Fermi National Accelerator Laboratory
Batavia, IL 60510

LARGE HADRON COLLIDER
LMQXB
COLD MASS MODULE ASSEMBLY TRAVELER

Reference Drawing(s):
Q2 Cold Mass Welded Assembly(ME-390309)
Q2 Module Assembly (ME-369888)

Project/Task Number: *300/1.1.1.6.2*

44 Pages

Project: Large Hadron Collider	**Magnet/Device Series:** LQXB
Budget Code: LPT	**Project Code:** CRYO
Released by: J. Szostak	**Date:** 5/7/02
Date Closed:	**Scanned Pages:**
Prepared by: J. Szostak	

Title	Signature	Date
TD / E&F Process Engineering	Bob Jensen / Designee	
TD / LHC Production Supervisor	Jim Rife / Designee	
TD / LHC Production Engineer	Rodger Bossert / Designee	
TD / LHC Project Engineer Cryostat	Tom Nicol / Designee	
TD / LHC Project Physicist	Michael Lamm / Designee	
TD / LHC Program Manager	Jim Kerby / Designee	

DRAFT

Revision Page

Revision	Step No.	Revision Description	TRR No.	Date
None	N/A	Initial Release	N/A	5/7/02

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/Inspectors 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 All personnel performing steps in this traveler must have documented training for this traveler and associated operating procedures.

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

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

2.0 Parts Kit List

2.1 Attach the completed Parts Kit 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.

Parts issued as needed — 5/7/02

Process Engineering/Designee — Date

3.0 Q2a Module Alignment (Granite Table)

3.1 Determine which module is Q2a and which is Q2b. Record the serial number for each Magnetic Component Assembly.

Q2a Serial Number: MQXB02

Q2b Serial Number: MQXB01

MCBX Serial Number: MCBXT001

Responsible Authority/Physicist

Date 5-7-02

DRAFT

4.0 Q2a Module Alignment (Module Assembly Tooling)

4.1 Configure tooling for Q2a/Q2b cold mass assembly per (ME-369768).

S Gould
Technician(s)

5/7/02
Date

4.2 Configure tooling for corrector mounting per (ME-369780), 13.780 Diameter Corrector Magnet.

S Gould
Technician(s)

5/7/02
Date

4.3 Configure tooling for End Dome mounting per (ME-369765, View F-F) (Insert Item 22).

S Gould
Technician(s)

5/7/02
Date

4.4 Install the mounts for the Corrector Coil on the Return End of Q2a as per Q2 Cold Mass Welded Assembly(ME-390309).

S Gould
Technician(s)

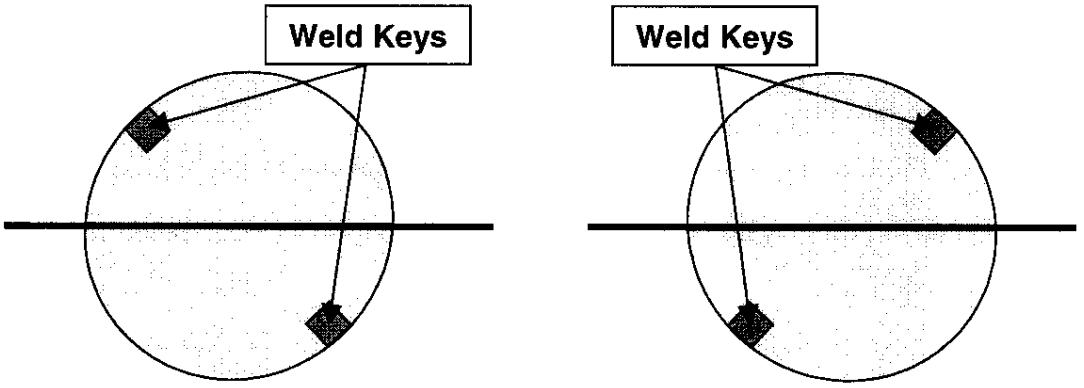
5/7/02
Date

4.5 Move the Q2a to the Cold Mass Module Assembly Tooling, placing it nearest the East End of ICB, with the Lead End of the Magnet facing East as per Q2 Cold Mass Welded Assembly(ME-390309).

S Gould
Technician(s)

5/7/02
Date

4.6 Rotate the Magnet such that the Weld Keys are approximately at a 45° diagonal.



Lead End Non-Lead End

Technician(s) Date 5/7/02

XXX 4.7 Determine and record the location at which the level gauge should be mounted to the Magnet.

Distance from Lead End Plate: 50 inches.

T. Page 5/7/02

Responsible Authority/Physicist Date

4.8 Mount the Twist Measuring Fixture to the Cold Mass at the assigned position.

Technician(s) Date 5/7/02

DRAFT

4.9 Mount the Precision V Block to the top of the Twist Measuring Fixture.

S Gould
Technician(s)

5/7/02
Date

4.10 Place a Precision Level on the top surface of the V Block.

S Gould
Technician(s)

5/7/02
Date

4.11 Rotate the Magnet until the Precision Level reads Horizontal 0.00 mm/m (+/- 0.50mm/m).

S Gould
Technician(s)

5/7/02
Date

4.12 Slide the Center Body Tube (MC-390112) over Return End of Q2a Coldmass as per Q2 Cold Mass Welded Assembly (ME-390309).

S Gould
Technician(s)

5/7/02
Date

DRAFT

5.0 Q2b Module Alignment (Module Assembly Tooling)

5.1 Move the Q2b to the Cold Mass Module Assembly Tooling, placing it nearest the West End of ICB, with the Lead End of the Magnet Facing West as per Q2 Cold Mass Welded Assembly(ME-390309).

S Gould
Technician(s)

5/7/02
Date

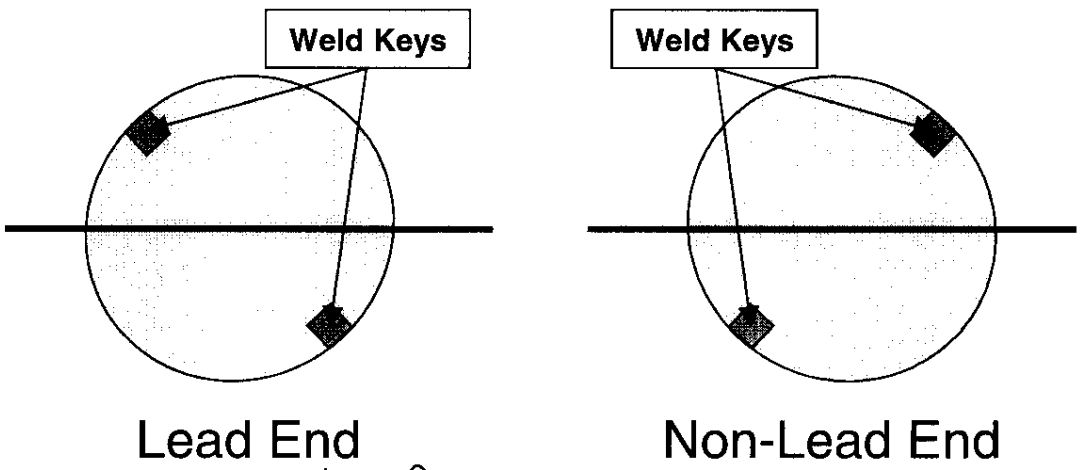
5.2 The distance from the magnetic center of Q2a to the magnetic center of Q2b as denoted by the markings on the OD of the Cold Mass should be 6524mm. (Needs to be the warm magnetic offset 6519.6 mm, plus ~~what we expect the weld shrinkage to be 3/16"~~)

9 3/16" (4.4 [illegible])

S Gould
Technician(s)

5/7/02
Date

5.3 Rotate the Magnet such that the Weld Keys are approximately at a 45° diagonal.



S Gould
Technician(s)

5/7/02
Date

DRAFT

XXX 5.4 Determine and record the location at which the level gauge should be mounted to the Magnet.

Distance from Lead End Plate: 150 inches.

T. Page — 5/7/02

Responsible Authority/Physicist — Date

5.5 Mount the Twist Measuring Fixture to the Cold Mass at the assigned position.

S Gould — 5/7/02

Technician(s) — Date

5.6 Mount the Precision V Block to the top of the Twist Measuring Fixture.

S Gould — 5/7/02

Technician(s) — Date

5.7 Place a Precision Level on the top surface of the V Block.

S Gould — 5/7/02

Technician(s) — Date

5.8 Rotate the Magnet until the Precision Level reads Horizontal 0.00mm/m (+/- 0.50mm/m).

S Gould — 5/7/02

Technician(s) — Date

DRAFT

6.0 Module Connection & Assembly

Lead Busses

6.1 Hipot the Lead Bus. (Procedure to be supplied by M. Lamm and R. Bossert)

5 kV	Measurement(s)
Lead Bus to Ground	

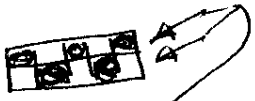
13kA Lead Bus to 5 ka lead bus — passed at 5KV — < 3 uA
5 ka Lead Bus to 8 ka lead bus — passed at 5KV — < 3 uA
corrector coil Busses — passed at 5KV — < uA

Parallel Hipot

Rodger Bent — 5-7-02
Inspector — Date

6.2 Slide Completed Bus Assembly (ME-369826) into Q2 as per Q2 Module Assembly (ME-369888).

Rodger Bent — 5-7-02
Technician(s) — Date



6.3 Connect the Bus Housing Lock (MB-369870) to the Bus Assembly (ME-369826) and Q2b Return End Plate as per Q2 Module Assembly (ME-369888).

Rodger Bent — 5-7-02
Technician(s) — Date

Checkerboard Hipot passed at 5KV < 3 uA

6.4 Solder 13kA bus to Q2a lead as per Q2 Module Assembly (ME-~~369888~~).

[signature] — 5-7-02
Technician(s) — Date

6.5 Solder 13kA bus to Q2b lead as per Q2 Module Assembly (ME-~~369888~~).

[signature] — 5-7-02
Technician(s) — Date

Setup for splicing w/ 3/4 block to standoff lead for thermal contraction

6.6 Attach the Q2a Bus Housing Extension (MD-369872) to Q2a Lead as per Q2 Module Assembly (ME-369888).

[signature] — 5-7-02
Technician(s) — Date

6.7 Attach the Q2a Bus Housing Extension Base (MC-369873) to Q2a Lead as per Q2 Module Assembly (ME-369888).

[signature] — 5-7-02
Technician(s) — Date

6.8 Attach the Q2a Bus Housing Extension Cover (MD-369874) to Q2a Lead as per Q2 Module Assembly (ME-369888).

[signature] — 5-7-02
Technician(s) — Date

DRAFT

6.9 Attach the Q2b Bus Housing Extension (MD-369867) to Q2b Lead as per Q2 Module Assembly (ME-369888).

Technician(s) _____ Date 5/7/02

6.10 Attach the Q2b Bus Housing Extension Cover (MD-369874) to Q2b Lead as per Q2 Module Assembly (ME-369888).

Technician(s) _____ Date 5/7/02

6.11 Hipot 13kA Lead vs. 5kA Lead.

5 kV	Measurement(s)
13kA Lead to 5kA Lead	<.05 uA

Inspector _____ Date 5/7/02

6.12 Slide Instrumentation Bus Assembly (ME-369896) into the proper Q2 Port as per Q2 Module Assembly (ME-369888). As instrumentation Bus Assembly is being inserted, feed ~~wires~~ Bus cable 369867 from Lead End of Q2a (4 strip heater wires, 8 voltage tap wires and 2 warmup heater wires) into bus channel, wrapping intermittently with glass tape entire channel and kevlar string as shown in drawing ~~MX-369XXX~~ ME-369896. Refer to Figures 1,2 & 3 to see the positions at which all wires are attached to the End Plates.

Technician(s) _____ Date 5-13-02

A) Wrap Q2a lead end wires into bus cable as per dwg. MB 369897. Wire labels and descriptions are shown in Table XX

B) Pull wire bundle from Q2a through entire Q2, and mark end plate position on bundle.

C) Remove Q2a bundle from Q2.

DRAFT

6.13 Install Warm-up Heaters (ME-369834) to the Non-Lead Ends of Q2a and Q2b as per Q2 Module Assembly (ME-369~~888~~).

6.13.1 Install Warm-up Heaters (MA-369834) onto the Warm-up Heater Base Plate (MA-369829).

6.13.2 Solder wires (MA-369833) to the Warm-up Heaters as per (ME-369888).

6.13.3 Install Warm-up Heater Base Plates (MA-369829) by bolting into holes in end plate.

make separate boxes to check off each of the 4 warmup heaters as they are installed

Rodger Rut — 5-15-02

Technician(s) — Date

6.14 Install RTD's as per Q2 Module Assembly (ME-369888). Record Serial Numbers of each RTD. in table XX. Also, attach data sheet for each RTD to traveler.

6.14.1 Attach RTD's (MA-369835) (Qty. 2) to each Return End Plate as per Q2 Module Assembly (ME-369~~888~~).

6.14.2 Solder wires (MA-369836) to RTD's as per For Q2b as per Q2 Module Assembly (ME-369~~888~~).

Add figure from CERN RTD procedure

Rodger Rut — 5-15-02

Technician(s) — Date

6.14.3 Perform continuity check on all RTD's and warmup heaters. Record data below. [redacted] 1mA

RTD's see page 31 for Data.

Serial No.	Location	Wire No.	
	Q2a inst bus side		
	Q2a non bus side		
	Q2b inst bus side		
	Q2b non-bus side		

6.14.4 Add Inst bus housing lock

DRAFT

6.15 Place the Correction Coil in the Correction Coil Mounting Tooling, between Q2a and Q2b. The Flange end of the MCBX should face the Return End Plate of Q2a.

A Gould — Technician(s) — 5/23/02 — Date

6.16 Solder MCBX Correction Coil Voltage Tap Wires (MA-369832) as per Q2 Module Assembly (ME-369888).

A Gould — Technician(s) — 5/23/02 — Date

6.17 Connect Correction Coil Bus wires from Bus Assembly (ME-369826) to the MCBX Correction Coil as per Q2 Module Assembly (ME-369888).

A Gould — Technician(s) — 5/23/02 — Date

6.18 Attach the Correction Coil Alignment Tooling (ME-390390) to the Correction Coil. Align the Scribe Lines on the Correction Coil with those on the tooling.

A Gould — Technician(s) — 5/23/02 — Date

6.19 Mount the Precision Level to the top of the Correction Coil Alignment Tooling.

A Gould — Technician(s) — 5/24/02 — Date

6.20 Rotate the Correction Coil such that the Precision Level is Horizontal 0.00 mm/m (+/- 0.50 mm/m).

A Gould — Technician(s) — 5/24/02 — Date

6.21 Move the Correction Coil up against the Mounting Hardware to the Q2a Magnet, and bolt the Correction Coil to the Q2a using the four bolts as per Q2 Cold Mass Welded Assembly (ME-390309).

A Gould — Technician(s) — 5/24/02 — Date

XXX 6.22 Verify Alignment of Correction Coil as per Q2 Cold Mass Welded Assembly (ME-390309).

T. Page — Responsible Authority/Physicist — 6/4/02 — Date

7.0 Electrical Inspection

7.1 Perform an electrical inspection on each of the individual ~~Inner Coils, Outer Coils~~ masses., Quadrants and the Cold Mass. Refer to the Valhalla and Leader Free Standing Coil Measurement Procedure (ES-292306).

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	_____	2V
Amp selector knob	_____	1A
Temperature compensator	_____	On
Test current	_____	On (testing)

Hp 4284:

Function	_____	"Ls-Q" selected

Record the Serial Number of the test equipment used.

Valhalla _____

HP 4284 _____

Insert more extensive table

Continuity Check	Measurement
Strip Heaters	Continuity
Voltage Taps	Continuity
RTD's	Continuity
Warmup Heaters	Continuity
Correction Coil Voltage Taps	Continuity
Corrector Coil Bus Wires	Continuity

Inspector _____ Date 5-28-02

7.2 → Hipot according to attached sheet + figures.

→ Put steps 6.16 and 6.17 after 7.1

DRAFT

8.0 Installation of Hypertronics

8.1 Install Hypertronics Connectors as per Q2 Module Assembly (ME-369888).

Technician(s) _____ Date 5/28/02

XXX 8.2 Check installation of Hypertronics. Ensure Hypertronics were installed as per Q2 Module Assembly (ME-369888).

Technician(s) _____ Date 5/29/02

Responsible Authority/Physicist _____ Date 5/30/02

9.0 Electrical Tests

9.1 Perform an Electrical Test of the following and record the data in the spaces provided.

Resistance	Measurement
Strip Heaters	Ω
Voltage Taps	Ω
RTD's	Ω
Warmup Heaters	Ω
Correction Coil Voltage Taps	Ω

See attached sheet

	Q2a	Q2b	Total Magnet
Resistance (R)	2.298	2.292	4.59
Inductance (L)			
Q-factor (Q)			

Inspector _____ Date 5-29-02

X 9.2 Perform a Hipot on the Module Assembly (**Maximum Leakage 3μA**).

	Measurement
Busses shorted together	.108 μA
Busses shorted to Ground	.216 μA
Heaters to Ground	1.097 μA

Inspector _____ Date 5-29-02

XXX 9.3 Verify that the results in Step 9.0 are acceptable.
Approved for next Assembly Procedure.

Responsible Authority/Physicist _____ Date 5-29-02

DRAFT

10.0 Dome Installation (IP End)

10.1 Attach IP End Dome (MD-390197) (Q2a) to the End Dome Positioning Fixture (MD-369776).

Technician(s) _____ Date 5-29-02

10.2 Align Dome as shown in Q2 Cold Mass Welded Assembly(ME-390309).

Technician(s) _____ Date 5/29/02

10.3 Level the Dome using the Ball Socket (MD-369777) and the (ultra-precision) Level.

Technician(s) _____ Date 5/29/02

10.4 Feed the Electrical wires/Bus through the proper ports as the Dome is brought into position against the End Plate.

Technician(s) _____ Date 5-29-02

10.5 Install Spider Assemblies (MC-369885) to protect wires/bus, if necessary.

Technician(s) N/A Date _____

10.6 Tack weld the Dome in place at approximately 6-8 places around the Dome.

Weldor(s) Michael J. Cooper Date 5-31-02

10.7 Weld the Dome, skip weld around to minimize distortion.

Weldor(s) Michael J. Cooper Date 5-31-02

DRAFT

11.0 Dome Installation (Non-IP End)

11.1 Attach Non-IP End Dome (MD-390253) (Q2b) to the End Dome Positioning Fixture (MD-369776).

Technician(s) _____ Date 5-29-02

11.2 Align Dome as shown in Q2 Cold Mass Welded Assembly (ME-390309).

Technician(s) _____ Date 5-29-02

11.3 Level the Dome using the Ball Socket (MD-369777) and the (ultra-precision) Level.

Technician(s) _____ Date 5-29-02

11.4 Feed the Electrical wires/bus through the proper ports as the Dome is brought into position against the End Plate.

Technician(s) _____ Date 5/29/02

11.5 Install Spider Assemblies (MC-369885) to protect wires/bus, if necessary.

Technician(s) N/A _____ Date _____

11.6 Tack weld the Dome in place at approximately 6-8 places around the Dome.

Weldor(s) Michael J. Cooper _____ Date 5-31-02

11.7 Weld the Dome, skip weld around to minimize distortion.

Weldor(s) Michael J. Cooper _____ Date 5-31-02

DRAFT

12.0 Beam Tube Installation

12.1 Inspect the Beam Tube as per Insulated Beam Tube Assembly For Q2a/Q2b (MD-369802).

[signature] 5-30-02
Technician(s) Date

12.2 Cut the beam tube to 12.610mm long as per Insulated Beam Tube Assembly For Q2a/Q2b (MD-369802).

Beam Tube Length = 12610

(Subtract) ~~3mm~~ TP

Cut Beam Tube to this Length: 12610

[signature] 5-30-02
Technician(s) Date

XXX 12.3 Verify Alignment of Q2a, Q2b and Correction Coil as per Q2 Cold Mass Welded Assembly (ME-390309).

T. [signature] 6/4/02
Responsible Authority/Physicist Date

12.3 Using Insertion Tooling, insert the Beam Tube into the Magnet Assembly as per Beam Tube Insertion Tooling (MD-369789).

BEAM TUBE # 05

[signature] 5/30/02
Technician(s) Date

X 12.4 Perform a Hipot on the Assembly (**Maximum Leakage 3µA**).

5 KV	Measurement(s)
Coils to Ground	.104 µA

[signature] 5-30-02
Inspector Date

[signature] 6/13/02

AFTER ADJUSTING BEAM TUBE .446 µA leakage

12.5 Perform a stretched wire measurement of the system, noting the relative position and roll of the three magnetic elements to each other.

Technician(s) 6/13/02
Date

12.6 Weld the Center Body Tube (MC-390112) as per Q2 Cold Mass Welded Assembly (ME-390309).

Root pass Weldor(s) 6/6/02
Date

DRAFT

13.0 Cold Bore

13.1 Flare both ends of the Beam Tube using Flaring Tool (MC-390351).

S Gould — 6/13/02

Technician(s) — Date

13.2 Position Cold Bore Flange (MC-390300) over the Beam Tube and onto IP End Dome (Q2a).

S Gould — 6/13/02

Technician(s) — Date

13.3 Weld the Beam Tube to the Flange at IP End as per Q2 Cold Mass Welded Assembly (ME-390309).

[signature] — 6/13/02

Weldor(s) — Date

13.4 Position the Cold Bore Flange (MC-390300) over the Beam Tube and onto the Non-IP End Dome (Q2b).

S Gould — 6/13/02

Technician(s) — Date

13.5 Weld Beam Tube to Flange at NON-IP End as per Q2 Cold Mass Welded Assembly (ME-390309).

[signature] — 6/13/02

Weldor(s) — Date

DRAFT

13.6 Align Beam Tube and the Flange at IP End (to de determined).

Technician(s) _____ Date 6/14/02

13.7 Weld the Flange to the IP End Dome as per Q2 Cold Mass Welded Assembly (ME-390309).

Weldor(s) _____ Date 6/14/02

13.8 Align Beam Tube and Flange NON-IP End (to de determined).

Technician(s) _____ Date 6/14/02

13.9 Weld the Flange to the Non-IP End Dome as per Q2 Cold Mass Welded Assembly (ME-390309).

Weldor(s) _____ Date 6/14/02

DRAFT

14.0 Production Complete

XXX 14.1 Process Engineering verify that the LHC Cold Mass Module Assembly Traveler (5520-TR-333643) 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:

John J. Szostak
Process Engineering/Designee

8/22/03
Date

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 # LMQXB01

REQUESTED BY *J. Rife*

DATE REQUESTED *5/9/02*

DELIVER TO *J. Rife - ICB*

BUDGET CODE *LQB*

NEED BY DATE *5/20/02*

JOB TICKET #

MMR #

MACHINE SHOP REQ. #

PO #

PURCHASE RELEASE #

OTHER

PARTS STATUS (CHECK ONE)

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

ACQUISITIONER SIGNATURE Marsha Schmidt **ID#** 7223 **DATE** 5/28/02

PLEASE INDICATE REVISION REQUIRED

LOCATION	PART #	REV	QTY	UOM	DESCRIPTION	RF #	SIR #
IB4	*MD 390197*	*B*	*1*	*Each*	*Q2 IP End Dome Weld.*	77855	
IB4	*MD 390253*	*A*	*1*	*Each*	*Q2 Non IP End Dome Weldment*	77985	

STOCKROOM SIGNATURE [illegible] **ID#** 12698 **DATE** 5/28/02

PARTS DELETED FROM DATABASE Ken Schmidt **ID#** 5158 **DATE** 5/29/02

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

PARTS RECEIVED BY Steve Powell **ID#** 4965 **DATE** 5/28/02

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 # LMQXB01

DATE REQUESTED 5-8-02

BUDGET CODE LQB

JOB TICKET #

MACHINE SHOP REQ. #

PURCHASE RELEASE #

REQUESTED BY Jim Rife

DELIVER TO Jim Rife

NEED BY DATE

MMR #

PO #

OTHER

PARTS STATUS (CHECK ONE)

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

ACQUISITIONER SIGNATURE Marsha Schmidt **ID#** 4223 **DATE** 5/10/02

PLEASE INDICATE REVISION REQUIRED

LOCATION	PART #	REV	QTY	UOM	DESCRIPTION	RF #	SIR #
IB4 BIN	MA-393030	0	8	Each	10-32 x.188 cup point set screw.S.S.	77839	
R10 1 2	MC-390300	B	2	Each	Beam tube flange	77028	

STOCKROOM SIGNATURE Chris Bosce **ID#** 12698 **DATE** 5/13/02

PARTS DELETED FROM DATABASE Jim Schmidt **ID#** 5158 **DATE** 5/15/02

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

PARTS RECEIVED BY [illegible] **ID#** 4895 **DATE** 5/13/02

ADDITIONAL PARTS REQUEST

0102-ES-292302 Revision E

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 # LMQXB01

REQUESTED BY *Jim Rife*

DATE REQUESTED *5-8-02*

DELIVER TO *Jim Rife*

BUDGET CODE *LQB*

NEED BY DATE 5/13/02

JOB TICKET #

MMR #

MACHINE SHOP REQ. #

PO #

PURCHASE RELEASE #

OTHER

PARTS STATUS (CHECK ONE)

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

ACQUISITIONER SIGNATURE [signature] **ID#** 4223 **DATE** 5/10/02

PLEASE INDICATE REVISION REQUIRED

LOCATION	PART #	REV	QTY	UOM	DESCRIPTION	RF #	SIR #
~~IB4~~	~~MD-390197~~	~~B~~	~~1~~	~~Each~~	~~IP End dome weldment~~		
~~IB4~~	~~MD-390253~~	~~A~~	~~1~~	~~Each~~	~~Non IP End dome weldment~~		
IB4 BIN	MC-390294	0	4	Each	MCBX transportation restraint nut	76666	
IB4 BIN	MC-390203	0	4	Each	MCBX corrector mounting spacer	75999	
IB4 BIN	MA-393029	0	16	Each	1/4 -28 x 1" hex SHCS S.S.	77851	
IB4BIN	MA-390248	0	4	Each	1/2 -20 x 3.5" silver plated screw	74623	
R1 S3L2	MB-390228	0	4	Each	MCBX corrector mounting flat washer	75739	
IB4 BIN	MB-390230	A	4	Each	Transportation restraint adjusting screw	76664	

STOCKROOM SIGNATURE [signature] **ID#** 12698 **DATE** 5/13/02

PARTS DELETED FROM DATABASE [signature] **ID#** 5158 **DATE** 5/15/02

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

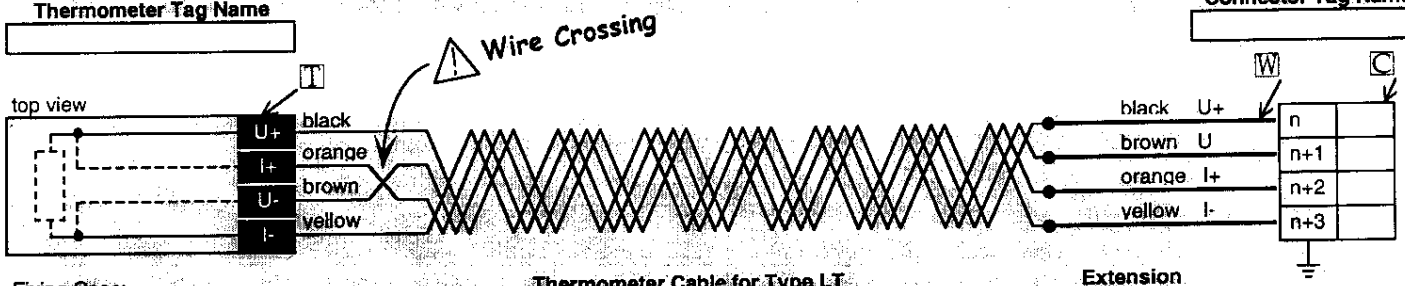
PARTS RECEIVED BY [signature] **ID#** 4890 **DATE** 5/15/02

Q2a inst bus side

Cabling

Thermometer Tag Name

Connector Tag Name



Fixing Case:

Thread ☐ Stud ☐

Hole ☐ Pipe ☐

Thermometer Cable for Type LT

ρ (300 K) = 38 Ω/m

Manganin AWG 36

Length = ____ m > 1.5 m

Extension

ρ (300 K) = 0.07 Ω/m

Copper AWG 24

Length: 0.8 m

Checks

Intervention	Date/ Day-Month-Year	Check Point	R(U+,U-,I+,I-)/ Ω 4W	R(U+,I+)/ Ω 2W	R(U-,I-)/ Ω 2W	R(U+,GND)/ Ω 2W	Temperature	Firm/Laboratory	Checked by
calibration	20/02/01	T W C	51,55	–	–	ovL	amb	IPN	Joly
reception	08/11/01	T W C	50,60	0,2	0,2	ovL	19°	CERN	Grivat
		T W C							
		T W C							
		T W C							
		T W C							
		T W C							

Long Thermometer (LT) Traveller

Thermometer Serial Number	CX_LS_X11821
Thermometer Tag Name	

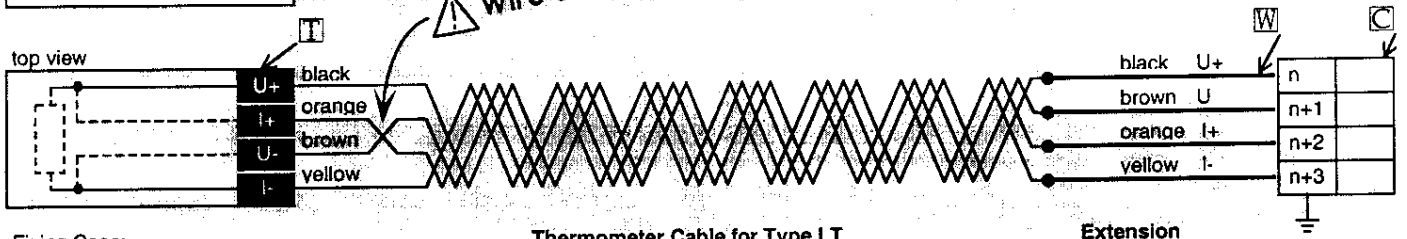
LMQXB01

Q2a non-bus side

Cabling

Thermometer Tag Name

Connector Tag Name



Fixing Case:

Thread ☐ Stud ☐

Hole ☐ Pipe ☐

Thermometer Cable for Type LT

ρ (300 K) = 38 Ω/m

Manganin AWG 36

Length = ____ m > 1.5 m

Extension

ρ (300 K) = 0.07 Ω/m

Copper AWG 24

Length: 0.8 m

Checks

Intervention	Date/ Day-Month-Year	Check Point	R(U+,U-,I+,I-)/ Ω 4W	R(U⁻,I⁻)/ Ω 2W	R(U⁺,I⁺)/ Ω 2W	R(U⁻,GND)/ Ω 2W	Temperature	Firm/Laboratory	Checked by
calibration	20/02/01	T W C	56,46	—	—	OVL	amb.	IPN	Jaly
reception	08/11/01	T W C	55,42	0,2	0,2	OVL	19°	CERN	Grivat
		T W C							
		T W C							
		T W C							
		T W C							
		T W C							

Long Thermometer (LT) Traveller

Thermometer Serial Number	CX-LS-X07047
Thermometer Tag Name	

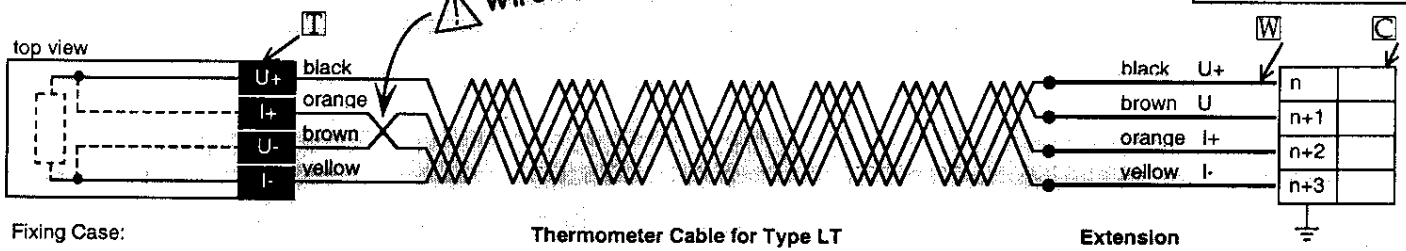
LMQXB01

Q2b inst bus side

Cabling

Thermometer Tag Name

Connector Tag Name



Fixing Case:

Thread ☐ Stud ☐

Hole ☐ Pipe ☐

Thermometer Cable for Type LT

ρ (300 K) = 38 Ω/m

Manganin AWG 36

Length = ____ m > 1.5 m

Extension

ρ (300 K) = 0.07 Ω/m

Copper AWG 24

Length: 0.8 m

Checks

Intervention	Date/ Day-Month-Year	Check Point	R(U+,U-,I+,I-)/ Ω 4W	R(U⁻,I⁻)/ Ω 2W	R(U⁺,I⁺)/ Ω 2W	R(U⁺,GND)/ Ω 2W	Temperature	Firm/Laboratory	Checked by
calibration	20/02/01	T W C	58,40	—	—	ovL	amb.	IPN	Joly
reception	08/11/01	T W C	57,47	0,2	0,2	ovL	19°	CERN	GRIVAT
		T W C							
		T W C							
		T W C							
		T W C							
		T W C							

Long Thermometer (LT) Traveller

Thermometer Serial Number	CX_LS_X07044
Thermometer Tag Name	

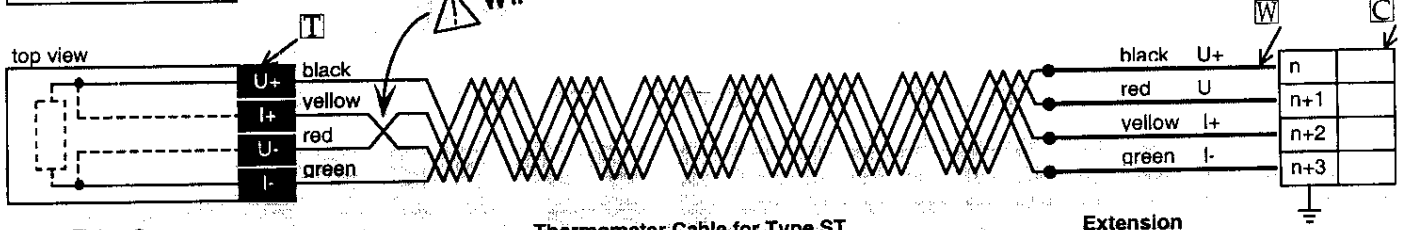
LMQXB01

Q2b non-bus side

Cabling

Thermometer Tag Name

Connector Tag Name



Fixing Case:

Thread ☐

Hole ☐

Stud ☐

Thermometer Cable for Type ST

ρ (300 K) = 0.32 Ω/m

Copper AWG 30

Length = ____ m

Extension

ρ (300 K) = 0.07 Ω/m

Copper AWG 24

Length: 0.8 m

Checks

Intervention	Date/ Day-Month-Year	Check Point	R(U+,U-,I+,I-)/ Ω 4W	R(U-,I-)/ Ω 2W	R(U+,I+)/ Ω 2W	R(U+,GND)/ Ω 2W	Temperature	Firm/Laboratory	Checked by
calibration	20/02/01	T ~~W~~	56,22	~~[illegible]~~	–	OVL	amb.	IPN	Joly
Reception	8/11/01	T ~~W~~ C	55,15	0,2	0,1	OVL	19°	CERN	Grivat
		T W C							
		T W C							
		T W C							
		T W C							
		T W C							

Short Thermometer (ST) Traveller

Thermometer Serial Number	CX_LS_X11826
Thermometer Tag Name	

LMQXB01

Before weld

1mA 2V scale

RTD		AFTER WELD
Tb Q2a	55.8 Ω	53.6 Ω ~~53.5 Ω~~ ~~50.4 Ω~~
Ta Q2b	57.9 Ω	56.5 Ω
Tb Q2b	55.5 Ω	53.5 Ω
Ta Q2a	51.0 Ω	50.4 Ω

warm up Heaters

Collected data from step 6.14.3 page 12,

w1 bQ2b, w2 bQ2b > 16.5 Ω

w1 bQ2a, w2 bQ2a > 16.5 Ω

w2 aQ2b, w1 aQ2b > 16.2 Ω

w1 aQ2a, w2 aQ2a > 17.1 Ω

Q1(male)-Q2(female) Connector - 6.5 cm (2.6")

Module	Pin	Wire	Description
M1	1		Blank Module
M1	2		
M1	3		
M1	4		
M1	5		
M2	1	VTa1Q1	Q1 Lead Voltage Tap "a", primary
M2	2	VTa2Q1	Q1 Lead Voltage Tap "a",redundant
M2	3	VTc1Q1	Q1 Center Voltage Tap "c", primary
M2	4	VTc2Q1	Q1 Center Voltage Tap "c", redundant
M2	5	VTb1Q1	Q1 Lead Voltage Tap "b", primary
M3	1	Empty	Jumpered to M3-2
M3	2	Empty	Jumpered to M3-3
M3	3	Empty	Jumpered to M3-4
M3	4	Empty	Jumpered to M3-5
M3	5	VTb2Q1	Q1 Lead Voltage Tap "b",redundant
M4	1		Blank Module
M4	2		
M4	3		
M4	4		
M4	5		
M5	1	VTH1	Corrector Q1-H1 Voltage Tap
M5	2	VTV1	Corrector Q1-V1 Voltage Tap
M5	3	Empty	No Connection
M5	4	Empty	No Connection
M5	5	Empty	No Connection
M6	1		Blank Module
M6	2		
M6	3		
M6	4		
M6	5		
M7	1	W1aQ1	Q1 Warmup Heater Lead "1", lead end heater
M7	2	W2aQ1	Q1 Warmup Heater Lead "2", lead end heater
M7	3	W1bQ1	Q1 Warmup Heater Lead "1", return end heater
M7	4	W2bQ1	Q1 Warmup Heater Lead "2", return end heater
M7	5	Empty	No Connection
M8	1		Blank Module
M8	2		
M8	3		
M8	4		
M8	5		

A

Q1(male)-Q2(female) Connector - 6.5 cm (2.6")

Module	Pin	Wire	Description
M1	1		Blank Module
M1	2		
M1	3		
M1	4		
M1	5		
M2	1	VTa1Q1	Q1 Lead Voltage Tap "a", primary
M2	2	VTa2Q1	Q1 Lead Voltage Tap "a",redundant
M2	3	VTc1Q1	Q1 Center Voltage Tap "c", primary
M2	4	VTc2Q1	Q1 Center Voltage Tap "c", redundant
M2	5	VTb1Q1	Q1 Lead Voltage Tap "b", primary
M3	1	Empty	Jumpered to M3-2
M3	2	Empty	Jumpered to M3-3
M3	3	Empty	Jumpered to M3-4
M3	4	Empty	Jumpered to M3-5
M3	5	VTb2Q1	Q1 Lead Voltage Tap "b",redundant
M4	1		Blank Module
M4	2		
M4	3		
M4	4		
M4	5		
M5	1	VTH1	Corrector Q1-H1 Voltage Tap
M5	2	VTV1	Corrector Q1-V1 Voltage Tap
M5	3	Empty	No Connection
M5	4	Empty	No Connection
M5	5	Empty	No Connection
M6	1		Blank Module
M6	2		
M6	3		
M6	4		
M6	5		
M7	1	W1aQ1	Q1 Warmup Heater Lead "1", lead end heater
M7	2	W2aQ1	Q1 Warmup Heater Lead "2", lead end heater
M7	3	W1bQ1	Q1 Warmup Heater Lead "1", return end heater
M7	4	W2bQ1	Q1 Warmup Heater Lead "2", return end heater
M7	5	Empty	No Connection
M8	1		Blank Module
M8	2		
M8	3		
M8	4		
M8	5		

Q2(male)-Q3(female) Connector - 11.5 cm (4.53")

Module	Pin	Wire	Description
M1	1		Blank Module
M1	2		
M1	3		
M1	4		
M1	5		
M2	1	VTa1Q1	Q1 Lead Voltage Tap "a", primary
M2	2	VTa2Q1	Q1 Lead Voltage Tap "a",redundant
M2	3	VTc1Q1	Q1 Center Voltage Tap "c", primary
M2	4	VTc2Q1	Q1 Center Voltage Tap "c", redundant
M2	5	VTb1Q1	Q1 Lead Voltage Tap "b", primary
M3	1	VTc1Q2a	Q2a Center Voltage Tap "c", primary
M3	2	VTdQ2a	Q2a Quarter Coil Voltage Tap "d" (1-3 interface)
M3	3	VTa2Q2a	Q2a Lead Voltage Tap "a", redundant
M3	4	VTa1Q2a	Q2a Lead Voltage Tap "a", primary
M3	5	VTb2Q1	Q1 Lead Voltage Tap "b",redundant
M4	1	VTc2Q2a	Q2a Center Voltage Tap "c", redundant
M4	2	VTeQ2a	Q2a Quarter Coil Voltage Tap "e" (2-4 interface)
M4	3	VTb1Q2a	Q2a Lead Voltage Tap "b", primary
M4	4	VTb2Q2a	Q2a Lead Voltage Tap "b", redundant
M4	5	VTb1Q2b	Q2b Lead Voltage Tap "b", primary
M5	1	VTdQ2b	Q2b Quarter Coil Voltage Tap "d" (1-3 interface)
M5	2	VTc2Q2b	Q2b Center Voltage Tap "c", redundant
M5	3	VTc1Q2b	Q2b Center Voltage Tap "c", primary
M5	4	VTeQ2b	Q2b Quarter Coil Voltage Tap "e" (2-4 interface)
M5	5	VTb2Q2b	Q2b Lead Voltage Tap "b", redundant
M6	1	VTa1Q2b	Q2b Lead Voltage Tap "a", primary
M6	2	VTa2Q2b	Q2b Lead Voltage Tap "a", redundant
M6	3	Empty	Jumpered to M6-2
M6	4	Empty	Jumpered to M6-3
M6	5	Empty	Jumpered to M6-4
M7	1		Blank Module
M7	2		
M7	3		
M7	4		
M7	5		
M8	1	VTH1	Corrector Q1-H1 Voltage Tap
M8	2	VTV1	Corrector Q1-V1 Voltage Tap
M8	3	VTH2	Corrector Q2-H2 Voltage Tap
M8	4	VTV2	Corrector Q2-V2 Voltage Tap
M8	5	Empty	No Connection

Blanks used to increase standoff V

Coil Voltage Taps Group

Layout follows an "S" pattern with no floating pins to minimize voltage between pins during a quench

Corrector Voltage Taps Group

Q2(male)-Q3(female) Connector - 11.5 cm (4.53")

Module	Pin	Wire	Description
M1	1		Blank Module
M1	2		
M1	3		
M1	4		
M1	5		
M2	1	VTa1Q1	Q1 Lead Voltage Tap "a", primary
M2	2	VTa2Q1	Q1 Lead Voltage Tap "a",redundant
M2	3	VTc1Q1	Q1 Center Voltage Tap "c", primary
M2	4	VTc2Q1	Q1 Center Voltage Tap "c", redundant
M2	5	VTb1Q1	Q1 Lead Voltage Tap "b", primary
M3	1	VTc1Q2a	Q2a Center Voltage Tap "c", primary
M3	2	VTdQ2a	Q2a Quarter Coil Voltage Tap "d" (1-3 interface)
M3	3	VTa2Q2a	Q2a Lead Voltage Tap "a", redundant
M3	4	VTa1Q2a	Q2a Lead Voltage Tap "a", primary
M3	5	VTb2Q1	Q1 Lead Voltage Tap "b",redundant
M4	1	VTc2Q2a	Q2a Center Voltage Tap "c", redundant
M4	2	VTeQ2a	Q2a Quarter Coil Voltage Tap "e" (2-4 interface)
M4	3	VTb1Q2a	Q2a Lead Voltage Tap "b", primary
M4	4	VTb2Q2a	Q2a Lead Voltage Tap "b", redundant
M4	5	VTb1Q2b	Q2b Lead Voltage Tap "b", primary
M5	1	VTdQ2b	Q2b Quarter Coil Voltage Tap "d" (1-3 interface)
M5	2	VTc2Q2b	Q2b Center Voltage Tap "c", redundant
M5	3	VTc1Q2b	Q2b Center Voltage Tap "c", primary
M5	4	VTeQ2b	Q2b Quarter Coil Voltage Tap "e" (2-4 interface)
M5	5	VTb2Q2b	Q2b Lead Voltage Tap "b", redundant
M6	1	VTa1Q2b	Q2b Lead Voltage Tap "a", primary
M6	2	VTa2Q2b	Q2b Lead Voltage Tap "a", redundant
M6	3	Empty	Jumpered to M6-2
M6	4	Empty	Jumpered to M6-3
M6	5	Empty	Jumpered to M6-4
M7	1		Blank Module
M7	2		
M7	3		
M7	4		
M7	5		
M8	1	VTH1	Corrector Q1-H1 Voltage Tap
M8	2	VTV1	Corrector Q1-V1 Voltage Tap
M8	3	VTH2	Corrector Q2-H2 Voltage Tap
M8	4	VTV2	Corrector Q2-V2 Voltage Tap
M8	5	Empty	No Connection

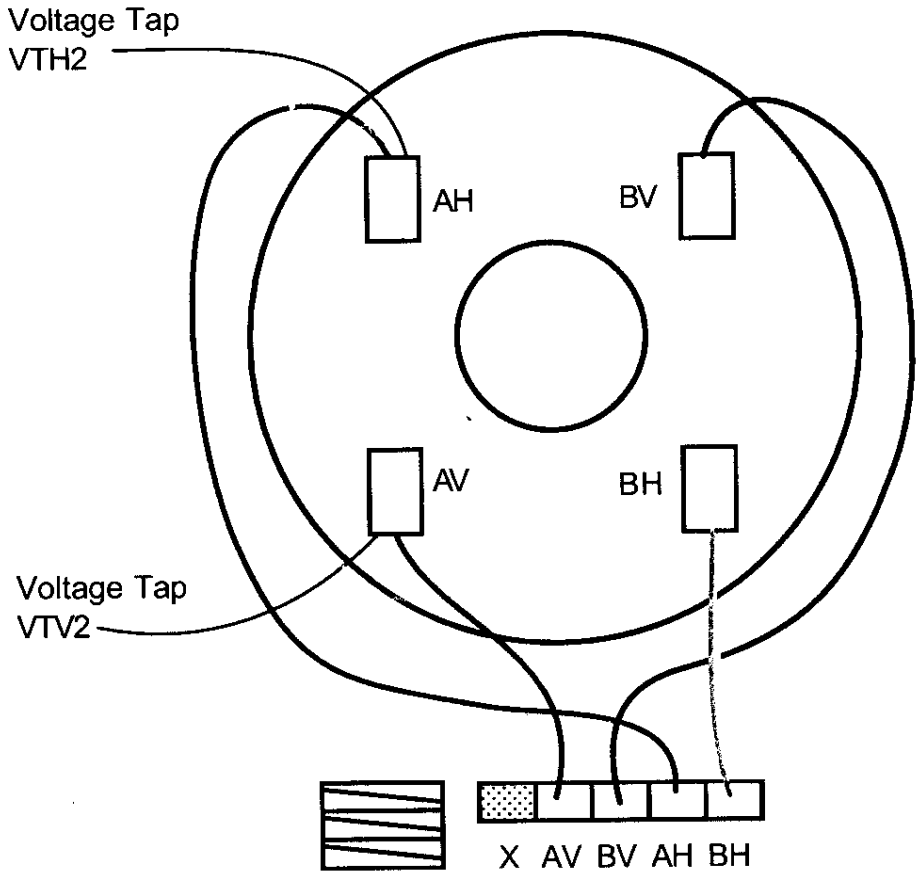
Blanks used to increase standoff V

Coil Voltage Taps Group

Layout follows an "S" pattern with no floating pins to minimize voltage between pins during a quench

Corrector Voltage Taps Group

Looking from Q2b to Q2a (into end of correction coil)



Q2a connector

Module	Pin #	Wire	Resistance
M2	1	VTa1Q1	2351
M2	2	VTa2Q1	2327
M2	3	VTc1Q1	2318
M2	4	VTc2Q1	2325
M2	5	VTb1Q1	2349
M3	5	VTb2Q1	2326
M5	1	VTH1	2368
M5	2	VTV1	2282
M7	1	W1aQ1	1093
M7	2	W2aQ1	1093
M7	3	W1bQ1	1075
M7	4	W2bQ1	1074
M9	1	H1aQ1	1086
M9	3	H2aQ1	1086
M9	5	H1bQ1	1087
M10	4	H2bQ1	1083
M12	1	TaQ1_I+	X
M12	2	TaQ1_I-	
M12	3	TaQ1_V+	X
M12	4	TaQ1_V-	
M12	5	TbQ1_I+	X
M12	6	TbQ1_I-	
M12	11	TbQ1_V+	X
M12	10	TbQ1_V-	

Dbice 5-28-02

Q2b connector

Module	Pin #	Wire	Resistance
M2	1	VTa1Q1	2351
M2	2	VTa2Q1	2332
M2	3	VTc1Q1	2348
M2	4	VTc2Q1	2325
M2	5	VTb1Q1	2349
M3	1	VTc1Q2a	1155
M3	2	VTdQ2a	1729
M3	3	VTa2Q2a	2303
M3	4	VTa1Q2a	2303
~~M3~~	~~5~~	~~VTb2Q2a~~	~~2300~~
M4	1	VTc2Q2a	1155
M4	2	VTeQ2a	~~1729082~~
M4	3	VTb1Q2a	~~2303000~~
M4	4	VTb2Q2a	~~2303000~~
M4	5	VTb1Q2b	0004
M5	1	VTdQ2b	1311
M5	2	VTc2Q2b	943
M5	3	VTc1Q2b	943
M5	4	VTeQ2b	575
M5	5	VTb2Q2b	.0004
M6	1	VTa1Q2b	1885
M6	2	VTa2Q2b	1885
M8	1	VTH1	2368
M8	2	VTV1	2287
M8	3	VTH2	X
M8	4	VTV2	
M10	1	W1aQ1	1093
M10	2	W2aQ1	1093
M10	3	W1bQ1	1075
M10	4	W2bQ1	1074
M11	1	W1aQ2A	16.734
M11	2	W2aQ2A	16.734
M11	3	W1bQ1	16.367
M11	4	W2bQ1	16.367
M12	1	W1aQ2B	16042
M12	2	W2aQ2B	16.042
M12	3	W1bQ2B	16.403
M12	4	W2bQ2B	16.403

Module	Pin #	Wire	Resistance
M14	1	H1aQ1	1086
M14	3	H2aQ1	1086
M14	5	H1bQ1	1087
M15	2	H1aQ2a	19.202
M15	4	H2bQ1	1083
M16	1	H2aQ2a	19.202
M16	3	H1bQ2a	19.285
M16	5	H2bQ2a	19285
M17	2	H2aQ2b	18956
M17	4	H1aQ2b	18.956
M18	1	H1bQ2b	18956
M18	3	H2bQ2b	18956
M20	1	TaQ1_I+	X
M20	2	TaQ1_I-	
M20	3	TaQ1_V+	X
M20	4	TaQ1_V-	
M20	5	TbQ1_I+	X
M20	6	TbQ1_I-	
M20	11	TbQ1_V+	X
M20	10	TbQ1_V-	
M20	9	TaQ2a_I+	X
M20	8	TaQ2a_I-	
M20	7	TaQ2a_V+	X
M20	12	TaQ2a_V-	
M20	13	TbQ2a_I+	X
M20	14	TbQ2a_I-	
M20	15	TbQ2a_V+	X
M20	16	TbQ2a_V-	
M21	1	TaQ2b_I+	X
M21	2	TaQ2b_I-	
M21	3	TaQ2b_V+	X
M21	4	TaQ2b_V-	
M21	5	TbQ2b_I+	X
M21	6	TbQ2b_I-	
M21	11	TbQ2b_V+	X
M21	10	TbQ2b_V-	

X = Continuity

1ST ✓ after connecting hyperture connectors 5/28/02

Dbice 5-28-02

VTA 1 q2a

Q2b connector

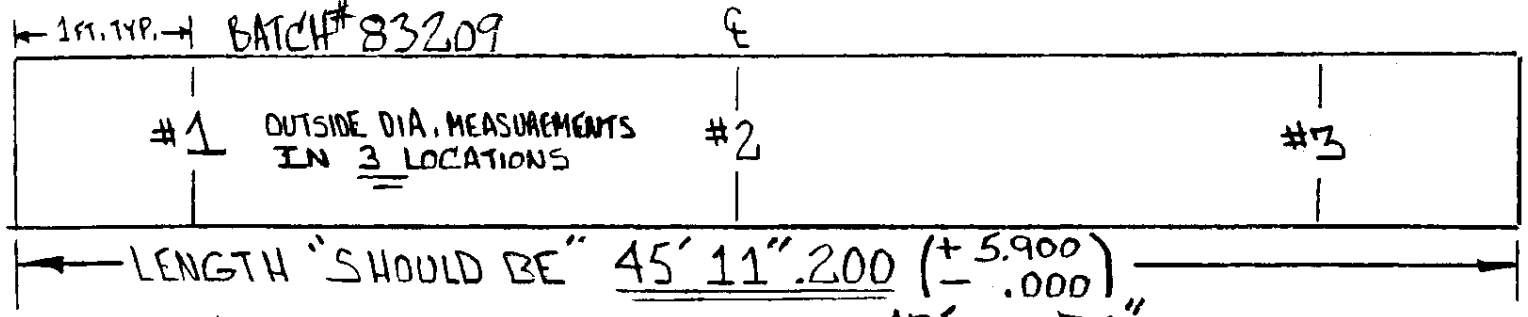
Module	Pin #	Wire	Resistance
M2	1		
M2	2		
M2	3		
M2	4		
M2	5		
M3	1	VTc1Q2a	3.462
M3	2	VTdQ2a	2.888
M3	3	VTa2Q2a	2.313
M3	4	VTa1Q2a	2.314
M3	5		
M4	1	VTc2Q2a	0.580
M4	2	VTeQ2a	1.155
M4	3	VTb1Q2a	
M4	4	VTb2Q2a	1.730
M4	5	VTb1Q2b	~~0.004~~
M5	1	VTdQ2b	
M5	2	VTc2Q2b	0.004
M5	3	VTc1Q2b	0.004
M5	4	VTeQ2b	
M5	5	VTb2Q2b	0.004
M6	1	VTa1Q2b	0.069
M6	2	VTa2Q2b	0.095
M8	1		
M8	2		
M8	3	VTH2	
M8	4	VTV2	
M10	1		
M10	2		
M10	3		
M10	4		
M11	1	W1aQ2A	
M11	2	W2aQ2A	
M11	3	W1bQ1	
M11	4	W2bQ1	
M12	1	W1aQ2B	
M12	2	W2aQ2B	
M12	3	W1bQ2B	
M12	4	W2bQ2B	

Module	Pin #	Wire	Resistance
M14	1		
M14	3		
M14	5		
M15	2	H1aQ2a	
M15	4		
M16	1	H2aQ2a	
M16	3	H1bQ2a	
M16	5	H2bQ2a	
M17	2	H2aQ2b	
M17	4	H1aQ2b	
M18	1	H1bQ2b	
M18	3	H2bQ2b	
M20	1	TaQ1_I+	
M20	2	TaQ1_I-	
M20	3	TaQ1_V+	
M20	4	TaQ1_V-	
M20	5	TbQ1_I+	
M20	6	TbQ1_I-	
M20	11	TbQ1_V+	
M20	10	TbQ1_V-	
M20	9	TaQ2a_I+	
M20	8	TaQ2a_I-	
M20	7	TaQ2a_V+	
M20	12	TaQ2a_V-	
M20	13	TbQ2a_I+	
M20	14	TbQ2a_I-	
M20	15	TbQ2a_V+	
M20	16	TbQ2a_V-	
M21	1	TaQ2b_I+	
M21	2	TaQ2b_I-	
M21	3	TaQ2b_V+	
M21	4	TaQ2b_V-	
M21	5	TbQ2b_I+	
M21	6	TbQ2b_I-	
M21	11	TbQ2b_V+	
M21	10	TbQ2b_V-	

Dbice 5-28-02

3/15/02 DATE SER# N.05 FERMI LAB BEAM TUBE

BATCH# 83209



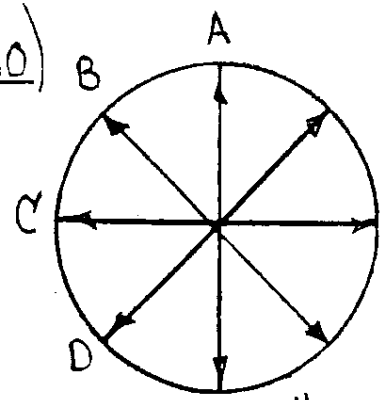
ACTUAL MEASURED LENGTH 47' FT. 3/4"

ACTUAL WALL THICKNESS .071 "TOLERANCE" (.073 ±.006)

ACTUAL SURFACE FINISH 18√ MAX. 63√

STRAIGHTNESS OVER 3' FT. (S/B WITHIN .020 ACTUAL .003)

TOTAL (MAX STRAIGHTNESS S/B WITHIN .120)
ACTUAL = .010



"OUTSIDE DIA. TOLERANCE"
2.618 (±.010)

	LOCATION #1	LOCATION #2	LOCATION #3
A	2.618	2.618	2.617
B	2.619	2.621	2.618
C	2.618	2.624	2.624
D	2.620	2.620	2.619

LMQXB01

BNL 631 3442190 03/22/02 10:31am P. 007

ORIGINAL

Using 1/8 TV

TOTAL RESISTANCE - Q2B - MQXB Ø1
2.292 Ω

1.258 Ω

~~V+C2Q2a - 1.461~~
~~V+C1Q2a 1.461~~
~~V+D1Q2a - .2541~~
~~V+D2Q2a - .2541~~
~~V+a2Q2a -~~
H1aQ2b } 18.931 Ω
H2aQ2b
H1bQ2b } 18.928 Ω
H2bQ2b
W1aQ2b } 16.024 Ω
W2aQ2b
W1bQ2a } 16.355 Ω
W2bQ2a
W1bQ2b } 16.391 Ω
W2bQ2b
H1bQ1 } .90 Ω (ENDS TWISTED TOGETHER)
H2bQ1
H1aQ1 } .90 Ω (TWISTED TOGETHER)
H2aQ1
W1aQ1 } .92 Ω (ENDS TWISTED Together)
W2aQ1
W1aQ2a } 16.701 Ω
W2aQ2a
H1bQ2a } 19.224 Ω
H2bQ2a
H1aQ2a } 19.145 Ω
H2aQ2a
TaQ2b 57.73 Ω
TaQ1 — ~~open~~ Through
TbQ1 — ~~open~~ Through
TaQ2a - 50.83 Ω
TbQ2b - 55.40
~~Tb Q2~~
TbQ2a - 55.66

ORIGINAL

		Using 1/8 TAP
2b Q1 1/8 TAP :	.8301 Ω	.831 Ω
2b Q2 1/8 TAP :	1.4647 Ω	1.467 Ω
2b Q3 1/8 TAP :	.2577 Ω	.258 Ω
2b Q4 1/8 TAP :	2.037 Ω	2.039 Ω
2a Q1 1/8 TAP :	3.758 Ω	.984 Ω
2a Q2 1/8 TAP :	3.123 Ω	1.575 Ω
2a Q3 1/8 TAP :	4.328 Ω	.369 Ω
2a Q4 1/8 TAP :	2.551 Ω	2.147 Ω
* VTC2Q2a :	3.440 Ω	1.258 Ω
* VTb2Q2a :	2.298 Ω	? 240Ω
* VTa2Q2a :	4.580 Ω	.114 Ω
* VTc1Q2a :	3.438 Ω	12.577 Ω
* VTa1Q2a :	?	1.145 Ω
* VTb1Q2a :	2.298 Ω	? 240Ω
VTd2Qa :	4.009 Ω	6.858 Ω
VTc2a1 :	through	
VTEQ2a :	2.8666	18.287 Ω
VTC1Q1 :	through	
VTV2 :	Through	
VTH2 :	Thru	
VTV1 :	Through	
VTA1Q1 :	Throug	
VTH1 :	through	
VTb1a1 :	through	
VTC1Q2b :	1.147 Ω	1.149
VTb1Q2b :	2.289 Ω	2.292
VTa2Q2b :	.003 Ω	.004
VTa1Q2b :	.004 Ω	.004
VTdQ2b :	.576 Ω	.577
VTb2Q2b :	2.290 Ω	2.293
VTeQ2b :	1.718 Ω	1.721
VTC2Q2b :	1.147	1.149
VTb2a1	Through	

Q2b connector

Module	Pin #	Wire	Resistance
M2	1		
M2	2		
M2	3		
M2	4		
M2	5		
M3	1	VTc1Q2a	3.478
M3	2	VTdQ2a	4.055
M3	3	VTa2Q2a	4.632
M3	4	VTa1Q2a	4.632
M3	5		
M4	1	VTc2Q2a	3.478
M4	2	VTeQ2a	2.901
M4	3	VTb1Q2a	2.324
M4	4	VTb2Q2a	2.324
M4	5	VTb1Q2b	2.316
M5	1	VTdQ2b	0.582
M5	2	VTc2Q2b	1.16
M5	3	VTc1Q2b	1.16
M5	4	VTeQ2b	1.738
M5	5	VTb2Q2b	2.316
M6	1	VTa1Q2b	0.004
M6	2	VTa2Q2b	0.004
M8	1		
M8	2		
M8	3	VTH2	0.768
M8	4	VTV2	1.128
M10	1		
M10	2		
M10	3		
M10	4		
M11	1	W1aQ2A	1.272
M11	2	W2aQ2A	1.285
M11	3	W1bQ1	1.324
M11	4	W2bQ1	1.491
M12	1	W1aQ2B	2.417
M12	2	W2aQ2B	2.451
M12	3	W1bQ2B	2.921
M12	4	W2bQ2B	4.554

Module	Pin #	Wire	Resistance
M14	1		
M14	3		
M14	5		
M15	2	H1aQ2a	4.698
M15	4		
M16	1	H2aQ2a	4.715
M16	3	H1bQ2a	4.594
M16	5	H2bQ2a	4.689
M17	2	H2aQ2b	4.745
M17	4	H1aQ2b	4.736
M18	1	H1bQ2b	4.725
M18	3	H2bQ2b	4.709
M20	1	TaQ1_I+	
M20	2	TaQ1_I-	
M20	3	TaQ1_V+	
M20	4	TaQ1_V-	
M20	5	TbQ1_I+	
M20	6	TbQ1_I-	
M20	11	TbQ1_V+	
M20	10	TbQ1_V-	
M20	9	TaQ2a_I+	
M20	8	TaQ2a_I-	
M20	7	TaQ2a_V+	
M20	12	TaQ2a_V-	
M20	13	TbQ2a_I+	
M20	14	TbQ2a_I-	
M20	15	TbQ2a_V+	
M20	16	TbQ2a_V-	
M21	1	TaQ2b_I+	
M21	2	TaQ2b_I-	
M21	3	TaQ2b_V+	
M21	4	TaQ2b_V-	
M21	5	TbQ2b_I+	
M21	6	TbQ2b_I-	
M21	11	TbQ2b_V+	
M21	10	TbQ2b_V-	

6/11/02
.1 Amp applied
D.Bice
S.Gould

After hypertronics
All resistance shown in Ohms

Q2A	
Voltage Tap	Resistance
VTa1Q2a	4.632
VTa2Q2a	4.632
VTb1Q2a	2.324
VTb2Q2a	2.324
VTc1Q2a	3.478
VTc2Q2a	3.478

6/11/2002

S.Gould/ D.Bice

.1 A applied

After hypertronics connectors installed.

All resistance shown in Ohms

Q2b	
Voltage Tap	Resistance
VTa1Q2b	0.004
VTa2Q2b	0.004
VTb1Q2b	2.316
VTb2Q2b	2.316
VTc1Q2b	1.16
VTc2Q2b	1.16