Document ID: 3585

LHC Q3 LQXC Cryostat Shipping Traveler

333731 / Rev. None

Job No:	**248**
E + F Project/Task No.:	**300/1.1.1.6.2**
M + S Project/Task No.:	**300/1.1.1.6.2**

Place This Side Down For Scanning!!!

LQXC01-0

Document ID:

3585

Job No.:

248

Project/Task No.

300/1.1.1.6.2

Series:

LQXC

Serial No:

LQXC01

Rework ID:

0

Specification No.:

333731

Revision:

None

LQXC01-0

Fermi National Accelerator Laboratory
Batavia, IL 60510

LARGE HADRON COLLIDER
Q3 - LQXC
SHIPPING TRAVELER

Reference Drawing(s):
Q1/Q3 Shipping Fixture Final Assembly
(ME-390729)
Q3 Magnet Shipping Assembly
(ME-390728)

Project/Task Number: *300/1.1.1.6.2*	**Job Number:** *248*
Released By: *John Szostak*	**Magnet/Device Series:** *LQXC*
Date Issued: *1/14/2005 3:18:28 PM*	**Scanned Pages:** ~~73~~ 77
Prepared by: B. Jensen, J. Szostak	

Title	Signature	Date
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Revision Page

Revision	Step No.	Revision Description	TRR No.	Date
None	N/A	Initial Release	N/A	1/14/05

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 All steps that require a sign-off shall include the Technician/Technician(s)s first initial and full last name.

1.2 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.

1.3 All Discrepancy Reports issued shall be recorded in the left margin next to the applicable step.

1.4 Personnel shall perform all tasks in accordance with current applicable ES&H guidelines and those specified within the step.

1.5 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.

J Ghostah
Process Engineering/Designee

1/14/05
Date

3.0 Magnet Electrical Preparation

3.1 Does magnet require a purge of compressed dry nitrogen (N_2)?

☒ YES, PURGE REQUIRED, Proceed to Step 3.2

☐ NO, PURGE NOT REQUIRED, Proceed to Step 4.0

STOP

Andy Hoc
Responsible Authority/Physicist

18-JAN-2005
Date

3.2 If YES box was checked in Step 3.1, perform a required purge for a minimum of 2.5 days (3 days maximum) at a flow rate of 5 CFH of N_2.

	Purge Time	Purge Date	Purge Flow Rate
Start	SJG ~~[illegible]~~ 7:15am	1/11/05	10
Finish	8.00AM	1-20-05	—

Technician(s)

1-20-05
Date

5B 5A
8A 8B

4.0 Magnet End Preparation (Non IP End)

4.1 Separate, identify, and label the Non-IP Magnet End Corrector leads as per (ME-369900 (sheet 4 of 5)) and figure 4.2-A below (Next Step).

DK HLQ 0522

Technician(s) 1/22/05 Date

4.2 Locate and identify the two 8KA Bus Leads and the two 5KA Bus Leads.

Corrector Bus Leads

	V3A	V3B	H3A	H3B	B3A	B3B	B6A	B6B	
	V2A	V2B	H2A	H2B	B4A	B4B	A4A	A4B	
	V1A	V1B	H1A	H1B	A2A	A2B	A3A	A3B	

(View Looking from DFBX into Q3)

"A" Lead [redacted] **8Ka** **5Ka** [redacted]

"B" Lead [redacted] **8Ka** **5Ka** [redacted]

Q3 Non-IP End (Non-Lead End)
Lead Configuration
Figure 4.2-A

Technician(s) 1/25/05 Date

TRR#1706 MOVE TO METER ELECT

4.3 Insulate the two 8Ka Bus Leads and the two 5Ka Bus Leads using approved methods.

Note(s):

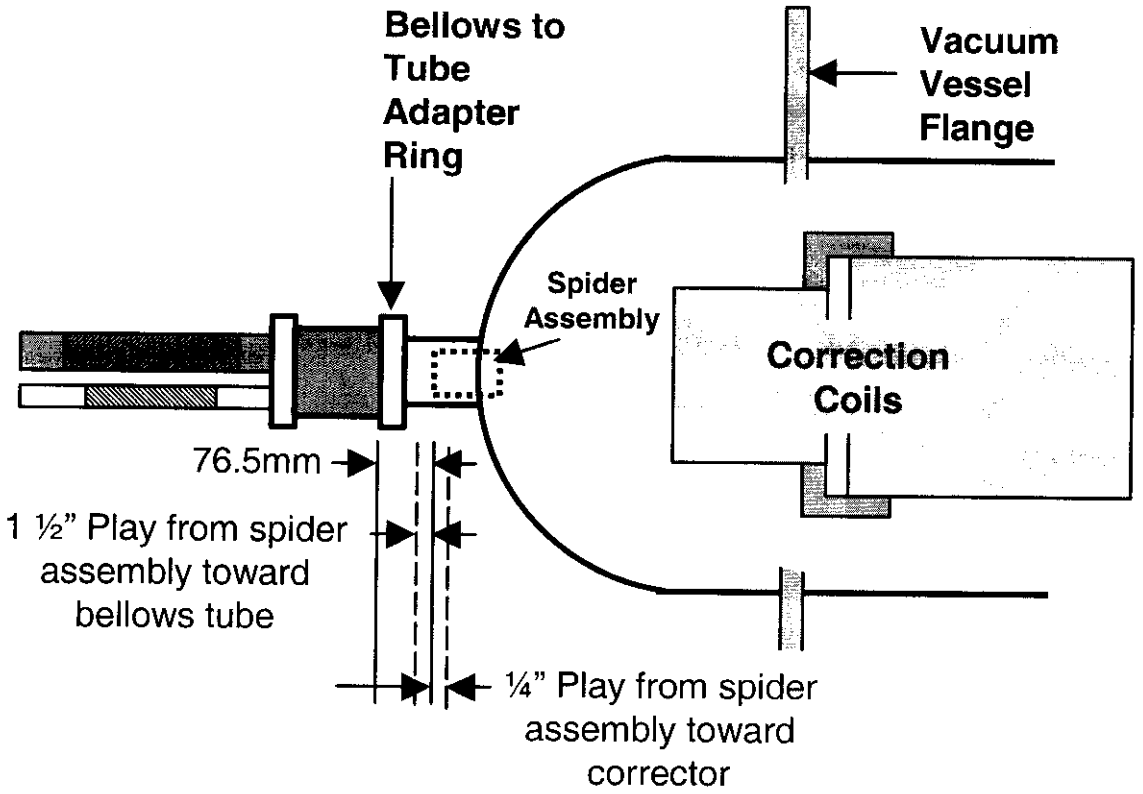
These leads must be insulated using approved methods (refer to ME-369900), first as an individual lead, then insulated as pairs to prevent 'shorting' to the other leads

Technician(s) _____ Date 1/24/05

4.4 Insulate the magnet leads using ¾" Black Shrink Tubing (MA-318797). Ensure that the entire length of magnet leads are covered before heat shrinking.

Technician(s) _____ Date 1/24/05

4.6 At the Non-IP End, move leads back and forth to ensure that the leads have sufficient travel for thermal expansion. Leads should have travel shown in figure below. From inside the bellows, measure from the outer edge of the Bellows to Tube adapter ring inward toward the magnet center.



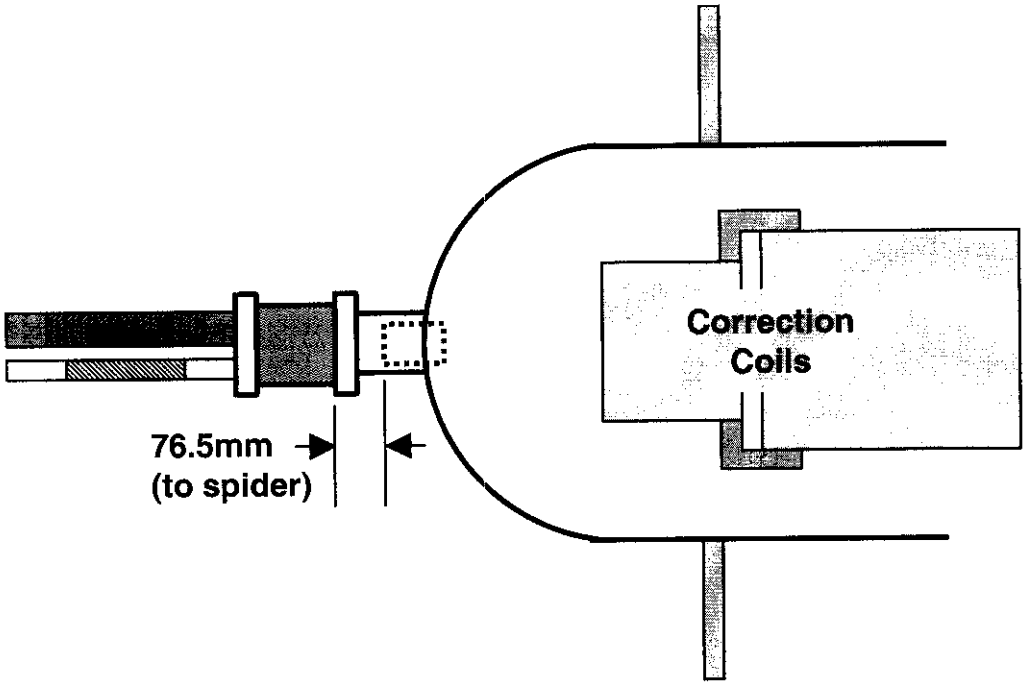
Non-IP End of Q3

Record Travel Distance: 1 7/8"

Technician(s) _____ Date 1-2005

STOP

4.7 At the Non-IP End, ensure the conductor and Spider assembly are in the "set" position (76.5mm) before taking measurement for step 4.8.



Non-IP End of Q3

Crew Chief _____ Date 1-20-05

TPR 1706
See Rodger
Dimension to be measured should be directly stated with tolerance

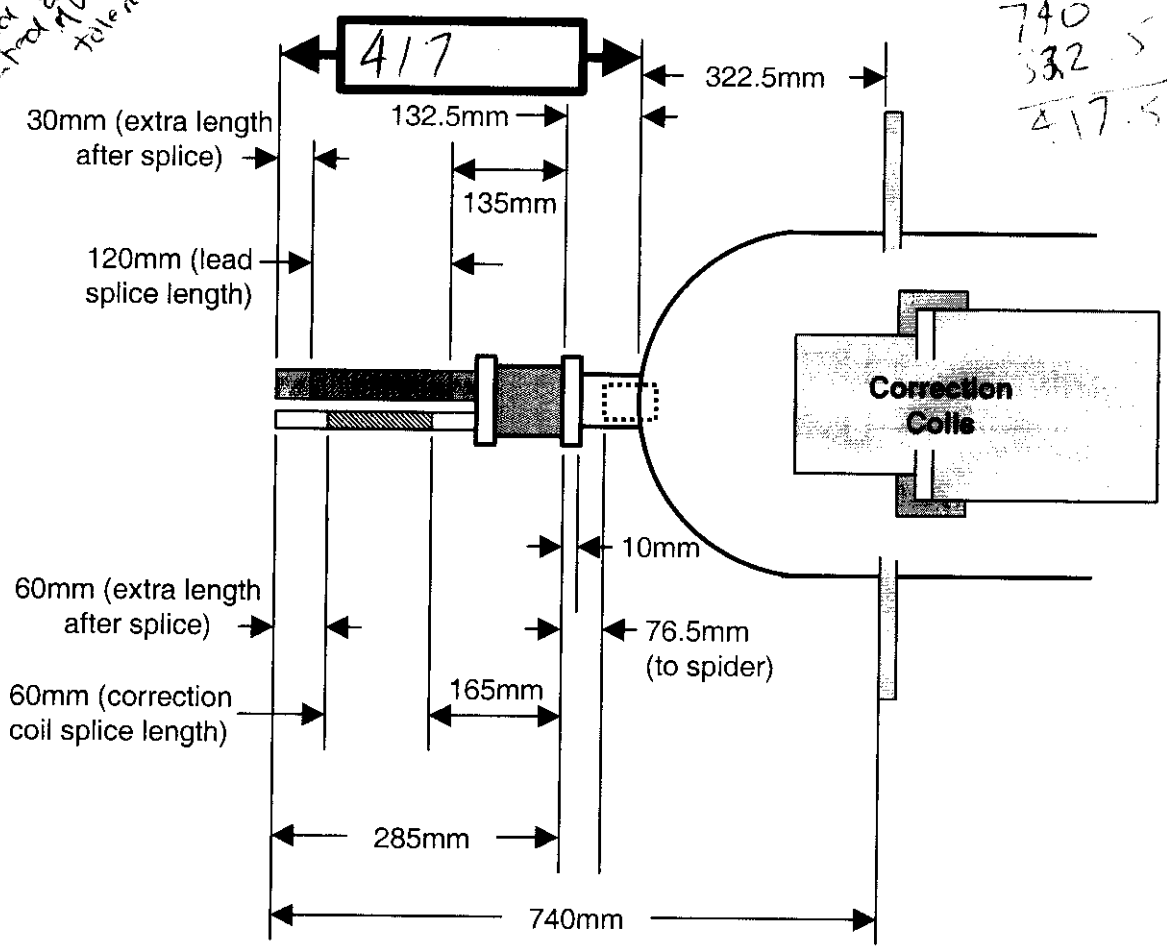
4.8 At the Non-IP End, measure and record the length of the conductor from the 'flat' of the magnet dome to the end of the conductor and record in the box provided below.

Note(s):

The 740 mm dimension for the magnet leads includes an approximate 30 mm of extra buffer cable for installation tolerances.

+/- 10mm Tolerance

740
322.5
417.5



Non-IP End of Q3

Technician(s) _____ Date 1.20.05

STOP

4.9 Verify Step 4.6 (Spider Assembly measurement) and 4.8 (Conductor measurement) are acceptable.

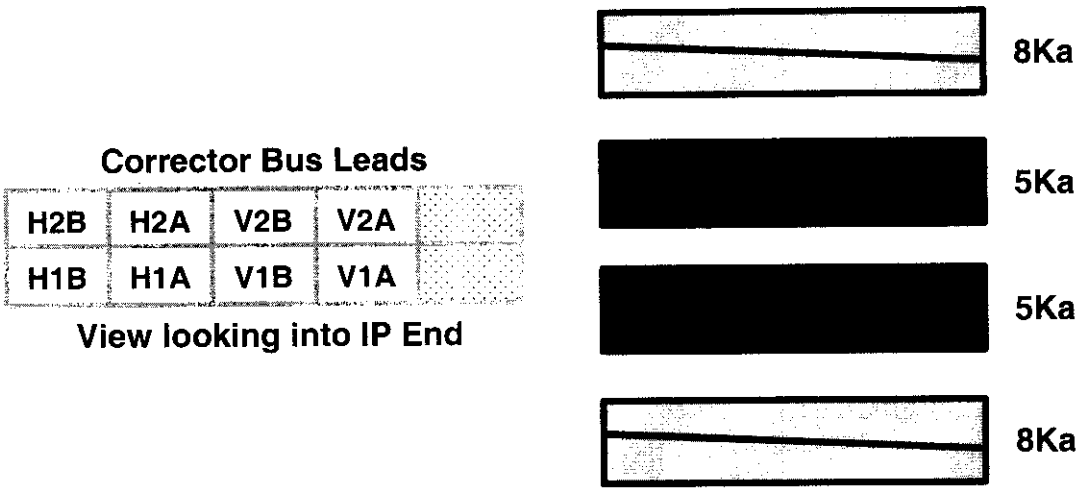
Responsible Authority/Physicists _____ Date 1-20-05

5.0 Magnet End Preparation (IP End)

5.1 Separate, identify, and label the IP Magnet End Corrector leads as per (ME-369900 (sheet 4 of 5)) and figure 5.2-A below (Next Step).

Technician(s) _____ Date 1/22/05

5.2 Locate and identify the two 8KA Bus Leads and the two 5KA Bus Leads.



Q3 IP End (Lead End)
Lead Configuration

Figure 5.2-A

Technician(s) _____ Date 1/22/05

MOVE TO AFTER ELEC TRR# 1706

5.3 Insulate the two 8Ka Bus Leads and the two 5Ka Bus Leads using approved methods.

Note(s):

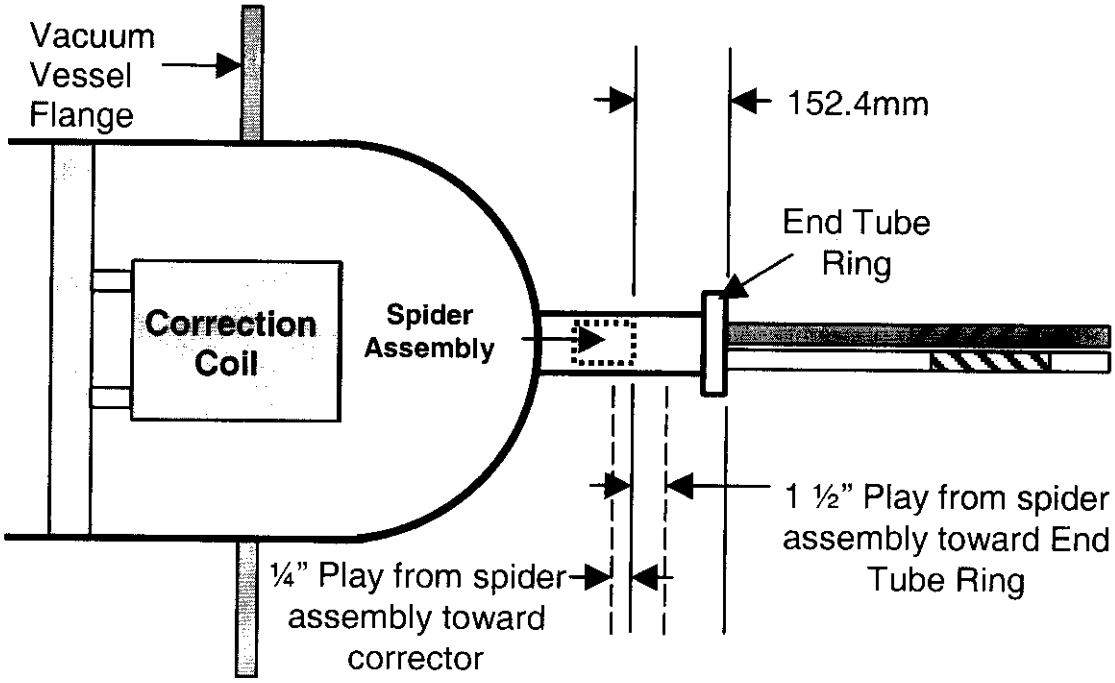
These leads must be insulated using approved methods (refer to ME-369900), first as an individual lead, then insulated as pairs to prevent 'shorting' to the other leads

Technician(s) _____ Date 1/22/05

5.4 Insulate the magnet leads using ¾" Black Shrink Tubing (MA-318797). Ensure that the entire length of magnet leads are covered before heat shrinking.

Technician(s) _____ Date 1/22/05

5.5 At the IP End, move leads back and forth to ensure that the leads have sufficient travel for thermal expansion. Leads should have travel shown in figure below.
Measure from the outer edge of the End Tube Ring inward toward the magnet center.



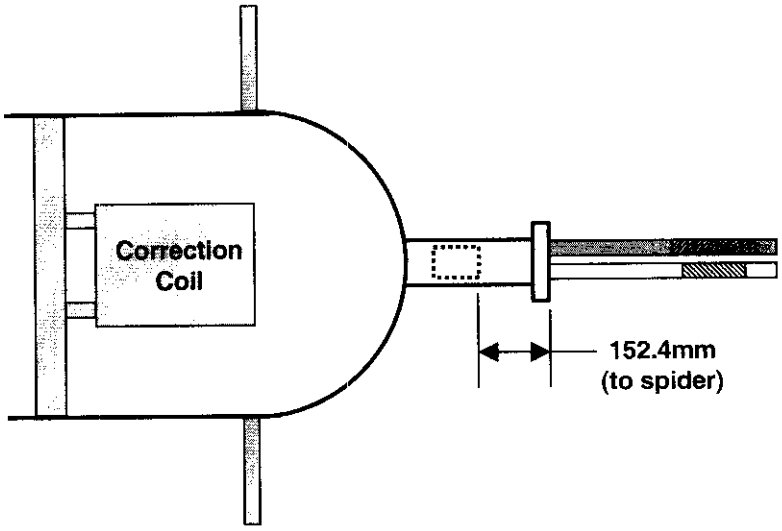
IP End of Q3

Record Travel Distance: 2"

Technician(s) _____ Date 1-20-05

STOP

5.6 At the IP End, ensure the conductor and Spider assembly are in the "set" position (152.4mm, see fig. below.) before taking measurement for step 5.7.



IP End of Q3

Crew Chief

1-20-05
Date

TRR 1706

See Rodger. Dimension to be measured should be stated with tolerance

5.7 At the IP End, measure and record the length of the conductor from the 'flat' of the magnet dome to the end of the conductor and record in the box provided below.

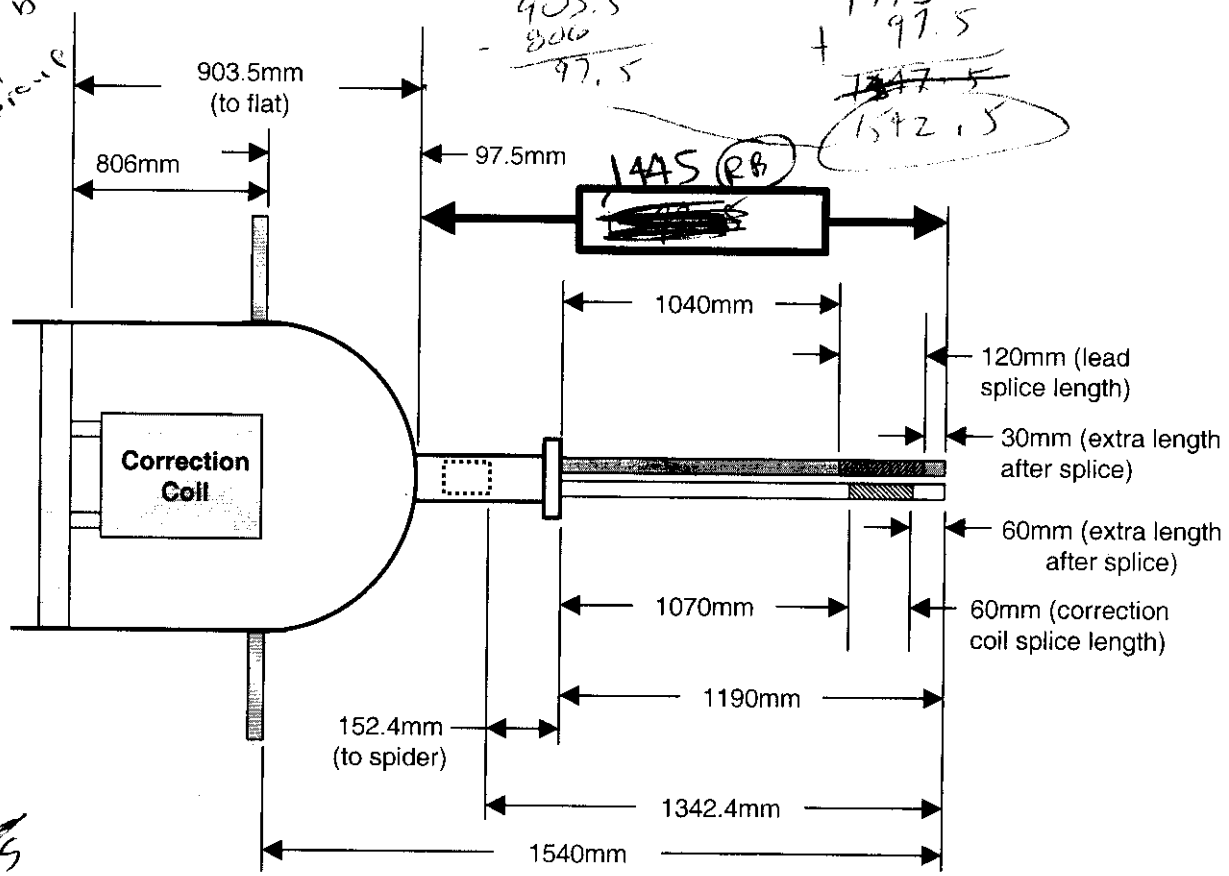
Note(s):

The 1540 mm dimension for the magnet leads includes an approximate 30 mm of extra buffer cable for installation tolerances.

903.5 − 806 = 97.5

1445 + 97.5 = ~~1347.5~~ 1542.5

Tolerance +/- 10 mm



IP End of Q3

1540.0 − 97.5 = 1442.5

Technician(s) _____ Date 1-20-05

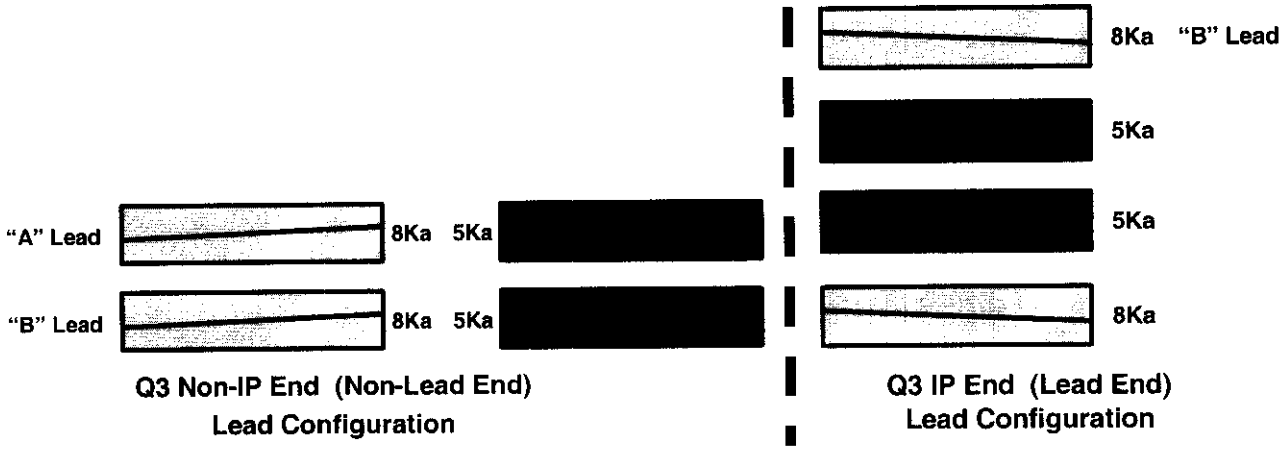
STOP

5.8 Verify Step 5.5 (Spider Assembly measurement) and 5.7 (Conductor measurement) are acceptable.

Responsible Authority/Physicists _____ Date 1-25-05

6.0 Final Electrical Inspection

6.1 At the IP End, jumper the two 5Ka leads together. At the Non-IP End, measure the resistance of the 5Ka Busses and record below.



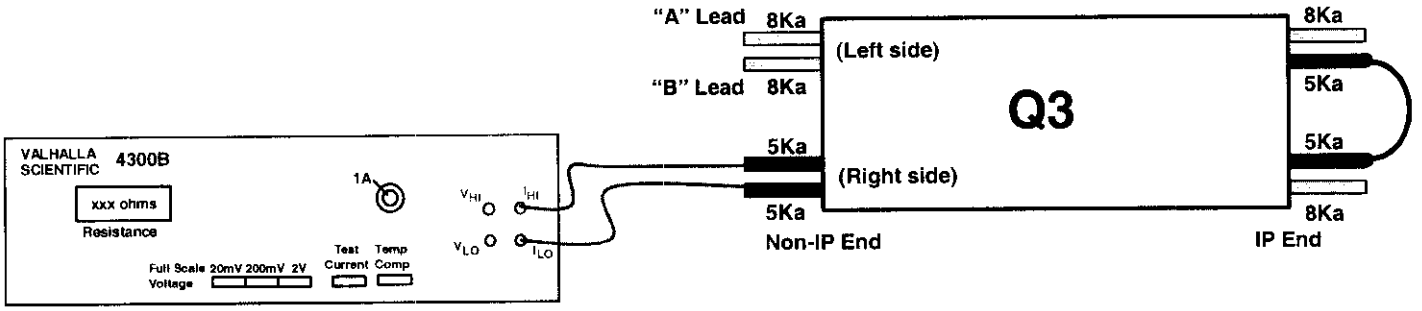


Figure 6.1-A

Q3 Non-IP End	
Lead	**Resistance**
5Ka Leads (Jumpered at IP End)	SNG ~~7.F~~.013x7 Ω

Technician(s) _____ Date 1/21/05

6.2 Perform an electrical inspection on each of the Individual Quadrants and the Cold Mass. Refer to the Valhalla and Leader Free Standing Coil Measurement Procedure (ES-292306).

To measure the Resistance of a Q3 Cold Mass:

1. Use Valhalla Scientific 4300B digital micro-ohmmeter.
2. Set Test Current to 0.1 amp.
3. Set Scale to 2V full scale.
4. Turn temperature compensation on.
5. Turn test current off.
6. Connect I_{HI} to "A" Lead as shown in figure 6.2-A.
7. Connect I_{LO} to "B" Lead as shown in figure 6.2-A.
8. Turn test current on.
9. Connect V_{HI} and V_{LO} to voltage taps as shown in resistance table.
10. To measure Total with leads, connect V_{HI} to "A" Lead and V_{LO} to "B" Lead.
11. Read resistance and record in traveler.
12. At the IP End, jumper the 8Ka leads as shown in Figure 6.2-A.

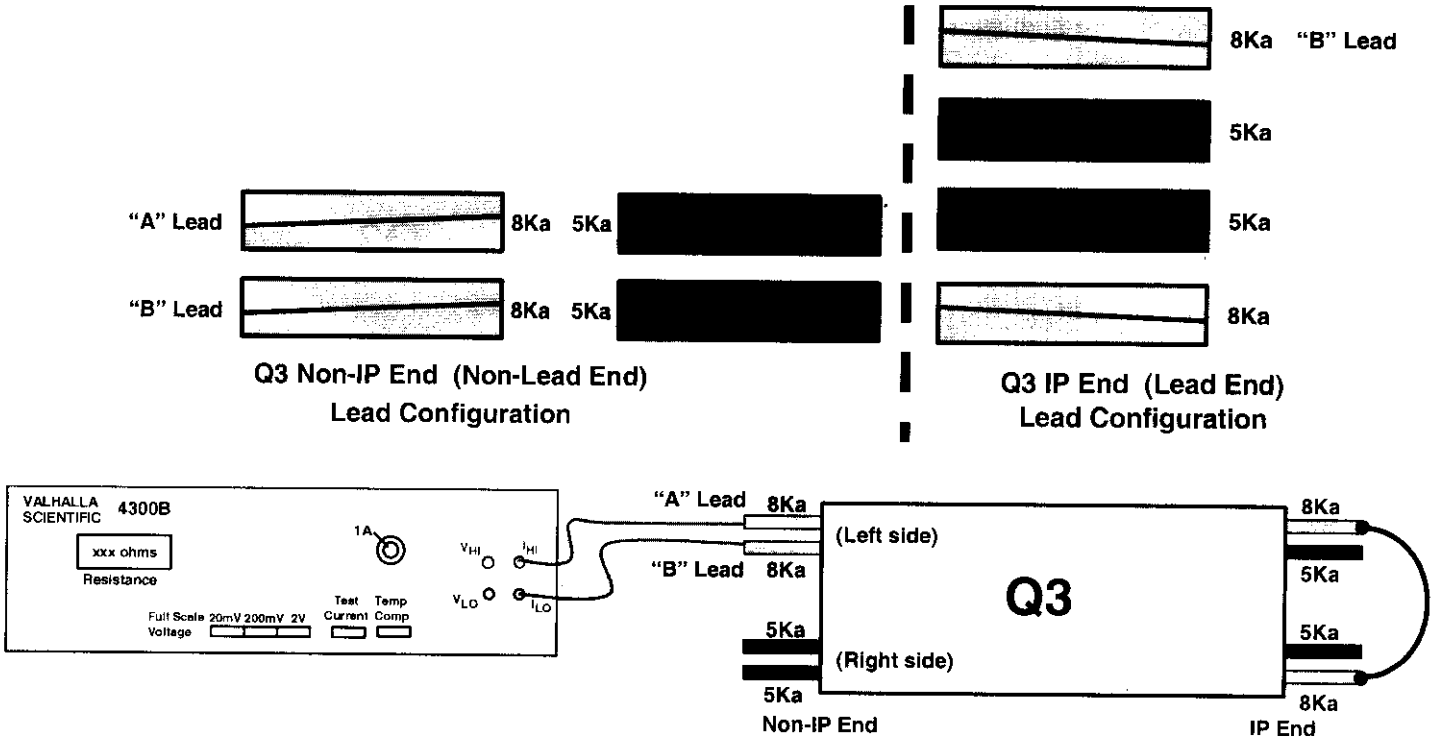


Figure 6.2-A

(Q3) Resistance				Nominal ~~3.35 to 3.45 Ω~~
Voltage Tap Serial Numbers				Total Resistance
Connect	Fermi	CERN	KEK	
V_{HI}	VTa1Q3	EE1113	a1	3.395 Ω
V_{LO}	VTc1Q3	EE1213	c1	
V_{HI}	VTc1Q3	EE1213	c1	3.395 Ω
V_{LO}	VTb1Q3	EE1313	b1	
V_{HI}	VTa1Q3	EE1113	a1	6.786 Ω
V_{LO}	VTb1Q3	EE1313	b1	

		Total Resistance with Leads
		Nominal 6.75 to 6.85 Ω
V_{HI}	"A" Power Lead	6.801 Ω
V_{LO}	"B" Power Lead	

Technician(s) _____ Date 1/21/05

Check resistance of Redundant Voltage Taps.

Q3 Redundant Voltage Taps				Nominal 3.35 to 3.45 Ω
Connect	Fermi	CERN	KEK	Resistance
V_{HI}	VTa2Q3	EE1123	a2	3.393 Ω
V_{LO}	VTc2Q3	EE1223	c2	
V_{HI}	VTc2Q3	EE1223	c2	3.393 Ω
V_{LO}	VTb2Q3	EE1323	b2	

Technician(s) _____ Date 1/21/05

To measure Ls and Q of a Q3 Cold Mass:

1. Use Agilent 4263B LCR Meter.
2. Turn power on by pushing line button. Wait 30 seconds until display screen is lit.
3. Recall program #1. To do this, push recall (Rcl), then push #1, then push Enter.
4. Push Auto/Hold button to release hold.
5. Verify that the frequency displayed in the upper right corner of the display screen is 1000 Hz and the level recorded in the lower right corner of the display screen is 1V or 1000 mV.
6. Connect H_{cur} to "A" power lead as shown in figure 6.2-B
7. Connect L_{cur} to "B" power lead as shown in figure 6.2-B.
8. Connect H_{pot} and L_{pot} buttons to voltage taps as shown below.
9. Read Ls and Q from display and record in table.

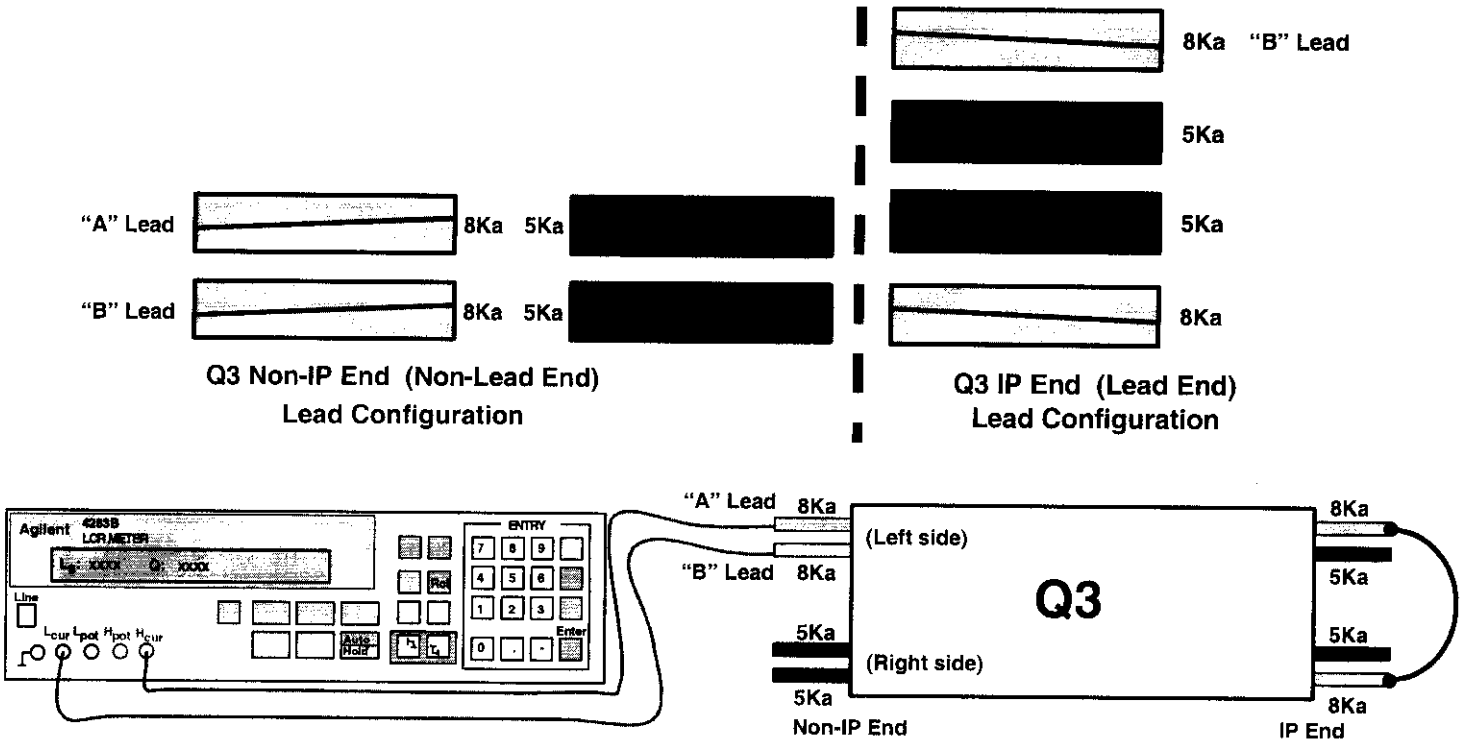


Figure 6.2-B

(Q3) Inductance				Nominal 15 to 16 mH
Voltage Tap Serial Numbers				Total Inductance
Connect	Fermi	CERN	KEK	
H_{POT}	VTa1Q3	EE1113	a1	15,150 mH
L_{POT}	VTc1Q3	EE1213	c1	
H_{POT}	VTc1Q3	EE1213	c1	15,157 mH
L_{POT}	VTb1Q3	EE1313	b1	

				Nominal 30 to 32 mH
				Total Inductance
H_{POT}	VTa1Q3	EE1113	a1	30,299 mH
L_{POT}	VTb1Q3	EE1313	b1	

(Q3) Q-Factor				Nominal 1.0 to 1.2
Voltage Tap Serial Numbers				Total Q
Connect	Fermi	CERN	KEK	
H_{POT}	VTa1Q3	EE1113	a1	1.1
L_{POT}	VTc1Q3	EE1213	c1	
H_{POT}	VTc1Q3	EE1213	c1	1.1
L_{POT}	VTb1Q3	EE1313	b1	

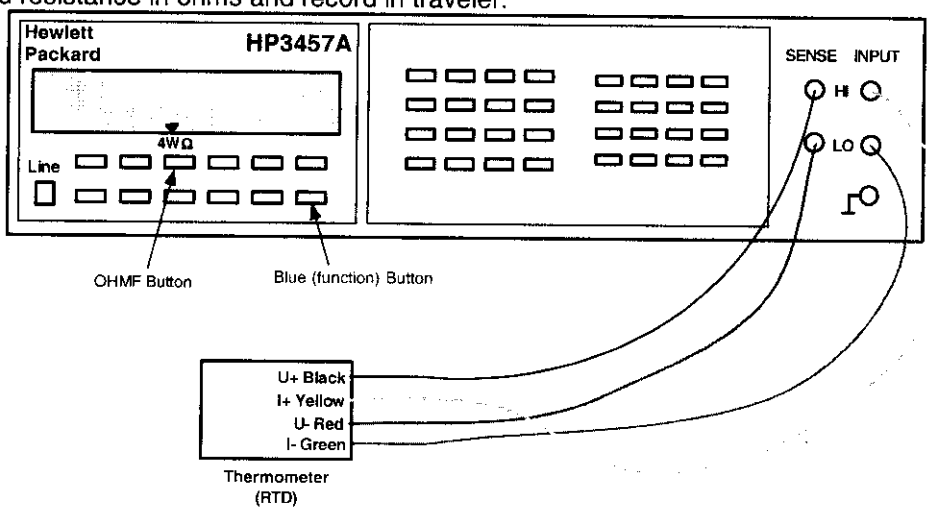
				Nominal 1.0 to 1.2
				Total Inductance
H_{POT}	VTa1Q3	EE1113	a1	1.1
L_{POT}	VTb1Q3	EE1313	b1	

A Gould
Technician(s)

1/21/05
Date

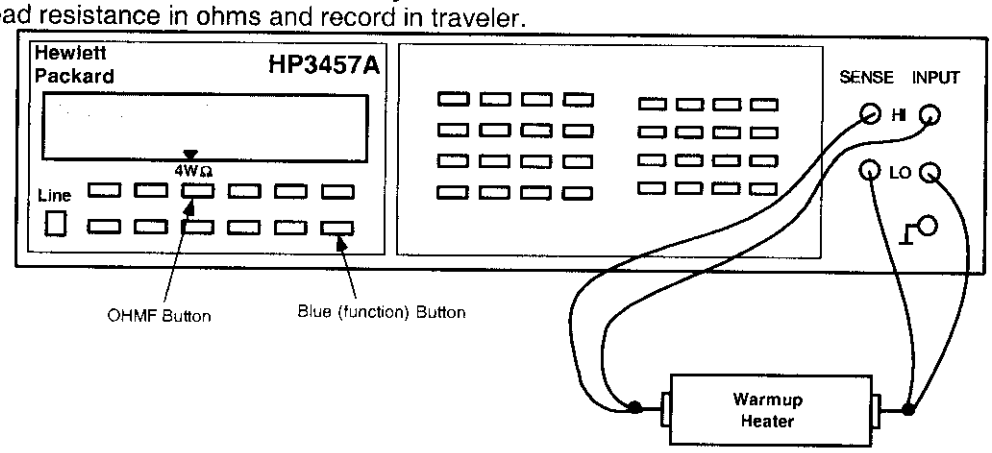
To measure the resistance of a Thermometer (RTD):

1. Use Hewlett Packard HP3457A digital multimeter.
2. Record temperature of building within +/- 5 degrees.
3. Press line button to turn line on.
4. Connect wires as shown in Figure below.
   U+ (Black) to Sense HI
   I+ (Yellow) to Input HI
   U- (Red) to Sense LO
   I- (Green) to Input LO
5. Push blue button (function key) once.
6. Push OHMF button.
7. Verify arrow in readout is above the 4WΩ (meaning a 4 wire resistance measurement).
8. Read resistance in ohms and record in traveler.



To measure the resistance of a Cryogenic (Warm-up) Heater

1. Use Hewlett Packard HP3457A digital multimeter.
2. Record temperature of building within +/- 5 degrees.
3. Press line button to turn line on.
4. Connect wires as shown in Figure below.
5. Push blue button (function key) once.
6. Push OHMF button.
7. Verify arrow in readout is above the 4WΩ (meaning a 4 wire resistance measurement).
   Note: Although this is technically a 4 wire measurement, it is effectively a 2 wire measurement, since there are only 2 wires connected to each heater.
8. Read resistance in ohms and record in traveler.



Q3 - RTD's and Cryogenic (warm-up) Heaters				
Temperature of Building (± 5°): 67°F				
Component	**Fermi**	**CERN**	**Range**	**Resistance**
Q3 Cryogenic (warm-up) Heater (LE) - wire at top (CERN #1 I+)	W1aQ3	EH8313+	16 to 18.5 Ω	18.2 Ω
Q3 Cryogenic (warm-up) Heater (LE) - wire at bottom (CERN #1 I-)	W2aQ3	EH8313-		
Q3 Cryogenic (warm-up) Heater (Non-LE) - wire at top (CERN #2 I+)	W1bQ3	EH8323+	16 to 18.5 Ω	17.8 Ω
Q3 Cryogenic (warm-up) Heater (Non-LE) - wire at bottom (CERN #2 I-)	W2bQ3	EH8323-		

Note(s):

Record the appropriate RTD Serial Numbers and Mfr. Resistance in the table below.

RTD Serial No.	Fermi	CERN	Measured Ω	Mfr. Resistance (Expedition)
Q3 RTD, primary:	TaQ3	TT8313	73.8	71,399 Ω
Q3 RTD, redundant:	TbQ3	TT8323	68.1	65.556 Ω

A Gould
Technician(s)

1/21/05
Date

Using the Hewlett Packard HP3457A digital multimeter, measure the Protection (Strip) Heater Resistance for Q3.

Q3 Protection (Strip) Heater Resistance					
Fermi	CERN	KEK	Description	Limit	Resistance
H1aQ3	YT1113+	HA1	Circuit A	28 to 32 Ω	31.7 Ω
H2aQ3	YT1113-	HA2			
H1bQ3	YT1123+	HB1	Circuit B	28 to 32 Ω	31.7 Ω
H2bQ3	YT1123-	HB2			

Technician(s)

1/21/05
Date

6.3 Using the Valhalla 4300B, connect 10mA applied voltage thru the corrector Power Leads. Measure Resistance and record in the table below.

Corrector Bus Leads

	V3A	V3B	H3A	H3B	B3A	B3B	B6A	B6B	
	V2A	V2B	H2A	H2B	B4A	B4B	A4A	A4B	
	V1A	V1B	H1A	H1B	A2A	A2B	A3A	A3B	

(View Looking from DFBX into Q3 – Non-IP End)

GOT FROM D. EDDY 1/21/05

Corrector Assembly	Corrector Element	Readout Labels		Power Labels		Resistance
				I_{HI}	I_{LO}	
MQSX	MQSX	A2A	EE8223	A2A	A2B	4.2
		EE8223	A2B			10.10
		A2A	A2B			8.3
MCBXA	MCBXV	V3A	EE8113	V3A	V3B	1.51
		EE8113	V3B			19.76
		V3A	V3B			18.1
	MCBXH	H3A	EE8123	H3A	H3B	1.27
		EE8123	H3B			4W ~~1.27~~ 24.66
		H3A	H3B			21.9
	MCTX	B6A	EE8613	B6A	B6B	1.54
		EE8613	B6B			101.5
		B6A	B6B			100.2
	MCSX	B3A	EE8313	B3A	B3B	1.68
		EE8313	B3B			29.26
		B3A	B3B			28
MCSOX	MCOSX	A4A	EE8423	A4A	A4B	1.42
		EE8423	A4B			13.6
		A4A	A4B			12.2
	MCOX	B4A	EE8413	B4A	B4B	1.41
		EE8413	B4B			14.45
		B4A	B4B			13.2
	MCSSX	A3A	EE8323	A3A	A3B	2.3
		EE8323	A3B			14.9
		A3A	A3B			14

Technician(s) _____ Date 1/21/05

6.4 Check Q1 & Q2 Instrumentation Bus Wires for Continuity.

Module	Pin	Fermi	CERN	KEK	Description	Done
M2	1	VTa1Q1	EE1111	a1	Q1 Lead Voltage Tap "a" , primary	✓
M2	2	VTa2Q1	EE1121	a2	Q1 Lead Voltage Tap "a", redundant	✓
M2	3	VTc1Q1	EE1211	c1	Q1 Center Voltage Tap "c", primary	✓
M2	4	VTc2Q1	EE1221	c2	Q1 Center Voltage Tap "c", redundant	✓
M2	5	VTb1Q1	EE1311	b1	Q1 Lead Voltage Tap "b", primary	✓
M3	1	VTc1Q2a	EE1212		Q2a Center Voltage Tap "c", primary	✓
M3	3	VTa2Q2a	EE1122		Q2a lead Voltage Tap "a", redundant	✓
M3	4	VTa1Q2a	EE1112		Q2a Lead Voltage Tap "a", primary	✓
M3	5	VTb2Q1	EE1321	b2	Q1 Lead Voltage Tap "b", redundant	✓
M4	1	VTc2Q2a	EE1222		Q2a Center Voltage Tap "c", redundant	✓
M4	3	VTb1Q2a	EE1312		Q2a Lead Voltage Tap "b", primary	✓
M4	4	VTb2Q2a	EE1322		Q2a Lead Voltage Tap "b", redundant	✓
M4	5	VTb1Q2b	EE1612		Q2b lead Voltage Tap "b", primary	✓
M5	2	VTc2Q2b	EE1522		Q2b Center Voltage Tap "c", redundant	✓
M5	3	VTc1Q2b	EE1512		Q2b Center Voltage Tap "c", primary	✓
M5	5	VTb2Q2b	EE1622		Q2b Lead Voltage Tap "b" redundant	✓
M6	1	VTa1Q2b	EE1412		Q2b Lead Voltage Tap "a", primary	✓
M6	2	VTa2Q2b	EE1422		Q2b Lead Voltage Tap "a", redundant	✓
M8	1	VTH1	EE8121		Corrector voltage tap Q1-H1 (skew dipole) (on MCBX, MCBXH, A+ lead)	✓
M8	2	VTV1	EE8111		Corrector voltage tap Q1-V1 (normal dipole) (on MCBX, MCBXV A+ lead)	✓
M8	3	VTH2	EE8122		Corrector voltage tap Q2-H2 (skew dipole) (on MCBX, MCBXH, A+ lead)	✓
M8	4	VTV2	EE8112		Corrector voltage tap Q2-V2 (normal dipole) (on MCBX, MCBXV, A+ lead)	✓
M10	1	W1aQ1	EH8311+		Q1 Cryogenic Heater lead end - wire at top (CERN #1 I+)	✓
M10	2	W2aQ1	EH8311-		Q1 Cryogenic Heater lead end - wire at bottom (CERN #1 I-)	✓
M10	3	W1bQ1	EH8321+		Q1 Cryogenic Heater non-lead end - wire at top (CERN #2 I+)	✓
M10	4	W2bQ1	EH8321-		Q1 Cryogenic Heater non-lead end - wire at bottom (CERN #2 I-)	✓
M11	1	W1aQ2A	EH8312+		Q2A Cryogenic Heater lead end - wire toward cold mass end plate (CERN #1 I+)	✓
M11	2	W2aQ2A	EH8312-		Q2A Cryogenic Heater lead end - wire toward cold mass mag center (CERN #1 I-)	✓
M11	3	W1bQ2A	EH8322+		Q2A Cryogenic Heater non-lead end- wire toward cold mass end plate (CERN #2 I+)	✓

Module	Pin	Fermi	CERN	KEK	Description	Done
M11	4	W2bQ2A	EH8322-		Q2A Cryogenic Heater non-lead end- wire toward cold mass mag center (CERN #2 I-)	✓
M12	1	W1aQ2B	EH8332+		Q2B Cryogenic Heater lead end - wire toward cold mass end plate (CERN #1 I+)	✓
M12	2	W2aQ2B	EH8332-		Q2B Cryogenic Heater lead end - wire toward cold mass mag center (CERN #1 I-)	✓
M12	3	W1bQ2B	EH8342+		Q2B Cryogenic Heater non-lead end- wire toward cold mass end plate (CERN #2 I+)	✓
M12	4	W2bQ2B	EH8342-		Q2B Cryogenic Heater non-lead end- wire toward cold mass mag center (CERN #2 I-)	✓
M14	1	H1aQ1	YT1111+	HA1	Q1 Protection (Strip) Heater, ("a" circuit) (CERN lead #1+)	✓
M14	3	H2aQ1	YT1111-	HA2	Q1Protection (Strip) Heater, ("a" circuit) (CERN lead #1-)	✓
M14	5	H1bQ1	YT1121+	HB1	Q1 Protection (Strip) Heater, ("b" circuit) (CERN lead #2+)	✓
M15	2	H1aQ2a	YT1112+		Q2a Protection (Strip) Heater, 1-4 & 2-3 circuit (FNAL lead A+) (CERN lead #1+)	✓
M15	4	H2bQ1	YT1121-	HB2	Q1 Protection (Strip) Heater, ("b" circuit) (CERN lead #2-)	✓
M16	1	H2aQ2a	YT1112-		Q2a Protection (Strip) Heater, 1-4 & 2-3 circuit (FNAL lead A-) (CERN lead #1-)	✓
M16	3	H1bQ2a	YT1122+		Q2a Protection (Strip) Heater, 1-2 & 3-4 circuit (FNAL lead B+) (CERN lead#2+)	✓
M16	5	H2bQ2a	YT1122-		Q2a Protection (Strip) Heater, 1-2 & 3-4 circuit (FNAL lead B-) (CERN lead #2-)	✓
M17	2	H2aQ2b	YT1132-		Q2b Protection (Strip) Heater, 1-4 & 2-3 circuit (FNAL lead A-) (CERN lead #1-)	✓
M17	4	H1aQ2b	YT1132+		Q2b Protection (Strip) Heater, 1-4 & 2-3 circuit (FNAL lead A+) (CERN lead #1+)	✓
M18	1	H1bQ2b	YT1142+		Q2b Protection (Strip) Heater, 1-2 & 3-4 circuit (FNAL lead B+) (CERN lead#2+)	✓
M18	3	H2bQ2b	YT1142-		Q2b Protection (Strip) Heater, 1-2 & 3-4 circuit (FNAL lead B-) (CERN lead #2-)	✓
M20	1	TaQ1_I+	TT8311 I+		Q1 RTD, primary Wire color: Yellow	✓
M20	2	TaQ1_I-	TT8311 I-		Q1 RTD, primary Wire color: Green	✓
M20	3	TaQ1_V+	TT8311 U+		Q1 RTD, primary Wire color: Black	✓
M20	4	TaQ1_V-	TT8311 U-		Q1 RTD, primary Wire color: Red	✓
M20	5	TbQ1_I+	TT8321 I+		Q1 RTD, redundant: Wire color: Yellow	✓
M20	6	TbQ1_I-	TT8321 I-		Q1 RTD, redundant: Wire color: Green	✓
M20	11	TbQ1_V+	TT8321 U+		Q1 RTD, redundant: Wire color: Black	✓
M20	10	TbQ1_V-	TT8321 U-		Q1 RTD, redundant: Wire color: Red	✓
M20	9	TaQ2a_I+	TT8312 I+		Q2a RTD, primary Wire color: Yellow	✓
M20	8	TaQ2a_I-	TT8312 I-		Q2a RTD, primary Wire color: Green	✓

Module	Pin	Fermi	CERN	KEK	Description	Done
M20	7	TaQ2a_V+	TT8312 U+		Q2a RTD, primary Wire color: Black	✓
M20	12	TaQ2a_V-	TT8312 U-		Q2a RTD, primary Wire color: Red	✓
M20	13	TbQ2a_I+	TT8322 I+		Q2a RTD, redundant: Wire color: Yellow	✓
M20	14	TbQ2a_I-	TT8322 I-		Q2a RTD, redundant: Wire color: Green	✓
M20	15	TbQ2a_V+	TT8322 U+		Q2a RTD, redundant: Wire color: Black	✓
M20	16	TbQ2a_V-	TT8322 U-		Q2a RTD, redundant: Wire color: Red	✓
M21	1	TaQ2b_I+	TT8332 I+		Q2b RTD, primary Wire color: Yellow	✓
M21	2	TaQ2b_I-	TT8332 I-		Q2b RTD, primary Wire color: Green	✓
M21	3	TaQ2b_V+	TT8332 U+		Q2b RTD, primary Wire color: Black	✓
M21	4	TaQ2b_V-	TT8332 U-		Q2b RTD, primary Wire color: Red	✓
M21	5	TbQ2b_I+	TT8342 I+		Q2b RTD, redundant: Wire color: Yellow	✓
M21	6	TbQ2b_I-	TT8342 I-		Q2b RTD, redundant: Wire color: Green	✓
M21	11	TbQ2b_V+	TT8342 U+		Q2b RTD, redundant: Wire color: Black	✓
M21	10	TbQ2b_V-	TT8342 U-		Q2b RTD, redundant: Wire color: Red	✓

Technician(s) — Date 1/21/05

Responsible Authority/Physicist — Date 21-JAN-2005

STOP

6.5 Does Magnet require Hipotential Testing?

☒ YES, HIPOT REQUIRED, Proceed to Step 6.6.

Maximum Voltage: 1500 VOLTS

☐ NO, HIPOT NOT REQUIRED, Proceed to Step 7.0

Responsible Authority/Physicist — Date: 1-21-05

6.6 Hipot according to table below. Hipot to value recorded in Step 6.5. Maximum leakage is 3μA.

STOP

Have Crew Chief verify setup and sign below before continuing.

Crew Chief — Date: 1/21/05

Hipot Heaters to Coil and Ground.			
High Potential	**Grounded**	**Floating**	**Leakage**
All Strip Heaters	Magnet Coils, Corrector Coils, Yoke, RTD's and Warm-up Heaters	Nothing	322nA

Hipot Coil to Heaters and Ground			
High Potential	**Grounded**	**Floating**	**Leakage**
All Magnet Coils	Corrector Coils, Strip Heaters, Yoke, RTD's and Warm-up Heaters	Nothing	453nA

Technician(s) — Date: 1-20-05

Responsible Authority/Physicist — Date: 1-20-05

7.0 Shipping Preparation

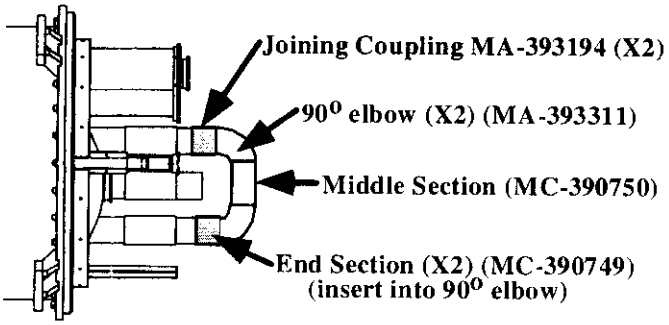
7.1 Install Electrical Bus Shipping Restraint Assembly (MD-390748).

Note(s):

Magnet wires must be inserted into the Shipping Restraint Assembly during installation.

Note(s):

Shipping Restraint Assembly is to be dry fit assembled, NOT GLUED!!!



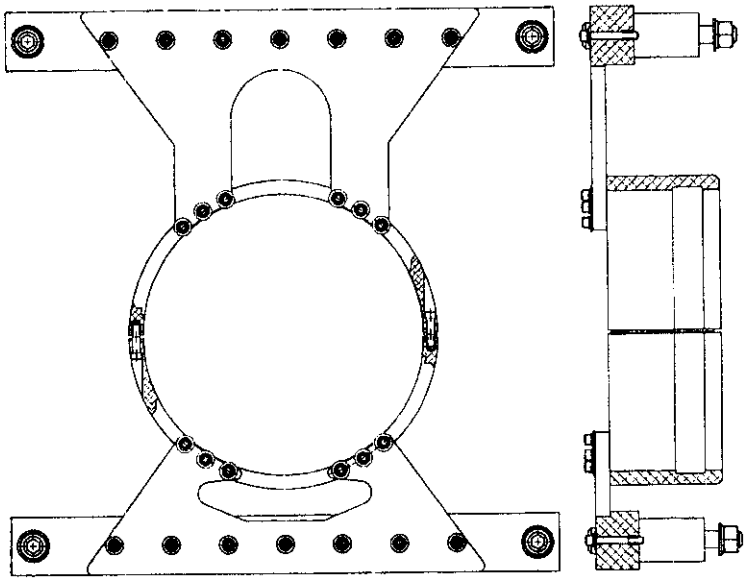
IP Magnet End
Side View

Technician(s) _____ Date 1-24-05

7.2 Install Bellows End Sliding Flange Assembly (ME-390021) using Bolts on both the Non-IP and IP Magnet Ends.

Technician(s) _____ Date 1-19-05

7.3 Acquire Q1/Q3 Shipping Restraint Assemblies (ME-390250)(2 ea).



Q1/Q3 Shipping Restraint
End View
ME-390250

Q1/Q3 Shipping Restraint
Side View
ME-390250

Technician(s) _____

Date 1/22/05

7.4 Install the Shipping Restraint on the Non- IP Magnet end.

Note(s):

Installation Shipping Restraint bolts should be only finger tight until complete assembly is installed.

TRP 1706

7.4.1 Install Cold Mass Collar (MD-390239) and secure using Bolt (MA-393191) (6 ea), and Washers (MX-XXXXXX)(X ea). NO WASHERS E.Z.

7.4.2 Install Upper Support Cross Bar (MD-390238)(1 ea) with Spacer Bushing (MB-390577) (2 ea) using Bolt (MA-393183 (2 ea), Lock Washer (MA-393186) (4 ea), Plain Washer (MA-393185) (4 ea), and Nut (MA-393184)(2 ea).

7.4.3 Install Lower Support Cross Bar (MD-390238)(1 ea) with Spacer Bushing (MB-390577) (2 ea) using Bolt (MA-393183 (2 ea), Lock Washer (MA-393186) (4 ea), Plain Washer (MA-393185) (4 ea), and Nut (MA-393184)(2 ea).

7.4.4 Install the Upper Bridge (ME-390240) to the Upper Support Bar using Bolt (MA-393187) (7 ea), Lock Washer (MA-393061) (7ea), and Flat Washer (MA-393060) (7ea).

7.4.5 Install the Lower Bridge (ME-390241) to the Lower Support Bar using Bolt (MA-393187) (7 ea), Lock Washer (MA-393061) (7ea), and Flat Washer (MA-393060) (7ea).

7.4.6 Secure Upper Bridge to Cold Mass Collar with Bolt (MA-393191) (6 ea), Lock Washer (MA-393061) (6 ea), and Plain Washer (MA-393060) (6 ea).

7.4.7 Secure Upper Bridge to Cold Mass Collar with Bolt (MA-393191) (6 ea), Lock Washer (MA-393061) (6 ea), and Plain Washer (MA-393060) (6 ea).

7.4.8 Tighten all the Shipping Restraint Bolts.

Technician(s) _____ Date JAN 22, 2005

TRR 1706

7.5 Install the Shipping Restraint on the IP Magnet end.

Note(s):

Installation Shipping Restraint bolts should be only finger tight until complete assembly is installed.

7.5.1 Install Cold Mass Collar (MD-390239) and secure using Bolt (MA-393191) (6 ea), and Washers (MX-XXXXXX)(X ea). WHAT WASHERS? TRR

7.5.2 Install Upper Support Cross Bar (MD-390238)(1 ea) with Spacer Bushing (MB-390577) (2 ea) using Bolt (MA-393183 (2 ea), Lock Washer (MA-393186) (4 ea), Plain Washer (MA-393185) (4 ea), and Nut (MA-393184)(2 ea).

7.5.3 Install Lower Support Cross Bar (MD-390238)(1 ea) with Spacer Bushing (MB-390577) (2 ea) using Bolt (MA-393183 (2 ea), Lock Washer (MA-393186) (4 ea), Plain Washer (MA-393185) (4 ea), and Nut (MA-393184)(2 ea).

7.5.4 Install the Upper Bridge (ME-390240) to the Upper Support Bar using Bolt (MA-393187) (7 ea), Lock Washer (MA-393061) (7ea), and Flat Washer (MA-393060) (7ea).

7.5.5 Install the Lower Bridge (ME-390241) to the Lower Support Bar using Bolt (MA-393187) (7 ea), Lock Washer (MA-393061) (7ea), and Flat Washer (MA-393060) (7ea).

7.5.6 Secure Upper Bridge to Cold Mass Collar with Bolt (MA-393191) (6 ea), Lock Washer (MA-393061) (6 ea), and Plain Washer (MA-393060) (6 ea).

7.5.7 Secure Upper Bridge to Cold Mass Collar with Bolt (MA-393191) (6 ea), Lock Washer (MA-393061) (6 ea), and Plain Washer (MA-393060) (6 ea).

7.5.8 Tighten all the Shipping Restraint Bolts.

Technician(s) _____ Date JAN 22, 2005

7.6 Install Electrical Bus Shipping Restraint Short End Cover (MD-390752) into Lower Cold Mass Pipe to protect the Buss Wire.

Technician(s) _____ Date 1-24-05

7.7 Install Protective End onto PVC Bus Protector Tube.

Technician(s) _____ Date 1-24-05

7.8 Secure bellows with Bellow Restraint/Protective Cover (MA-390153) using Screws (MA-390180).

Technician(s) _____ Date 1.24-05

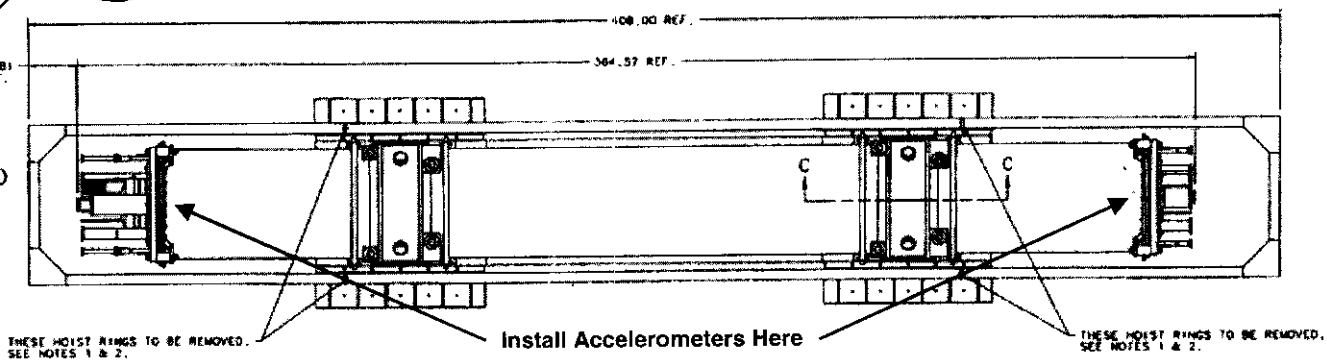
7.9 Install Protective Covers on flanges.

Technician(s) _____ Date 1.24-05

TRR NEEDED 1706

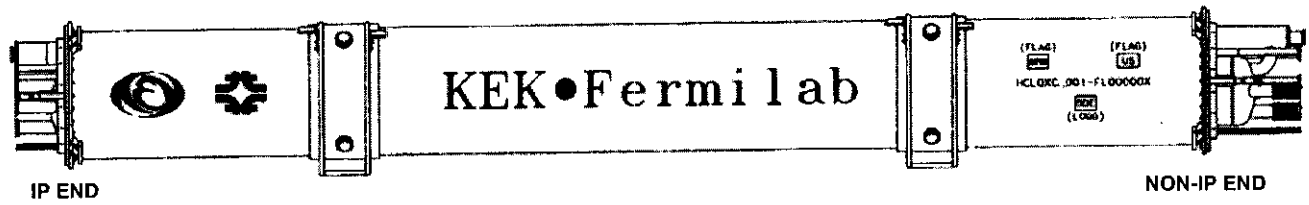
7.10 Install Accelerometers (provided by CERN) as per Responsible Authority and drawing below.

MOVE TO PUT ON THIS ONE

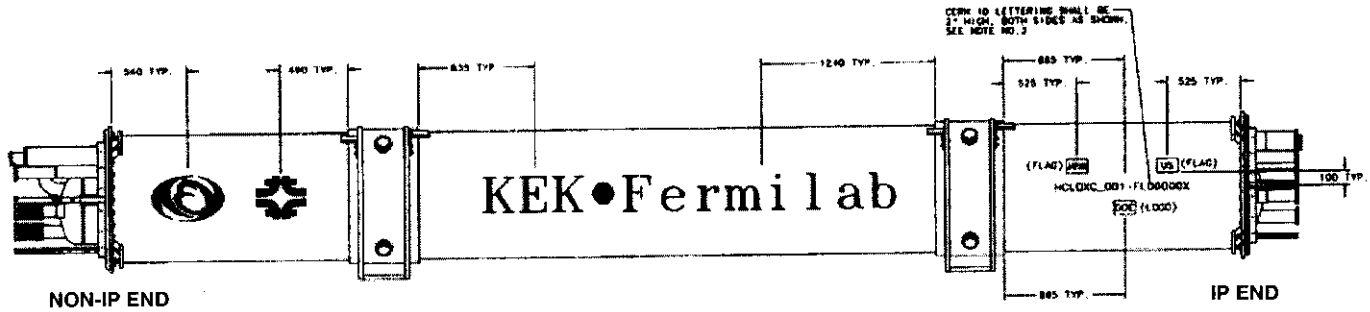


N/A
Technician(s) Date

7.11 Install Magnet Identification Labels as per Q3 Indentificat5ion Labeling Layout (ME-390762).



OPPOSITE SIDE VIEW



Q3 IDENTIFICATION LABELING LAYOUT

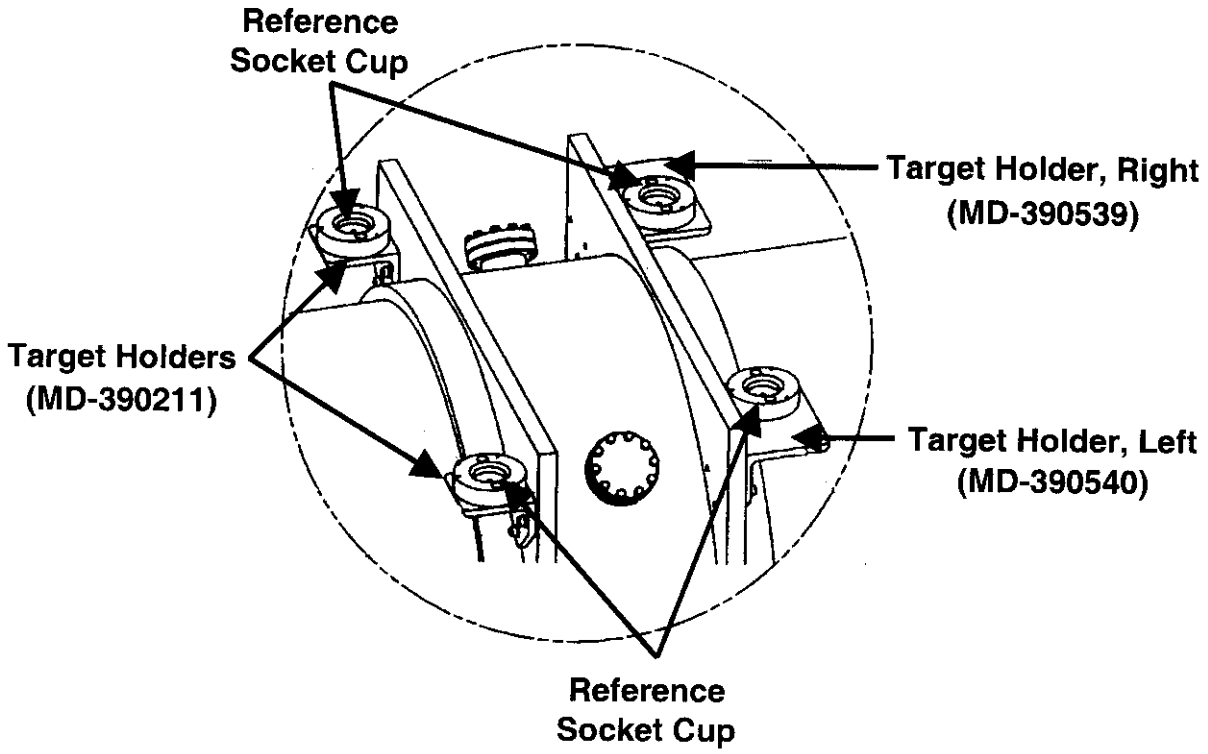
William Robertson
Technician(s) Date 1/24/05

DR# 1GQ-P523

7.12 Verify Magnet has been properly labeled/stenciled, and serial number matches the bottom of this traveler and as per (ME-390762).

A Hale
Lead Person Date 1/26/05

8.0 Final Inspection/Installation



8.1 Verify Target Holder (MD-390211) (4 ea), Target Holder, Right (MD-390539) (2 ea), and Target Holder, Left (MD-390540) (2 ea) with Reference Socket Cup (MA-390426) (8 ea) and Protective Covers (MA-390495) are installed.

Lead Person _____ Date 1-24-05

8.2 Verify that the Target Holder had been pinned using Spring Pins (MA-393048) as per Q3 Cryostat General Assembly (ME-390132).

Lead Person _____ Date 1-24-05

9.0 Shipping the Magnet

☑ Check box if shipping frame is installed in Shipping Container. Proceed to STEP 10.0

☐ Check box if Shipping Frame is **NOT** already installed in a Shipping Container. Proceed to STEP 9.1

Lead Person _____ Date 1/27/05

9.1 Acquire the Shipping Frame Assembly (ME-390729).

Technician(s) _____ Date _____

9.2 Verify that Frame Separator Bars are installed on the Shipping Frame Assembly. Refer to Q1/Q3 and Q2 Fixture Return Shipping Assembly (ME-390798).

☐ Not Installed, proceed to Step 9.3. Verify Separator Bars are ordered via Parts Kit. Contact Process Engineering Traveler Coordinator.

☐ Installed on Shipping Frame Assembly, Proceed to Step 11.4

Technician(s) _____ Date _____

9.3 Acquire the following parts.

Separator Bars	**ME-390797**	**3 ea**	
Screw ½" – 13 X 3.5" l	**MA-393384**	**6 ea**	NEED 2
Washer, Flat ½"	**MA-393325**	**6 ea**	NEED 2
Washer, Bevel ½"	**MA-393385**	**6 ea**	NEED 1
Hex Nut ½" - 13	**MA-393298**	**6 ea**	NEED 2

Note(s):

Ensure Q2 to Q1/Q3 Hardware is also acquired/installed for usage by CERN:

Screw ¾" -10 x 3.5"	**MA-393384**	**4 ea** 1	**Installed on two end Separator Bars**
Washer Flat ¾"	**MA-393323**	**4 ea** 2	**Installed on two end Separator Bars**
Hex Nut ¾"- 10	**MA-393387**	**4 ea** 2	**Installed on two end Separator Bars**
Screw 1"-8 x 4" long	**MA-393388**	**2 ea**	**Installed on center Separator Bar**
Washer Flat 1"	**MA-393389**	**2 ea**	**Installed on center Separator Bar**
Hex Nut 1"-8	**MA-393390**	**2 ea**	**Installed on center Separator Bar**

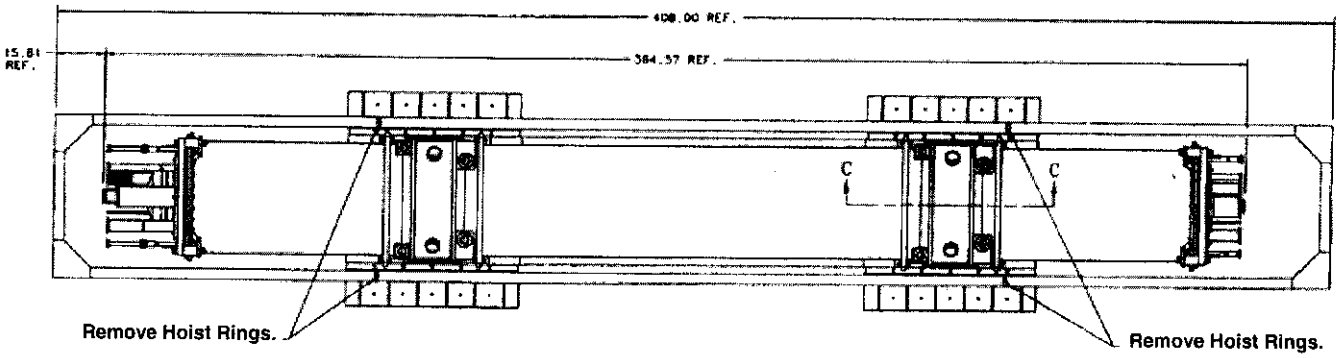
Technician(s) _____ Date _____

9.4 Acquire the following shipping hardware:

Eyebolt	**McMaster-Carr 3016T87**	**4 ea**
Eyebolt	**McMaster-Carr 3016T85**	**4 ea**
Hex Nut	**MA-393327**	**16 ea**
Flat Washer	**MA-393328**	**8 ea**
Lock Washer	**MA-393329**	**8 ea**
Chain w/2 Hooks	**MA-390702**	**4 ea**
Mounting Bolts	**MA-393321**	**6 ea**
Flat Washer	**MA-393323**	**6 ea**
Lock Washer	**MA-393322**	**6 ea**

SJG _____ Technician(s) 1/27/05 Date

9.5 Remove the Hoist Rings (4 Total) from the Outer Frame as per Q3 Magnet Shipping Assembly (ME-390728).



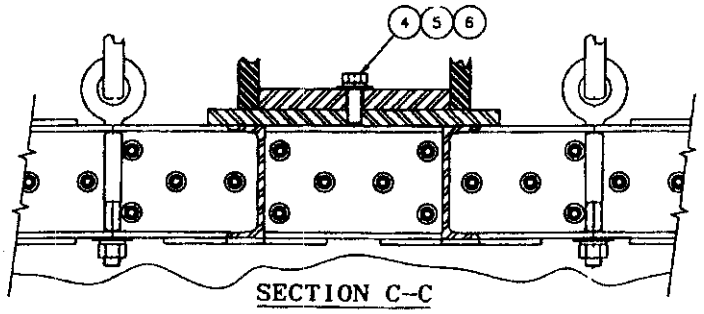
PMS wps NOT DONE YET! _____ Technician(s) 1-27-05 Date

9.6 Transport the Q1/Q3 Shipping Fixture (ME-390729) and install into the Shipping Container using approved methods.

SJG _____ Technician(s) 1/27/05 Date

10.0 Magnet to Shipping Frame/Platform Installation

10.1 Transport the magnet to the Magnet Shipping Fixture and install using Bolt (MA-393321)(6 ea), Flat Washer (MA-393323)(6 ea), and Lock Washer (MA-393322)(6 ea).
Torque bolts to XX FT/LBS.

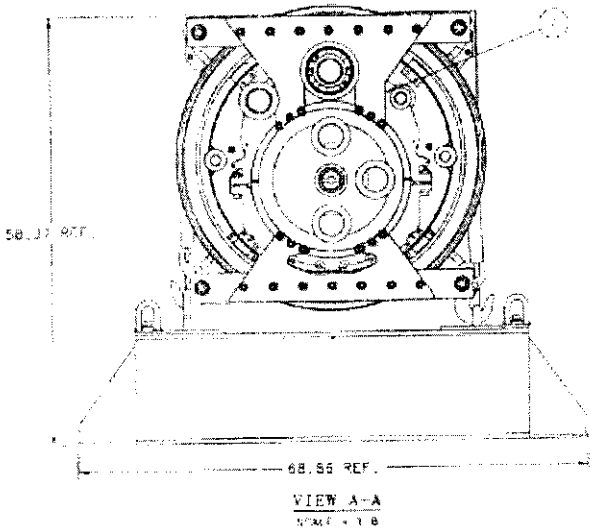


Q3 Magnet Shipping Assembly
(ME-390728)

Note(s):
Apply a small amount of Anti-Seize to all of the bolt threads prior to installing the bolts.

10.2 Install Eyebolts, McMaster-Carr #3016T85 (4 ea), Eyebolts, McMaster Carr #3016T87 (4 ea), Flat Washer (MA-393328) (8 ea), and Lock Washer (MA-393329) (8 ea) into Shipping Fixture.

Note(s):
Install all Eyebolts #3016T85 on one side of the shipping fixture. Eyebolts #3016T87 go on the opposite side.



Q3 Shipping Assembly - End View

10.3 Install the Lift All Pukka Wear Pad Protectors (MA-393345) onto magnet prior to installing Chain Sling.

Technician(s) _____ Date 1-27-05

10.4 Install chain sling w/2 hooks (MA-390702) (4 ea) into eyebolts

Technician(s) _____ Date 1-27-05

10.5 Tighten eyebolts until chains are snug.

Technician(s) _____ Date 1-27-05

10.6 Install an additional nut (double nutting) on each eyebolt and tighten.

Technician(s) _____ Date 1-27-05

10.7 Wrapping of the magnet.

☐ Performed by Shipping Company, proceed to Step 11.0

☒ Performed by Fermilab, proceed to Step 10.8

Lead Person _____ Date 1/27/05

10.8 Wrap the magnet in protective material (VCI Plastic) and seal the seam using approved methods to form a protective bag.

Technician(s) _____ Date 1-27-05

10.9 Install cross braces on the top of the shipping container.

Technician(s) _____ Date 1-27-05

10.10 Install protective cover on the top of the shipping container and secure.

Technician(s) _____ Date 1-28-05

STOP

10.11 Verify the magnet, shipping frame are properly secured, and protected.

Responsible Authority/designee _____ Date 1/27/05

10.12 Close and secure doors on the shipping container.

Crew Chief _____ Date 1/28/05

11.0 Documentation Update

11.1 Perform the following:

- [x] **Update DSR Keywords.**
- [x] **Location.**
- [x] **Location Verified Date.**
- [x] **Status.**
- [x] **Make entry regarding work performed.**

TD/E&F Production Supervisor/designee

Date 1/28/05

12.0 Production Complete

12.1 Process Engineering; verify that the Traveler is accurate and complete. This shall include a review of all steps to ensure that all operations have been completed and signed off. Ensure that all Discrepancy Reports, Nonconformance Reports, Repair/Rework Forms, Deviation Index and dispositions have been reviewed by the Responsible Authority for conformance before being approved.

Comments:

_____

_____

_____

_____

_____

_____

_____

J. Spostak
Process Engineering/Designee

FEB 0 2 2005
Date

THIS WAS FOR IB# 1 TECH'S !

~~Note(s):~~

This Q3 Magnet (LQXC01) was tested at the MTF.

As a requirement for LHC magnets to be tested at MTF, the Magnet needed to be equipped with a Q2 Hypertronics Connector.

The Q2 Hypertronics Connector was installed in the Q3 Module Assembly Traveler (TR-333729) (LMQXC01).

The following steps are for documenting the removal of the Q2 Hypertronics Connector and the installation of the Q3 Hypertronics Connector.

1.0 Removal of Q2 Hypertronics

1.1 Remove the Q2 Hypertronics Connector at the **IP End**.

N/A
Technician(s) _____ Date _____

1.2 Remove the Q2 Hypertronics Connector at the **Non-IP End**.

Paul Eddy
Technician(s) _____ Date 01/08/05

1.3 Verify that the Q2 Hypertronics Connectors have been properly removed. Inspect wires for any damage that may have occurred during removal.

Paul Eddy
Technician(s) _____ Date 01/08/05

Responsible Authority/Physicist _____ Date 21-JAN-2005

2.0 Installation of Hypertronics

2.1 Assemble/Install Hypertronics Connectors, **without Cover** at **Non-IP End** as per Q3 Module Assembly (ME-369900). Pin Numbers for connectors are shown in Table 2.1 below.

Table 2.1

Module	Pin	Fermilab Label	CERN Label	KEK Label	Description
M1	1				Blank Module
M1	2				
M1	3				
M1	4				
M1	5				
M2	1	VTa1Q1	EE1111	a1	Q1 Lead Voltage Tap "a" , primary
M2	2	VTa2Q1	EE1121	a2	Q1 Lead Voltage Tap "a", redundant
M2	3	VTc1Q1	EE1211	c1	Q1 Center Voltage Tap "c", primary
M2	4	VTc2Q1	EE1221	c2	Q1 Center Voltage Tap "c", redundant
M2	5	VTb1Q1	EE1311	b1	Q1 Lead Voltage Tap "b", primary
M3	1	VTc1Q2a	EE1212		Q2a Center Voltage Tap "c", primary
M3	2	Empty	Empty		No connection
M3	3	VTa2Q2a	EE1122		Q2a lead Voltage Tap "a", redundant
M3	4	VTa1Q2a	EE1112		Q2a Lead Voltage Tap "a", primary
M3	5	VTb2Q1	EE1321	b2	Q1 Lead Voltage Tap "b", redundant
M4	1	VTc2Q2a	EE1222		Q2a Center Voltage Tap "c", redundant
M4	2	Empty	Empty		No connection
M4	3	VTb1Q2a	EE1312		Q2a Lead Voltage Tap "b", primary
M4	4	VTb2Q2a	EE1322		Q2a Lead Voltage Tap "b", redundant
M4	5	VTb1Q2b	EE1612		Q2b lead Voltage Tap "b", primary
M5	1	Empty	Empty		No connection
M5	2	VTc2Q2b	EE1522		Q2b Center Voltage Tap "c", redundant
M5	3	VTc1Q2b	EE1512		Q2b Center Voltage Tap "c", primary
M5	4	Empty	Empty		No connection
M5	5	VTb2Q2b	EE1622		Q2b Lead Voltage Tap "b" redundant
M6	1	VTa1Q2b	EE1412		Q2b Lead Voltage Tap "a", primary
M6	2	VTa2Q2b	EE1422		Q2b Lead Voltage Tap "a", redundant
M6	3	Empty	Empty		No connection
M6	4	Empty	Empty		No connection
M6	5	Empty	Empty		No connection
M7	1				Blank Module
M7	2				
M7	3				
M7	4				
M7	5				

Table 2.1 (continued)

Module	Pin	Fermilab Label	CERN Label	KEK Label	Description
M8	1	VTH1	EE8121		Corrector voltage tap Q1-H1 (skew dipole) (on MCBX, MCBXH, A+ lead)
M8	2	VTV1	EE8111		Corrector voltage tap Q1-V1 (normal dipole) (on MCBX, MCBXV A+ lead)
M8	3	VTH2	EE8122		Corrector voltage tap Q2-H2 (skew dipole) (on MCBX, MCBXH, A+ lead)
M8	4	VTV2	EE8112		Corrector voltage tap Q2-V2 (normal dipole) (on MCBX, MCBXV, A+ lead)
M8	5	Empty	Empty		No connection
M9	1				Blank Module
M9	2				
M9	3				
M9	4				
M9	5				
M10	1	W1aQ1	EH8311+		Q1 Cryogenic Heater lead end - wire at top (CERN #1 I+)
M10	2	W2aQ1	EH8311-		Q1 Cryogenic Heater lead end - wire at bottom (CERN #1 I-)
M10	3	W1bQ1	EH8321+		Q1 Cryogenic Heater non-lead end - wire at top (CERN #2 I+)
M10	4	W2bQ1	EH8321-		Q1 Cryogenic Heater non-lead end - wire at bottom (CERN #2 I-)
M10	5	Empty	Empty		No connection
M11	1	W1aQ2A	EH8312+		Q2A Cryogenic Heater lead end - wire toward cold mass end plate (CERN #1 I+)
M11	2	W2aQ2A	EH8312-		Q2A Cryogenic Heater lead end - wire toward cold mass mag center (CERN #1 I-)
M11	3	W1bQ2A	EH8322+		Q2A Cryogenic Heater non-lead end- wire toward cold mass end plate (CERN #2 I+)
M11	4	W2bQ2A	EH8322-		Q2A Cryogenic Heater non-lead end- wire toward cold mass mag center (CERN #2 I-)
M11	5	Empty	Empty		No connection
M12	1	W1aQ2B	EH8332+		Q2B Cryogenic Heater lead end - wire toward cold mass end plate (CERN #1 I+)
M12	2	W2aQ2B	EH8332-		Q2B Cryogenic Heater lead end - wire toward cold mass mag center (CERN #1 I-)
M12	3	W1bQ2B	EH8342+		Q2B Cryogenic Heater non-lead end- wire toward cold mass end plate (CERN #2 I+)
M12	4	W2bQ2B	EH8342-		Q2B Cryogenic Heater non-lead end- wire toward cold mass mag center (CERN #2 I-)
M12	5	Empty	Empty		No connection

Table 2.1 (continued)

Module	Pin	Fermilab Label	CERN Label	KEK Label	Description
M13	1				Blank Module
M13	2				
M13	3				
M13	4				
M13	5				
M14	1	H1aQ1	YT1111+	HA1	Q1 Protection (Strip) Heater, ("a" circuit) (CERN lead #1+)
M14	2	Empty	Empty		No connection
M14	3	H2aQ1	YT1111-	HA2	Q1Protection (Strip) Heater, ("a" circuit) (CERN lead #1-)
M14	4	Empty	Empty		No connection
M14	5	H1bQ1	YT1121+	HB1	Q1 Protection (Strip) Heater, ("b" circuit) (CERN lead #2+)
M15	1	Empty	Empty		No connection
M15	2	H1aQ2a	YT1112+		Q2a Protection (Strip) Heater, 1-4 & 2-3 circuit (FNAL lead A+) (CERN lead #1+)
M15	3	Empty	Empty		No connection
M15	4	H2bQ1	YT1121-	HB2	Q1 Protection (Strip) Heater, ("b" circuit) (CERN lead #2-)
M15	5	Empty	Empty		No connection
M16	1	H2aQ2a	YT1112-		Q2a Protection (Strip) Heater, 1-4 & 2-3 circuit (FNAL lead A-) (CERN lead #1-)
M16	2	Empty	Empty		No connection
M16	3	H1bQ2a	YT1122+		Q2a Protection (Strip) Heater, 1-2 & 3-4 circuit (FNAL lead B+) (CERN lead#2+)
M16	4	Empty	Empty		No connection
M16	5	H2bQ2a	YT1122-		Q2a Protection (Strip) Heater, 1-2 & 3-4 circuit (FNAL lead B-) (CERN lead #2-)
M17	1	Empty	Empty		No connection
M17	2	H2aQ2b	YT1132-		Q2b Protection (Strip) Heater, 1-4 & 2-3 circuit (FNAL lead A-) (CERN lead #1-)
M17	3	Empty	Empty		No connection
M17	4	H1aQ2b	YT1132+		Q2b Protection (Strip) Heater, 1-4 & 2-3 circuit (FNAL lead A+) (CERN lead #1+)
M17	5	Empty	Empty		No connection
M18	1	H1bQ2b	YT1142+		Q2b Protection (Strip) Heater, 1-2 & 3-4 circuit (FNAL lead B+) (CERN lead#2+)
M18	2	Empty	Empty		No connection
M18	3	H2bQ2b	YT1142-		Q2b Protection (Strip) Heater, 1-2 & 3-4 circuit (FNAL lead B-) (CERN lead #2-)
M18	4	Empty	Empty		No connection
M18	5	Empty	Empty		No connection

Table 2.1 (continued)

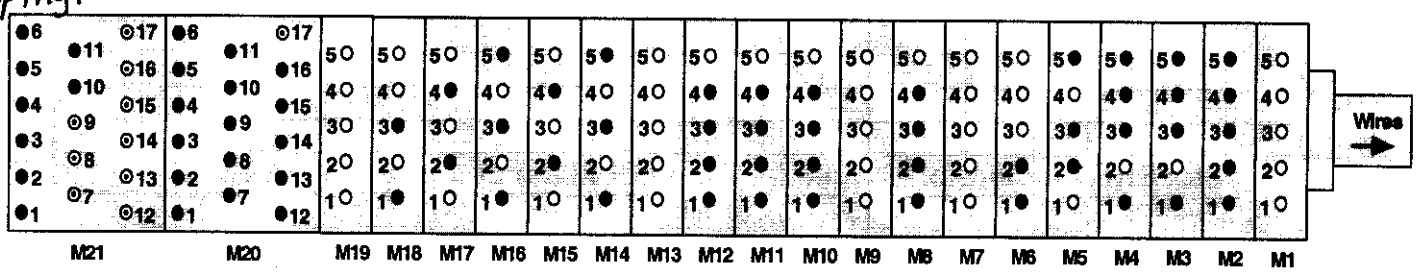
Module	Pin	Fermilab Label	CERN Label	KEK Label	Description
M19	1				Blank Module
M19	2				
M19	3				
M19	4				
M19	5				
Note: Pin Numbers of Module M20 are not listed in numerical order.					
M20	1	TaQ1_I+	TT8311 I+		Q1 RTD, primary Wire color: Yellow
M20	2	TaQ1_I-	TT8311 I-		Q1 RTD, primary Wire color: Green
M20	3	TaQ1_V+	TT8311 U+		Q1 RTD, primary Wire color: Black
M20	4	TaQ1_V-	TT8311 U-		Q1 RTD, primary Wire color: Red
M20	5	TbQ1_I+	TT8321 I+		Q1 RTD, redundant: Wire color: Yellow
M20	6	TbQ1_I-	TT8321 I-		Q1 RTD, redundant: Wire color: Green
M20	11	TbQ1_V+	TT8321 U+		Q1 RTD, redundant: Wire color: Black
M20	10	TbQ1_V-	TT8321 U-		Q1 RTD, redundant: Wire color: Red
M20	9	TaQ2a_I+	TT8312 I+		Q2a RTD, primary Wire color: Yellow
M20	8	TaQ2a_I-	TT8312 I-		Q2a RTD, primary Wire color: Green
M20	7	TaQ2a_V+	TT8312 U+		Q2a RTD, primary Wire color: Black
M20	12	TaQ2a_V-	TT8312 U-		Q2a RTD, primary Wire color: Red
M20	13	TbQ2a_I+	TT8322 I+		Q2a RTD, redundant: Wire color: Yellow
M20	14	TbQ2a_I-	TT8322 I-		Q2a RTD, redundant: Wire color: Green
M20	15	TbQ2a_V+	TT8322 U+		Q2a RTD, redundant: Wire color: Black
M20	16	TbQ2a_V-	TT8322 U-		Q2a RTD, redundant: Wire color: Red
M20	17	Empty	Empty		No connection
Note: Pin Numbers of Module M21 are not listed in numerical order.					
M21	1	TaQ2b_I+	TT8332 I+		Q2b RTD, primary Wire color: Yellow
M21	2	TaQ2b_I-	TT8332 I-		Q2b RTD, primary Wire color: Green
M21	3	TaQ2b_V+	TT8332 U+		Q2b RTD, primary Wire color: Black
M21	4	TaQ2b_V-	TT8332 U-		Q2b RTD, primary Wire color: Red
M21	5	TbQ2b_I+	TT8342 I+		Q2b RTD, redundant: Wire color: Yellow
M21	6	TbQ2b_I-	TT8342 I-		Q2b RTD, redundant: Wire color: Green
M21	11	TbQ2b_V+	TT8342 U+		Q2b RTD, redundant: Wire color: Black
M21	10	TbQ2b_V-	TT8342 U-		Q2b RTD, redundant: Wire color: Red
M21	9	Empty	Empty		No connection
M21	8	Empty	Empty		No connection
M21	7	Empty	Empty		No connection
M21	12	Empty	Empty		No connection
M21	13	Empty	Empty		No connection
M21	14	Empty	Empty		No connection
M21	15	Empty	Empty		No connection
M21	16	Empty	Empty		No connection
M21	17	Empty	Empty		No connection

No TDR NEEDED For Q3 Shipping.

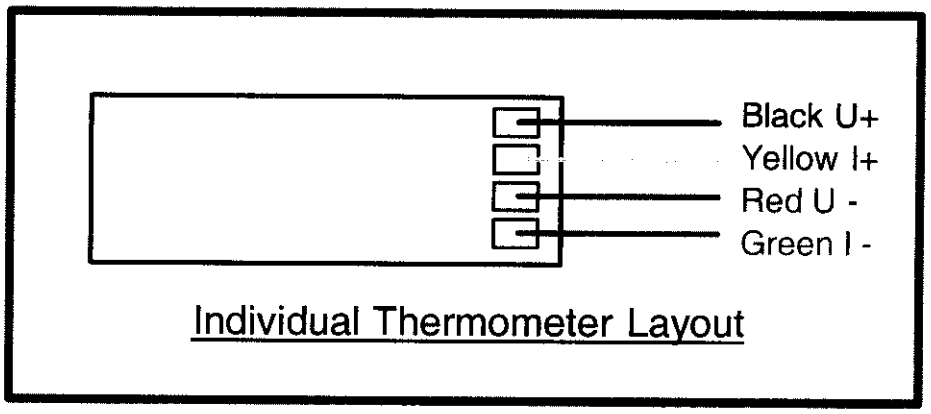
WRONG PICTURE! Should be a 26 Pin connector

Hypertronics Connector Pin Locations (Q3 non-IP end)

VIEW: Male (pin) solder cup side



- ● Hole filled in grey: Wire soldered to pin.
- ⊙ Hole with dot in center: Pin exists but no wire soldered to it.
- ○ Hole filled in white: No pin. Hole is drilled out.



Note(s):

Ensure the Hypertronics cover has NOT been installed.

Technician(s) _____ Date 1/21/05

2.2 Assemble/Install Hypertronics Connectors, **without Cover** at **IP End** as per Q3 Module Assembly (ME-369900). Pin Numbers for connectors are shown in Table 2.2 below.

Table 2.2

Module	Pin	Fermilab Label	CERN Label	KEK Label	Description
M1	1				Blank Module
M1	2				
M1	3				
M1	4				
M1	5				
M2	1	VTa1Q1	EE1111	a1	Q1 Lead Voltage Tap "a" , primary
M2	2	VTa2Q1	EE1121	a2	Q1 Lead Voltage Tap "a", redundant
M2	3	VTc1Q1	EE1211	c1	Q1 Center Voltage Tap "c", primary
M2	4	VTc2Q1	EE1221	c2	Q1 Center Voltage Tap "c", redundant
M2	5	VTb1Q1	EE1311	b1	Q1 Lead Voltage Tap "b", primary
M3	1	VTc1Q2a	EE1212		Q2a Center Voltage Tap "c", primary
M3	2	Empty	Empty		No connection
M3	3	VTa2Q2a	EE1122		Q2a lead Voltage Tap "a", redundant
M3	4	VTa1Q2a	EE1112		Q2a Lead Voltage Tap "a", primary
M3	5	VTb2Q1	EE1321	b2	Q1 Lead Voltage Tap "b", redundant
M4	1	VTc2Q2a	EE1222		Q2a Center Voltage Tap "c", redundant
M4	2	Empty	Empty		No connection
M4	3	VTb1Q2a	EE1312		Q2a Lead Voltage Tap "b", primary
M4	4	VTb2Q2a	EE1322		Q2a Lead Voltage Tap "b", redundant
M4	5	VTb1Q2b	EE1612		Q2b lead Voltage Tap "b", primary
M5	1	Empty	Empty		No connection
M5	2	VTc2Q2b	EE1522		Q2b Center Voltage Tap "c", redundant
M5	3	VTc1Q2b	EE1512		Q2b Center Voltage Tap "c", primary
M5	4	Empty	Empty		No connection
M5	5	VTb2Q2b	EE1622		Q2b Lead Voltage Tap "b" redundant
M6	1	VTa1Q2b	EE1412		Q2b Lead Voltage Tap "a", primary
M6	2	VTa2Q2b	EE1422		Q2b Lead Voltage Tap "a", redundant
M6	3	Empty	Empty		No connection
M6	4	Empty	Empty		No connection
M6	5	Empty	Empty		No connection
M7	1				Blank Module
M7	2				
M7	3				
M7	4				
M7	5				

Table 2.2 (continued)

Module	Pin	Fermilab Label	CERN Label	KEK Label	Description
M8	1	VTH1	EE8121		Corrector voltage tap Q1-H1 (skew dipole) (on MCBX, MCBXH, A+ lead)
M8	2	VTV1	EE8111		Corrector voltage tap Q1-V1 (normal dipole) (on MCBX, MCBXV A+ lead)
M8	3	VTH2	EE8122		Corrector voltage tap Q2-H2 (skew dipole) (on MCBX, MCBXH, A+ lead)
M8	4	VTV2	EE8112		Corrector voltage tap Q2-V2 (normal dipole) (on MCBX, MCBXV, A+ lead)
M8	5	Empty	Empty		No connection
M9	1				Blank Module
M9	2				
M9	3				
M9	4				
M9	5				
M10	1	W1aQ1	EH8311+		Q1 Cryogenic Heater lead end - wire at top (CERN #1 I+)
M10	2	W2aQ1	EH8311-		Q1 Cryogenic Heater lead end - wire at bottom (CERN #1 I-)
M10	3	W1bQ1	EH8321+		Q1 Cryogenic Heater non-lead end - wire at top (CERN #2 I+)
M10	4	W2bQ1	EH8321-		Q1 Cryogenic Heater non-lead end - wire at bottom (CERN #2 I-)
M10	5	Empty	Empty		No connection
M11	1	W1aQ2A	EH8312+		Q2A Cryogenic Heater lead end - wire toward cold mass end plate (CERN #1 I+)
M11	2	W2aQ2A	EH8312-		Q2A Cryogenic Heater lead end - wire toward cold mass mag center (CERN #1 I-)
M11	3	W1bQ2A	EH8322+		Q2A Cryogenic Heater non-lead end- wire toward cold mass end plate (CERN #2 I+)
M11	4	W2bQ2A	EH8322-		Q2A Cryogenic Heater non-lead end- wire toward cold mass mag center (CERN #2 I-)
M11	5	Empty	Empty		No connection
M12	1	W1aQ2B	EH8332+		Q2B Cryogenic Heater lead end - wire toward cold mass end plate (CERN #1 I+)
M12	2	W2aQ2B	EH8332-		Q2B Cryogenic Heater lead end - wire toward cold mass mag center (CERN #1 I-)
M12	3	W1bQ2B	EH8342+		Q2B Cryogenic Heater non-lead end- wire toward cold mass end plate (CERN #2 I+)
M12	4	W2bQ2B	EH8342-		Q2B Cryogenic Heater non-lead end- wire toward cold mass mag center (CERN #2 I-)
M12	5	Empty	Empty		No connection

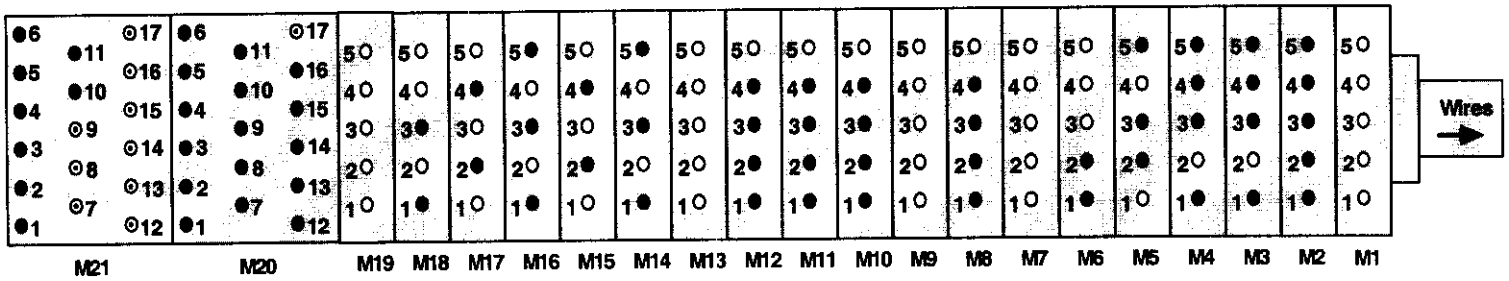
Table 2.2 (continued)

Module	Pin	Fermilab Label	CERN Label	KEK Label	Description
M13	1				Blank Module
M13	2				
M13	3				
M13	4				
M13	5				
M14	1	H1aQ1	YT1111+	HA1	Q1 Protection (Strip) Heater, ("a" circuit) (CERN lead #1+)
M14	2	Empty	Empty		No connection
M14	3	H2aQ1	YT1111-	HA2	Q1Protection (Strip) Heater, ("a" circuit) (CERN lead #1-)
M14	4	Empty	Empty		No connection
M14	5	H1bQ1	YT1121+	HB1	Q1 Protection (Strip) Heater, ("b" circuit) (CERN lead #2+)
M15	1	Empty	Empty		No connection
M15	2	H1aQ2a	YT1112+		Q2a Protection (Strip) Heater, 1-4 & 2-3 circuit (FNAL lead A+) (CERN lead #1+)
M15	3	Empty	Empty		No connection
M15	4	H2bQ1	YT1121-	HB2	Q1 Protection (Strip) Heater, ("b" circuit) (CERN lead #2-)
M15	5	Empty	Empty		No connection
M16	1	H2aQ2a	YT1112-		Q2a Protection (Strip) Heater, 1-4 & 2-3 circuit (FNAL lead A-) (CERN lead #1-)
M16	2	Empty	Empty		No connection
M16	3	H1bQ2a	YT1122+		Q2a Protection (Strip) Heater, 1-2 & 3-4 circuit (FNAL lead B+) (CERN lead#2+)
M16	4	Empty	Empty		No connection
M16	5	H2bQ2a	YT1122-		Q2a Protection (Strip) Heater, 1-2 & 3-4 circuit (FNAL lead B-) (CERN lead #2-)
M17	1	Empty	Empty		No connection
M17	2	H2aQ2b	YT1132-		Q2b Protection (Strip) Heater, 1-4 & 2-3 circuit (FNAL lead A-) (CERN lead #1-)
M17	3	Empty	Empty		No connection
M17	4	H1aQ2b	YT1132+		Q2b Protection (Strip) Heater, 1-4 & 2-3 circuit (FNAL lead A+) (CERN lead #1+)
M17	5	Empty	Empty		No connection
M18	1	H1bQ2b	YT1142+		Q2b Protection (Strip) Heater, 1-2 & 3-4 circuit (FNAL lead B+) (CERN lead#2+)
M18	2	Empty	Empty		No connection
M18	3	H2bQ2b	YT1142-		Q2b Protection (Strip) Heater, 1-2 & 3-4 circuit (FNAL lead B-) (CERN lead #2-)
M18	4	Empty	Empty		No connection
M18	5	Empty	Empty		No connection
M19	1				Blank Module
M19	2				
M19	3				
M19	4				
M19	5				

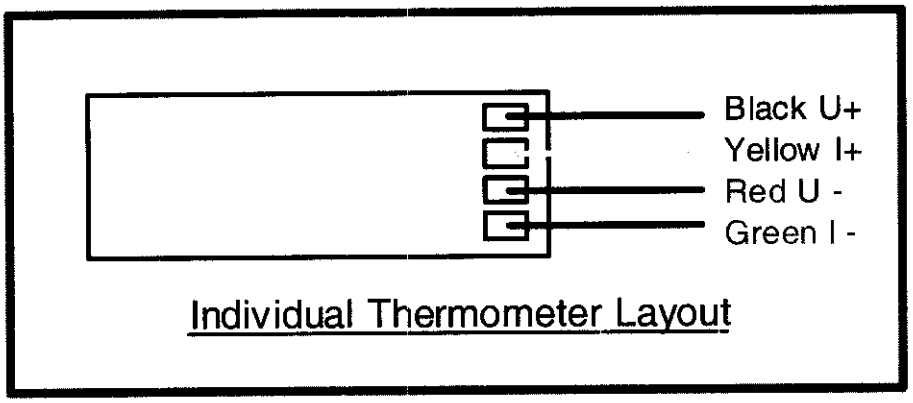
Table 2.2 (continued)

Module	Pin	Fermilab Label	CERN Label	KEK Label	Description
Note: Pin Numbers of Module M20 are not listed in numerical order.					
M20	1	TaQ1_I+	TT8311 I+		Q1 RTD, primary Wire color: Yellow
M20	2	TaQ1_I-	TT8311 I-		Q1 RTD, primary Wire color: Green
M20	3	TaQ1_V+	TT8311 U+		Q1 RTD, primary Wire color: Black
M20	4	TaQ1_V-	TT8311 U-		Q1 RTD, primary Wire color: Red
M20	5	TbQ1_I+	TT8321 I+		Q1 RTD, redundant: Wire color: Yellow
M20	6	TbQ1_I-	TT8321 I-		Q1 RTD, redundant: Wire color: Green
M20	11	TbQ1_V+	TT8321 U+		Q1 RTD, redundant: Wire color: Black
M20	10	TbQ1_V-	TT8321 U-		Q1 RTD, redundant: Wire color: Red
M20	9	TaQ2a_I+	TT8312 I+		Q2a RTD, primary Wire color: Yellow
M20	8	TaQ2a_I-	TT8312 I-		Q2a RTD, primary Wire color: Green
M20	7	TaQ2a_V+	TT8312 U+		Q2a RTD, primary Wire color: Black
M20	12	TaQ2a_V-	TT8312 U-		Q2a RTD, primary Wire color: Red
M20	13	TbQ2a_I+	TT8322 I+		Q2a RTD, redundant: Wire color: Yellow
M20	14	TbQ2a_I-	TT8322 I-		Q2a RTD, redundant: Wire color: Green
M20	15	TbQ2a_V+	TT8322 U+		Q2a RTD, redundant: Wire color: Black
M20	16	TbQ2a_V-	TT8322 U-		Q2a RTD, redundant: Wire color: Red
M20	17	Empty	Empty		No connection
Note: Pin Numbers of Module M21 are not listed in numerical order.					
M21	1	TaQ2b_I+	TT8332 I+		Q2b RTD, primary Wire color: Yellow
M21	2	TaQ2b_I-	TT8332 I-		Q2b RTD, primary Wire color: Green
M21	3	TaQ2b_V+	TT8332 U+		Q2b RTD, primary Wire color: Black
M21	4	TaQ2b_V-	TT8332 U-		Q2b RTD, primary Wire color: Red
M21	5	TbQ2b_I+	TT8342 I+		Q2b RTD, redundant: Wire color: Yellow
M21	6	TbQ2b_I-	TT8342 I-		Q2b RTD, redundant: Wire color: Green
M21	11	TbQ2b_V+	TT8342 U+		Q2b RTD, redundant: Wire color: Black
M21	10	TbQ2b_V-	TT8342 U-		Q2b RTD, redundant: Wire color: Red
M21	9	Empty	Empty		No connection
M21	8	Empty	Empty		No connection
M21	7	Empty	Empty		No connection
M21	12	Empty	Empty		No connection
M21	13	Empty	Empty		No connection
M21	14	Empty	Empty		No connection
M21	15	Empty	Empty		No connection
M21	16	Empty	Empty		No connection
M21	17	Empty	Empty		No connection

Hypertronics Connector Pin Locations Q3 Lead (IP) End
VIEW: Female (receptacle) solder cup side



- ● **Hole filled in grey: Wire soldered to pin.**
- ⊙ **Hole with dot in center: Pin exists but no wire soldered to it.**
- ○ **Hole filled in white: No pin. Hole is drilled out.**



Note(s):

Ensure the Hypertronics cover has NOT been installed.

N/A
Technician(s)

Date

2.3 Inspect Hypertronics Connector. Ensure that it is free of flux and that Kapton has been installed properly.

Responsible Authority/Physicist

20-JAN-2005
Date

2.4 After LHC Project Physicist / designee has signed the above step, complete the installation of the Hypertronics.

Technician(s)

01/21/2005
Date

3.0 Final Electrical Inspection

3.1 Perform an electrical inspection on each of the Individual Quadrants and the Cold Mass. Refer to the Valhalla and Leader Free Standing Coil Measurement Procedure (ES-292306).

To measure the Resistance of a Q3 Cold Mass:

1. Use Valhalla Scientific 4300B digital micro-ohmmeter.
2. Set Test Current to 0.1 amp.
3. Set Scale to 2V full scale.
4. Turn temperature compensation on.
5. Turn test current off.
6. Connect I_{HI} to Q4 inner power lead as shown in figure.
7. Connect I_{LO} to Q3 inner power lead as shown in figure.
8. Turn test current on.
9. Connect V_{HI} and V_{LO} to voltage taps as shown in resistance table.
10. To measure Total with leads, connect V_{HI} to Q4 power lead and V_{LO} to Q3 power lead.
11. Read resistance and record in traveler.

(Q3) Resistance				Nominal 3.35 to 3.45 Ω
Voltage Tap Serial Numbers				Total Resistance
Connect	Fermi	CERN	KEK	
V_{HI}	VTa1Q3	EE1113	a1	3.395 Ω
V_{LO}	VTc1Q3	EE1213	c1	
V_{HI}	VTc1Q3	EE1213	c1	3.395 Ω
V_{LO}	VTb1Q3	EE1313	b1	
V_{HI}	VTa1Q3	EE1113	a1	6.786 Ω
V_{LO}	VTb1Q3	EE1313	b1	

		Total Resistance with Leads
		Nominal 6.75 to 6.85 Ω
V_{HI}	A ~~Q4~~ Power Lead	6.801 Ω
V_{LO}	B ~~Q8~~ Power Lead	

Technician(s) _____ Date 1/21/05

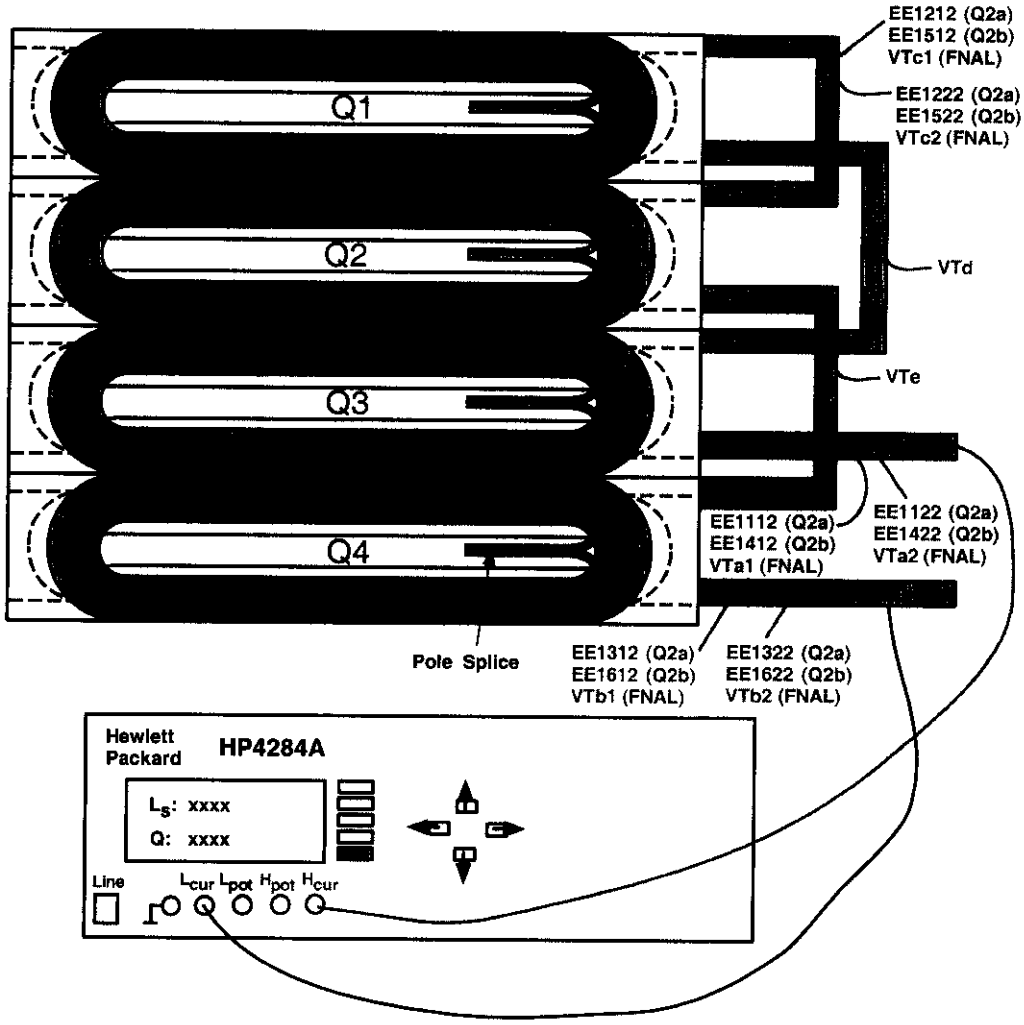
Check resistance of Redundant Voltage Taps.

Q3 Redundant Voltage Taps				Nominal 3.35 to 3.45 Ω
Connect	Fermi	CERN	KEK	Resistance
V_{HI}	VTa2Q3	EE1123	a2	3.393 Ω
V_{LO}	VTc2Q3	EE1223	c2	
V_{HI}	VTc2Q3	EE1223	c2	3.393 Ω
V_{LO}	VTb2Q3	EE1323	b2	

Technician(s) _____ Date 1/21/05

To measure Ls and Q of a Q3 Cold Mass:

1. Use Hewlett Packard HP4284A digital LCR meter.
2. Turn line switch to on. The words "Measurement Display" should now be highlighted in the upper left corner of the display screen.
3. Use cursor buttons (shown in figure with arrows) to toggle down until "function" is highlighted near the upper left corner of the display screen.
4. Push the lowest of the five buttons to the right of display 3 times. (This button is shaded gray in the figure) The line in the display screen next to the second button down should now read "Ls-Q" and "function" near the upper left corner of the display should have the option "Ls-Q" chosen.
5. Scroll to "integer" using the cursor buttons. "Integer" will have the option "medium" chosen.
6. Press the 3rd button of five. The word "medium" should change to "long".
7. Connect H_{cur} to Q4 power lead as shown in figure.
8. Connect L_{cur} to Q3 power lead as shown in figure.
9. Connect H_{pot} and L_{pot} to voltage taps as shown in table.
10. Read Ls and Q from display and record in traveler.



(Q3) Inductance				Nominal 15 to 16 mH
Voltage Tap Serial Numbers				Total Inductance
Connect	Fermi	CERN	KEK	
H_{POT}	VTa1Q3	EE1113	a1	15.150 mH
L_{POT}	VTc1Q3	EE1213	c1	
H_{POT}	VTc1Q3	EE1213	c1	15.157 mH
L_{POT}	VTb1Q3	EE1313	b1	

				Nominal 30 to 32 mH
				Total Inductance
H_{POT}	VTa1Q3	EE1113	a1	30.299 mH
L_{POT}	VTb1Q3	EE1313	b1	

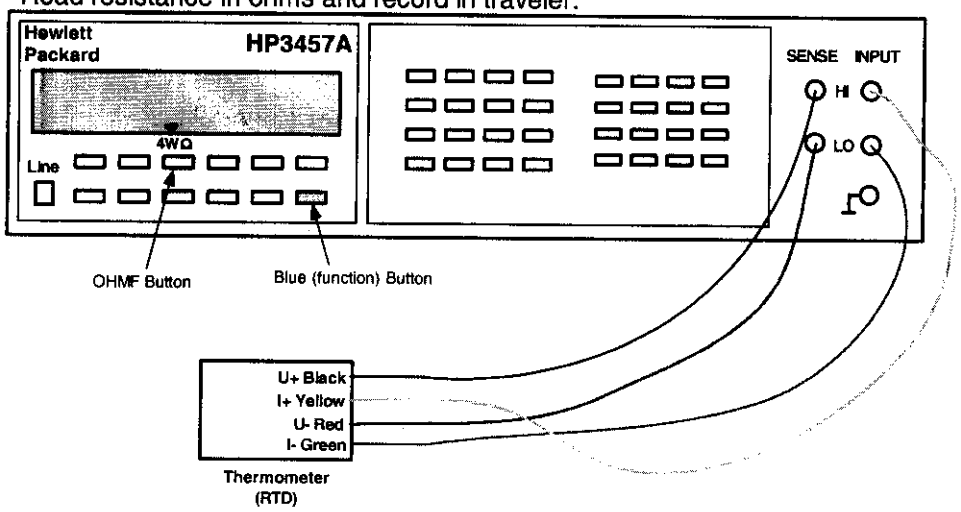
(Q3) Q-Factor				Nominal 1.0 to 1.2
Voltage Tap Serial Numbers				Total Q
Connect	Fermi	CERN	KEK	
H_{POT}	VTa1Q3	EE1113	a1	1.1
L_{POT}	VTc1Q3	EE1213	c1	
H_{POT}	VTc1Q3	EE1213	c1	
L_{POT}	VTb1Q3	EE1313	b1	

				Nominal 1.0 to 1.2
				Total Q
H_{POT}	VTa1Q3	EE1113	a1	1.1
L_{POT}	VTb1Q3	EE1313	b1	

Technician(s) _____ Date 1/21/05

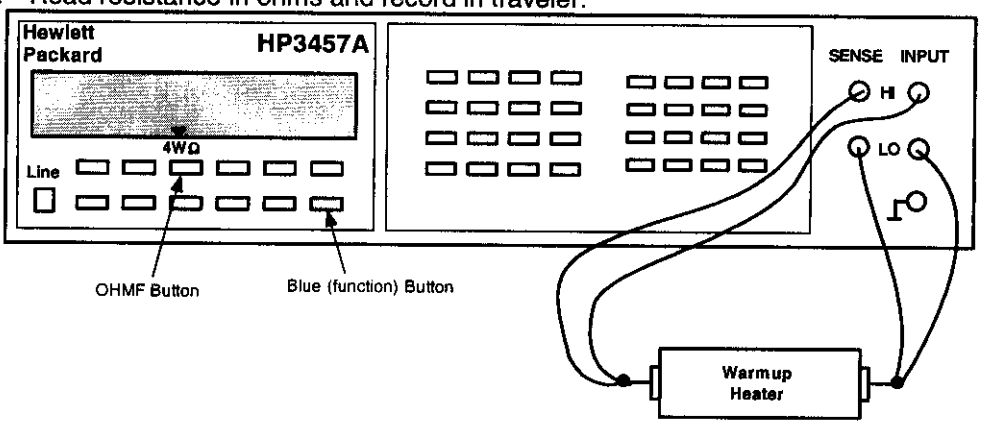
To measure the resistance of a Thermometer (RTD):

1. Use Hewlett Packard HP3457A digital multimeter.
2. Record temperature of building within +/- 5 degrees.
3. Press line button to turn line on.
4. Connect wires as shown in Figure below.
   U+ (Black) to Sense HI
   I+ (Yellow) to Input HI
   U- (Red) to Sense LO
   I- (Green) to Input LO
5. Push blue button (function key) once.
6. Push OHMF button.
7. Verify arrow in readout is above the 4WΩ (meaning a 4 wire resistance measurement).
8. Read resistance in ohms and record in traveler.



To measure the resistance of a Cryogenic (Warm-up) Heater

1. Use Hewlett Packard HP3457A digital multimeter.
2. Record temperature of building within +/- 5 degrees.
3. Press line button to turn line on.
4. Connect wires as shown in Figure below.
5. Push blue button (function key) once.
6. Push OHMF button.
7. Verify arrow in readout is above the 4WΩ (meaning a 4 wire resistance measurement).
   Note: Although this is technically a 4 wire measurement, it is effectively a 2 wire measurement, since there are only 2 wires connected to each heater.
8. Read resistance in ohms and record in traveler.



Q3 - RTD's and Cryogenic (warm-up) Heaters				
Temperature of Building (± 5°): _____				
Component	**Fermi**	**CERN**	**Range**	**Resistance**
Q3 RTD, primary	TaQ3	TT8313	**60 to 70 Ω**	73.8 Ω
Q3 RTD, redundant	TbQ3	TT8323	**60 to 70 Ω**	68.1 Ω
Q3 Cryogenic (warm-up) Heater (LE) - wire at top (CERN #1 I+)	W1aQ3	EH8313+	**16 to 18.5 Ω**	18.2 Ω
Q3 Cryogenic (warm-up) Heater (LE) - wire at bottom (CERN #1 I-)	W2aQ3	EH8313-		
Q3 Cryogenic (warm-up) Heater (Non-LE) - wire at top (CERN #2 I+)	W1bQ3	EH8323+	**16 to 18.5 Ω**	17.8 Ω
Q3 Cryogenic (warm-up) Heater (Non-LE) - wire at bottom (CERN #2 I-)	W2bQ3	EH8323-		

Technician(s) _____ Date 1/21/05

Using the Hewlett Packard HP3457A digital multimeter, measure the Protection (Strip) Heater Resistance for Q3.

Q3 Protection (Strip) Heater Resistance					
Fermi	**CERN**	**KEK**	**Description**	**Limit**	**Resistance**
H1aQ3	**YT1113+**	**HA1**	**Circuit A**	**28 to 32 Ω**	31.7 Ω
H2aQ3	**YT1113-**	**HA2**			
H1bQ3	**YT1123+**	**HB1**	**Circuit B**	**28 to 32 Ω**	31.7 Ω
H2bQ3	**YT1123-**	**HB2**			

Technician(s) _____ Date 1/21/05

3.2 Using the Valhalla 4300B, connect 10mA applied voltage thru the corrector Power Leads. Measure Resistance and record in the table below.

Corrector Bus Leads

	V3A	V3B	H3A	H3B	B3A	B3B	B6A	B6B	
	V2A	V2B	H2A	H2B	B4A	B4B	A4A	A4B	
	V1A	V1B	H1A	H1B	A2A	A2B	A3A	A3B	

(View Looking from DFBX into Q3)

Corrector Assembly	Corrector Element	Readout Labels		Power Labels	Resistance
MQSX	MQSX	A2A	EE8223	A2A, A2B	4.2
		EE8223	A2B		10.10
		A2A	A2B		8.3
MCBXA	MCBXV	V3A	EE8113	V3A, V3B	1.51
		EE8113	V3B		19.76
		V3A	V3B		18.1
	MCBXH	H3A	EE8123	H3A, H3B	1.27
		EE8123	H3B		24.66
		H3A	H3B		21.9
	MCTX	B6A	EE8613	B6A, B6B	1.54
		EE8613	B6B		101.5
		B6A	B6B		100.2
	MCSX	B3A	EE8313	B3A, B3B	1.68
		EE8313	B3B		29.26
		B3A	B3B		28
MCSOX	MCOSX	A4A	EE8423	A4A, A4B	1.42
		EE8423	A4B		13.6
		A4A	A4B		12.2
	MCOX	B4A	EE8413	B4A, B4B	1.41
		EE8413	B4B		14.45
		B4A	B4B		13.2
	MCSSX	A3A	EE8323	A3A, A3B	2.3
		EE8323	A3B		14.9
		A3A	A3B		14

Technician(s) _____ Date 1/21/05

3.3 Hipot according to table below. Hipot to 3kV. Maximum leakage is 3μA.

STOP

Have Crew Chief verify setup and sign below before continuing.

Crew Chief _____ Date 1/21/05

Hipot Heaters to Coil and Ground.

High Potential	Grounded	Floating	Leakage
All Strip Heaters	Coils, Yoke, Q3 Instrumentation Bus, Lead and Corrector Coil Busses, RTD's and Warm-up Heaters	Nothing	322nA

Hipot Coil to Heaters and Ground.

High Potential	Grounded	Floating	Leakage
All Coils	Strip Heaters, Yoke, Q3 Instrumentation Bus, 8kA and 5kA Lead Busses and Corrector Coil Busses, RTD's and Warm-up Heaters	Nothing	453nA

Technician(s) _____ Date 1-21-05

STOP

3.4 Ensure electrical measurements are acceptable and confirm Hypertronics Connector has been installed properly.

Responsible Authority/Physicist _____ Date 21-JAN-2005

H01

TD - Engineering Fabr tion Component Kit List

ORIGINAL

Process Engineering

Component Serial No.: LQXC01
Kit submitted by: John Szostak | Ext. 2003
Fermi ID No.: 02943C
Date submitted: 5-Jan-05
Need date: 7-Jan-05
Deliver to: ICB
Use with Traveler No.: 333731
Job No.: 248
M&S task number: 300 | 1.1.1.3.4
Drawing Title: Q3 MAGNET SHIPPING ASSEMBLY
Drawing No.: ME-390728 | Rev. NONE

Material Control

Parts available

Verified by: M. Schmidt
Fermi ID No.: 04223N
Date submitted to stockroom: 6-Jan-05

Parts issued

Issued by:
Fermi ID No.: 01269
Date issued: 1-7-05
Parts received by E&F:
Fermi ID No.: 02943C
Date received by E&F: 1/7/05

	Description	Dwg Size	Number	Rev	Unit	Quantity Required	Location	Quantity Issued	E&F Verified	Routing Form Number	Spares Number / Comment
1	KAPTON TAPE	MA	106723	A	EA	A/R					
2	¾" BLACK SHRINK TUBING	MA	318797	A	EA	A/R					
3	Q3 CRYOSTAT GENERAL ASSEMBLY	ME	390132	G	EA	ICB HAS					
4	BELLOWS PROTECTORS	MA	390153	*	EA	6	R7,2,2	6		79773	138 pcs.
5	Q1/Q3 SHIPPING RESTRAINT ASSEMBLY	ME	390250	A	EA	2	Site 38	2		82443	CALLED 1/6/05 4 pcs.
6	CHAIN SLING W/ 2 HOOKS	MA	390702	*	EA	4	ICB Has				In Container
7	Q1/Q3 SHIPPING FIXTURE	ME	390729	*	EA	ICB HAS	ICB Has				In Container
8	ELECTRICAL BUS SHIPPING RESTRAINT ASSEMBLY	MD	390748	*	EA	1	R7,3,4	1		81801	15 pcs.
9	ELECTRICAL BUS SHORT END COVER	MD	390752	*	EA	1	R7,3,4	1		81802	20 pcs.
10	SCREWS	MA	393180	*	EA	18	IB4 Bin	18		79631	835 pcs.
11	3/4-10 HEX HD. BOLT x 2.50 LG. - GR. 8 STL.	MA	393321	*	EA	6	IB4 Bin	6		81277	17 pcs.
12	3/4 LOCK WASHER - STL.	MA	393322	*	EA	6	IB4 Bin	6		81278	17 pcs.

HOT

ORIGINAL

TD - Engineering Fabr tion Component Kit List

	Description	Dwg Size	Number	Rev	Unit	Quantity Required	Location	Quantity Issued	E&F Verified	Routing Form Number	Spares Number / Comment
13	3/4 FLAT WASHER - STL.	MA	393323	*	EA	6	IB4 Bin	6		81279	13 pcs.
14	1"-8 HEX NUT - STL.	MA	393327	*	EA	16	ICB Has				In Container
15	1" FLAT WASHER - STL.	MA	393328	*	EA	8	ICB Has				In Container
16	1" LOCK WASHER - STL.	MA	393329	*	EA	8	ICB Has				In Container
17	LIFT ALL PUKKA WEAR PAD PROTECTORS	MA	393345	*	EA	4	ICB Has				In Container
18	EYEBOLT - 1"-8 x 12" LG.		390731-11	*	EA	4	ICB Has				In Container
19	EYEBOLT - 1"-8 x 9" LG.		390731-7	*	EA	4	ICB Has				In Container
20	ANTI-SEIZE			*	EA	A/R					
21	ACCELEROMETER			*	EA	ICB HAS					

ADDITIONAL PARTS REQUEST

ADDITIONAL PARTS REQUEST FORM SHALL BE USED TO ACCESS ALL ITEMS FROM INVENTORY WITH THE EXCEPTION OF PARTS KITS.

THIS FORM MUST BE SIGNED BY AN ACQUISITIONER BEFORE BRINGING TO THE STOCKROOM

MAGNET OR COIL # LQXC01

DATE REQUESTED 1/14/05

BUDGET CODE LCD 300.1.1.1.3.4

JOB TICKET #

MACHINE SHOP REQ. #

PURCHASE RELEASE #

REQUESTED BY Jim Rife

DELIVER TO Jim Rife

NEED BY DATE 1/14/05

MMR #

PO #

OTHER

PARTS STATUS (CHECK ONE)

- ☐ DEFECTIVE PARTS ISSUED
- ☐ DEFECTIVE ASSEMBLY
- ☒ INDIVIDUAL PARTS
- ☐ PARTS SCRAPPED
- ☐ MISSING FROM KIT ALREADY ISSUED
- ☐ CONSUMABLES
- ☐ A/R ITEMS
- ☐ PARTS LOST

ACQUISITIONER SIGNATURE Marsha Shuss **ID#** 4223 **DATE** 1/14/05

PLEASE INDICATE REVISION REQUIRED

SIR NO

LOCATION	PART #	REV	QTY	UOM	DESCRIPTION	RF #	SIR #
R1,1,3	MB-390808	0	2	Each	Q1/Q3 Fuducial Mounting Block	82260	

STOCKROOM SIGNATURE [illegible] **ID#** 12698 **DATE** 1-14-05

PARTS DELETED FROM DATABASE **ID#** **DATE**

A COPY OF THIS FORM IS TO BE INCLUDED IN WITH THE TRAVELER

PARTS RECEIVED BY [illegible] **ID#** 4895 **DATE** 1/14/05

Revision Request Control Number: 1706

Specification Number: 5520 - TR - 333731 Current Revision: None

Traveler or Document Title LHC Q3 LQXC Cryostat Shipping Traveler

Step #/Description of Revision:

1.6 Added Step. "Protect the bellows during all stages of production." DR No. HGQ-0500.
4.3 Modified Step. Moved to after electrical Inspection per Production request. LQXC01. New Step 6.7.
4.4 Modified Step. Moved to after electrical Inspection per Production request. LQXC01. New Step 6.8.
4.8 Modified Step. Changed to "At the Non-IP End, measure and record the length of the conductor (in mm) from the 'flat' of the magnet dome to the end of the conductor and record in the box provided below. New Step 4.5.(+/- 10mm)" LQXC01.
5.3 Modified Step. Moved to after electrical Inspection per Production request. LQXC01. New Step 6.9.
5.4 Modified Step. Moved to after electrical Inspection per Production request. LQXC01. New Step 6.10.
5.7 Modified Step. Changed to "At the IP End, measure and record the length of the conductor (in mm) from the 'flat' of the magnet dome to the end of the conductor and record in the box provided below. (+/- 10mm)" New step 5.5. LQXC01.
7.2 Modified Step. Added "...and the Fixed End Flange (ME-390020)..." per LQXC01.
7.4.1 Modified Step. Changed to "Install Cold Mass Collar (ME-390202) and secure using Bolt (MA-393191), and Plain Washers (MA-393060), and Lock Washers (MA-393061) per Q3 Shipping Restraint Assembly (ME-390250)."
7.5.1 Modified Step. Changed to "Install Cold Mass Collar (ME-390202) and secure using Bolt (MA-393191), and Plain Washers (MA-393060), and Lock Washers (MA-393061) per Q3 Shipping Restraint Assembly (ME-390250)."
7.10 Modified Step. Changed to "Are Accelerometers (Shock Recorders) available for installation? rYes - Install Accelerometers as per Responsible Authority and Figure 8.10-A. below. rNo - Accelerometers are NOT available for installation." DR No. HGQ-0512.
7.11 Modified Step. Added Note "Example: If Serial No. at bottom of Traveler is: LQXC02 Stencil Serial No. should be: HCLQXC_001-FL000002"
7.12 Modified Step. Added Note "Example: If Serial No. at bottom of Traveler is: LQXC02 Stencil Serial No. should be: HCLQXC_001-FL000002"
9.3 Modified Step. Changed MA-393384 to MA-393386, per production request.

John Szostak	Jim Rife	1/20/2005
Originator	Responsible Authority	Date

Revision Incorporated into the Traveler:

	Revision Incorporated By	Date

Process Engineering Final Review:

	Process Engineering/Designee	Date

Instructions for the completion of the Revision Request Form

Note(s):

Multiple steps may be effected by one Revision Request Form but only one specific Traveler or Document may be effected by each Revision Request Form.

If completing this form by hand, a Revision Request Control Number must be obtained before processing.

If completing this form entirely by electronic means, the printed copy to be filed in the Process Engineering Office is to be initialed by the individual incorporating the Revision Request and the individual who reviewed the Traveler or Document.

Originator Instructions:

1) Specification Number: - Enter the Specification Number of the Traveler or Document to be revised. (Document title is inserted automatically from the spec. #)

2) Current Revision: - Enter the Revision of the Traveler or Document to be revised.

3) Step# / Description of the Revision: - Enter a description of the revision to be made and the step# it applies to, if applicable. If needed to describe the revision attach a copy of the page(s). If the revision is coming from a related document such as a Discrepancy Report or an Engineering Order attach a copy of that document to the Revision Request Form.

4) Originator: - Originator is the person generating the form. (Select Name from List)

5) Responsible Authority: - Responsible Authority is person responsible for the process in question. (Select Name from List)

Process Engineering Office Instructions:

1) Revision Incorporated into the Traveler: - Signature of the individual who incorporated the revision.

2) Process Engineering Final Review: - Review the Traveler or Document revised, sign and date the form. The original completed Revision Request Form will be retained by the Process Engineering Office in the Revision Request Binder.

Traveler Title:	Specification No:	Revision:	DR No:
LHC Q3 LQXC Cryostat Shipping Traveler	5520-TR-333731	None	HGQ-0523

Step No:	Drawing No:	Routing Form No:	Serial No:	Rework ID:
7.12	ME-390762		LQXC01	0

Discrepancy Description:

The labels were put on using the Q1 print (ME-390761). They are in the wrong orientation.

SCANNED
FEB 2 2005

Originator: Steve Gould

Date: 1/26/2005

Cause of Nonconformance:

The magnet labels, logos, names and flags, were placed on the magnet according to the Q1 Magnet Label drawing (ME-390761). The correct drawing for the Q3 magnet labels is drawing number (ME-390762). The traveler specifying the correct drawing was not available at the time the magnet labels were applied. [NOTE: The traveler was not available because the labeling was applied in early January. At the time the labels were applied, the technician was not informed that this particluar vessel was going to be a Q3. J.Blowers 31-Jan-2005]

Responsible Authority: Thomas Page

Date: 1/26/2005

Disposition:

We will leave the labels as they are on LQXC01. The remaining magnets will be labeled according to drawing number (ME-390762).

Responsible Authority: Thomas Page

Date: 1/26/2005

Corrective Action to Prevent Recurrence:

The Q3 shipping traveler has been released since this incident and should be followed for future magnet labeling.

Responsible Authority: Thomas Page

Date: 1/26/2005

Corrective Action/Disposition Verified By: John Szostak

Date: 1/31/2005

Will Configuration be affected?: ☐ YES ☑ NO

Identified problem area:

☐ Material ☐ Manpower ☑ Method ☐ Machine ☐ Measurement

Reviewed By: Bob Jensen

Date: 2/2/2005

FORM #1 FIXED VOLTAGE TAPS _1A_FORM

Test of Q3 FVTs

Apply 1 A current between BUS #1 & BUS #2 on the feed end (see diagram to right)
1. Clamp bus #1 to bus #2 on return end
2. Connect Current Source: BUS #1 to Positive and BUS #2 to Negative
Use a 3457 or equilivent DVM and record measurement to 4 decimal places
Use 2 wires Voltage Measurements Technique:
1. Connect DVM LO wire to BUS#2 (or Negative output of Power source)
2. HI wire of DVM will move through wires to measure V
DO NOT USE DC CURRENT LARGER THAN 2A.
DO NOT APPLY CURRENT THROUGH MAGNET LONGER THAN 30MIN.

BUS #1
BUS #2
BUS #3
BUS #4

POWER BUS LOCATION
RETURN END

BUS #1	BUS #2
BUS #3	BUS #4

POWER BUS LOCATION
FEED END

HYPERTRONIC CONNECTOR		FNAL Labels	Description	Wire Labels	Expected Voltage, V	Measured
Module	Pin					
M5	2	VTa1Q3	Q3 Lead Voltage Tap "a", primary	EE1113	7.0000	6.9073
M5	1	VTa2Q3	Q3 Lead Voltage Tap "a", redundant	EE1123	7.0000	6.9073
M6	3	VTb1Q3	Q3 lead Voltage Tap "b", primary	EE1313	0.0030	0.022343
M6	4	VTb2Q3	Q3 Lead Voltage Tap "b" redundant	EE1323	0.0030	0.022373
M6	1	VTc1Q3	Q3 Center Voltage Tap "c", primary	EE1213	3.5000	3.4646
M6	2	VTc2Q3	Q3 Center Voltage Tap "c", redundant	EE1223	3.5000	3.4646

Across BUS #1 and BUS #2	6.914

Q3 - LQXC01

Form #2 CRYO HEATER CHECK_OUT

MEASURE RESISTANCE ACROSS EACH HEATER USING HANDHELD METER
MEASURE RESISTANCE FROM HEATER TO GND USING HANDHELD METER

Module	Pin		Expected Resistance, OHM	Measured Resistance, OHM	FNAL Label	Description
M15	1	EH8313+	17	18.07	W1aQ3	Q3 Cryogenic Heater lead end - wire toward cold mass end plate (CERN #1 I+)
M15	2	EH8313-			W2aQ3	Q3 Cryogenic Heater lead end - wire toward cold mass mag center (CERN #1 I-)
M15	3	EH8323+	17	17.67	W1bQ3	Q3 Cryogenic Heater non-lead end- wire toward cold mass end plate (CERN #2 I+)
M15	4	EH8323-			W2bQ3	Q3 Cryogenic Heater non-lead end- wire toward cold mass mag center (CERN #2 I-)

M15	1	EH8313+	more than 20MOHM	Inf	W1aQ3	Q3 Cryogenic Heater lead end - wire toward cold mass end plate (CERN #1 I+)
		GND				
M15	3	EH8323+	more than 20MOHM	Inf	W1bQ3	Q3 Cryogenic Heater non-lead end- wire toward cold mass end plate (CERN #2 I+)
		GND				

Q3 - LQXC01

Form #3 PROTECTION STRIP HEATERS

MEASURE RESISTANCE ACROSS EACH HEATER USING HANDHELD METER
MEASURE RESISTANCE FROM HEATER TO GND USING HANDHELD METER
MEASURE RESISTANCE FROM HEATER TO COIL USING HANDHELD METER

M22	4	YT1113-	30	31.7	H2aQ1	Q1 Protection (Strip) Heater, 1-4 & 2-3 circuit (FNAL lead A-) (CERN lead #1-)
M21	5	YT1113+			H1aQ1	Q1 Protection (Strip) Heater, 1-4 & 2-3 circuit (FNAL lead A+) (CERN lead #1+)
M22	2	YT1123+	30	31.7	H1bQ3	Q3 Protection (Strip) Heater, 1-2 & 3-4 circuit (FNAL lead B+) (CERN lead#2+)
M23	1	YT1123-			H2bQ3	Q3 Protection (Strip) Heater, 1-2 & 3-4 circuit (FNAL lead B-) (CERN lead #2-)
M22	4	YT1113- GND	more than 20MOHM	INF	H2aQ3	Q3 Protection (Strip) Heater, 1-4 & 2-3 circuit (FNAL lead A-) (CERN lead #1-)
M22	2	YT1123+ GND	more than 20MOHM	INF	H1bQ3	Q3 Protection (Strip) Heater, 1-2 & 3-4 circuit (FNAL lead B+) (CERN lead#2+)
M22	4	YT1113- COIL	more than 20MOHM	INF	H2aQ3	Q3 Protection (Strip) Heater, 1-4 & 2-3 circuit (FNAL lead A-) (CERN lead #1-)
M22	2	YT1123+ COIL	more than 20MOHM	INF	H1bQ3	Q3 Protection (Strip) Heater, 1-2 & 3-4 circuit (FNAL lead B+) (CERN lead#2+)

Q3 - LQXC01

Form#4 RTDs Measurements

MEASURE RESISTANCE ACROSS EACH RTD USING A FOUR WIRE METER
MEASURE RESISTANCE FROM RTD TO GROUND USING HANDHELD METER
MEASURE RESISTANCE FROM RTD TO THE COIL USING HANDHELD METER

Module	Pin	Breakout BOX Labels	Expected Resistance, OHM	Measured Resistance OHM	FNAL Label	Description
M26	9	TT8313 I+	57	73.54	TaQ3_I+	Q3 RTD, primary Wire color: Yellow
M26	8	TT8313 I-			TaQ3_I-	Q3 RTD, primary Wire color: Green
M26	7	TT8313 U+			TaQ3_V+	Q3 RTD, primary Wire color: Black
M26	12	TT8313 U-			TaQ3_V-	Q3 RTD, primary Wire color: Red
M26	13	TT8323 I+	57	67.88	TbQ3_I+	Q3 RTD, redundant: Wire color: Yellow
M26	14	TT8323 I-			TbQ3_I-	Q3 RTD, redundant: Wire color: Green
M26	15	TT8323 U+			TbQ3_V+	Q3 RTD, redundant: Wire color: Black
M26	16	TT8323 U-			TbQ3_V-	Q3 RTD, redundant: Wire color: Red
M26	9	TT8313 I+	more than 20MOHM	INF	TaQ3_I+	Q3 RTD, primary Wire color: Yellow
		GND				
M26	9	TT8323 I+	more than 20MOHM	INF	TbQ3_I+	Q3 RTD, redundant: Wire color: Yellow
		GND				
M26	9	TT8313 I+	more than 20MOHM	INF	TaQ3_I+	Q3 RTD, primary Wire color: Yellow
		COIL				
M26	9	TT8323 I+	more than 20MOHM	INF	TbQ3_I+	Q3 RTD, redundant: Wire color: Yellow
		COIL				

Q3 - LQXC01

Ccoil bus #	NA	3	4	1	2	7	8	5	6	NA
	XXX	V3A	V3B	H3A	H3B	B3A	B3B	B6A	B6B	XXX
	XXX	V2A	V2B	H2A	H2B	B4A	B4B	A4A	A4B	XXX
	XXX	V1A	V1B	H1A	H1B	A2A	A2B	A3A	A3B	XXX

Form#5 Correction COILs for Q3 magnet

MEASURE RESISTANCE ACROSS BOTH CCOIL BUSES
MEASURE RESISTANCE FROM CCOIL TO GROUND
MEASURE RESISTANCE BETWEEN TAPS
MEASURE RESISTANCE FROM EACH TAP TO CCOIL BUS
MEASURE CONTINUITY OF Q1 CCOIL BUS
MEASURE FOR SHORT BETWEEN Q1 CCOIL BUS AND GRD
MEASURE CONTINUITY OF Q2 CCOIL BUS
MEASURE FOR SHORT BETWEEN Q2 CCOIL BUS AND GRD

Horizontal Corrector Coil		Expected	Measured
H3-A	CCOIL BUS #1	*23 OHMS*	21.7 OHMS
H3-B	CCOIL BUS #2		
Vertical Corrector Coil			
V3-A	CCOIL BUS #3	19 OHMS	17.7 OHMS
V3-B	CCOIL BUS #4		
A2 Corrector Coil			
A2-A	CCOIL BUS #7	10 OHMS	8 OHMS
A2-B	CCOIL BUS #8		
H3-A	CCOIL BUS #1	>20 KOHMS	INF

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Q3 - LQXC01

	GND		
V3-A	CCOIL BUS #3	>20 KOHMS	INF
	GND		
A2-A	CCOIL BUS #7	>20 KOHMS	INF
	GND		

A3 Corrector Coil resistance

A3-A	CCOIL BUS #5	*14 OHMS*	13.7 OHMS
A3-B	CCOIL BUS #6		

B3 Corrector Coil resistance

B3-A	CCOIL BUS #7	28 OHMS	27.8 OHMS
B3-B	CCOIL BUS #8		

A4 Corrector Coil resistance

A4-A	CCOIL BUS #5	12 OHMS	12.1 OHMS
A4-B	CCOIL BUS #6		

A3-A	CCOIL BUS #1	>20K OHMS	INF
	GND		
B3-A	CCOIL BUS #3	>20K OHMS	INF
	GND		
A4-A	CCOIL BUS #7	>20K OHMS	INF
	GND		

B4 Corrector Coil resistance			
B4-A	CCOIL BUS #7	*13 OHMS*	13.1 OHMS
B4-B	CCOIL BUS #8		
B6 Corrector Coil resistance			
B6-A	CCOIL BUS #5	100 OHMS	100.1 OHMS
B6-B	CCOIL BUS #6		
B4-A	CCOIL BUS #1	>20K OHMS	INF
	GND		
B6-A	CCOIL BUS #3	>20K OHMS	INF
	GND		

	Expected	Measured			Expected	Measured
EE8123	>20M OHMS	INF		**EE8123**	>20M OHMS	INF
EE8113				**EE8613**		
EE8123	>20M OHMS	INF		**EE8123**	>20M OHMS	INF
EE8223				**EE8613**		
EE8123	>20M OHMS	INF		**EE8113**	>20M OHMS	INF
EE8323				**EE8223**		
EE8123	>20M OHMS	INF		**EE8113**	>20M OHMS	INF
EE8313				**EE8323**		
EE8123	>20M OHMS	INF		**EE8113**	>20M OHMS	INF
EE8423				**EE8323**		

Q3 - LQXC01

EE8123	>20M OHMS	INF	
EE8413			

EE8113	>20M OHMS	INF	
EE8313			

	Expected	Measured	
EE8113	>20M OHMS	INF	
EE8423			

	Expected	Measured	
EE8223	>20M OHMS	INF	
EE8613			

EE8113	>20M OHMS	INF	
EE8413			

EE8323	>20M OHMS	INF	
EE8313			

EE8113	>20M OHMS	INF	
EE8613			

EE8323	>20M OHMS	INF	
EE8423			

EE8223	>20M OHMS	INF	
EE8323			

EE8323	>20M OHMS	INF	
EE8413			

EE8223	>20M OHMS	INF	
EE8313			

EE8323	>20M OHMS	INF	
EE8613			

EE8223	>20M OHMS	INF	
EE8423			

EE8313	>20M OHMS	INF	
EE8423			

EE8223	>20M OHMS	INF	
EE8413			

EE8313	>20M OHMS	INF	
EE8413			

EE8313	>20M OHMS	INF	
EE8613			

EE8423	>20M OHMS	INF	
EE8613			

EE8423	>20M OHMS	INF	

EE8413	>20M OHMS	INF	

Q3 - LQXC01

EE8413		
Measure Vtap to each Ccoil		
	Expected	Measured
H3A	<5 OHMS	1.27 OHMS
EE8123		
V3A	<5 OHMS	1.51 OHMS
EE8113		
B6A	<5 OHMS	1.54 OHMS
EE8613		
B3A	<5 OHMS	1.68 OHMS
EE8313		
A4A	<5 OHMS	1.42 OHMS
EE8423		
B4A	<5 OHMS	1.41 OHMS
EE8413		
A3A	<5 OHMS	2.3 OHMS
EE8323		
A2A	<5 OHMS	4.2 OHMS
EE8223		

EE8613		
	Expected	Measured
H3B	24 OHMS	24.66 OHMS
EE8123		
V3B	19 OHMS	19.76 OHMS
EE8113		
B6B	100 OHMS	101 OHMS
EE8613		
B3B	29 OHMS	29.26 OHMS
EE8313		
A4B	12 OHMS	13.6 OHMS
EE8423		
B4B	13 OHMS	14.45 OHMS
EE8413		
A3B	13 OHMS	14.9 OHMS
EE8323		
A2B	10 OHMS	10.10 OHMS
EE8223		

Q3 - LQXC01

Measure continuity of Q1 through bus

Ccoil	Bus	OK??
V1A	3	YES
V1B	4	YES
H1A	1	YES
H1B	2	YES

Measure continuity of Q2 through bus

Ccoil	Bus	OK??
V1A	3	YES
V1B	4	YES
H1A	1	YES
H1B	2	YES

Measure Ccoil through bus of Q2 to GND

Ccoil	Bus	OK??
V2A	3	YES
V2B	4	YES
H2A	1	YES
H2B	2	YES

Measure Ccoil through bus of Q1 to GND

Ccoil	Bus	OK??
V2A	3	YES
V2B	4	YES
H2A	1	YES
H2B	2	YES

Q3 - LQXC01

Form#6 Feed through Test

MEASURE RESISTANCE BETWEEN ALL 24-Q1 FEED THROUGH SIGNALS

MEASURE RESISTANCE BETWEEN ALL 46-Q2 FEED THROUGH SIGNALS

Q1			Q2		
	EXPECTED RESISTANCE	OK??		EXPECTED RESISTANCE	OK??
EE1111	< 1 OHM	YES	EE1112	< 1 OHM	YES
EE1121	< 1 OHM	YES	EE1122	< 1 OHM	YES
EE1211	< 1 OHM	YES	EE1212	< 1 OHM	YES
EE1221	< 1 OHM	YES	EE1222	< 1 OHM	YES
EE1311	< 1 OHM	YES	EE1312	< 1 OHM	YES
EE1321	< 1 OHM	YES	EE1322	< 1 OHM	YES
EE8121	< 1 OHM	YES	EE8122	< 1 OHM	YES
EE8111	< 1 OHM	YES	EE8112	< 1 OHM	YES
EH8311+	< 1 OHM	YES	EH8312+	< 1 OHM	YES
EH8311-	< 1 OHM	YES	EH8312-	< 1 OHM	YES
EH8321+	< 1 OHM	YES	EH8322+	< 1 OHM	YES
EH8321-	< 1 OHM	YES	EH8322-	< 1 OHM	YES
YT1111+	< 1 OHM	YES	YT1112+	< 1 OHM	YES
YT1111-	< 1 OHM	YES	YT1112-	< 1 OHM	YES
YT1121+	< 1 OHM	YES	YT1122+	< 1 OHM	YES
YT1121-	< 1 OHM	YES	YT1122-	< 1 OHM	YES
TT8311I+	< 1 OHM	YES	TT8312I+	< 1 OHM	YES
TT8311I-	< 1 OHM	YES	TT8312I-	< 1 OHM	YES
TT8311U+	< 1 OHM	YES	TT8312U+	< 1 OHM	YES
TT8311U-	< 1 OHM	YES	TT8312U-	< 1 OHM	YES
TT8321I+	< 1 OHM	YES	TT8322I+	< 1 OHM	YES
TT8321I-	< 1 OHM	YES	TT8322I-	< 1 OHM	YES
TT8321U+	< 1 OHM	YES	TT8322U+	< 1 OHM	YES
TT8321U-	< 1 OHM	YES	TT8322U-	< 1 OHM	YES
			EE1412	< 1 OHM	YES
			EE1422	< 1 OHM	YES
			EE1512	< 1 OHM	YES
			EE1522	< 1 OHM	YES
			EE1612	< 1 OHM	YES
			EE1622	< 1 OHM	YES
			EH8332+	< 1 OHM	YES
			EH8332-	< 1 OHM	YES
			EH8342+	< 1 OHM	YES
			EH8342-	< 1 OHM	YES
			YT1132+	< 1 OHM	YES
			YT1132-	< 1 OHM	YES
			YT1142+	< 1 OHM	YES
			YT1142-	< 1 OHM	YES
			TT8332I+	< 1 OHM	YES
			TT8332I-	< 1 OHM	YES
			TT8332U+	< 1 OHM	YES
			TT8332U-	< 1 OHM	YES
			TT8342I+	< 1 OHM	YES
			TT8342I-	< 1 OHM	YES
			TT8342U+	< 1 OHM	YES
			TT8342U-	< 1 OHM	YES

Q3 - LQXC01