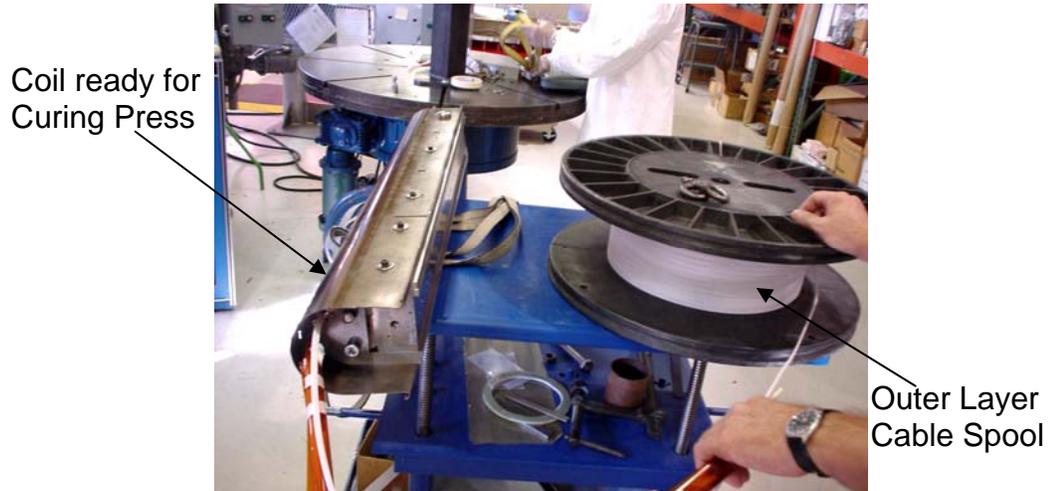
7.14 Ensure the Cable is secured, reduce tension and shut off the Tensioner. Cut the Cable one (1) meter from the Saddle.

Technician(s) Date

7.15 Use proper slings and lifting device to move the Outer Coil Cable Spool to a rolling table. Be cautious with the attached cable, do not damage.

Technician(s) Date

- 7.16 Secure the Mandrel and Coil Assembly with slings and remove it from the winding table. Place the Winding Assembly on the rolling table. Roll it counter clockwise, when viewed from the Lead End, onto the coil's side on the table and attach the lifting eye bolts. Do not allow the cable to twist or have sharp bends while moving the coil. Move the rolling cart with the spool and winding assembly to the area of the curing press.



Inner Layer Coil in the Curing Fixture Prepared for the Curing Press. The Outer Layer Cable Spool is attached.

Technician(s)

Date

- 7.17 Lift and rotate the Winding Assembly with the Mandrel to the Up-side down position.

Technician(s)

Date

9.0 Curing the Inner Coil

9.1 Connect the Chromolox Resistance Heaters.

9.2 Use the Curing Press to apply the following pressures:

- a) Mandrel Pressure to 500 psi
- b) Platen Pressure to 500 psi
- c) Record Platen Gaps in the table below

SIDE A	SIDE B

9.3 Use the Curing Press to apply the following pressures:

- a) Platen Pressure to 0psi
- b) Mandrel Pressure to 0psi

9.4 Use the Curing Press to apply the following pressures. Record the time that pressure is attained.

- a) Mandrel Pressure to 500 psi
- b) Platen Pressure to 750 psi
- c) Record Platen Gaps in the table below

SIDE A	SIDE B

9.5 Use the Curing Press to apply the following pressures. Record the time that pressure is attained.

- a) Mandrel Pressure to 500 psi
- b) Platen Pressure to 1000 psi
- c) Record Platen Gaps in the table below

SIDE A	SIDE B

d) **If the measured gaps are both zero (0) then it is not necessary to increase the pressure in the next steps.**

9.6 Use the Curing Press to apply the following pressures. Record the time that pressure is attained.

- a) Mandrel Pressure to 500 psi
- b) Platen Pressure to 1500 psi
- c) Record Platen Gaps in the table below
- d) Start the Cure cycle Time _____

SIDE A	SIDE B

9.7 Use the Curing Press to apply the following pressures. Record the time that temperature is attained.

- a) Temperature to 150°C Time _____
- b) Mandrel Pressure to 500 psi
- c) Platen Pressure to 1500 psi
- d) Record Platen Gaps in the table below

SIDE A	SIDE B

9.8

- a) Wait for 30 minutes
- b) Record temp _____
- c) Switch off the heaters and lock off the hydraulic system

Technician(s)

Date

9.9 Record Temperature, Time and Platen Gaps.

- a) Date and Time _____
- b) Temperature _____
- c) Mandrel Pressure to _____ psi
- d) Platen Pressure to _____ psi
- e) Record Platen Gaps in the table below

SIDE A	SIDE B

Technician(s)

Date

10.0 Inner Coil Curing Cycle Complete

10.1 Shut down the System Power. Make sure that all power systems are shut down.

Mandrel Hydraulic System

Platen Hydraulic System

Electric Heater Control System

Technician(s)

Date

10.2 After cooling, extract the Mold from the Press.

Technician(s)

Date

10.3 Use the crane to remove the Mandrel Assembly from the Curing Mold and place on the Winding Table.

Technician(s)

Date

10.4 Remove the Inner Layer Curing Spacer Assembly (MC-411727).

Technician(s)

Date

11.0 Cured Inner Coil Inspection

11.1 Measure the Coil length from End Shoe to End Saddle.

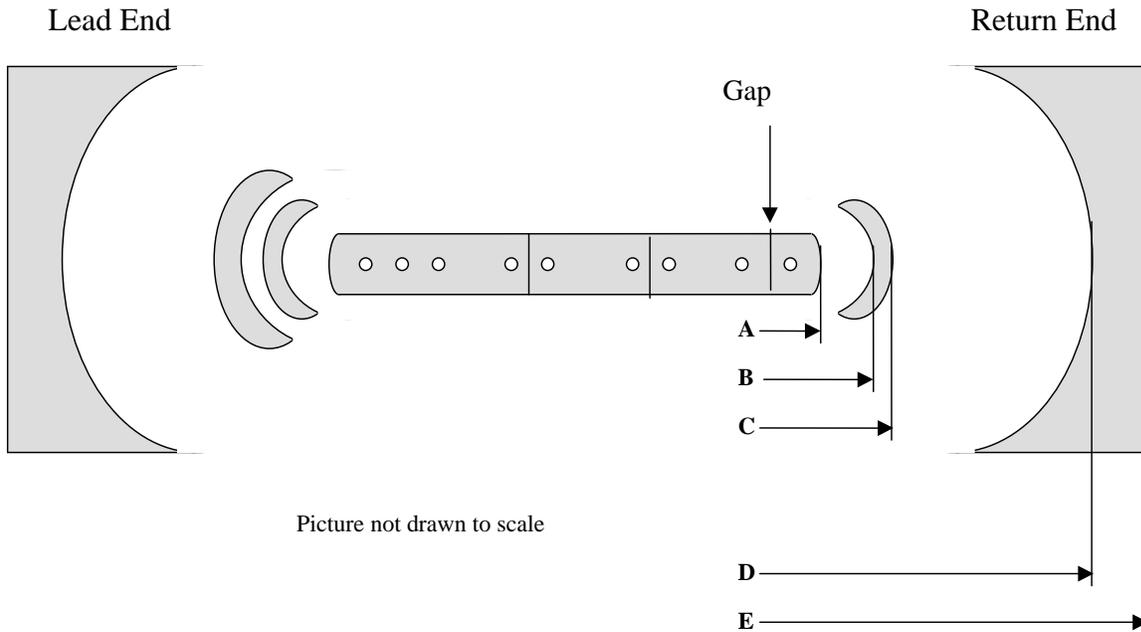
Coil Length _____

Inspector

Date

11.2 Using a caliper or equivalent, measure the Return End of the Coil.

Inner Layer



Return End	Nominal (to spacer) mm/in	Measured (to spacer)	Gap between spacer and conductor
A (End of 411761)	60/2.362		
B (Start of 411766)	70.59/2.779		
C (End of 411766)	110/4.331		
D (Start of 411767)	132.51/5.217		
E (End of 411767)	161.42/6.355		

Inspector

Date

LARP Quadrupole Inner and Outer Coil
Winding and Curing Traveler

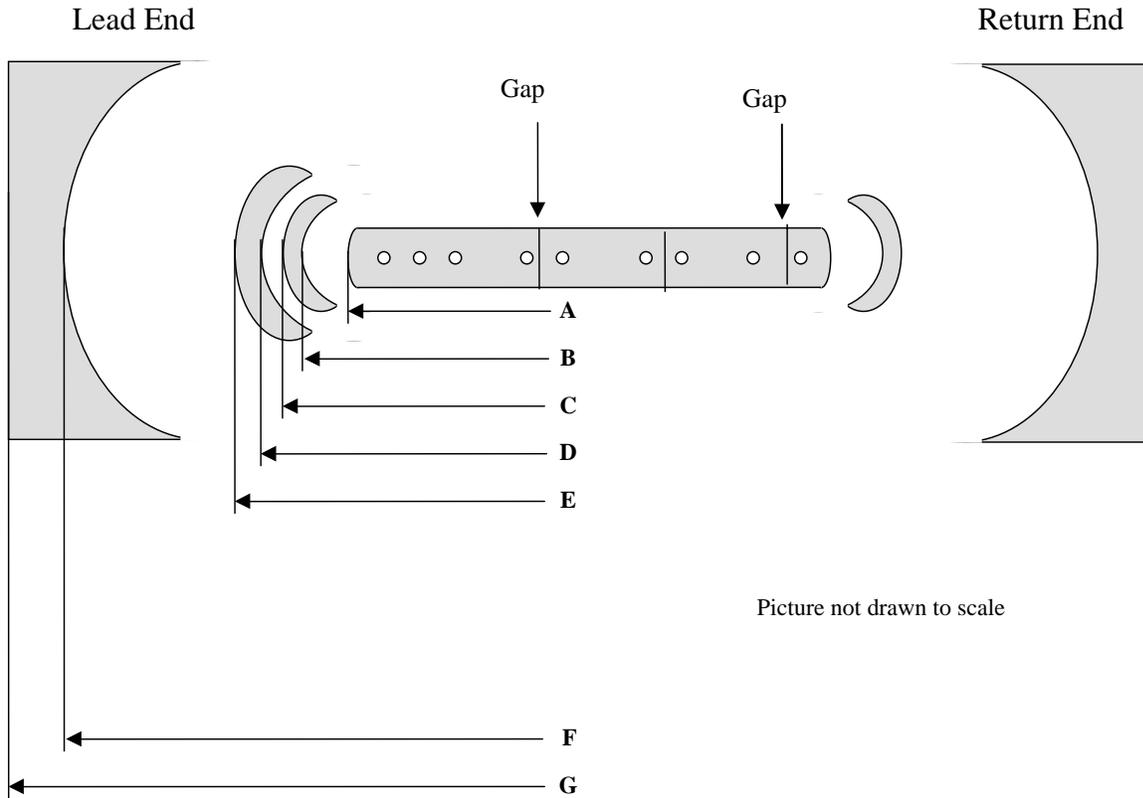
Serial No.: «SerialNo»-«ReworkID»

Note(s): «Notes»

11.3 Using a caliper or equivalent, measure the Lead End of the Coil.

Spacer

Inner Layer



Picture not drawn to scale

Lead End	Nominal (to spacer) mm/in	Measured (to spacer)	Gap between spacer and conductor
A (End of 411768)	217.09/8.547		
B (Start of 411769)	225.91/8.895		
C (End of 411769)	242.09/9.532		
D (Start of 411770)	243.91/9.603		
E (End of 411770)	265.33/10.446		
F (Start of 411771)	285.97/11.259		
G (End of 411771)	309.9/12.201		

Inspector _____

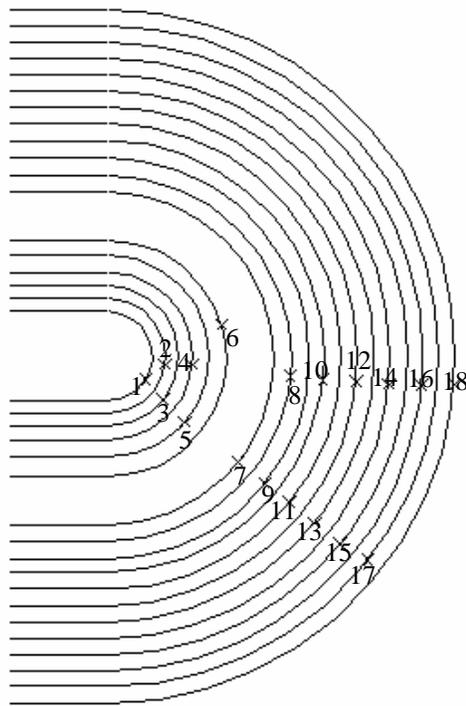
Date _____

LARP Quadrupole Inner and Outer Coil
Winding and Curing Traveler

Serial No.: «SerialNo»-«ReworkID»

Note(s): «Notes»

- 11.4 Perform turn to turn Electrical tests. Check all turns, 1 to 18.
Record the results of the table following.



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

Voltage Drops from the Inner Layer Power Lead to each Turn.

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

Instrument Used	Current Applied	Turn number	Measured voltage
	1 Amp	1	
		2	
		3	
		4	
		5	
		6	
		7	
		8	
		9	
		10	
		11	
		12	
		13	
		14	
		15	
		16	
		17	
		18	

Review the Turn to Turn measurements. Continue Winding Yes _____ No _____

Responsible Authority

Date

11.5 Use a scalpel to remove debris from the gaps in the Wedges and the Pole Pieces.

 Technician(s) _____
 Date

11.6 Verify the gaps between the pole parts are clean.

 Inspector _____
 Date

11.9 Perform an Electrical Inspection.

Note(s):

Data is not final measurements as coil is still mounted on the Winding Mandrel.

Total Resistance is taken from the Inner Power Lead 1" past the Lead End Saddle to 6" past the location where the Inner layer Transitions to the Outer Layer.

Resistance check of heater	Equipment Serial Number	Limit	Actual Measurement	Pass	Fail	Out of Tolerance
Coil Resistance @ 0.1 A		For Reference Only	Ω			
Ls @ 20 Hz		For Reference Only	μH			
Q @ 20 Hz		For Reference Only				
Ls @ 1 KHz		For Reference Only	μH			
Q @ 1 KHz		For Reference Only				

 Inspector

 Date

12.0 Pre-Coil Winding Preparation for Outer Layer:

- 12.1 Using the appropriate lifting device, position the Reel of Insulated Conductor for the Outer Layer onto the tensioning machine Rotate the Outer Layer Cable Spool 360° in the Clockwise direction to introduce a full Counter Clockwise Twist in the Favorable direction into the Cable to the Coil.. Record the serial number of the Reel.

Reel Serial No. _____



Cable from Cable Spool to Coil showing the full CCW Twist in the Favorable direction

Technician(s)

Date

- 12.2 Clean the Winding Table using a vacuum, Isopropyl Alcohol (Fermi stock 1920-0300) and Heavy Disposable Wipers (Fermi stock 1660-2600) or equivalent ensuring that all the tooling is clean of dirt, dust and other contaminants.

Technician(s)

Date

- 12.3 Use a file, fine round, (Fermi Stock 1246-1760) or equivalent, to deburr all the Retainers and Sizing Bars as required. Once these items have been deburred, clean them using Isopropyl Alcohol (Fermi stock 1920-0300) and Heavy Disposable Wipers (Fermi stock 1660-2600) or equivalent.

Item Description:	Quantity	Part Number	Completed
Quad. Coil Winding Mandrel Assembly		MC-411727	
Mandrel Support Block		MD-344049	
Mandrel Block		MC-411718	
Spacer		MD-411720	
Pusher Outer		MD-411722	
Guiding Spacer		MB-411726	
Sector Outer		MB-411724	
Mold Retainer		MD-344109	
Roller Guide Support		MC-376111	
Teflon Retainers		MC-376115/376116	
Roller Guide Support Bar		MC-376105	

Technician(s)

Date

- 12.4 Clean the following using Heavy Disposable Wipers (Fermi stock 1660-2600) or equivalent. The parts apply to Fermi TQC or to LBL TQS Quadrupoles.

Description (Qty)	Part No.	Cleaned
L2_LE_SPLICE_BLOCK	MC-411794-A	
L2_G10_SPACER	MC-411791	
L2_CENTER_POLE_SPACER	MC-411787_B	
L2_LE_RT_SADDLE_LARP_90	MC-411776-A	
L2_LE_RT_SPACER1_LARP_90	MC-411775/411829	
L2_LE_POLE_LARP_90	MC-411774	
L2_RE_SADDLE_LARP_90	MC-411773	
L2_RE_POLE_LARP_90	MC-411772	
L2_LE_SPACER1_EXTENSION	MC-411763	
L2_Center_Pole Spacer_1	MC-411802	

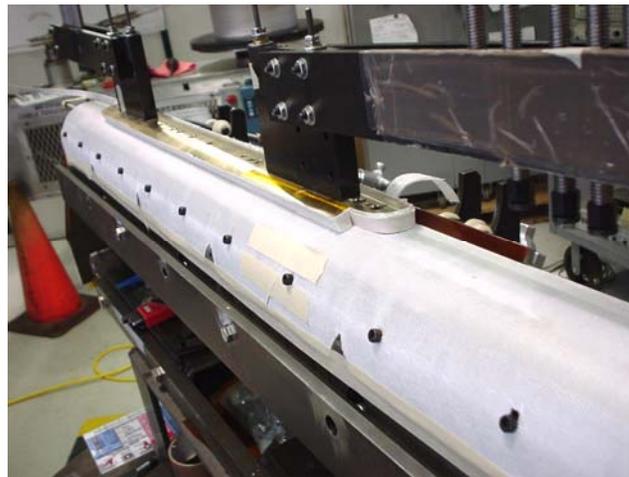
Technician(s)

Date

- 12.6 Place the 10 mil Cured Ceramic Interlayer Insulation on top of the Cured Inner Layer (ME-411783).

Technician(s)

Date



Cured Ceramic (10 mil) Blanket over the cured Inner layer. Ready for the outer layer to be wound.

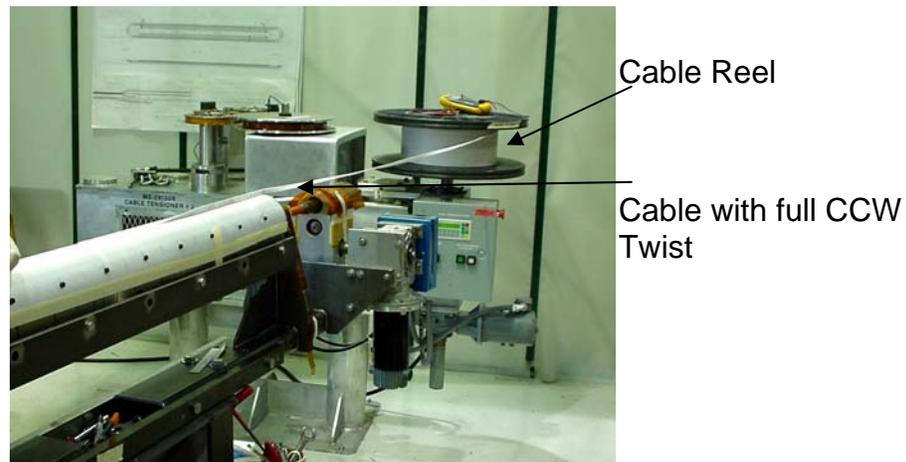
- 12.7 Mount the Rolling Guide Support Bar to the Winding Mandrel.

Technician(s)

Date

13.0 Outer Coil Winding Set-Up

- 13.1 Thread Using the overhead crane and appropriate lifting device, position the Reel of Insulated Conductor for the Outer Coil onto the tensioning machine with the thick edge of the Conductor facing up. To introduce a twist in the favorable direction (counter-clockwise), rotate the Outer Coil Reel of Insulated Conductor 360° in the clockwise direction. The CCW twist in the conductor should help prevent decabbling.



Coil Winding and Tensioner System
(Machine # 2) (ME-291308)

Note(s):

The thick edge of the cable is mounted up.

The cable tension is determined by the cross-section of the cable.

Technician(s)

Date

14.0 Outer Coil Winding

14.1 Position the turntable so that the Cable lay flat on the transition of the Outer Layer Lead End Pole (MC-411774), and will lay flat against the Outer Layer Center Pole Spacer (MC-411787_A). Clamp the Cable to the Pole Pieces. Increase Winding tension to 35 lbs. Winding tension should be kept at 35 lbs.

Note(s):

Coil is wound Counter Clockwise.

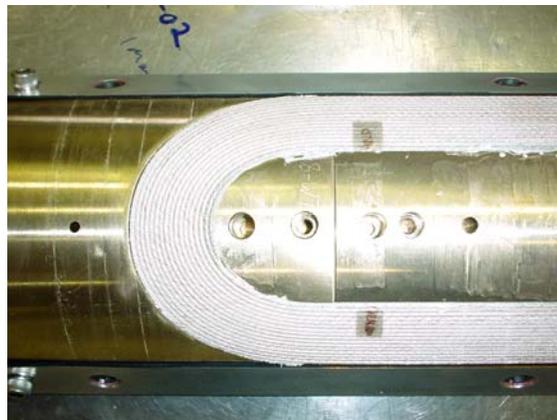
Constantly monitor for a cable to ground short through out the winding process.

Ensure that the Protective Insulated Steel Bars are installed between the Clamp and Conductor.

Technician(s)

Date

14.2 Add the 4 Voltage Taps to the cable for the first turn. See the locations specified in the drawing from LBL. See Step 6.3 for detailed Voltage Tap Installation Procedures.



Outer Layer with two Voltage Taps installed and protected with thin Mica sheets.

Technician(s)

Date

14.3 Wind Turn 1 around the Outer Layer Return End Pole (MC-411772), removing and replacing the Clamps as needed, proceeding to the Lead End.

Technician(s)

Date

- 14.4 Install the Outer Layer Lead End Spacer1_Extension (MC-411763) and the Outer Layer Lead End Spacer1 (MC-411775) and continue the winding process, clamping as required, until there are 2 Turns wound and the wire is exiting the Coil at the Lead End.

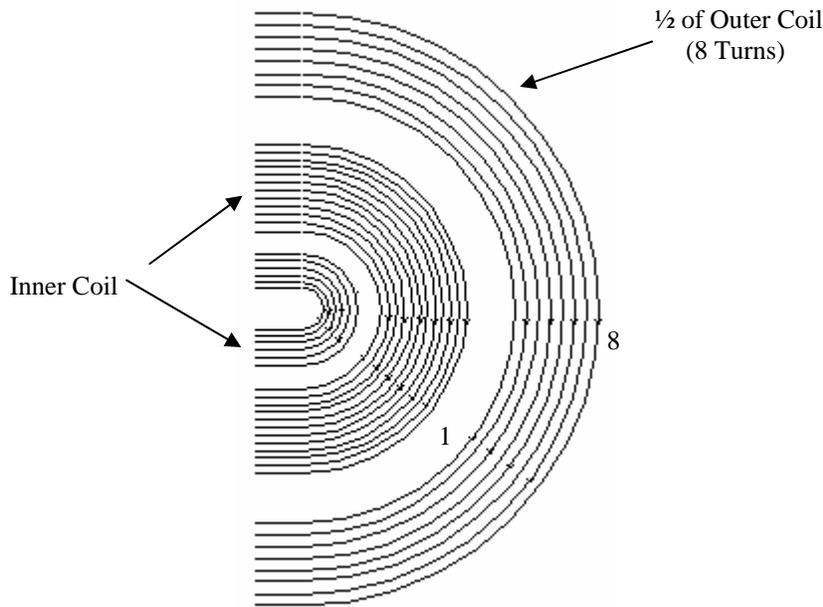
Note(s):

Press the Spacer to the Mandrel with the End Clamp.

Technician(s)

Date

- 14.5 Continue the winding process, stopping the table after 8 turns are wound and the wire is exiting at the Lead End. Do a check for Turn to Turn Shorts.



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

Instrument Used	Current Applied	Turn number	Measured voltage
	1 Amp	1	
		2	
		3	
		4	
		5	
		6	
		7	
		8	

Review the Turn to Turn measurements. Continue Winding Yes _____ No _____

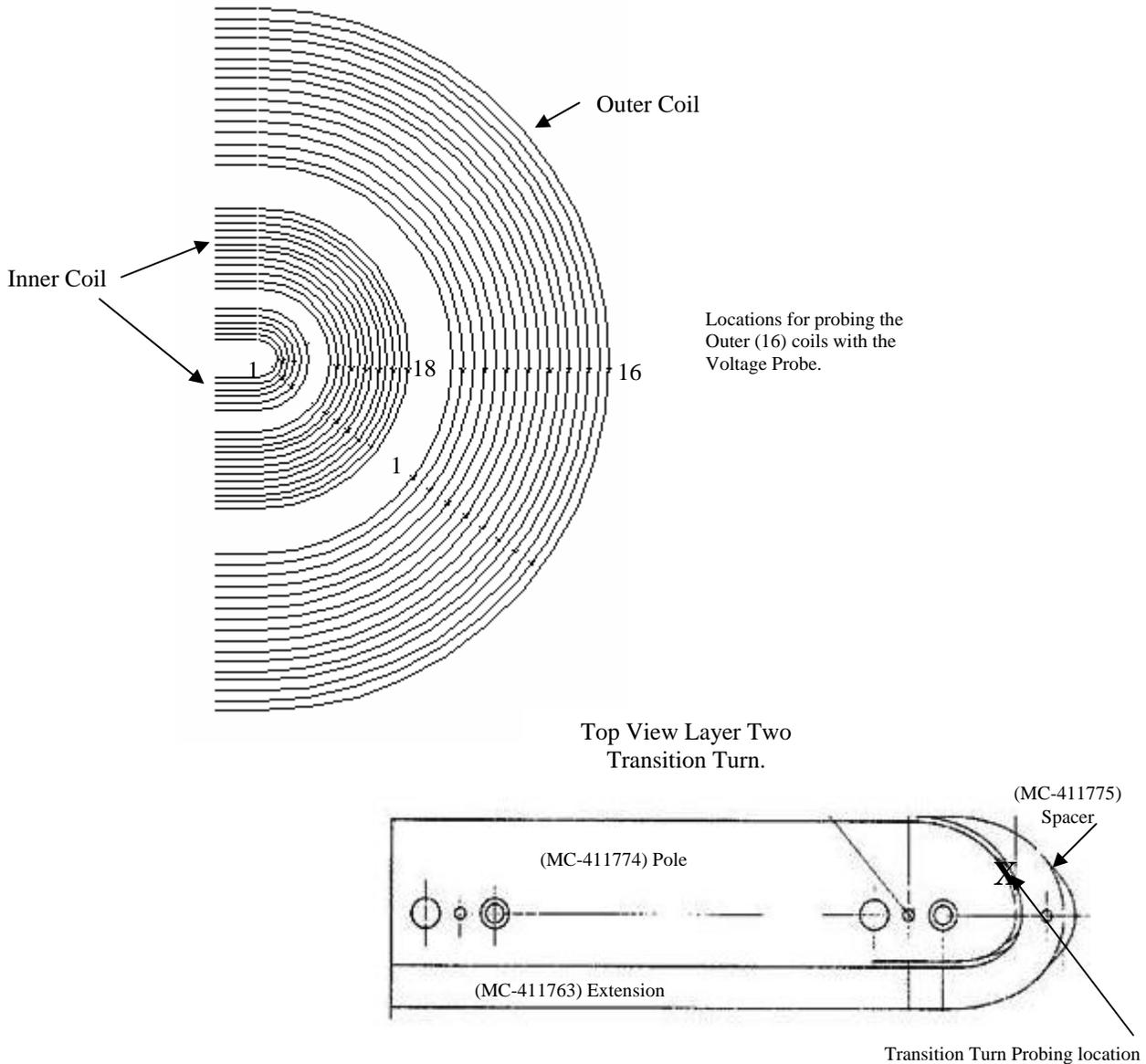
Responsible Authority

Date

15.0 Pre-Curing Coil Inspection

15.1 Perform turn to turn Electrical tests. Check all the turns in the Outer Coil (16).

Record the results in the tables that follow.



Record the turn to turn test results for the Outer Coil
Record the measurements. **Graph** the results, print the graph and attach the graph to the traveler.

Instrument Used	Current Applied	Turn number	Measured voltage
	1 Amp	Transition Turn	
		1	
		2	
		3	
		4	
		5	
		6	
		7	
		8	
		9	
		10	
		11	
		12	
		13	
		14	
		15	
		16	

Review the Turn to Turn measurements. Continue Winding Yes _____ No _____

 Responsible Authority

 Date

16.6 Carefully trim the excess and ragged edges of the ceramic tape.

 Technician(s) _____ Date

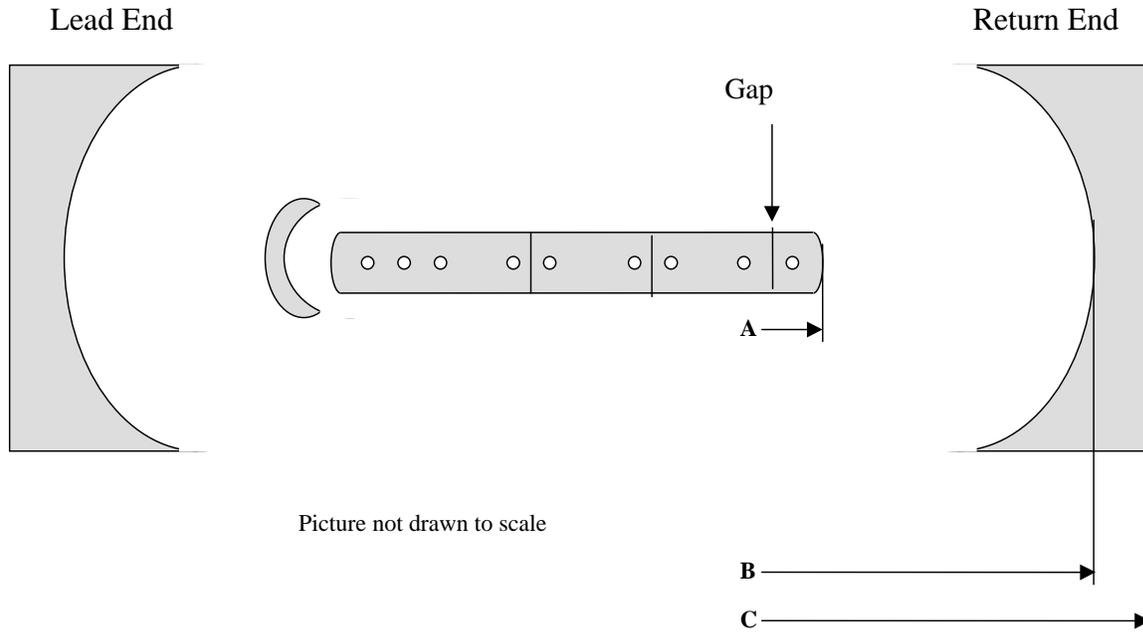
16.7 Measure the Coil length from End Saddle to End Saddle

Coil Length _____

 Inspector _____ Date

16.8 Using a caliper or equivalent, measure the Return End of the Coil.

Outer Layer

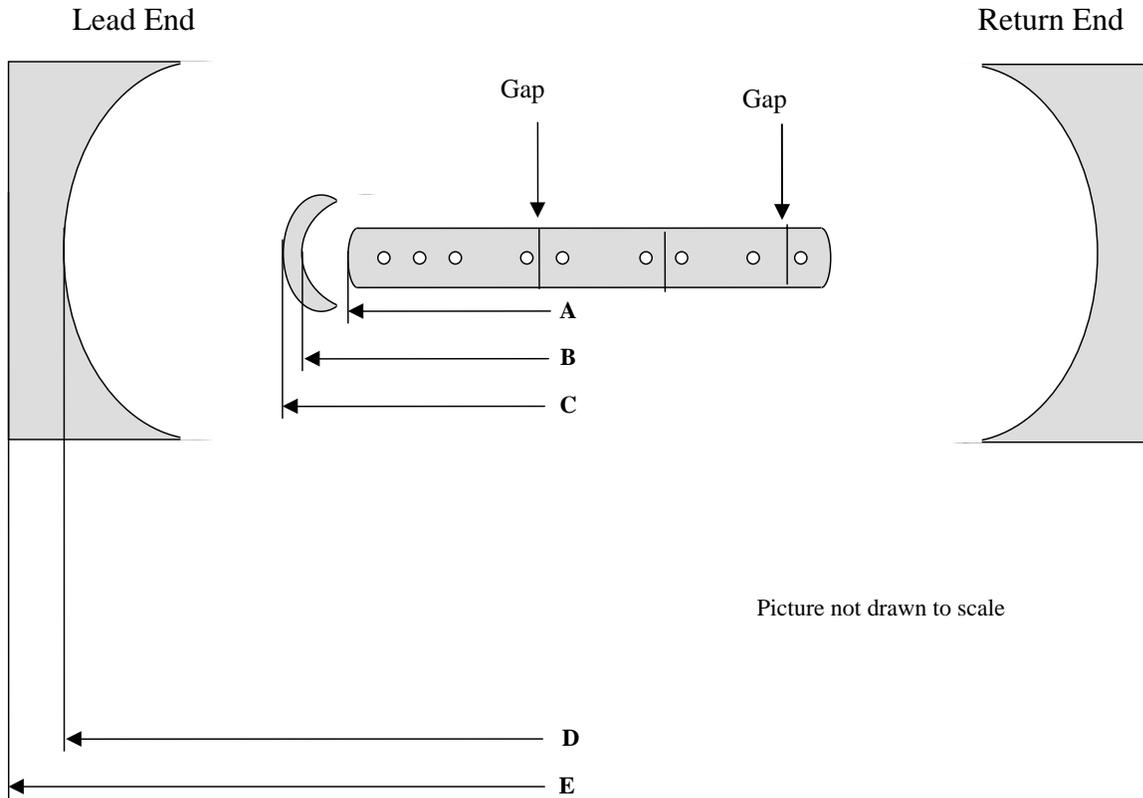


	Nominal (to spacer) mm/in.	Measured (to spacer)	Gap between spacer and conductor
A (End of 411772)	40/1.575		
B (Start of 411773)	67.39/2.653		
C (End of 411773)	161.42/6.355		N/A

 Inspector _____ Date

16.9 Using a caliper or equivalent, measure the Lead End of the Coil.

Outer Layer



	Nominal (to spacer) mm/in.	Measured (to spacer)	Gap between spacer and conductor
A (End of 411774)	181/7.126		
B (Start of 411775)	182.79/7.197		
C (End of 411775)	195/7.678		
D (Start of 411776)	222.42/8.758		
E (End of 411776)	309.89/12.202		N/A

Inspector

Date

16.10 Locate the 4 Taps and trap Mica Sheet pieces place one under and one on the Voltage Taps to protect them during Curing. .

Technician(s)

Date

- 16.11 Apply Ceramic Matrix Binder (CTD 1002X) to the entire coil using a 10 cc syringe. Record the time.

Time _____ Amount used _____ cc

Note(s):

Wear Surgical Latex Gloves (Fermi stock 2250-2494 or similar) while doing this operation.

Coil should be totally wetted at the end of this step.

Technician(s)

Date

- 16.12 Wrap Mylar (2 mil thick x 3/4" wide) around the entire coil and mandrel assembly. Use the 50% overlap for coverage. Remove cable ties as the wrap progresses.

Technician(s)

Date

- 16.13 Place the 10 mil thick Stainless Steel blanket over the Coil and Mandrel Assembly. Adjustments to the thickness of the shim applied to the External Shells may be required. Record the amount of shimming used.

Actual shims used _____

Responsible Authority

Date _____

- 16.14 Install the Outer Layer Mold Retainer (MD-344109).

Technician(s)

Date

18.0 Curing the Outer Coil

18.1 Connect the Chromolox Resistance Heaters.

18.2 Use the Curing Press to apply the following pressures:

- a) Mandrel Pressure to 600 psi
- b) Platen Pressure to 750 psi
- c) Record Platen Gaps in the table below

SIDE A	SIDE B

18.3 Use the Curing Press to apply the following pressures:

- a) Platen Pressure to 0psi
- b) Mandrel Pressure to 0psi

18.4 Use the Curing Press to apply the following pressures:

- a) Mandrel Pressure to 600 psi
- b) Platen Pressure to 1000 psi
- c) Record Platen Gaps in the table below

SIDE A	SIDE B

18.5 Use the Curing Press to apply the following pressures:

- a) Mandrel Pressure to 600 psi
- b) Platen Pressure to 1500 psi
- c) Record Platen Gaps in the table below

SIDE A	SIDE B

18.6 Use the Curing Press to apply the following pressures:

- a) Mandrel Pressure to 600 psi
- b) Platen Pressure to 2000 psi
- c) Record Platen Gaps in the table below

SIDE A	SIDE B

- d) Start the Cure cycle Time _____

18.7 Use the Curing Press to apply the following pressures. Record the time that temperature is attained.

- a) Temperature to 100°C Time _____
- b) Mandrel Pressure to 600 psi
- c) Platen Pressure to 2000 psi
- d) Record Platen Gaps in the table below

SIDE A	SIDE B

18.8 Use the Curing Press to apply the following pressures. Record the time that temperature is attained.

- a) Temperature to 150°C Time _____
- b) Mandrel Pressure to 600 psi
- c) Platen Pressure to 2000 psi
- d) Record Platen Gaps in the table below

SIDE A	SIDE B

18.9

- a) Wait for 30 minutes
- b) Switch off the heaters and the Lock off Hydraulic system

Technician(s)

Date

19.0 Outer Coil Curing Cycle Complete

19.1 Shut down the System Power. Make sure that all power systems are shut down.

Mandrel Hydraulic System

Platen Hydraulic System

Electric Heater Control System

Technician(s)

Date

19.2 After cooling extract the Mold from the Press.

Technician(s)

Date

19.3 Remove the Mandrel Assembly from the Curing Mold and place on the Winding Table.

Technician(s)

Date

19.4 Remove the Outer Layer Mold Retainer (ME-344109).

Technician(s)

Date

20.0 **Cured Coil Inspection**

20.1 Measure the Coil length from End Saddle to End Saddle.

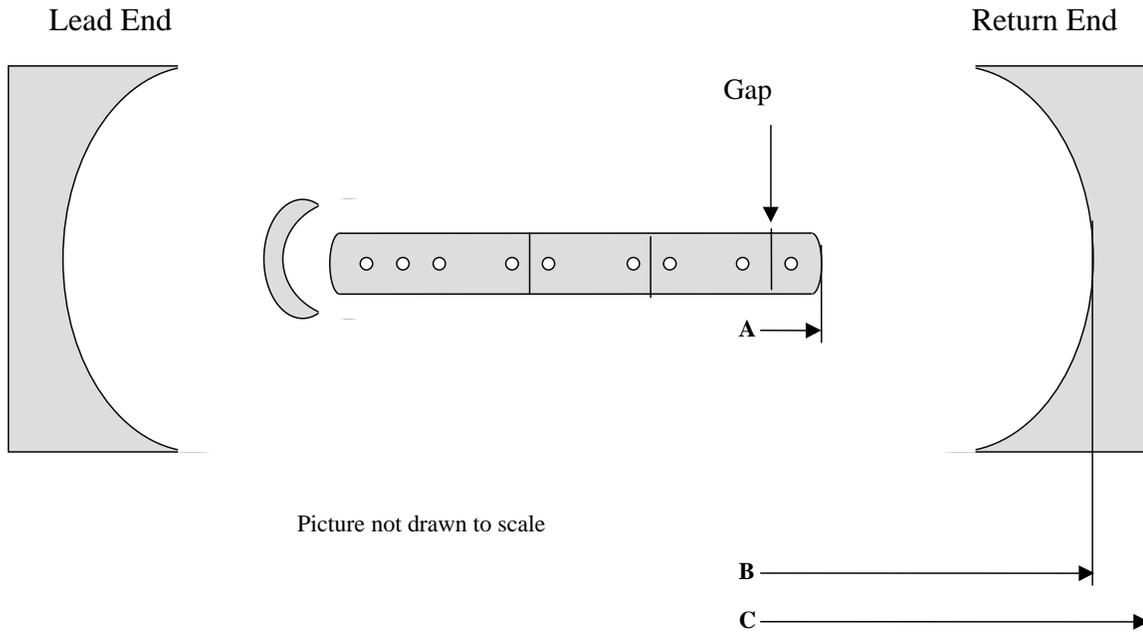
Coil Length _____

Inspector _____

Date _____

20.2 Using a caliper or equivalent, measure the Return End of the Coil.

Outer Layer

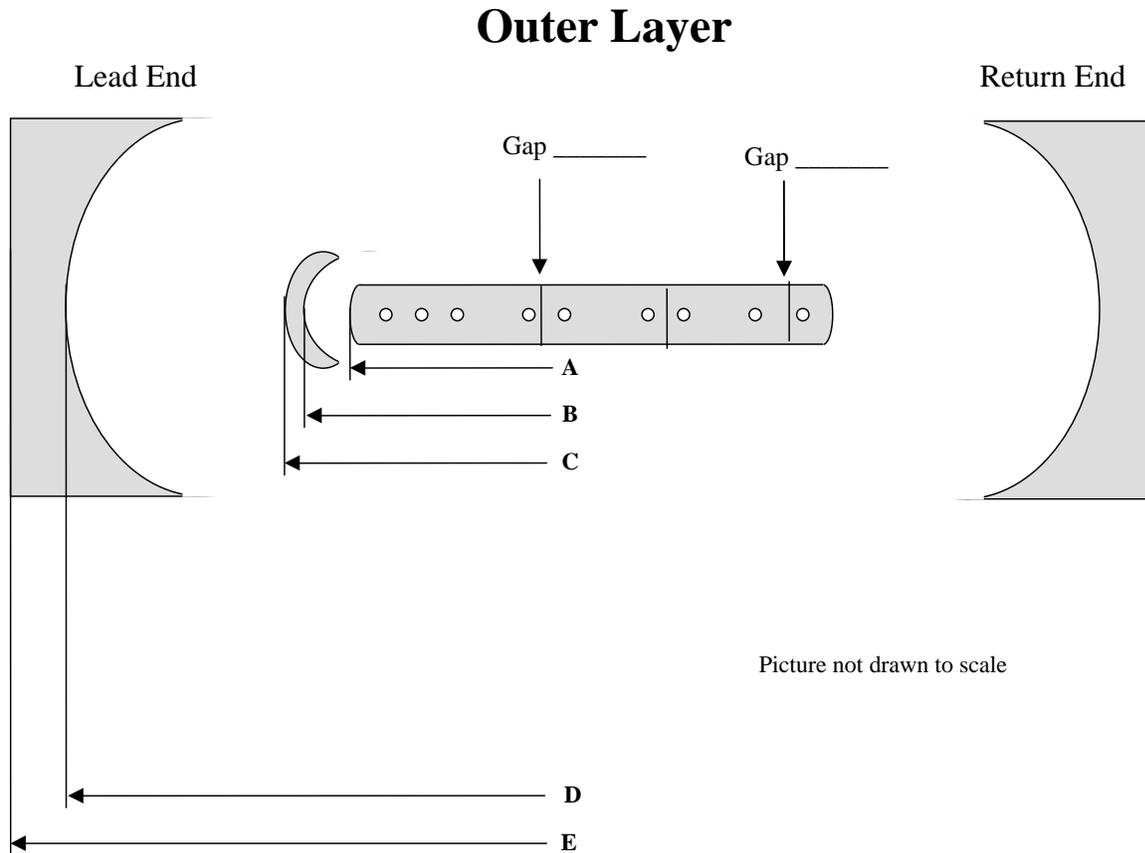


	Nominal (to spacer) mm/in.	Measured (to spacer)	Gap between spacer and conductor
A (End of 411772)	40/1.575		
B (Start of 411773)	67.39/2.653		
C (End of 411773)	161.42/6.355		N/A

Inspector _____

Date _____

20.3 Using a caliper or equivalent, measure the Lead End of the Coil.



	Nominal (to spacer) mm/in.	Measured (to spacer)	Gap between spacer and conductor
A (End of 411774)	181/7.126		
B (Start of 411775)	182.79/7.197		
C (End of 411775)	195/7.678		
D (Start of 411776)	222.42/8.758		
E (End of 411776)	309.89/12.202		N/A

Inspector

Date

21.0 Post Curing

21.1 Remove the Side Bars and the Outer Layer Retainer Clips.

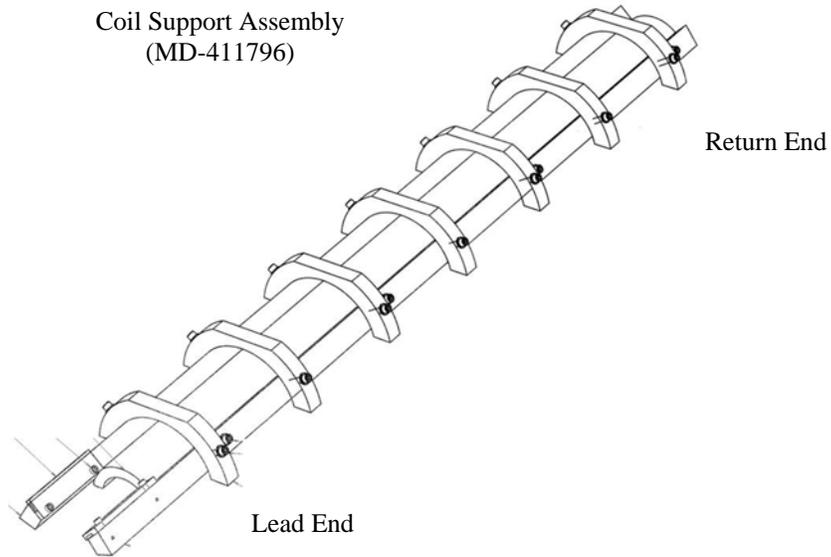
Technician(s)

Date

21.2 Place Coil Support Mandrel Assembly (MD-411796) under the cured coil to stabilize as it is removed from the Winding Mandrel.

Technician(s)

Date



21.3 Remove the Coil from the Mandrel by removing the screws from the Center Pole Pieces, and place on a clean surface.

Note(s):

Take every precaution to ensure the Lead End Saddles do not separate from the cured coil.

Technician(s)

Date

21.4 Use a scalpel to remove debris from the gaps in the Wedges and the Pole Pieces.

Technician(s)

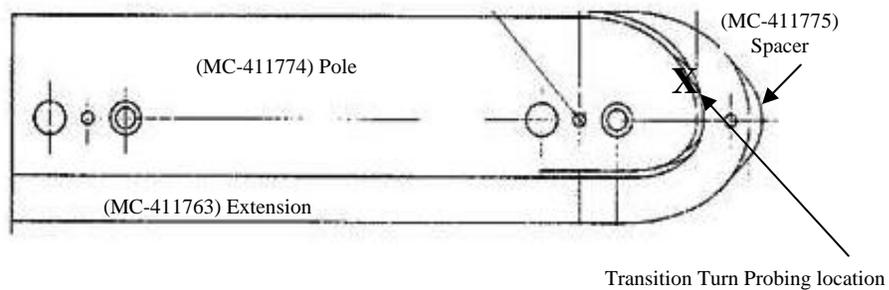
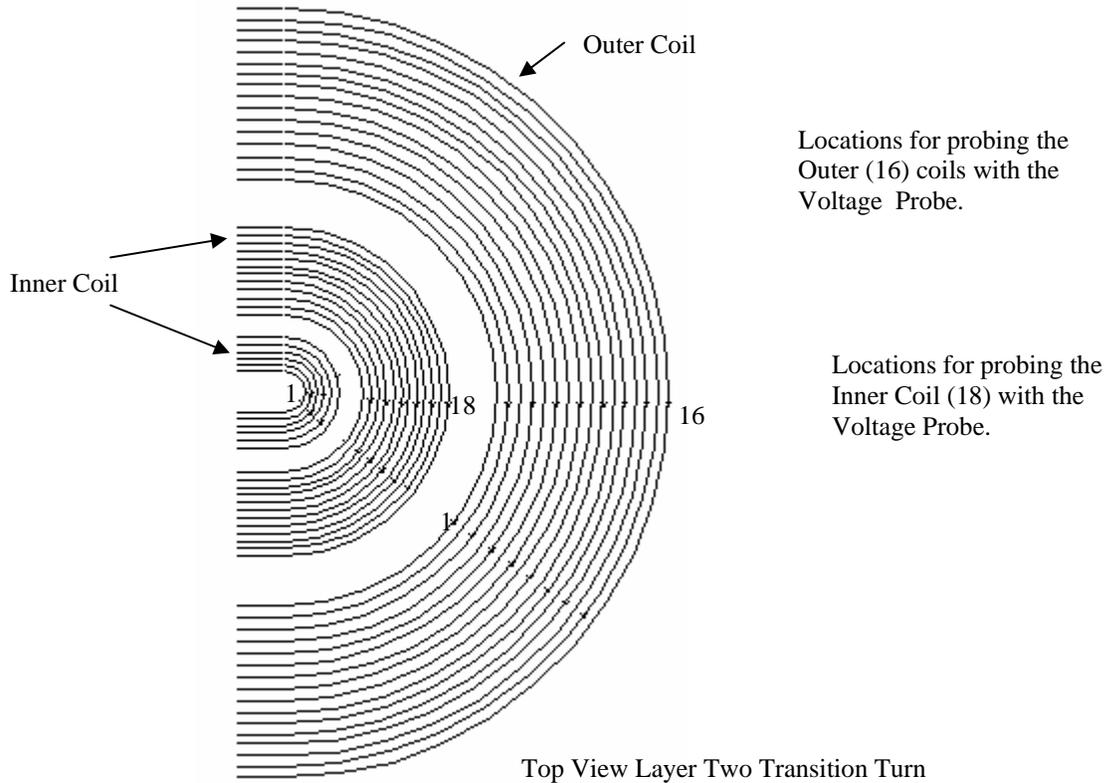
Date

21.5 Verify the Gaps between the poles are clean.

Inspector

Date

- 21.6 Perform turn to turn Electrical tests. Check all the turns in the Inner and Outer Coils. The Measurements are taken at the Lead End from the Inner Layer Power Lead to each Turn. Record the results in the tables that follow.



Voltage Drop is from the Inner Layer Power Lead to Each Turn.

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

Record the turn to turn test results for the Inner Coil

Instrument Used	Current Applied	Turn number	Measured voltage
	1 Amp	1	
		2	
		3	
		4	
		5	
		6	
		7	
		8	
		9	
		10	
		11	
		12	
		13	
		14	
		15	
		16	
		17	
		18	

Voltage Drop is from the Inner Layer Power Lead to Each Turn.

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

Record the turn to turn test results for the Outer Coil

Instrument Used	Current Applied	Turn number	Measured voltage
	1 Amp	Transition Turn	
		1	
		2	
		3	
		4	
		5	
		6	
		7	
		8	
		9	
		10	
		11	
		12	
		13	
		14	
		15	
		16	

Review the Turn to Turn measurements. Continue Winding Yes _____ No _____

Responsible Authority

Date

21.7 Perform an Electrical Inspection for the full coil.

Note(s):

The Cured Quadrupole off the Winding Mandrel should be placed on a wooden support during these measurements.

Support the Lead End at all times.

Resistance check of heater	Equipment Serial Number	Limit	Actual Measurement	Pass	Fail	Out of Tolerance
Coil Resistance @ 1 A		For Reference Only	Ω			
Ls @ 20 Hz		For Reference Only	μH			
Q @ 20 Hz		For Reference Only				
Ls @ 1 KHz		For Reference Only	μH			
Q @ 1 KHz		For Reference Only				

Inspector

Date

22.0 Prepare the Quadrupole Coil for Sizing

22.1 Record the Coil being sized

LARP 90mm Quadrupole Coil Serial Number _____

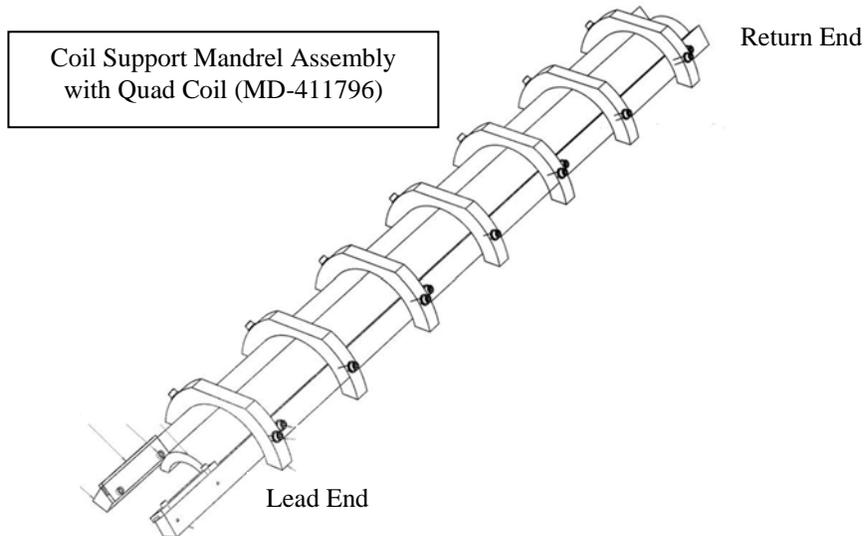
Technician(s)

Date

22.2 Two people lift the Quad Coil while in the Coil Support Mandrel Assembly (MD-411796). Rotate the Coil so the inner coil faces down and position it on the Quad Sizing Mandrel. The Lead End faces away from the Sizing Machine.

Technician(s)

Date



- 22.3 Remove the Coil Support mandrel Assembly (MD-411796) while assuring that the Coil stays in position on the Sizing Mandrel. Attach the Coil with tie wraps on the Lead End.

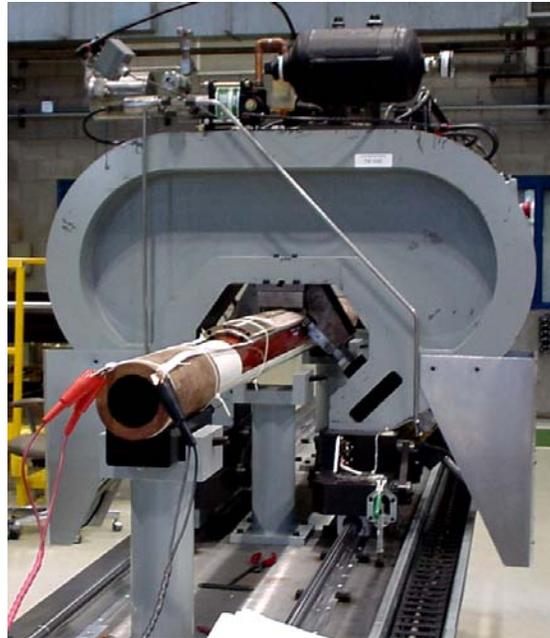


Sizing Machine from the Return End of the
Coil

Technician(s)

Date

- 22.4 Attach the power leads to the Coil Leads for the Inner and Outer Coil. See that the two negative (black) leads go to one Coil Lead and the two positive (red) leads to the other Coil Lead. One Amp will be applied during the HFM sizing program.



Sizing Machine from the Lead End of the Coil

Technician(s)

Date

23.0 Sizing each Quadrupole Coil.

23.1 Run the HFM LabView program (compactpop 16HFM) for sizing the LARP Quad Coils.



Controls on the Sizing Machine

- a. Check position of Master and the Coil to be measured and the leads are attached to the resistance measurement.
- b. Open program HFM.
- c. Enter Coil identification.
- d. Select Master1 for first run.



Computer with LabView program for Sizing Coils

- e. To move the Sizer forward and back for positioning, be sure the left knob is pointing at OFF and the right knob is pointing at LOCAL. Place the Sizer over the Master; be sure the encoder is reading zero (0) in the program. At the Sizer move the left knob to CLAMP and the right knob to REMOTE.
- f. Start the program and Push the TAKE MEASUREMENT button (yellow) on the Sizer

Technician(s)

Date

23.2 Size the Master (ME-369629). The Sizing Data will be attached to the traveler. Not recorded here.

Mega Pascals/Pressure (psi)	Position
5/904	
10/1135	
15/1703	
20/2267	

23.3 Continue to run the same HFM Labview program for sizing the LARP Quad Coils.

- a. Before measuring check the position of the Quad Coil. Be sure the leads are attached for the resistance measurement.
- b. In the program select Coil for first position run.
- c. To reposition the Coil Sizer
 - 1) To raise or lower the Coil Sizer, switch to control to LOCAL and switch the control to RAISE.
 - 2) Raise the Coil Sizer and move it to the location between the Mandrel and the Return End of the Coil
 - 3) Switch the control to OFF to lower the Coil Sizer.
- d. Place the Sizer over Position 1 (L2_RE_Center Pole Spacer) on the Quad Coil, seeing that the encoder is reading zero (0) in the program.
- e. Start the program and Push the TAKE MEASUREMENT button (yellow) on the Sizer.

Technician(s)

Date

23.4 Size the Quad Coil. The Sizing Data will be attached to the traveler. Not recorded here.

Mega Pascals/Pressure (psi)	Position 1
5/904	
10/1135	
15/1703	
20/2267	

23.5 Continue to run the same HFM Labview program for sizing the LARP Quad Coils.

- a. Keep Coil selected in the program for Second Position run.
- b. Place the Sizer over Position 2 (L2_Center Pole Spacer) on the Coil. Check to be sure the encoder is reading zero (0) in the program.
- c. Push the TAKE MEASUREMENT button (yellow) on the Sizer

Technician(s)

Date

23.6 Size the Quad Coil. The Sizing Data will be attached to the traveler. Not recorded here.

Mega Pascals/Pressure (psi)	Position 2
5/904	
10/1135	
15/1703	
20/2267	

LARP Quadrupole Inner and Outer Coil
Winding and Curing Traveler

Serial No.: <<SerialNo>>-<<ReworkID>>

Note(s): <<Notes>>

- 23.7 Continue to run the same HFM Labview program for sizing the LARP Quad Coils.
- a. Select Coil for Third Position run.
 - b. Place the Sizer over Position 3 (L2_LE Center Pole Spacer) on the Quad Coil. Check to be sure the encoder is reading zero (0) in the program.
 - c. Push the TAKE MEASUREMENT button (yellow) on the Sizer

Technician(s)

Date

- 23.8 Size the Quad Coil. The Sizing Data will be attached to the traveler. Not recorded here.

Mega Pascals/Pressure (psi)	Position 3
5/904	
10/1135	
15/1703	
20/2267	

- 23.9 Continue to run the same HFM Labview program for sizing the LARP Quad Coils
- a. Check position of Master and the Coil to be measured and that the leads are attached for the resistance measurement.
 - b. Select Master2 for second Master run in the Labview program.
 - c. Move the Sizer Head to a Low Section on the Return End of the Coil Mandrel and Raise the Head for clearance to move back to the Master.
 - d. To reposition the Coil Sizer
 - 1) To raise or lower the Coil Sizer, switch to control to LOCAL and switch the control to RAISE.
 - 2) Raise the Coil Sizer and move it to Coil Master.
 - 3) Switch the control to OFF to lower the Coil Sizer.
 - e. Place the Sizer over the Master; be sure the encoder is reading zero (0) in the program.
 - f. Start the program and Push the TAKE MEASUREMENT button (yellow) on the Sizer

Technician(s)

Date

23.10 Size the Master (ME-369629). The Sizing Data will be attached to the traveler. Not recorded here.

Mega Pascals/Pressure (psi)	Position
5/904	
10/1135	
15/1703	
20/2267	

Technician

Date

23.11 Move the Sizer to the Park location on the table. Reattach the Coil Support Assembly and release the tie wraps. Support the Cable leads and remove from the Sizing Mandrel.

Technician(s)

Date

23.12 Perform an Electrical Inspection for the full Coil.

Coil Name _____

Note(s):

The Cured Quadrupole (off the Winding Mandrel) should be placed on a wooden support during these measurements.

Support the Lead End at all times.

Resistance check of heater	Equipment Serial Number	Limit	Actual Measurement	Pass	Fail	Out of Tolerance
Coil Resistance @ 1 Amp		For Reference Only	Ω			
Ls @ 20 Hz		For Reference Only	μH			
Q @ 20 Hz		For Reference Only				
Ls @ 1 KHz		For Reference Only	μH			
Q @ 1 KHz		For Reference Only				

Inspector

Date

