

**Fermi National Accelerator Laboratory
Batavia, IL 60510**

**LARGE HADRON COLLIDER
MAGNET ASSEMBLY TRAVELER**

**Reference Drawing(s)
Cold Mass Coil Insulation Assembly
MC-369582**

Budget Code: <i>LCC</i>	Project Code: <i>LHC</i>	
Released by: <i>[Signature]</i>	Date: <i>9/19/01</i>	
Prepared by: M. Cullen		
Title	Signature	Date
TD/E&F Process Engineering	<i>[Signature]</i> Bob Jensen / Designee	5/25/01
TD/LHC Production Supervisor	<i>[Signature]</i> Jim King / Designee	5-25-01
TD/LHC Production Engineer	<i>[Signature]</i> Rodger Boesert / Designee	5/25/01
TD/LHC Tooling Engineer	<i>[Signature]</i> John Carson / Designee	5/25/01
TD / LHC Program Manager	<i>[Signature]</i> Jim Kerby / Designee	5/21/01

Revision Page

Revision	Step No.	Revision Description	TRR No.	Date
None	N/A	Initial Release	N/A	9/29/00
A	4.0	Changed assembly order to Q1 I, O then Q2 I, O then Q3 I, O then Q4 I, O.	1179	5/25/01
	5.0	Added Limits		
	6.0	Added Space for Volt Tap Drawing, and Spot heater Number, Resistance.		
	9.4	Added Limits.		

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 All personnel performing steps in this traveler must have documented training for this traveler and associated operating procedures.
- 1.6 Personnel shall perform all tasks in accordance with current applicable ES&H guidelines and those specified within the step.
- 1.7 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 for this production operation to this traveler. Ensure that the serial number on the Parts Kit matches the serial number of this traveler. Verify that the Parts Kit received is complete.



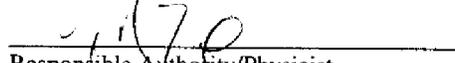
 Process Engineering/Designee



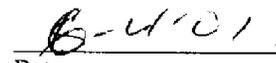
 Date



- 2.2 Attach figure with Coil Serial Numbers, Locations and Shimming Dimensions.



 Responsible Authority/Physicist



 Date

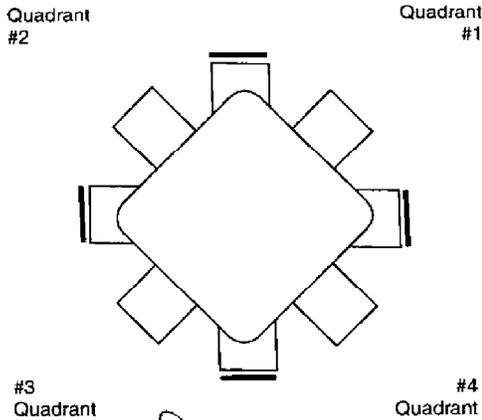
3.0 Mandrel Preparation

- 3.1 Clean the Coil Assembly/Collaring Mandrel (ME-369016) using lint free Heavy Duty Wipers (Fermi stock 1660-0150) and Isopropyl Alcohol (Fermi stock 1920-0300) or equivalent, and install in the Coil Assembly and Rollover Fixture.

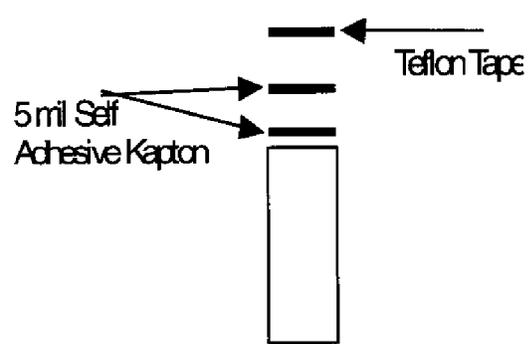
J.P.
 Technician(s)

MAY 22, 2001
 Date

- 3.2 Shim the length of the Mandrel with 2 layers of 5 mil self adhesive Kapton, and 1 layer of 2", 3mil Teflon tape (MA-116533) or equivalent on the Parting Plane of the Mandrel.

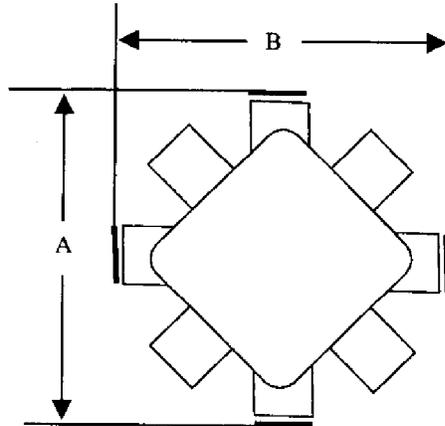


J.P.
 Technician(s)



MAY 22, 2001
 Date

X 3.3 Measure the Mandrel Shimming.



	Limits	Lead End	Middle	Return End
A	< 2.740"	2.737	2.737	2.736
B	< 2.740"	2.735	2.736	2.735

A. Gould
 Inspector

6/4/2001
 Date

3.4 Mark the Mandrel at 25.5" from the Return End of the Mandrel for all four quadrants.

A. Gould
 Technician(s)

6/4/2001
 Date

4.0 Assemble the Coils

Note(s):

Ensure the Outer Coils are installed with the Inner Coil Preform in contact with the Outer Lead End Key.

Ensure all Inner Lead End Keys are Coplanar

DR#
0227

- 4.1 Install the Coil per Figure in Step 2.2 in to Quadrant #1 Inner Coil as per the Rollover and Assembly Station Operating Procedure (OP-333505), using the Insertion/Extraction Fixture (MC-344719) as per the Insertion/Extraction Fixture Operating Procedure (OP-333504).

[Signature] 6/4/01
 Technician(s) Date

DR#
0228

- 4.2 Install the Coil per Figure in Step 2.2 in to Quadrant #1 Outer Coil as per the Rollover and Assembly Station Operating Procedure (OP-333505), using the Insertion/Extraction Fixture (MC-344719) as per the Insertion/Extraction Fixture Operating Procedure (OP-333504).

[Signature] 6/4/01
 Technician(s) Date

- 4.3 Install the Coil per Figure in Step 2.2 in to Quadrant #2 Inner Coil as per the Rollover and Assembly Station Operating Procedure (OP-333505), using the Insertion/Extraction Fixture (MC-344719) as per the Insertion/Extraction Fixture Operating Procedure (OP-333504).

[Signature] 6/4/01
 Technician(s) Date

- 4.4 Install the Coil per Figure in Step 2.2 in to Quadrant #2 Outer Coil as per the Rollover and Assembly Station Operating Procedure (OP-333505), using the Insertion/Extraction Fixture (MC-344719) as per the Insertion/Extraction Fixture Operating Procedure (OP-333504).

[Signature] 6/4/01
 Technician(s) Date

- 4.5 Install the Coil per Figure in Step 2.2 in to Quadrant #3 Inner Coil as per the Rollover and Assembly Station Operating Procedure (OP-333505), using the Insertion/Extraction Fixture (MC-344719) as per the Insertion/Extraction Fixture Operating Procedure (OP-333504).

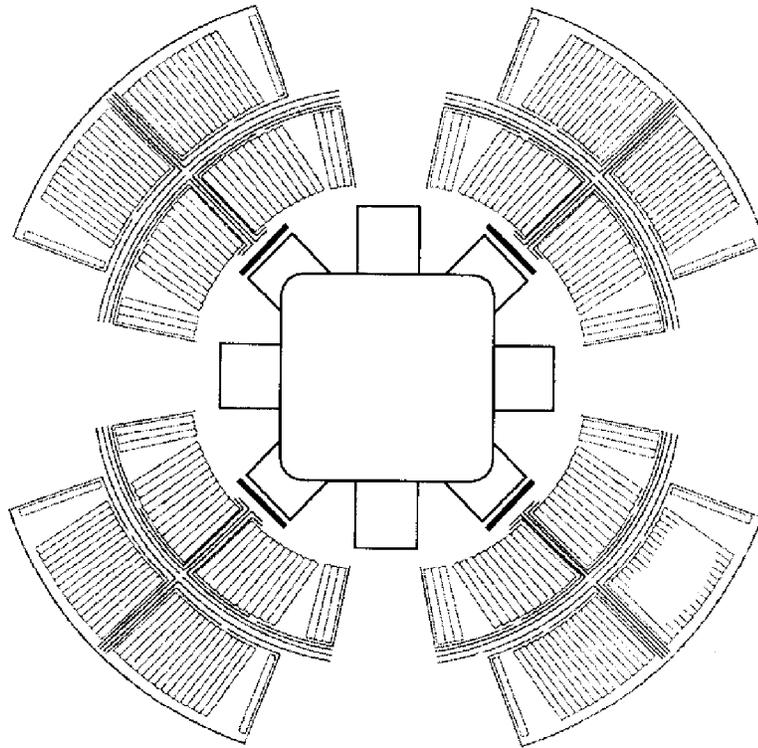
[Signature] 6/4/01
 Technician(s) Date

- 4.6 Install the Coil per Figure in Step 2.2 in to Quadrant #3 Outer Coil as per the Rollover and Assembly Station Operating Procedure (OP-333505), using the Insertion/Extraction Fixture (MC-344719) as per the Insertion/Extraction Fixture Operating Procedure (OP-333504).

[Signature] 6/4/01
 Technician(s) Date

- 4.7 Install the Coil per Figure in Step 2.2 in to Quadrant #4 Inner Coil as per the Rollover and Assembly Station Operating Procedure (OP-333505), using the Insertion/Extraction Fixture (MC-344719) as per the Insertion/Extraction Fixture Operating Procedure (OP-333504).

[Signature] 6/4/01
 Technician(s) Date



4.8 Install the Coil per Figure in Step 2.2 in to Quadrant #4 Outer Coil as per the Rollover and Assembly Station Operating Procedure (OP-333505), using the Insertion/Extraction Fixture (MC-344719) as per the Insertion/Extraction Fixture Operating Procedure (OP-333504).

Shard
Technician(s)

6/4/01
Date

X (4.9) Verify the Coils are properly installed per the engineers diagram in step 2.2 and that all Inner Lead End Keys are Coplanar.

[Signature]
Crew Chief

6/5/01
Date

TRC
Dr # 0228
ADD STEP TO COPLANAR INNER & OUTER COILS

Q1	Q2	Q3	Q4
35.803	35.809	35.812	35.810

From KEY TO MANDREL w/ JOE BLOCK!
SNG

5.0 Assembly Inspection

- X 5.1 Perform an electrical inspection on each of the individual Inner Coils, Outer Coils and Quadrants. Refer to the Valhalla and Leader Free Standing Coil Measurement Procedure (ES-292306), and the Procedure for Electrical Inspection of Voltage Taps (ES-301383).

Note(s):

Ensure that all measurements are recorded correctly, and have the proper value and symbol (i.e., m Ω , mH, etc.).

Caution:

During testing, ensure that the test current is off and the disconnect status safe light is lit while connecting and disconnecting test leads from the Coil Assembly.

Valhalla 4300B settings:

Test current	_____	Off (not testing)
Power	_____	On
Full scale voltage	_____	20mv
Amp selector knob	_____	10 mA
Temperature compensator	_____	On
Test current	_____	On (testing)

Hp 4263 B:

Function _____ "Ls-Q" selected

Record the Serial Number of the test equipment used.

Valhalla _____

HP 4263b _____

Resistance Limits		Inner	Outer	Pass	Fail
		240 m Ω to 265 m Ω	310 m Ω to 340 m Ω		
Quadrant 1	Inner	.2599 m Ω		✓	
	Outer		.3175 m Ω	✓	
Quadrant 2	Inner	.2563 m Ω		✓	
	Outer		.3208 m Ω	✓	
Quadrant 3	Inner	.2607 m Ω		✓	
	Outer		.3195 m Ω	✓	
Quadrant 4	Inner	.2594 m Ω		✓	
	Outer		.3211 m Ω	✓	



Inductance Limits		Inner	Outer	Pass	Fail
		575 to 620 mH	1.120 to 1.17 H		
Quadrant 1	Inner	566.37 mH			
	Outer		1.1051 H		
Quadrant 2	Inner	610.80 mH			
	Outer		1.1088 H		
Quadrant 3	Inner	610.92 mH			
	Outer		1.1017 H		
Quadrant 4	Inner	625.74 mH			
	Outer		1.1012 H		

Q Factor Limits		Inner	Outer	Pass	Fail
		3.30 to 3.75	4.80 to 5.30		
Quadrant 1	Inner	3.58			
	Outer		4.41		
Quadrant 2	Inner	3.38			
	Outer		4.08		
Quadrant 3	Inner	3.29			
	Outer		3.86		
Quadrant 4	Inner	3.32			
	Outer		3.89		

J. Howard
Inspector

6/4/01
Date



5.2 Check the readings in Step 5.1 for consistency coil to coil and compared to the Inspection Traveler Readings. Verify the Coil Positioning (Quadrant to Quadrant, and Inner to Outer) is acceptable. Approved for next major assembly procedure.

Rodger R. T.
Responsible Authority/Physicist

6/4/01
Date

6.0 Splice Joints

6.1 Using the Soldering Jig (MD-344703), Kester Flux (MC-106761) and 1 layer 4.5" of 5 mil Kester Solder tape (MA-344821) or equivalent, position the Quadrant #1 Leads into the soldering jig, attach the Leads from the jig to the Soldering Station Controller.

J.P.
Technician(s)

5 JUNE 2001
Date

6.2 Set temperature controllers to 550°F (288 °C) and monitor temperature. When the Soldering Fixture attains 550°F (288 °C) shut down the soldering station and allow the Conductor to cool. Once the Conductor has cooled, remove the soldering jig. Using Scotch Brite 7447 (Fermi stock 1202-2020) or equivalent, clean the area that has just been soldered.

J.P.
Technician(s)

5 JUNE 2001
Date

6.3 Insulate the bare areas of the Quadrant #1 Conductor as per the Inner Insulated Cable Assembly (MB-369691), stopping at the end of the Splice.

J. Rife
Technician(s)

6-6-01
Date

6.4 Install the Quadrant #1 Outer Lead End Keys Parts C, D and E (MA-369646/MA-369647/MA-369648).

J. Rife
Technician(s)

6-6-01
Date

6.5 Install the Voltage Tap iors for Quadrant #1 per Outer Coil Voltage Tap Drawing (MD-369584).

J. Rife
Technician(s)

6-6-01
Date

6.6 Verify the Quadrant #1 Outer Lead End Keys and the Inner Lead End Key are coplanar $\pm 1/32"$.

J. Rife
Crew Chief

6-6-01
Date

TAP
X

1. CHECK THIS ASSEMBLY # TO VERIFY INSULATION SCHEME ON SPLICE JOINT.
2. MOVE THE INSTALLATION OF SPLICE ~~TAP~~ TAP TO AFTER INSTALLING GROUND WRAP. NOTE: VOLTAGE TAP WIRE SPEC HAS CHANGED.

J. RIFE 6-6-01

6.7 Using the Soldering Jig (MD-344703), Kester Flux (MC-106761) and 1 layer 4.5" of 5 mil Kester Solder tape (MA-344821) or equivalent, position the Quadrant #2 Leads into the soldering jig, attach the Leads from the jig to the Soldering Station Controller.

[Signature]
Technician(s)

6-6-01
Date

6.8 Set temperature controllers to 550°F (288 °C) and monitor temperature. When the Soldering Fixture attains 550°F (288 °C) shut down the soldering station and allow the Conductor to cool. Once the Conductor has cooled, remove the soldering jig. Using Scotch Brite 7447 (Fermi stock 1202-2020) or equivalent, clean the area that has just been soldered.

[Signature]
Technician(s)

6-6-01
Date

TRP

6.9 Insulate the bare areas of the Quadrant #2 Conductor as per the Inner Insulated Cable Assembly (MB-369691), stopping at the end of the Splice.

[Signature]
Technician(s)

6-6-01
Date

6.10 Install the Quadrant #2 Outer Lead End Keys Parts C, D and E (MA-369646/MA-369647/MA-369648).

[Signature]
Technician(s)

6-6-01
Date

6.11 Install the Voltage Tap iors for Quadrant #2 per Outer Coil Voltage Tap Drawing (MD-369584).

Technician(s)

Date

X

6.12 Verify the Quadrant #2 Outer Lead End Keys and the Inner Lead End Key are coplanar $\pm 1/32"$.

[Signature]
Crew Chief

6-6-01
Date

1. CHANGE THIS STEP TO READ SAME AS REVISED STEP 6.3

2. CHANGE THIS STEP TO READ SAME AS REVISED STEP 6.5

- 6.13 Using the Soldering Jig (MD-344703), Kester Flux (MC-106761) and 1 layer 4.5" of 5 mil Kester Solder tape (MA-344821) or equivalent, position the Quadrant #3 Leads into the soldering jig, attach the Leads from the jig to the Soldering Station Controller.

J.P. Technician(s) 6 JUNE 2001 Date

- 6.14 Set temperature controllers to 550°F (288 °C) and monitor temperature. When the Soldering Fixture attains 550°F (288 °C) shut down the soldering station and allow the Conductor to cool. Once the Conductor has cooled, remove the soldering jig. Using Scotch Brite 7447 (Fermi stock 1202-2020) or equivalent, clean the area that has just been soldered.

J.P. Technician(s) 6 JUNE 2001 Date

- 6.15 Insulate the bare areas of the Quadrant #3 Conductor as per the Inner Insulated Cable Assembly (MB-369691), stopping at the end of the Splice.

J. Bice Technician(s) 6-6-01 Date

- 6.16 Install the Quadrant #3 Outer Lead End Keys Parts C, D and E (MA-369646/MA-369647/MA-369648).

J. Bice Technician(s) 6-6-01 Date

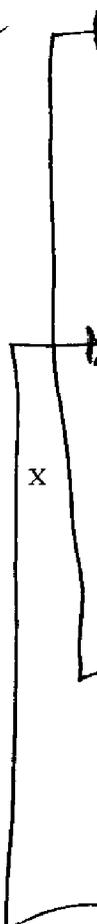
- 6.17 Install the Voltage Tap ions for Quadrant #3 per Outer Coil Voltage Tap Drawing (MD-369584).

T Technician(s) _____ Date

- 6.18 Verify the Quadrant #3 Outer Lead End Keys and the Inner Lead End Key are coplanar $\pm 1/32"$.

J. Bice Crew Chief 6-6-01 Date

TAP



1. CHANGE THIS STEP TO READ SAME AS REVISED STEP 6.3

2. CHANGE THIS STEP TO READ SAME AS REVISED STEP 6.5

6.19 Using the Soldering Jig (MD-344703), Kester Flux (MC-106761) and 1 layer 4.5" of 5 mil Kester Solder tape (MA-344821) or equivalent, position the Quadrant #4 Leads into the soldering jig, attach the Leads from the jig to the Soldering Station Controller.

J. R. Rice
Technician(s)

6-6-01
Date

6.20 Set temperature controllers to 550°F (288 °C) and monitor temperature. When the Soldering Fixture attains 550°F (288 °C) shut down the soldering station and allow the Conductor to cool. Once the Conductor has cooled, remove the soldering jig. Using Scotch Brite 7447 (Fermi stock 1202-2020) or equivalent, clean the area that has just been soldered.

J. R. Rice
Technician(s)

6-6-01
Date

JAR

6.21 Insulate the bare areas of the Quadrant #4 Conductor as per the Inner Insulated Cable Assembly (MB-369691), stopping at the end of the Splice.

J. R. Rice
Technician(s)

6-6-01
Date

6.22 Install the Quadrant #4 Outer Lead End Keys Parts C, D and E (MA-369646/MA-369647/MA-369648).

J. R. Rice
Technician(s)

6-6-01
Date

6.23 Install the Voltage Tap iors for Quadrant #4 per Outer Coil Voltage Tap Drawing (MD-369584).

Technician(s)

Date

X 6.24 Verify the Quadrant #4 Outer Lead End Keys and the Inner Lead End Key are coplanar $\pm 1/32"$.

J. R. Rice
Crew Chief

6-6-01
Date

1. CHANGE THIS STEP TO READ SAME AS REVISED STEP 6.2

2. CHANGE THIS STEP TO READ SAME AS REVISED STEP 6.5

*FR
CHANGE WOULD DO
TO CHECK OUTER
ARE COPLANAR*

7.0 Return End Key Modification

Verify the Outer Return End Keys are coplanar with the other Outer Return End Keys $\pm 1/32"$.

Quadrant 1:	<u>.011</u>
Quadrant 2:	<u>.010</u>
Quadrant 3:	<u>.009</u>
Quadrant 4:	<u>.010</u>

[Signature]
Technician(s)

6-6-01
Date

7.2 Measure the step between the Modified Inner Return End Keys and the Outer Return End Key.

Quadrant 1:	<u>.126</u>
Quadrant 2:	<u>.105</u>
Quadrant 3:	<u>.115</u>
Quadrant 4:	<u>.113</u>

[Signature]
Technician(s)

6-6-01
Date

7.3 Remove and cut the Modified Inner Return End Keys (MA-369098).

Note(s):

Ensure the Keys are marked with the serial number of the coil.

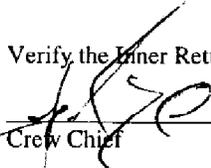
[Signature]
Technician(s)

6-6-01
Date

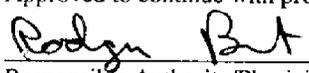
7.4 Reinstall the Modified Inner Return End Keys (MD-369098).

[Signature]
Technician(s)

6-6-01
Date

X 7.5 Verify the Inner Return End Key and the Outer Return End Keys are co-plainer $\pm 1/32"$.

Crew Chief _____ Date 6/6/01



7.6 Verify the four Splices are acceptable, and the two Spot Heaters have been installed correctly.
Verify the Inner Return End Key and the Outer Return End Keys are acceptable.
Approved to continue with processing.

Responsible Authority/Physicist _____ Date 6/6/01

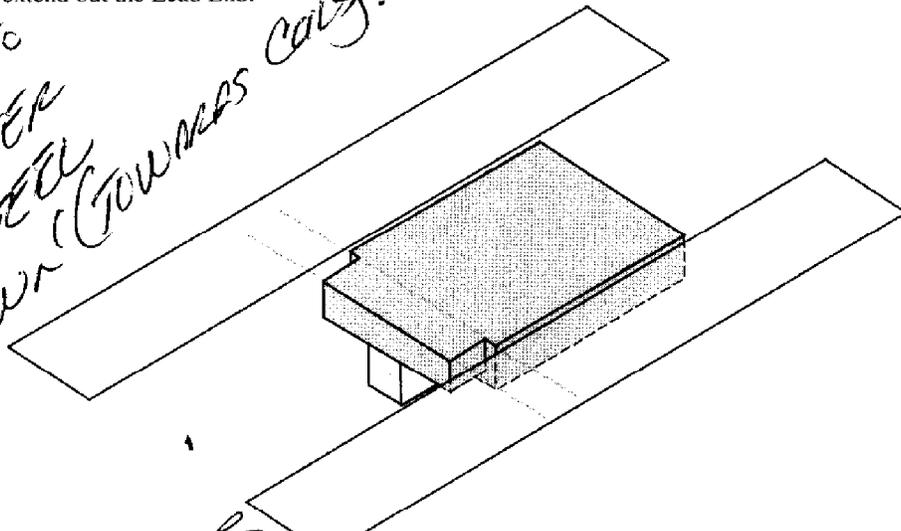
8.0 Ground Wrap and Quench Protection Heater Installation

8.1 Clean Quench Protector Heaters (MD-369619) with Isopropyl Alcohol (Fermi stock 1920-0300) and Lint Free Wipers (Fermi stock 1660-0150) or equivalent.

Heater 1-2	<u>[Signature]</u>	<u>6-7-01</u>
	Technician(s)	Date
Heater 2-3	<u>[Signature]</u>	<u>6-7-01</u>
	Technician(s)	Date
Heater 3-4	<u>[Signature]</u>	<u>6-7-01</u>
	Technician(s)	Date
Heater 4-1	<u>[Signature]</u>	<u>6-7-01</u>
	Technician(s)	Date

X 8.2 Install Quench Protector Heaters (MD-369619) onto the individual Coils. The Heater Leads extend out the Lead End.

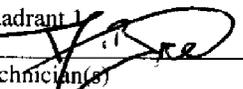
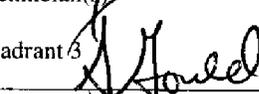
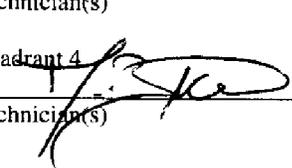
*TRR →
ADD TO STEP 10
INSTALL HEATER
STAINLESS STEEL
SIDE DOWN (TOWARDS COIL)*



*TRR
CHECK ALL STEPS TO
READ FOR CREW CALL
10 "VERIFYS" IN
OF DRAWING*

Heater 1-2	<u>[Signature]</u>	<u>6-7-01</u>
	Technician(s)	Date
Heater 2-3	<u>[Signature]</u>	<u>6-7-01</u>
	Technician(s)	Date
Heater 3-4	<u>[Signature]</u>	<u>6-7-01</u>
	Technician(s)	Date
Heater 4-1	<u>[Signature]</u>	<u>6-7-01</u>
	Technician(s)	Date
Crew Chief	<u>[Signature]</u>	<u>6-7-01</u>
		Date

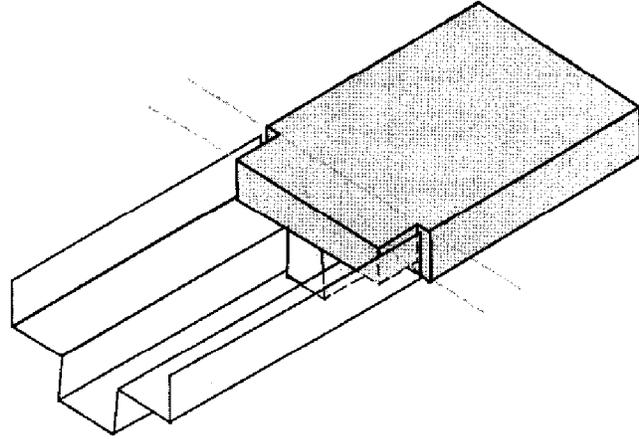
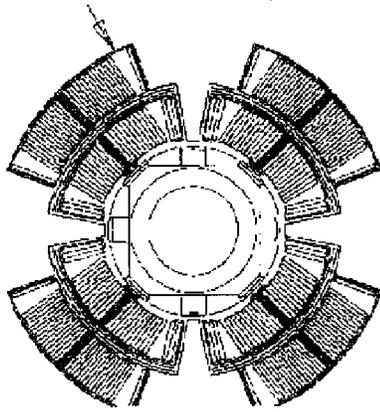
8.3 Clean Pole Ground Wrap 1 (MC-369623) (4 EA.) Kapton with Isopropyl Alcohol (Fermi Stock 1920-0300) and Lint Free Wipers (Fermi-Stock 1660-0150) or equivalent.

Quadrant 1		<u>6-7-01</u>
Technician(s)		Date
Quadrant 2		<u>6-7-01</u>
Technician(s)		Date
Quadrant 3		<u>6/7/01</u>
Technician(s)		Date
Quadrant 4		<u>6/7/01</u>
Technician(s)		Date

8.4 Install Pole Ground Wrap 1 (MC-369623). See Coil Insulation Assembly (MC-369582).

Note(s):

Ensure the Ground Wrap is inserted between the Key and Coil for .3/8"



*FOR
CHANGE FOR CREW CHIEF
TO VERIFY & INSTALLATION*

Quadrant 1 *[Signature]*

Technician(s)

6-7-01
Date

Quadrant 2 *[Signature]*

Technician(s)

6-7-01
Date

Quadrant 3 *[Signature]*

Technician(s)

6-7-01
Date

Quadrant 4 *[Signature]*

Technician(s)

6-7-01
Date

Crew Chief *[Signature]*

6-7-01
Date

8.5 Clean the Lead End Outer Coil Heater Strip Filler (MC-369632) Kapton with Isopropyl Alcohol (Fermi stock 1920-0300) and Lint Free Wipers (Fermi stock 1660-0150) or equivalent.

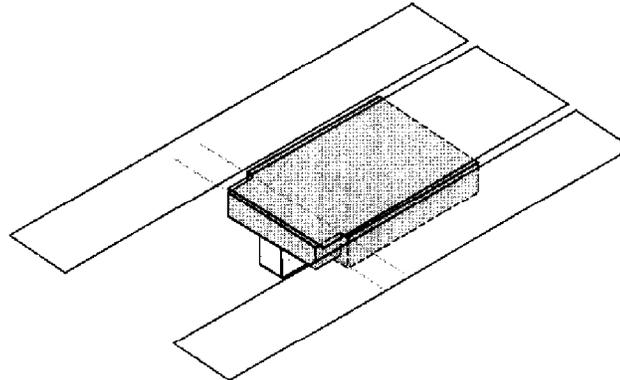
Quadrant 1 J.P. 7 JUNE 2001
Technician(s) Date

Quadrant 2 J.P. 7 JUNE 2001
Technician(s) Date

Quadrant 3 J.P. 7 JUNE 2001
Technician(s) Date

Quadrant 4 J.P. 7 JUNE 2001
Technician(s) Date

X 8.6 Install Lead End Outer Coil Heater Strip Filler (MC-369632). See Coil Insulation Assembly (MC-369582).



Quadrant 1 J.P. 7 JUNE 2001
Technician(s) Date

Quadrant 2 J.P. 7 JUNE 2001
Technician(s) Date

Quadrant 3 J.P. 7 JUNE 2001
Technician(s) Date

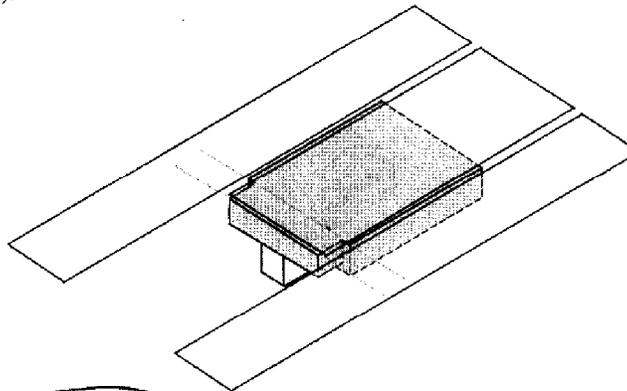
Quadrant 4 J.P. 7 JUNE 2001
Technician(s) Date

A. Gould 6/7/01
Crew Chief Date

- 8.7 Clean the Return End Outer Coil Heater Strip Filler (MC-369632) Kapton with Isopropyl Alcohol (Fermi stock 1920-0300) and Lint Free Wipers (Fermi stock 1660-0150) or equivalent.

Quadrant 1	<u>T. Rice</u>	<u>6-7-01</u>
Technician(s)		Date
Quadrant 2	<u>T. Rice</u>	<u>6-7-01</u>
Technician(s)		Date
Quadrant 3	<u>J.P.</u>	<u>7 June 2001</u>
Technician(s)		Date
Quadrant 4	<u>J.P.</u>	<u>7 June 2001</u>
Technician(s)		Date

- X 8.8 Install Return End Outer Coil Heater Strip Filler (MC-369632). See Coil Insulation Assembly (MC-369582).



Quadrant 1	<u>T. Rice</u>	<u>6-7-01</u>
Technician(s)		Date
Quadrant 2	<u>T. Rice</u>	<u>6-7-01</u>
Technician(s)		Date
Quadrant 3	<u>J.P.</u>	<u>7 June 2001</u>
Technician(s)		Date
Quadrant 4	<u>J.P.</u>	<u>7 June 2001</u>
Technician(s)		Date
Crew Chief	<u>A. Arnold</u>	<u>6/7/01</u>
		Date

8.9 Clean and modify the Pole Ground Wrap 2 (MC-369624) Kapton (4 EA.) with Isopropyl Alcohol (Fermi stock 1920-0300) and Lint Free Wipers (Fermi stock 1660-0150) or equivalent.

Quadrant 1
J.P.
Technician(s)

7 June 2001
Date

Quadrant 2
J.P.
Technician(s)

6-8-01
Date

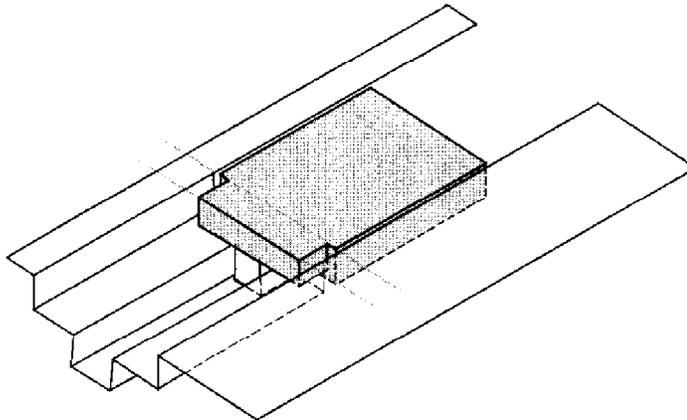
Quadrant 3
J.P.
Technician(s)

6-7-01
Date

Quadrant 4
J.P.
Technician(s)

6-7-01
Date

X 8.10 Install Pole Ground Wrap 2 (MC-369624) to extend to back of Saddles. See Coil Insulation Assembly.



*TRP
CHANGES HAVE BEEN
MADE TO VERIFY
INSTALLATION*

Quadrant 1
J.P.
Technician(s)

7 June 2001
Date

Quadrant 2
J.P.
Technician(s)

6-8-01
Date

Quadrant 3
J.P.
Technician(s)

6-8-01
Date

Quadrant 4
J.P.
Technician(s)

6-7-01
Date

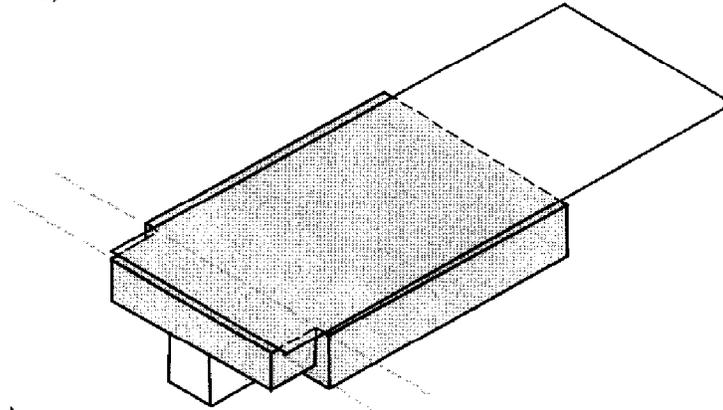
J. Howell
Crew Chief

6/11/01
Date

8.11 Clean the Lead End Outer Coil Heater Strip Filler (MC-369632) Kapton with Isopropyl Alcohol (Fermi stock 1920-0300) and Lint Free Wipers (Fermi stock 1660-0150) or equivalent.

Quadrant 1	<u>[Signature]</u>	<u>6-11-01</u>
Technician(s)		Date
Quadrant 2	<u>[Signature]</u>	<u>6-11-01</u>
Technician(s)		Date
Quadrant 3	<u>[Signature]</u>	<u>6-11-01</u>
Technician(s)		Date
Quadrant 4	<u>[Signature]</u>	<u>6-11-01</u>
Technician(s)		Date

X 8.12 Install Lead End Outer Coil Heater Strip Filler (MC-369632). See Coil Insulation Assembly (MC-369582).



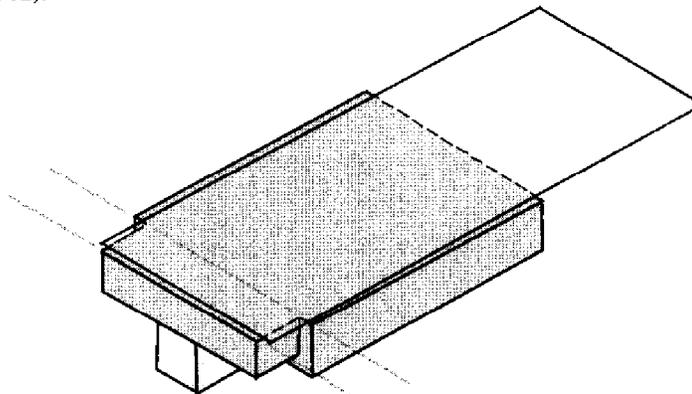
*TRR
CHANGE PER CREW CHIEF
TO VERIFY INSULATION*

Quadrant 1	<u>[Signature]</u>	<u>6-11-01</u>
Technician(s)		Date
Quadrant 2	<u>[Signature]</u>	<u>6-11-01</u>
Technician(s)		Date
Quadrant 3	<u>[Signature]</u>	<u>6-11-01</u>
Technician(s)		Date
Quadrant 4	<u>[Signature]</u>	<u>6-11-01</u>
Technician(s)		Date
Crew Chief	<u>[Signature]</u>	<u>6/11/01</u>
		Date

8.13 Clean the Return End Outer Coil Heater Strip Filler (MC-369632) Kapton with Isopropyl Alcohol (Fermi stock 1920-0300) and Lint Free Wipers (Fermi stock 1660-0150) or equivalent.

Quadrant 1	<u>[Signature]</u>	<u>6-11-01</u>
Technician(s)		Date
Quadrant 2	<u>[Signature]</u>	<u>6-11-01</u>
Technician(s)		Date
Quadrant 3	<u>[Signature]</u>	<u>6-11-01</u>
Technician(s)		Date
Quadrant 4	<u>[Signature]</u>	<u>6-11-01</u>
Technician(s)		Date

X 8.14 Install Return End Outer Coil Heater Strip Filler (MC-369632). See Coil Insulation Assembly (MC-369582).



THE CHANGES FOR COIL INSULATION TO "WORKING" INSTALLATION

Quadrant 1	<u>[Signature]</u>	<u>6-11-01</u>
Technician(s)		Date
Quadrant 2	<u>[Signature]</u>	<u>6-11-01</u>
Technician(s)		Date
Quadrant 3	<u>[Signature]</u>	<u>6-11-01</u>
Technician(s)		Date
Quadrant 4	<u>[Signature]</u>	<u>6-11-01</u>
Technician(s)		Date
<input checked="" type="checkbox"/> Crew Chief	<u>[Signature]</u>	<u>6/11/01</u>
		Date

8.15 Clean and modify the Pole Ground Wrap 3 (MC-369625) (4 ea.) with Isopropyl Alcohol (Fermi stock 1920-0300) and Lint Free Wipers (Fermi stock 1660-0150) or equivalent.

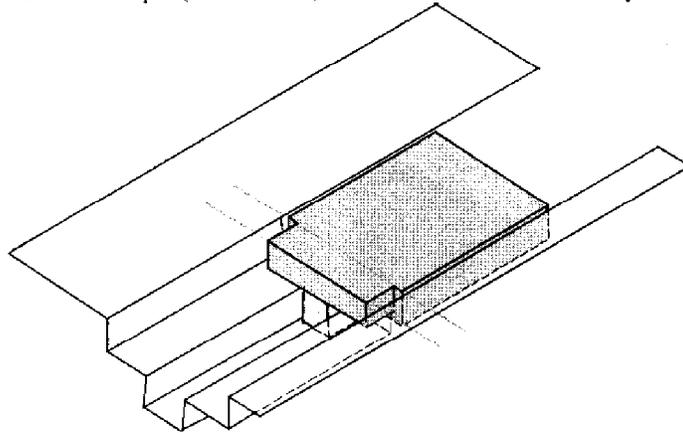
Quadrant 1 J.P. 7 JUNE 2001
Technician(s) Date

Quadrant 2 J.P. 7 JUNE 2001
Technician(s) Date

Quadrant 3 J.P. 7 JUNE 2001
Technician(s) Date

Quadrant 4 J.P. 7 JUNE 2001
Technician(s) Date

X 8.16 Install Pole Ground Wrap 3 (MC-369625). See Coil Insulation Assembly.



*7/1/01
CHANGE FOR CREW CHIEF
TO VERIFY & INSTALL*

Quadrant 1 J.P. 7 JUNE 2001
Technician(s) Date

Quadrant 2 J.P. 7 JUNE 2001
Technician(s) Date

Quadrant 3 J.P. 7 JUNE 2001
Technician(s) Date

Quadrant 4 J.P. 7 JUNE 2001
Technician(s) Date

↓ J. Howard 6/7/01
Crew Chief Date

9.0 Electrical Inspection

9.1 Apply Shrink-Wrap Mylar (MC-106937) on the entire length of the Collared Coil Assembly.

W. Gould
Technician(s)

6/12/01
Date

9.2 Shim the Return End Saddles coplanar $\pm 1/32"$.

Note(s):

Use Teflon Tape on the Saddles and Green Putty.

W. Man
Technician(s)

6-12-01
Date

X 9.3 Verify the Saddles are coplanar.

J. G. P.
Crew Chief

6-12-01
Date

- X 9.4 Perform an electrical inspection on each of the individual Inner Coils, Outer Coils, Quadrants and Voltage Taps. Refer to the Valhalla and Leader Free Standing Coil Measurement Procedure (ES-292306), and the Procedure for Electrical Inspection of Voltage Taps (ES-301383).

Note(s):

Ensure that all measurements are recorded correctly, and have the proper value and symbol (i.e., mΩ, mH, etc.).

Valhalla 4300B settings:

Test current	_____	Off (not testing)
Power	_____	On
Full scale voltage	_____	20mv
Amp selector knob	_____	10 mA
Temperature compensator	_____	On
Test current	_____	On (testing)

Hp 4263 B:

Function _____ "Ls-Q" selected

Record the Serial Number of the test equipment used.

Valhalla _____

HP 4263b _____

Resistance Limits		Inner	Outer	Total	Pass	Fail
		240 mΩ to 265 mΩ	310 mΩ to 340 mΩ	550 to 605 mΩ		
Quadrant 1	Inner	.2606 mΩ				
	Outer		.3222 mΩ			
	Total			.5803 mΩ		
Quadrant 2	Inner	.2597 mΩ				
	Outer		.3207 mΩ			
	Total			.5794 mΩ		
Quadrant 3	Inner	.2596 mΩ				
	Outer		.3210 mΩ			
	Total			.5809 mΩ		
Quadrant 4	Inner	.2593 mΩ				
	Outer		.3217 mΩ			
	Total			.5833 mΩ		



Inductance Limits		Inner	Outer	Total	Pass	Fail
		575-620 mH	1.120 to 1.17 H	2.890 to 2.920 H		
Quadrant 1	Inner	635.075 mH				
	Outer		1.11897 H			
	Total			2.90399 H		
Quadrant 2	Inner	635.996 mH				
	Outer		1.11713 H			
	Total			2.90784 H		
Quadrant 3	Inner	639.971 mH				
	Outer		1.11007 H			
	Total			2.91331 H		
Quadrant 4	Inner	640.255 mH				
	Outer		1.10368 H			
	Total			2.90285 H		

(Q) Limits		Inner	Outer	Total	Pass	Fail
		3.3 to 3.7	4.8 to 5.3	4.5 to 5.2		
Quadrant 1	Inner	2.70				
	Outer		3.39			
	Total			4.46		
Quadrant 2	Inner	2.71				
	Outer		3.39			
	Total			4.48		
Quadrant 3	Inner	2.67				
	Outer		3.29			
	Total			4.48 4.36		
Quadrant 4	Inner	2.66				
	Outer		3.23			
	Total			4.32		

Donald
Inspector

6/12/01
Date

Electrical Test	Limit	Actual Measurement	Pass	Fail
Heater Strips 1/2 Resistance	9.20 to 9.60 Ω	9.446 Ω	✓	
Heater Strips 2/3 Resistance	9.20 to 9.60 Ω	11.556 Ω		✓
Heater Strips 3/4 Resistance	9.20 to 9.60 Ω	9.500 Ω	✓	
Heater Strips 4/1 Resistance	9.20 to 9.60 Ω	9.465 Ω	✓	

[Signature]
Inspector

6/12/01
Date

Voltage Tap	Quadrant 1	Quadrant 2	Quadrant 3	Quadrant 4
Color	Brown	Brown	Brown	Brown
Coil Serial Number	MQXB1-21	MQXB1-22	MQXB1-023	MQXB1-024
Valhalla Serial Number	32-858			
Iors (ramp splice)	5327 mV	5762 mV	5304 mV	5088 mV

[Signature]
 Inspector

6/12/01
 Date



9.5 Verify readings in Step 9.4 are acceptable. Approved for next major assembly procedure.

[Signature]
 Responsible Authority/Physicist

6-12-01
 Date

10.0 Production Complete

- 10.1 Process Engineering verify that the LHC Coil Insulation and Assembly Traveler (333494) 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, Nonconformance Reports, Repair/Rework Forms, Deviation Index and dispositions have been reviewed by the Responsible Authority for conformance before being approved.

Comments:

*Changed Serial # from
MAXB-001 to MAXB-001*

[Signature]
Process Engineering/Designee

6/12/01
Date

1) Traveler Title: LHC Magnet Assembly		2) Specification No.: 5520-TR-333494		3) Revision: A	4) DR No.: HGQ-0228
5) Step No.: 4.9	6) Drawing No. & Revision: MC-369582	7) Routing No.:	8) Component/Item/Batch/Lot No.: MQXB-002 / <i>1</i>		9) Serial No.: MQXB-002 / <i>1</i>
10) Nonconformance Description by First Hand Observer: <input type="checkbox"/> Class I <input checked="" type="checkbox"/> Class II The inner ramp lead is longer than the outer g-11 keys.					
11) Name: Steve Gould			Date: 6/5/01		
12) Cause of Nonconformance: <i>Preform</i> Preform was cut, at winding, a little longer than necessary					
13) Responsible Authority <i>Rodger Rt</i>			Date: 6/5/01		
14) Disposition: <i>Trim</i> Preform preform until within confines of outer key and continue.					
13) Responsible Authority <i>Rodger Rt</i>			Date: 6/5/01		
15) Corrective Action to Prevent Recurrence: Check preform length at this point and cut if necessary. <i>JRR 11/99</i>					
13) Responsible Authority <i>Rodger Rt</i>			Title: <i>Engineer</i>		Date: <i>6/5/01</i>
16) Corrective Action/Disposition Verified By: <i>Rodger Rt</i>			17) Reviewed By: <i>Jamie Blau</i>		
13) Responsible Authority		Date: <i>6/5/01</i>		Process Engineering Manager	
<input type="checkbox"/> Class I		<input type="checkbox"/> Class II		Date: <i>5-Jul-2001</i>	
Will Configuration be affected? <input type="checkbox"/> Yes <input type="checkbox"/> No					

- 18) Material Manpower Method Machine Measurement
Process Engineering determine (identify), appropriate problem area and check.

JUL 9 2001

1) Traveler Title: Large Hadron Collider Magnet assembly		2) Specification No.: 5520-tr-333494		3) Revision: A	4) DR No.: HGQ-0230
5) Step No.: 9.4	6) Drawing No. & Revision: MC-369582	7) Routing No.: #Name?	8) Component/Item/Batch/Lot No.: MQXBC01		9) Serial No.: MQXBC01
10) Nonconformance Description by First Hand Observer: <input type="checkbox"/> Class I <input checked="" type="checkbox"/> Class II The Ls and Q measurements for all of the individual inner and outer coils are outside of the specified limits given.					
11) Name: Damon Bice				Date: 6/12/01	
12) Cause of Nonconformance: Limits were set based on previous magnets and are inappropriate					
13) Responsible Authority <i>Rodger Bt</i>				Date: 6/12/01	
14) Disposition: Continue with magnet					
13) Responsible Authority <i>Rodger Bt</i>				Date: 6/12/01	
15) Corrective Action to Prevent Recurrence: Reassess and change limits in traveler					
13) Responsible Authority <i>Rodger Bt</i>			Title: Engineer		Date: 6/12/01
16) Corrective Action/Disposition Verified By: <i>Rodger Bt</i>			17) Reviewed By: <i>Bob J...</i> 7/18/01		
13) Responsible Authority <i>Rodger Bt</i> Date: 6/12/01			Process Engineering Manager Date:		
[] Class I <input checked="" type="checkbox"/> Class II			Will Configuration be affected? [] Yes [<input checked="" type="checkbox"/>] No		

- 18) Material Manpower Method Machine Measurement
Process Engineering determine (identify), appropriate problem area and check.

JUL 18 2001

Instructions for the completion of the Discrepancy Report Form

Definition:

>>Discrepancy Report - A form used to report all Class I & Class II problems (Discrepancies).

Process Engineering Responsibility:

>> Process Engineering - Maintains and Controls the Group's Discrepancy Report and Control Log.

1. Traveler Title - Enter the title of the Traveler at the point the Discrepancy was found.
2. Enter the Specification Number in place at the time of the Discrepancy.
3. Enter the Revision in place at the time of the Discrepancy.
4. DR Number - Enter the next number from the control log that is maintained by Process Engineering.
5. Step No. - Record the step in the Traveler where the Discrepancy was found or the process stopped. Attach a copy of traveler page (s) or the process description as appropriate or required to clarify the condition.
6. Drawing No. & Revision - Reference the applicable drawing that describes the item or condition.
7. If part is defective, record Routing No. from Parts Kit.
8. Enter - The Component/Item/Batch/Lot Number - (an identification Number assigned to the Item).
9. Enter - The Serial Number - (an identification Number assigned to the Item).
10. Nonconformance Description by First Hand Observer - Enter a brief and concise description of those actions, conditions, or facts that result in a nonconforming condition along with the reason it is out of specification. This is done by the person that observed the condition and is assisted by a Process Engineering Technician or Production Supervisor.
11. Enter Name, Title, Date - the First Hand Observer, his /her job title and the date the condition was observed.
12. Cause of Nonconformance - Enter the agreed event or condition that rendered the item unacceptable for use. If unable to determine the cause at this time, state "Unknown" with an explanation.
13. Responsible Authority - That person in charge of the area or activity in question states the cause and disposition of the nonconforming condition and verifies that the Corrective Action and Disposition have been completed. Before closing the report he determines if the configuration of the component/item is effected and if the nonconforming condition is Class I or II.

CONFIGURATION - The physical and functional characteristics of a Component/Item, including the materials, parts and limit criteria that are "frozen" in the design documents.

CLASS I - A major problem that affects configuration, performance, form, fit, function, reliability or safety, significant cost or schedule increase.

CLASS II - A minor problem that is not Class I, but can be eliminated by approved repair or rework that when completed in an acceptable manner will bring the nonconforming condition into compliance with the design requirements.

14. Disposition - A plan by the Responsible Authority that will render the item or condition acceptable for use. This may be use-as-is, rework, repair, replace, substitute or scrap along with details.
15. Corrective Action to Prevent Recurrence - Those actions necessary to correct, minimize or eliminate the cause from repeating itself in the process, work instructions, work practices, inspections, drawing, tools, equipment or materials, etc.
16. Corrective Action/Disposition Verified - To be signed after the Cause, Disposition and Corrective Action to Prevent Recurrence have been put into place or completed.
17. Reviewed By: - The Process Engineering Manager performs a review of the report to assure proper completion; that the Corrective Action to Prevent Recurrence and Disposition have been completed and are acceptable.
18. Process Engineering determine (identify); appropriate problem area.

1) Traveler Title: LHC Magnet Assembly		2) Specification No.: 5520-TR-333494		3) Revision: A	4) DR No.: HGQ-0234
5) Step No.: 4.0	6) Drawing No. & Revision: MC-369582		7) Routing No.:	8) Component/Item/Batch/Lot No.: MQXB-001	9) Serial No.: MQXB-002
10) Nonconformance Description by First Hand Observer: <input type="checkbox"/> Class I <input checked="" type="checkbox"/> Class II The inner coils are much longer than the outer coils in length.					
11) Name: Steve Gould				Date: 6/4/2001	
12) Cause of Nonconformance: Press was repaired, causing radial pressure on coils during curing to be increased to the desired levels. As a result, the coil "springback" changes, affecting the coil length.					
13) Responsible Authority: <i>Rodger R. T.</i>				Date: 6/4/01	
14) Disposition: Use coils as is. Shim outer coils to match inner coil length.					
13) Responsible Authority: <i>Rodger R. T.</i>				Date: 6/4/01	
15) Corrective Action to Prevent Recurrence: Modify traveler to increase the length of the have production engineer verify coil length, and shim coils at assembly. <i>TRR 1199</i>					
13) Responsible Authority: <i>Rodger R. T.</i>				Title: <i>Engineer</i>	Date: 6/4/01
16) Corrective Action/Disposition Verified By: <i>Rodger R. T.</i>			17) Reviewed By: <i>Steve Blaine</i> 8/13/01		
13) Responsible Authority: <i>Rodger R. T.</i>			Date: 6/4/01	Process Engineering Manager	Date:
<input type="checkbox"/> Class I	<input checked="" type="checkbox"/> Class II	Will Configuration be affected? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No			

18) Material Manpower Method Machine Measurement
 Process Engineering determine (identify), appropriate problem area and check.

Notes on Document:

Magnet Travelers - 06/12/2001

1) Traveler Comments - Expert Subject Matter - Traveler Comments - Expert Subject Matter -
03/24/2003 - On Page: 1

This device should have been called MQXBC-001. This traveler was issued prior to the official
naming convention being issued.

2) Data Comments - ProEng - Data Comments - ProEng - 09/06/2001 - On Page: 10
Outer Inductance actually measured in milli Henrys

3) Data Comments - ProEng - Data Comments - ProEng - 09/06/2001 - On Page: 28
Readings for Outer Inductance actually measured in Milli Henrys
