Document ID:

103

Q2 LMQXB Cold Mass Module Assembly Traveler

333643 / 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!!!

LMQXB03-0

Document ID:

103

Job No.:

248

Project/Task No.

300/1.1.1.6.2

Series:

LQXB

Serial No:

LMQXB03

Rework ID:

0

Specification No.:

333643

Revision:

NONE

LMQXB03-0

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-369895)

Project/Task Number: *300/1.1.1.6.2*

Released by: *John Szostak* **Magnet/Device Series:** *LQXB*

Date Issued: *4/4/2003 2:23:50 PM* **Scanned Pages:** 81 91

Prepared by: J. Szostak

Title	Signature	Date
TD / E&F Process Engineering	*Jamie Blowers* Bob Jensen / Designee	*10/15/02*
TD / LHC Production Supervisor	*Jim Rife* Jim Rife / Designee	*10/15/02*
TD / LHC Production Engineer	*Jim Rife* Rodger Bossert / Designee	*10/15/02*
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TD / LHC Project Physicist	*Jim Kirby* Michael Lamm / Designee	*10/15/02*
TD / LHC Program Manager	*Jim Kirby* Jim Kerby / Designee	*10/15/02*

Revision Page

Revision	Step No.	Revision Description	TRR No.	Date
None	N/A	Initial Release	N/A	10/15/02

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/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 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.

J Goodwin
Process Engineering/Designee

4/4/03
Date

3.0 Q2 Module Alignment

XXX 3.1 Record the serial number for each Magnetic Component Assembly.

Q2a Serial Number: MQXB - 06

Q2b Serial Number: MQXB - 05

MCBX Serial Number: HCMCBX_001-SI000004

Responsible Authority/Physicist — Date: 4-11-03

3.2 File the End Plate Welds, and Alignment Welds at the Non-Lead End of Coldmass Q2a to allow Center Body Tube (MC-390112) to fit properly.

Technician(s) — Date: 4/11/03

4.0 Q2a Magnet Placement (Module Assembly Tooling)

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

Technician(s) Date 4/11/03

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

Technician(s) Date 4/11/03

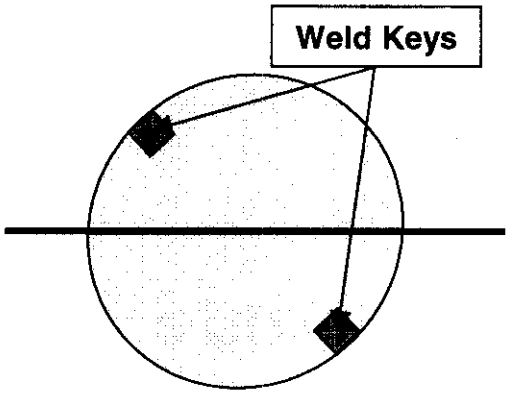
4.3 Configure tooling for End Dome Mounting per (ME-369765, View F-F) (Insert Item 22).

Technician(s) Date 4/11/03

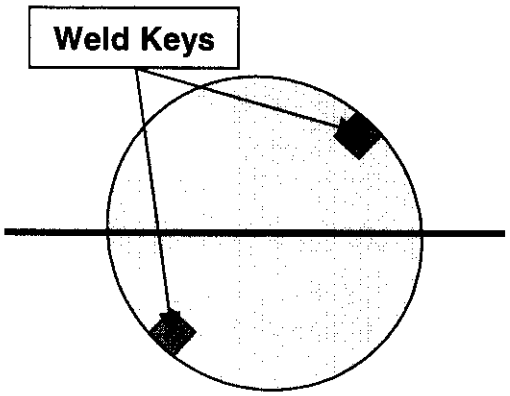
4.4 Move the Q2a Cold Mass to the Cold Mass Module Assembly Tooling, placing it nearest the East End of ICB, with the Lead End of the Magnet facing East as per Q2 Cold Mass Welded Assembly (ME-390309).

Technician(s) Date 4/11/03

4.5 Rotate the Q2a Cold Mass, such that the Weld Keys are approximately at a 45° diagonal.



Lead End



Non-Lead End

Technician(s) Date 4/14/03

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

Technician(s) Date 4/11/03

5.0 Q2b Magnet Placement (Module Assembly Tooling)

5.1 Move the Q2b Cold Mass 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).

Technician(s) Date 4/11/03

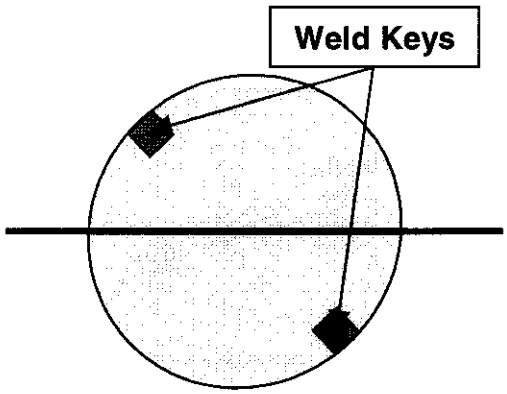
5.2 Position the Cold Masses so that the distance from the magnetic center of Q2a Cold Mass to the magnetic center of Q2b Cold Mass as denoted by the markings on the OD of the Cold Mass is 6524mm +/- 2 mm

Note(s):

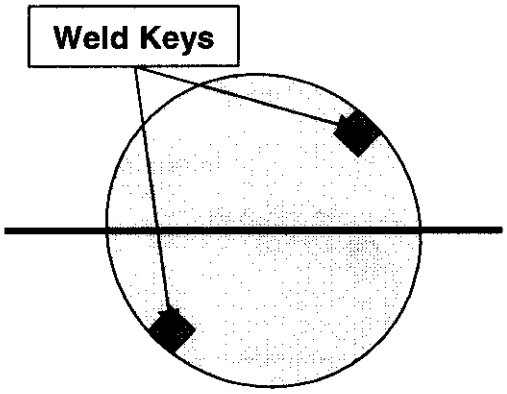
Needs to be the warm magnetic offset 6519.6 mm, plus 3/16" (4.4mm) allowance for weld shrinkage.

Technician(s) Date 4/11/03

5.3 Rotate the Q2b Cold Mass such that the Weld Keys are approximately at a 45° diagonal.



Lead End



Non-Lead End

Technician(s) Date 4/14/03

6.0 Q2a / Q2b Module Alignment

Q2a

XXX 6.1 Determine and record the location at which the level gauge should be mounted to the Cold Mass.

Distance from Lead End Plate: 120 inches.

T. Peterson — 4/15/03
Responsible Authority/Physicist — Date

6.2 Mount the Twist Measuring Fixture to the Q2a Cold Mass at the assigned position.

[signature] — 4/14/03
Technician(s) — Date

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

[signature] — 4/14/03
Technician(s) — Date

6.4 Place the Mini Level on the top surface of the V Block.

[signature] — 4/14/03
Technician(s) — Date

6.5 Rotate the Q2a Cold Mass until the Mini Level reads Horizontal 0.00 mm/m (+/- 0.50mm/m).

Note(s):
Mini Level should be "zeroed" at reference stand location before this operation.

[signature] — 4/14/03
Technician(s) — Date

Q2b

XXX 6.6 Determine and record the location at which the level gauge should be mounted to the Q2b Cold Mass.

Distance from Lead End Plate: 150 inches.

T. Peryt — Responsible Authority/Physicist — Date 4/14/03

6.7 Mount the Twist Measuring Fixture to the Q2b Cold Mass at the assigned position.

A Howell — Technician(s) — Date 4/14/03

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

A Howell — Technician(s) — Date 4/14/03

6.9 Place the Mini Level on the top surface of the V Block.

A Howell — Technician(s) — Date 4/14/03

6.10 Rotate the Q2b Cold Mass until the Mini Level reads Horizontal 0.00mm/m (+/- 0.50mm/m).

TRR #1578 Needed here

Note(s):

Mini Level should be "zeroed" at reference stand location before this operation.

A Howell — Technician(s) — Date 4/14/03

ADD A TRR HERE FOR A STRETCHED WIRE VERIFICATION MEASUREMENT AS PER TOM PAGE.

Perform a stretched wire measurement to verify that the coldmasses are properly aligned. Adjust coldmasses as needed, (+/- 0.2 mrad.)

Resp Auth Sign. — Date

7.0 Bus & Instrumentation Connection and Assembly

Note(s):

Figure "7.0-A" shows the configuration of magnet and corrector bus leads in a Q2 Magnet.

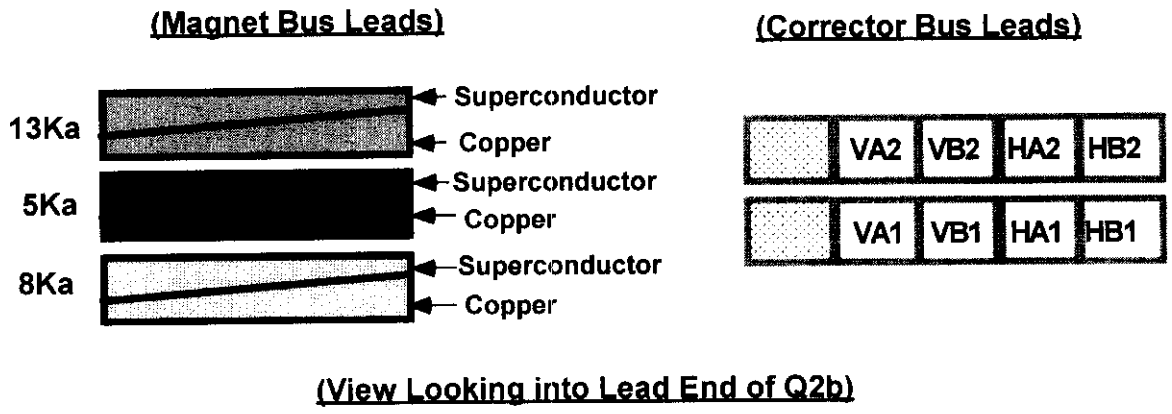


Figure 7.0-A

7.1 Obtain Lead Bus (ME-369825). Inspect Bus for damaged or broken areas. Clean Bus using lint free Heavy Duty Wipers (Fermi stock 1660-0150) and Isopropyl Alcohol (Fermi stock 1920-0300)

A Gould
Technician(s)

6/19/03
Date

7.2 Obtain parts for Bus Assembly (ME-369826) and assemble per Q2 Module Assembly Insulated Bus Assembly (ME-369826).

A Gould
Technician(s)

6/19/03
Date

7.3 Verify Bus Assembly (ME-369826) is assembled correctly per Q2 Module Assembly Insulated Bus Assembly (ME-369826).

Crew Chief — Date: 6-19-03

XXX 7.4 Hipot the 5kA Lead Bus to the 8kA and 13 kA Lead Busses on table before inserting into magnets. Power the 15kA bus to 5000V and ground the 13kA Lead Bus and the 8kA Lead Bus. **(Max. Leakage < 0.5μA)**

Note(s):

Ensure that the Bus is isolated from the Assembly Table during Hipotting.

Power Lead Assembly Hipot	Leakage or Failure Voltage
5kA lead bus	.634 μA

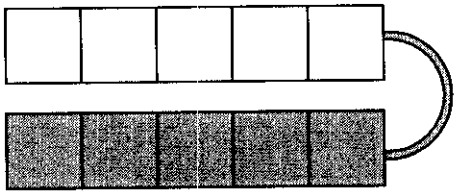
Technician(s) — Date: 6-19-03

Responsible Authority/Physicist — Date: 6-19-03

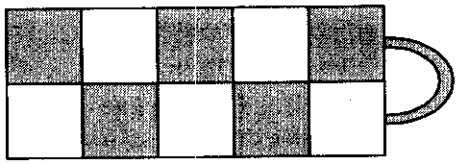
XXX 7.5 Hipot the Corrector Magnet (MD-390312) Busses at 5kV before inserting into magnet in both the parallel and checkerboard configurations as shown below. Corrector Wires not shaded should be at high potential, while those shaded should be connected to each other and grounded. **(Max. Leakage < 0.5μA)**

Note(s):

Ensure that the Bus is isolated from the Assembly Table during Hipotting.



Parallel Hipot



Checkerboard Hipot

Corrector Coil Assembly Hipot	Leakage or Failure Voltage
Parallel Hipot	.787 μA
Checkerboard Hipot	.106

Technician(s) — Date: 6-20-03

Responsible Authority/Physicist — Date: 6-20-03

7.6 Slide Completed Bus Assembly (ME-369826) into Q2 as per Q2 Module Assembly (ME-369895).

Technician(s) Date 7/16/03

7.7 Connect the Bus Housing Lock (MB-369870) to the Bus Assembly (ME-369826) and Q2b Return End Plate as per Q2 Module Assembly (ME-369895).

Technician(s) Date 7/22/03

7.8 Connect the Bus Housing End Support (MB-369892) on the Q2a End per (ME-369895).

Technician(s) Date 7/31/03

7.9 Connect the Bus Housing End Support (MB-369892) on the Q2b End per (ME-369895).

Technician(s) Date 7/31/03

7.10 Set up the Power Leads for splicing. Create a ¾" space behind the Kevlar wrapped Leads to allow for Thermal Contraction differences between the bus and Cold Masses

Technician(s) Date 7-31-03

7.11 Solder 13kA bus to Q2a Quadrant 4 lead as per Q2 Module Assembly (ME-369895) per LHC Cable Splice Joint Procedure (ES-369950).

Technician(s) Date 7-31-03

7.12 Cut Q2a Quadrant 4 Lead at end of splice per Drawing (ME-369895).

Technician(s) Date 8-1-03

7.13 Insulate splice area with ¾ overlap, .001 x 3/8 wide kapton.

Technician(s) Date 8/1/03

7.14 Attach the Q2a Bus Housing Extension (MD-369872) to Q2a Lead as per Q2 Module Assembly (ME-369895).

Technician(s) Date 8-4-03

7.15 Attach the Q2a Bus Housing Extension Base (MC-369873) to Q2a Lead as per Q2 Module Assembly (ME-369895).

Technician(s) Date 8/11/03

DR 04/6 # HERE

7.16 Attach the Q2a Bus Housing Extension Cover (MD-369874) to Q2a Lead as per Q2 Module Assembly (ME-369895).

Technician(s) 8/11/03 Date

7.17 Solder 13kA bus to Q2b Quadrant 4 lead as per Q2 Module Assembly (ME-369895) as per LHC Cable Splice Joint Procedure (ES-369950).

Technician(s) 8-1-03 Date

7.18 Cut Q2a Quadrant 4 Lead at end of splice per Drawing (ME-369895).

Technician(s) 8-1-03 Date

7.19 Insulate splice area with ¾ overlap, .001 x 3/8 wide kapton.

Technician(s) 8/2/03 Date

7.20 Attach the Q2b Bus Housing Extension (MD-369867) to Q2b Lead as per Q2 Module Assembly (ME-369895).

Technician(s) 8/4/03 Date

7.21 Attach the Q2b Bus Housing Extension Cover (MD-369874) to Q2b Lead as per Q2 Module Assembly (ME-369895).

Technician(s) 8/4/03 Date

XXX 7.22 Hipot the 5kA Lead Bus to all other components at 5 kV. Ensure that all Magnet components (*i.e. both Yokes, all Coils, Strip Heaters and 8kA Bus*) are grounded. **(Max. Leakage < 0.5μA)**

TRR#1578
Add note here
To show that all components except RTD's + warmup Heaters, as in step 8.2
Rodger Bossert 8-5-03

Power Lead Assembly Hipot	Leakage or Failure Voltage	Pass	Fail
5kA to all other components	.371 μA	✓	

Technician(s) 8/5/03 Date

Responsible Authority/Physicist 8/4/03 Date

7.23 Prepare Q2a Lead End Instrumentation wire bundle. Wrap the Q2a Lead End instrumentation wires into Bus Cable as per (MB-369897). Wire Labels and descriptions are shown in Table 7.23 and per (MB-369897).

Q2a bundle MB-369897 (from lead end of Q2a)

Wire Description	Wire Label	Gauge	
Lead tap from A lead (Q3 inner coil)	VTa1Q2a	26	Twist all three together
Lead tap from B lead (Q4 inner coil)	VTb1Q2a	26	
1/2 coil tap (Q1 outer - Q2 outer)	VTc1Q2a	26	
Lead tap from A lead (Q3 inner coil)	VTa2Q2a	26	Twist all three together
Lead tap from B lead (Q4 inner coil)	VTb2Q2a	26	
1/2 coil tap (Q1 outer - Q2 outer)	VTc2Q2a	26	
1/4 coil tap (Q1 inner - Q3 outer)	VTdQ2a	26	
1/4 coil tap (Q2 inner - Q4 outer)	VTeQ2a	26	
Warm up heater wire toward end plate	W1aQ2a	20	
Warm up heater wire away from end plate	W2aQ2a	20	
Strip heater wire circuit A+	H1aQ2a	20	Twist Together
Strip heater wire circuit A-	H2aQ2a	20	
Strip heater wire circuit B+	H1bQ2a	20	Twist Together
Strip heater wire circuit B-	H2bQ2a	20	

Table 7.23

7.24 Pull wire bundle from Q2a through entire Q2 Assembly and mark the Q2b Lead End Plate position on bundle. **(See Note below)** Leave sufficient slack in cable to allow for differential thermal contraction.

Note(s):

When Bus Assembly (ME-369896) is inserted into the Q2 in step 7.27, the mark from step 7.24 should be located 1 inch from the Q2b end of the aluminum channel.

Technician(s) Date 7/21/03

XXX 7.25 Verify that there is sufficient slack in cable to allow for differential thermal contraction.

Responsible Authority/Physicist Date 7/21/03

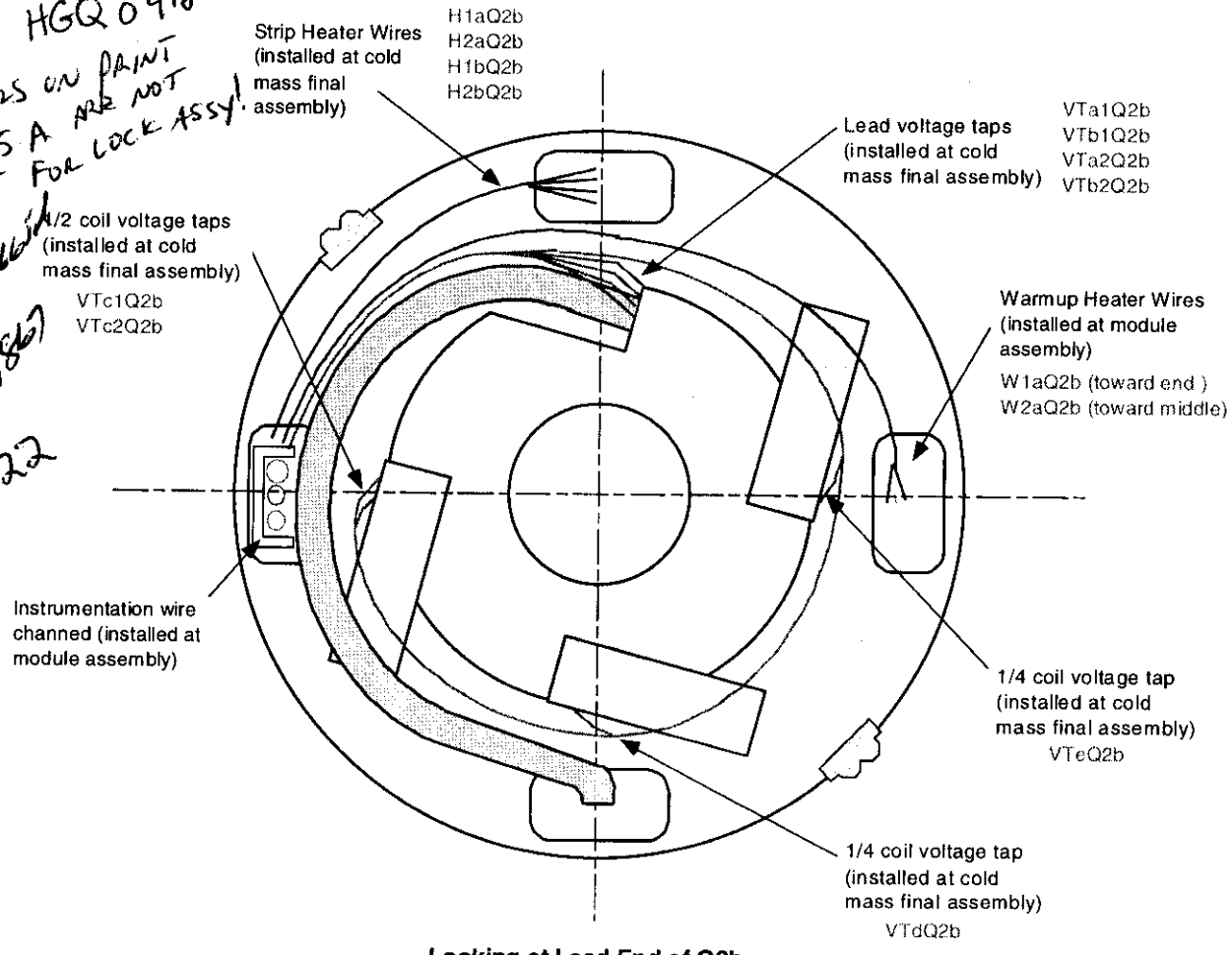
7.26 Remove Q2a bundle from Q2 Assembly.

Technician(s) Date 7/21/03

7.27 Slide Instrumentation Bus Assembly (ME-369896) into the proper Q2 Port as per Q2 Module Assembly (ME-369895). As instrumentation Bus Assembly is being inserted, feed Bus Cable (MA-369897) from Lead End of Q2a (4 strip heater wires, 8 voltage tap wires and 2 warm-up heater wires) into bus channel, wrapping entire channel intermittently with glass tape and Kevlar string as shown in drawing (ME-369896). Refer to Figures 7.27-A, 7.27-B, 7.27-C, 7.27-D and Drawing (ME-369895) to see the positions at which all wires are attached to the End Plates.

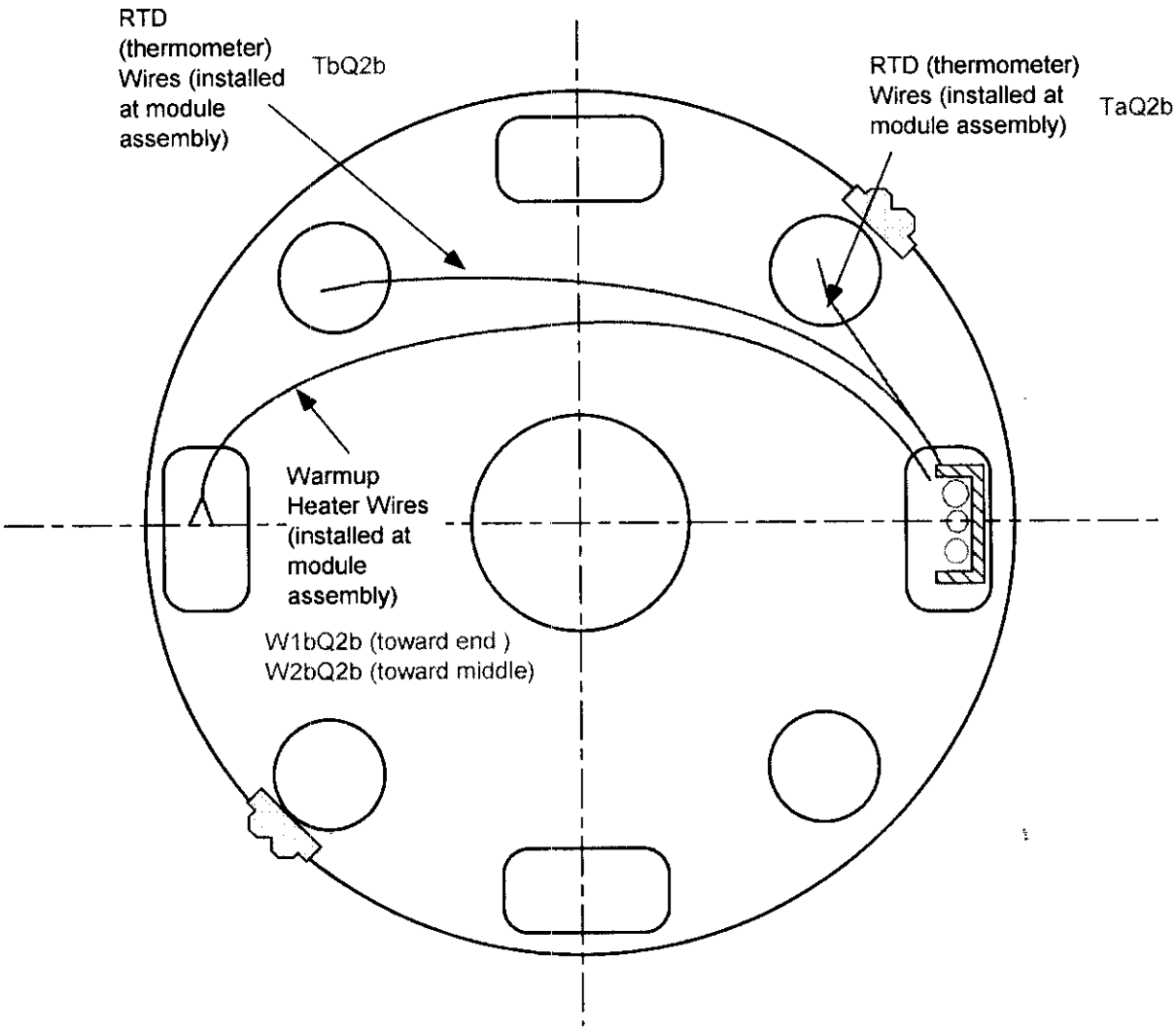
Technician(s) _____ Date 7/21/03

TRR# 1578
ADD STEP HERE TO ATTACH INSTRUMENTATION Bus CHANNEL LOCK (369937)
DR # HGQ 0418
FASTENERS ON PRINT 369895 A ARE NOT CORRECT FOR LOCK ASSY.
DR # 0423 INCLUDED MODIFY MO-369867 OF MO-369867 HGQ-0422



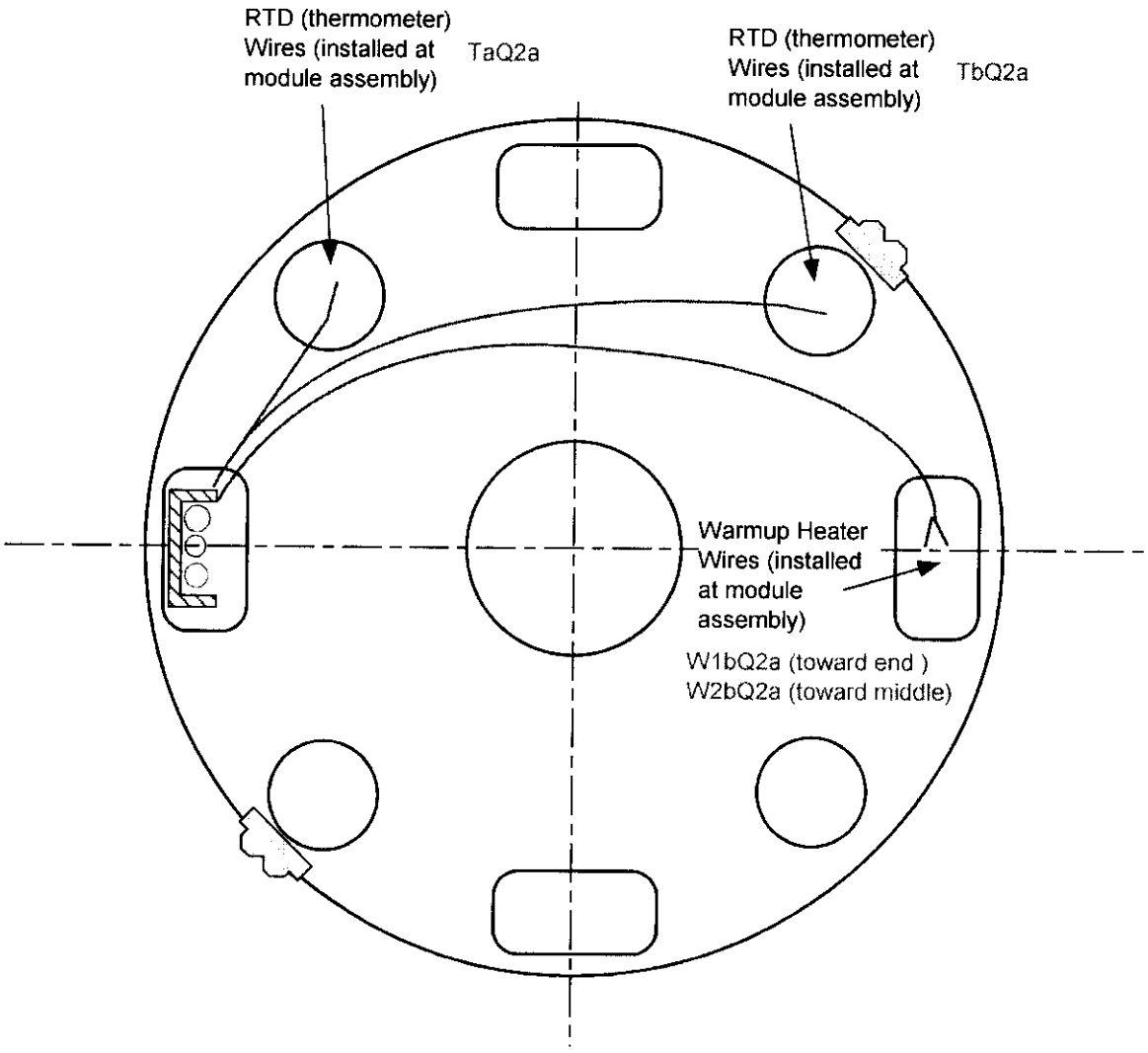
Looking at Lead End of Q2b

Figure 7.27-A



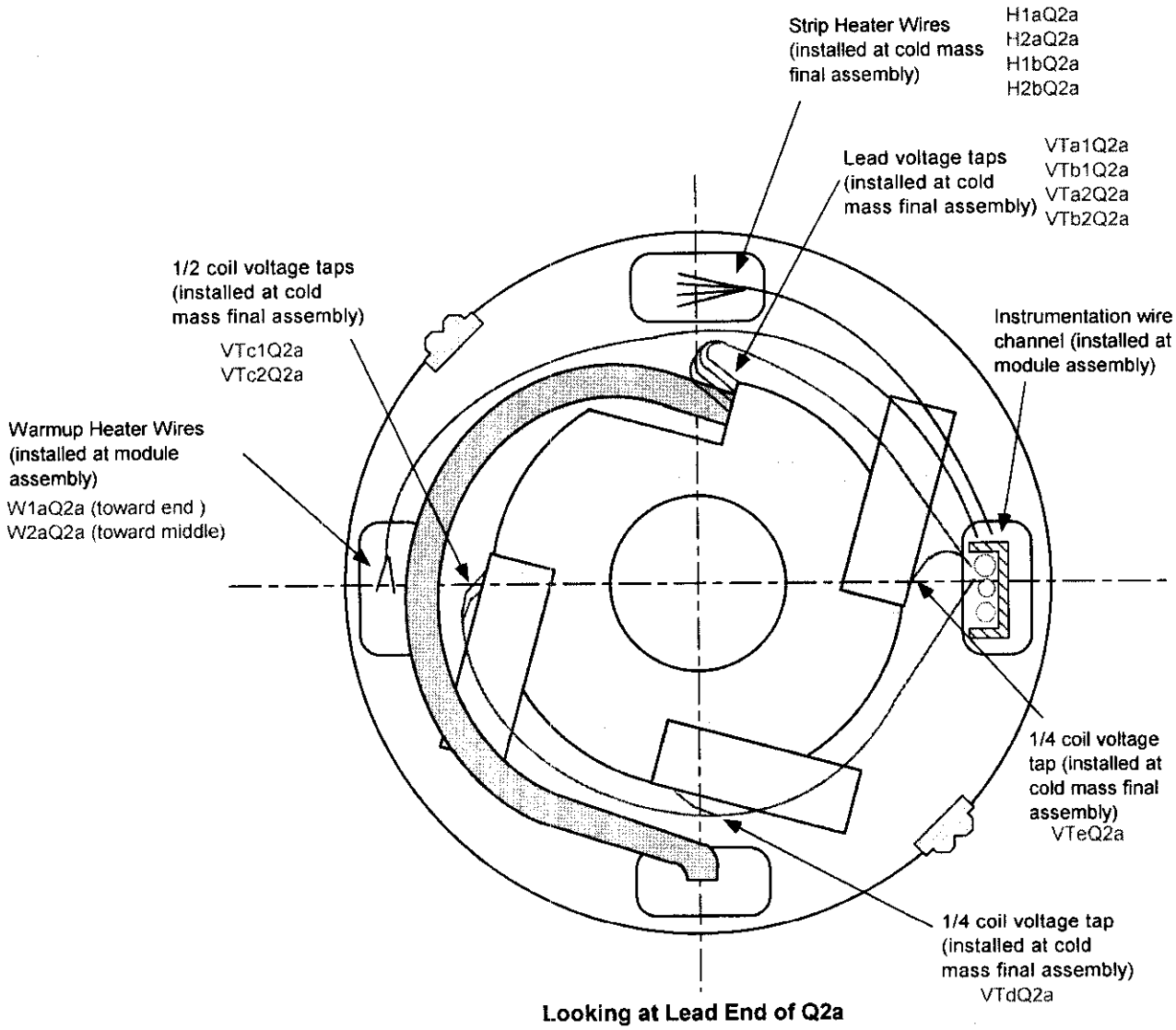
Looking at Non-lead End of Q2b

Figure 7.27-B



Looking at Non-lead End of Q2a

Figure 7.27-C



Looking at Lead End of Q2a

Figure 7.27-D

7.28 Install Warm-up Heaters (ME-369834) to the Non-Lead Ends of Q2a and Q2b as per Q2 Module Assembly (ME-369895).

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

7.28.2 Solder wires (MA-369833) to the Warm-up Heaters as per (ME-369895).

7.28.3 Install Warm-up Heater Base Plates (MA-369829) by bolting into holes in End Plate. (Check each box as Heater is installed.)

Warm-up Heater #1 ☑

Warm-up Heater #2 ☑

Warm-up Heater #3 ☑

Warm-up Heater #4 ☑

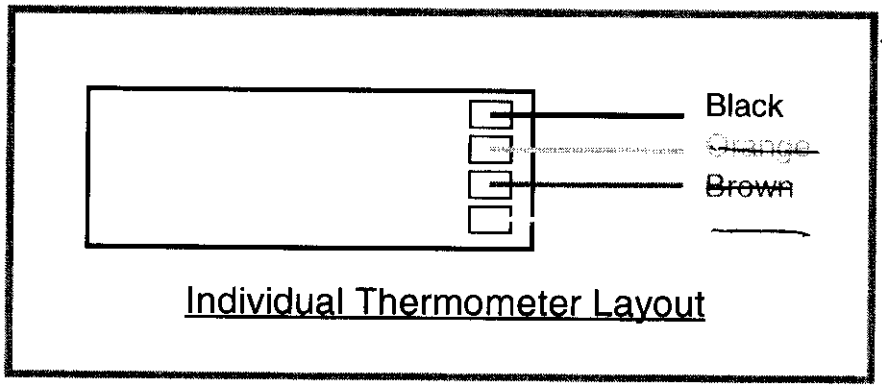
Technician(s) 7/21/03 Date

7.29 Install RTD's as per Q2 Module Assembly (ME-369895). Record Serial Numbers of each RTD in the table below. Attach Data Sheet for each RTD to traveler.

TRR# 1573

7.29.1 Attach RTD's (MA-369835) (Qty. 2) to each Return End Plate as per Q2 Module Assembly (ME-369895).

7.29.2 Solder wires (MA-369836) to RTD's as per Q2 Module Assembly (ME-369895). Individual RTD wiring is shown in Figure B below.



change to:
Black
Yellow
Red
Green

Figure 7.29.2-A

Technician(s) 7/21/03 Date

7.30 Perform a continuity check on all RTD's and Warm-Up Heaters. Record the Data below. (1mA)

Room Temp 73° F.

RTD'S			
Serial No.	**Location**	**Wire No.**	**Resistance @ 1 mA**
CX-LS-X16772	Q2a Inst. Bus Side	TaQ2a	71.955 Ω
CX-LS-X16826	Q2a Non-Bus Side	TbQ2a	66.78 Ω
CX-LS-X16905	Q2b Inst. Bus Side	TaQ2b	70.69 Ω
CX-LS-X16907	Q2b Non-Bus Side	TbQ2b	68.994 Ω

Warm-up Heaters			
Serial No.	**Location**	**Wire No.**	**Resistance @ 1 mA**
—	Q2a Lead End	W1aQ2a W2aQ2a	16.8436
—	Q2a Non-Lead End	W1bQ2a W2bQ2a	16.48
—	Q2b Lead End	W1aQ2b W2aQ2b	16.1281
—	Q2b Non-Lead End	W1bQ2b W2bQ2b	16.4673

Technician(s)

8/5/03
Date

7.31 Hipot Heaters (300 V) and RTD's (100 V)

RTD'S			
Serial No.	**Location**	**Wire No.**	**Hipot Leakage @ 1 mA**
CX-LS-X16922	Q2a Inst. Bus Side	TaQ2a	>.1
CX-LS-X16826	Q2a Non-Bus Side	TbQ2a	>.1
CX-LS-X16905	Q2b Inst. Bus Side	TaQ2b	>.1
CX-L-X16907	Q2b Non-Bus Side	TbQ2b	>.1

Warm-up Heaters			
Serial No.	**Location**	**Wire No.**	**Hipot Leakage @ 1 mA**
—	Q2a Lead End	W1aQ2a W2aQ2a	>.1
—	Q2a Non-Lead End	W1bQ2a W2bQ2a	>.1
—	Q2b Lead End	W1aQ2b W2aQ2b	>.1
—	Q2b Non-Lead End	W1bQ2b W2bQ2b	>.1

Technician(s) _____ Date 8/5/03

7.32 Install the mounts for the MCBX Corrector Magnet (MD-390312) on the Return End of Q2a as per Q2 Cold Mass Welded Assembly (ME-390309).

Technician(s) _____ Date 8/5/03

7.33 Place the MCBX Corrector Magnet (MD-390312) in the Corrector Magnet Mounting Tooling, between Q2a and Q2b. The Flange end of the MCBX should face the Return End Plate of Q2a.

Technician(s) _____ Date 8/5/03

7.34 Attach the MCBX Corrector Magnet Alignment Tooling (ME-390390) to the MCBX Corrector Magnet (MD-390312). Align the Scribe Lines on the Corrector Magnet (MD-390312) with those on the tooling.

Technician(s) _____ Date 8/5/03

7.35 Mount the Mini Level to the top of the MCBX Corrector Magnet Alignment Tooling.

Note(s):
Mini Level should be "zeroed" at reference stand location before this operation.

Technician(s) Date 8-5-03

7.36 Rotate the MCBX Corrector Magnet (MD-390312) such that the Mini Level is Horizontal 0.00 mm/m (+/- 0.50 mm/m).

Technician(s) Date 8-5-02

7.37 Move the MCBX Corrector Magnet (MD-390312) up against the Mounting Hardware to the Q2a Magnet, and bolt the MCBX Corrector Magnet (MD-390312) to the Q2a Cold Mass as per Q2 Cold Mass Welded Assembly (ME-390309).

Technician(s) Date 8-5-03

XXX 7.38 Verify Alignment of MCBX Corrector Magnet (MD-390312) as per Q2 Cold Mass Welded Assembly (ME-390309).

Responsible Authority/Physicist Date 8/5/03

7.39 Connect the MCBX Corrector Magnet (MD-390312) Bus wires from Bus Assembly (ME-369826) to the MCBX Corrector Magnet (MD-390312) as per Q2 Module Assembly (ME-369895).

Technician(s) Date 8 5 03

7.40 Solder MCBX Corrector Magnet Voltage Tap Wires (MA-369832) as per Q2 Module Assembly (ME-369895).

Technician(s) Date 8-5-03

8.0 Electrical Inspection

8.1 Perform an electrical inspection on each of the individual Quadrants and the Cold Masses. 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 32-858

HP 4284 2848J00912

HP 3457A 2703A11653

Q2a

LEADS + TAPS TAPS ONLY

(Q2a) Resistance			Total	
Nominal			560 to 585 mΩ	
Quadrant 1			579.6 mΩ	V 579.6
Quadrant 2			580.1 mΩ	V 580
Quadrant 3			590.3 mΩ	V
Quadrant 4			585.1 mΩ	V
Total Cold Mass	**Nominal**	2.305 Ω	2335 mΩ	V 2317 mΩ

(Q2a) Inductance			Total
Nominal			2.880 to 2.935 mH
Quadrant 1			3.38712 mH
Quadrant 2			3.41032 mH
Quadrant 3			3.33509 mH
Quadrant 4			3.4068 mH
Total Cold Mass	**Nominal**	13.3376 mH	13.3902 mH

(Q2a) Q-Factor			Total
Nominal			4.5 to 5.2
Quadrant 1			5.04
Quadrant 2			4.93
Quadrant 3			5.07
Quadrant 4			4.72
Total Cold Mass	**Nominal**	5.036	5.17

J Howard
Technician(s)

8/5/03
Date

(Q2a) Resistance Test	Limit	Actual Measurement	
(Q2a) Heater Circuit A	18.20 to 21 Ω	20.0861 Ω	HP
(Q2a) Heater Circuit B	18.20 to 21 Ω	20.3158 Ω	HP

J Howard
Technician(s)

8/5/03
Date

Q2b

(Q2b) Resistance			Total
Nominal			560 to 585 mΩ
Quadrant 1			575.9 mΩ
Quadrant 2			576.2 mΩ
Quadrant 3			579.5 mΩ
Quadrant 4			577.2 mΩ
Total Cold Mass	Nominal	2.305 Ω	2.312 Ω

(Q2b) Inductance			Total
Nominal			2.880 to 2.935 mH
Quadrant 1			3.38287 mH
Quadrant 2			3.41059 mH
Quadrant 3			3.35459 mH
Quadrant 4			3.40662 mH
Total Cold Mass	Nominal	13.3376 mH	13.4109 mH

(Q2b) Q-Factor			Total
Nominal			4.5 to 5.2
Quadrant 1			5.14
Quadrant 2			4.97
Quadrant 3			5.11
Quadrant 4			4.85
Total Cold Mass	Nominal	5.036	5.24

Technician(s)

8/5/03
Date

Heater Resistance			
(Q2b) Resistance Test	**Limit**	**Actual Measurement**	
(Q2b) Heater Circuit A	18.20 to 21 Ω	19.5783 Ω	HP 3457 A
(Q2b) Heater Circuit B	18.20 to 21 Ω	19.4208 Ω	"

Technician(s) _____ Date 8/5/03

Instrumentation Q2a			
Component	**Wire Labels**	**Resistance**	
¼ Coil Tap	VTdQ2a	587.3 mΩ	Valhalla
¼ Coil Tap	VTeQ2a	1740.2 mΩ	"
½ Coil Tap	VTc1Q2a	1163.2 mΩ	"
½ Coil Tap	VTc2Q2a	1163.1 mΩ	"
Lead Tap	VTa1Q2a	2314 mΩ	"
Lead Tap	VTb1Q2a	10.4 mΩ	"
Lead Tap	VTa2Q2a	2314 mΩ	"
Lead Tap	VTb2Q2a	11 MΩ	"
RTD (Non-LE)	TaQ2a	72.191 Ω	HP 3457 A
RTD (Non-LE)	TbQ2a	66.971 Ω	"
Warm-up Heater (LE)	W1aQ2a (toward end) W2aQ2a (toward middle)	16.8423 Ω	"
Warm-up Heater (Non-LE)	W1bQ2a (toward end) W2bQ2a (toward middle)	16.4792 Ω	"

1A
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.1A
73°F

Technician(s) _____ Date 8/5/03

Instrumentation Q2b		
Component	**Wire Labels**	**Resistance**
¼ Coil Tap	VTdQ2b	~~SWG2~~ 576.8 Ω
¼ Coil Tap	VTeQ2b	1722.7 mΩ
½ Coil Tap	VTc1Q2b	1149.5 mΩ
½ Coil Tap	VTc2Q2b	1149.5 mΩ
Lead Tap	VTa1Q2b	3.8 mΩ
Lead Tap	VTb1Q2b	2297 mΩ
Lead Tap	VTa2Q2b	3.8 mΩ
Lead Tap	VTb2Q2b	2297 mΩ
RTD	TaQ2b	70.954 Ω
RTD	TbQ2b	69.237 Ω
Warm-up Heaters (LE)	W1aQ2b (toward end) W2aQ2b (toward middle)	16.1322 Ω
Warm-up Heaters (Non-LE)	W1bQ2b (toward end) W2bQ2b (toward middle)	16.4689 Ω

1A 1A 1A 1A 1A 1A

TRR 1578 ADD TAIS TO THIS TABLE 73°

V " " " " " " HP " "

Technician(s)

8/5/03
Date

MCBX Corrector Coil Taps		
Component	**Wire Labels**	**Resistance**
Tap 1	VTH2	894 mΩ
Tap 2	VTV2	~~SWG~~ 894 mΩ

Technician(s)

8/5/03
Date

XXX 8.2 Hipot according to table below. Hipot to 5kV. Maximum leakage is 3μA.

Hipot Heaters to Coil and Ground.

High Potential	Grounded	Floating	Leakage
All Strip Heaters	Coils, Yoke, Q1 Instrumentation Bus, Lead and Corrector Coil Busses.	RTD's and Warm-up Heaters	.899 μA

Hipot Coil to Heaters and Ground.

High Potential	Grounded	Floating	Leakage
All Coils	Strip Heaters, Yoke, Q1 Instrumentation Bus, 8kA and 5kA Lead Busses and Corrector Coil Busses.	RTD's and Warm-up Heaters	.901 μA

Technician(s) — Date 8/4/03

Responsible Authority/Physicist — Date 8/5/03

9.0 Dome Setup

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

Technician(s) Date 8/7/03

9.2 Align IP End Dome (MD-390197) as shown in Q2 Cold Mass Welded Assembly (ME-390309).

Technician(s) Date 8/7/03

9.3 Level the IP End Dome (MD-390197) using the Ball Socket (MD-369777) and the Mini Level.

Technician(s) Date 8/7/03

9.4 Feed the Electrical wires/Bus through the proper ports as the Dome is brought into position against the End Plate. Ensure that no damage to wires has occurred during insertion.

Technician(s) Date 8/7/03

9.5 Mark the IP End Dome (MD-390197) and the End Plate with a Horizontal Witness Line. This Step will be used in Step 11.0 to reposition the Domes prior to Welding.

Technician(s) Date 8/7/03

9.6 Remove the IP End Dome (MD-390197) from the Tooling.

Technician(s) Date 8/7/03

DR# HGQ-0423

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

Technician(s) Date 8/6/03

9.8 Align Non-IP End Dome (MD-390253) as shown in Q2 Cold Mass Welded Assembly (ME-390309).

Technician(s) 8/6/03 Date

9.9 Level the Non-IP End Dome (MD-390253) using the Ball Socket (MD-369777) and the Mini Level.

Technician(s) 8/6/03 Date

9.10 Feed the Electrical wires/bus through the proper ports as the Non-IP End Dome (MD-390253) is brought into position against the End Plate.

Technician(s) 8/6/03 Date

9.11 Mark the Non-IP End Dome (MD-390253) and the End Plate with a Horizontal Witness Line. This Step will be used in Step 11.0 to reposition the Domes prior to Welding.

Technician(s) 8/6/03 Date

DR# HGQ 0424

9.12 Remove the Non-IP End Dome (MD-390253) from the Tooling.

Technician(s) 8/6/03 Date

10.0 Beam Tube Insertion

10.1 Inspect the Beam Tube (MD-369802) for damage. Clean Beam Tube using lint free Heavy Duty Wipers (Fermi stock 1660-0150) and Isopropyl Alcohol (Fermi stock 1920-0300) as per Insulated Beam Tube Assembly for Q2a/Q2b (MD-369802).

Technician(s) Date 8/7/03

XXX 10.2 Verify Alignment of Q2a, Q2b and Corrector Magnet (MD-390312) as per Q2 Cold Mass Welded Assembly (ME-390309).

Responsible Authority/Physicist Date 8/7/03

10.3 Using Insertion Tooling, insert the Beam Tube (MD-369802) into the Magnet Assembly as per Beam Tube Insertion Tooling (MD-369789).

Technician(s) Date 8/7/03

10.4 Center the Beam Tube (MD-369802) between the Coldmasses by leaving equal amounts of insulated Beam Tube protruding from the End Plates. Measure from the face of the End Plate to the End of the Kapton Wrap on the Beam Tube.

Technician(s) Date 8/7/03

10.5 Measure the Beam Tube length and record this measurement below.

10.5.1 Beam Tube Length: 14m SNG 13mm 14,013 mm

10.5.2 Subtract 12,610 mm from the Beam Tube Length, and record here: 1403 mm

10.5.3 Divide the Number recorded in step 10.5.2 by 2 and record here: 701.5

The measurement recorded in step 10.5.3 is the amount to be cut off from each end.

Technician(s) Date 8/7/03

10.6 Measure from one end of the Beam Tube and place a mark at the distance from step 10.5.3.

Technician(s) Date 8/7/03

10.7 Verify the placement of the Mark, measured in Step 10.6 is correct.

Crew Chief Date 8.7.03

10.8 Using the Wachs Cutter, cut the Beam Tube at the Mark from Step 10.6.

Technician(s) — Date 8/7/03

10.9 Measure from one end of the Beam Tube and place a mark at the distance from step 10.5.3.

Technician(s) — Date 8/7/03

10.10 Verify the placement of the Mark, measured in Step 10.9 is correct. Measuring from the End Plate, this mark should be equal to the 'End Plate to Beam Tube' distance at the other end.

Crew Chief — Date 8-7-03

10.11 Using the Wachs Cutter, cut the Beam Tube at the Mark from Step 10.9.

Technician(s) — Date 8/7/03

XXX 10.12 Hipot the Beam Tube to coil, heaters and ground. (Max. Leakage < 0.5μA)

Beam Tube Length 12610 mm

Hipot	Leakage or Failure Voltage	Pass	Fail
Beam Tube to coil, heaters and ground @ 5KV	.818 uA	✓	

Technician(s) — Date 8/8/03

T. Page — Date 8/8/03

Responsible Authority/Physicist

11.0 Dome Installation

11.1 Reposition the IP End Dome as shown in Q2 Cold Mass Welded Assembly (ME-390309) using the Horizontal Witness Line from step 9.5.

Technician(s) Date 8/8/03

11.2 Feed the Electrical wires/Bus through the proper ports as the IP End Dome (MD-390197) is brought into position against the End Plate.

Technician(s) Date 8/8/03

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

Spider Assemblies Installed ☐

Spider Assemblies **NOT** Installed ☒ (No Signature Necessary)

Technician(s) Date 8/8/03

11.4 Tack weld the IP End Dome in place at approximately 6-8 places around the Dome per (ME-390309).

Weldor(s) Date 8/8/03

11.5 Weld the IP End Dome, skip weld around to minimize distortion per (ME-390309).

SNG

Weldor(s) Date 8/8/03

→ William Gutfeld 8-9-03

11.6 Reposition the Non-IP End Dome as shown in Q2 Cold Mass Welded Assembly (ME-390309) using the Horizontal Witness Line from step 9.11.

Technician(s) Date 8/8/03

11.7 Feed the Electrical wires/Bus through the proper ports as the Non-IP End Dome is brought into position against the End Plate.

Technician(s) Date 8/8/03

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

Spider Assemblies Installed ☐

Spider Assemblies **NOT** Installed ☑ (No signature necessary)

Technician(s) Date 8/8/03

11.9 Tack weld the Non-IP End Dome in place at approximately 6-8 places around the Dome as per (ME-390309).

Weldor(s) Date 8/8/03

11.10 Weld the Non-IP End Dome, skip weld around to minimize distortion as per (ME-390309).

Weldor(s) Date 8/8/03

11.11 If needed, perform a stretched wire measurement of the system, noting the relative position and roll of the three magnetic elements to each other.

Performed Stretch Wire Measurement?

Yes ☒ No ☐ (No Signature necessary, if 'No' box is checked)

Technician(s) Date 8/8/03

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

Weldor(s) Date 8-9-03 8/12/03

12.0 Cold Bore

12.1 Flare both ends of the Beam Tube using Flaring Tool (MC-390416) per Q2 Cold Mass Welded Assembly (MB-390309).

Technician(s) 8-20-03 Date

12.2 Position Cold Bore Flange (MC-390300) over the Beam Tube and onto IP End Dome (Q2a) per Q2 Cold Mass Welded Assembly (MB-390309).

Technician(s) 8-20-03 Date

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

Michael Cooper
Weldor(s) 8-20-03 Date

12.4 Add Spacer between Beam Tube Flange and End Dome, if necessary.

Spacer Added? Yes ☑ No ☐

Technician(s) 8-20-03 Date

12.5 Position the Cold Bore Flange (MC-390300) over the Beam Tube and onto the Non-IP End Dome (Q2b) per Q2 Cold Mass Welded Assembly (MB-390309).

Technician(s) 8-20-03 Date

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

Michael Cooper
Weldor(s) 8-20-03 Date

12.7 Align Beam Tube and the Flange at IP End per Q2 Cold Mass Welded Assembly (MB-390309).

Technician(s) Date 8-20-03

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

Michael Cooper 8-20-03

Weldor(s) Date

12.9 Align Beam Tube and Flange at NON-IP End per Q2 Cold Mass Welded Assembly (MB-390309).

Technician(s) Date 8-20-03

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

William E Gaylord 8-20-03

Weldor(s) Date

13.0 Electrical Inspection

13.1 Perform an electrical inspection on each of the individual Quadrants and the Cold Masses. 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 32-858

HP 4284 2848S00912

HP3457A 2703A11653

Q2a

(Q2a) Resistance			Total
Nominal			560 to 585 mΩ
Quadrant 1			580.2 mΩ
Quadrant 2			580.5 mΩ
Quadrant 3			591.6 mΩ
Quadrant 4			585.4 mΩ
Total Cold Mass	**Nominal**	2.305 Ω	2.338 Ω

(Q2a) Inductance			Total
Nominal			2.880 to 2.935 mH
Quadrant 1			3.34666 mH
Quadrant 2			3.36357 mH
Quadrant 3			3.29545 mH
Quadrant 4			3.35724 mH
Total Cold Mass	**Nominal**	13.3376 mH	13.2251 mH

(Q2a) Q-Factor			Total
Nominal			4.5 to 5.2
Quadrant 1			4.02
Quadrant 2			3.90
Quadrant 3			3.97
Quadrant 4			3.76
Total Cold Mass	**Nominal**	5.036	4.08

Technician(s) 8/18/03 Date

(Q2a) Resistance Test	Limit	Actual Measurement
(Q2a) Heater Circuit A	18.20 to 21 Ω	19794 Ω
(Q2a) Heater Circuit B	18.20 to 21 Ω	19703 Ω

Technician(s) 8/18/03 Date

Q2b

(Q2b) Resistance			Total
Nominal			560 to 585 mΩ
Quadrant 1			576.7 mΩ
Quadrant 2			577 mΩ
Quadrant 3			577.1 mΩ
Quadrant 4			577.7 mΩ
Total Cold Mass	**Nominal**	2.305 Ω	2.310

(Q2b) Inductance			Total
Nominal			2.880 to 2.935 mH
Quadrant 1			3.34864 mH
Quadrant 2			3.37042 mH
Quadrant 3			3.31441 mH
Quadrant 4			3.36672 mH
Total Cold Mass	**Nominal**	13.3376 mH	13.2679

(Q2b) Q-Factor			Total
Nominal			4.5 to 5.2
Quadrant 1			4.07
Quadrant 2			3.91
Quadrant 3			4.00
Quadrant 4			3.82
Total Cold Mass	**Nominal**	5.036	4.11

Technician(s) A Jones

Date 8/18/03

Heater Resistance		
(Q2b) Resistance Test	**Limit**	**Actual Measurement**
(Q2b) Heater Circuit A	18.20 to 21 Ω	19.3 Ω HP
(Q2b) Heater Circuit B	18.20 to 21 Ω	19.14 Ω HP

Technician(s) _____ Date 8/18/03

Instrumentation Q2a			
Component	**Wire Labels**	**Resistance**	
¼ Coil Tap	VTdQ2a	591.5	
¼ Coil Tap	VTeQ2a	[redacted]1752	
½ Coil Tap	VTc1Q2a	1172	
½ Coil Tap	VTc2Q2a	1171	
Lead Tap	VTa1Q2a	2330	
Lead Tap	VTb1Q2a	10.4	
Lead Tap	VTa2Q2a	2330	
Lead Tap	VTb2Q2a	10.4	
RTD (Non-LE)	TaQ2a	74.91	HP
RTD (Non-LE)	TbQ2a	66.68	HP
Warm-up Heater (LE)	W1aQ2a (toward end) W2aQ2a (toward middle)	16.83	HP
Warm-up Heater (Non-LE)	W1bQ2a (toward end) W2bQ2a (toward middle)	16.47	HP

740

Technician(s) _____ Date 8/18/03

Instrumentation Q2b		
Component	**Wire Labels**	**Resistance**
¼ Coil Tap	VTdQ2b	581.1
¼ Coil Tap	VTeQ2b	1735.2
½ Coil Tap	VTc1Q2b	1157.9
½ Coil Tap	VTc2Q2b	1157.8
Lead Tap	VTa1Q2b	3.8
Lead Tap	VTb1Q2b	2.314
Lead Tap	VTa2Q2b	3.8
Lead Tap	VTb2Q2b	2.314
RTD	TaQ2b	70,554
RTD	TbQ2b	68.849
Warm-up Heaters (LE)	W1aQ2b (toward end) W2aQ2b (toward middle)	16.10
Warm-up Heaters (Non-LE)	W1bQ2b (toward end) W2bQ2b (toward middle)	16.45

740

J Howell
Technician(s)

8/18/03
Date

MCBX Corrector Coil Taps		
Component	**Wire Labels**	**Resistance**
Tap 1	VTH2	858
Tap 2	VTV2	872

J Howell
Technician(s)

8/18/03
Date

XXX 13.2 Hipot according to table below. Hipot to 5kV. Maximum leakage is 3μA.

Hipot Heaters to Coil and Ground.

High Potential	Grounded	Floating	Leakage
All Strip Heaters	Coils, Yoke, Q1 Instrumentation Bus, Lead and Corrector Coil Busses.	RTD's and Warm-up Heaters	.332 μA

Hipot Coil to Heaters and Ground.

High Potential	Grounded	Floating	Leakage
All Coils	Strip Heaters, Yoke, Q1 Instrumentation Bus, 8kA and 5kA Lead Busses and Corrector Coil Busses.	RTD's and Warm-up Heaters	.49 μA

Technician(s) — Date 8/18/03

XXX 13.3 Verify that the results in Step 13.0 are acceptable.
Approved for next Assembly Procedure.

Responsible Authority/Physicist — Date 8/18/03

14.0 Installation of Hypertronics

14.1 Install Hypertronics Connectors at Q2a end as per Q2 Module Assembly (ME-369895) and Hypertronics Connector Assembly Procedure ES-XXXXXX.
Pin Numbers for connectors are shown in Table 14.1 below

Table 14.1

CERN Label	Wire Label	Module	Pin No.	Description
EE111Q1	VTa1Q1	M2	1	Q1 Voltage Tap, Lead "a", primary
EE112Q1	VTa2Q1	M2	2	Q1 Voltage Tap, Lead "a", redundant
EE131Q1	VTc1Q1	M2	3	Q1 Voltage Tap, "center tap", primary
EE132Q1	VTc2Q1	M2	4	Q1 Voltage Tap, "center tap", redundant
EE151Q1	VTb1Q1	M2	5	Q1 Voltage Tap, Lead "b", primary
EE152Q1	VTb2Q1	M3	5	Q1 Voltage, Lead "b", redundant
EE811H1	VTH1	M5	1	Q1 MCBXH, Lead "a" Voltage Tap
EE811V1	VTV1	M5	2	Q1 MCBXV, Lead "a" Voltage Tap
EH111Q1	W1aQ1	M7	1	Q1 Warm-up Heater, Lead "1", lead end heater
EH151Q1	W2aQ1	M7	2	Q1 Warm-up Heater, Lead "2", lead end heater
EH112Q1	W1bQ1	M7	3	Q1 Warm-up Heater, Lead "1", non-lead end heater
EH152Q1	W2bQ1	M7	4	Q1 Warm-up Heater, Lead "2", non-lead end heater
YT111Q1	H1aQ1	M9	1	Q1 Protection heater, Lead "1", heater circuit "a"
YT151Q1	H2aQ1	M9	3	Q1 Protection heater, Lead "2", heater circuit "a"
YT112Q1	H1bQ1	M9	5	Q1 Protection heater, Lead "1", heater circuit "b"
YT152Q1	H2bQ1	M10	4	Q1 Protection heater, Lead "2", heater circuit "b"
TT111Q1	TaQ1_I+	M12	1	Q1 RTD, primary
TT121Q1	TaQ1_I-	M12	2	
TT131Q1	TaQ1_V+	M12	3	
TT141Q1	TaQ1_V-	M12	4	
TT112Q1	TbQ1_I+	M12	5	Q1 RTD, redundant
TT122Q1	TbQ1_I-	M12	6	
TT142Q1	TbQ1_V-	M12	10	
TT132Q1	TbQ1_V+	M12	11	

Technician(s)

8/22/03
Date

14.2 Install Hypertronics Connectors at Q2b end as per Q2 Module Assembly (ME-369895) and Hypertronics Connector Assembly Procedure ES-XXXXXX. Pin Numbers for connectors are shown in Table 14.2 below.

Table 14.2

CERN Label	Wire Label	Module	Pin No.	Description
EE131Q2a	VTc1Q2a	M3	1	Q2a Voltage Tap, "center tap", primary
EE121Q2a	VTdQ2a	M3	2	Q2a Quarter Coil Voltage Tap "d" (1-3 interface)
EE112Q2a	VTa2Q2a	M3	3	Q2a Voltage Tap, Lead "a", redundant
EE111Q2a	VTa1Q2a	M3	4	Q2a Voltage Tap, Lead "a", primary
EE132Q2a	VTc2Q2a	M4	1	Q2a Voltage Tap, "center tap", redundant
EE141Q2a	VTeQ2a	M4	2	Q2a Quarter Coil Voltage Tap "e" (2-4 interface)
EE151Q2a	VTb1Q2a	M4	3	Q2a Voltage Tap, Lead "b", primary
EE152Q2a	VTb2Q2a	M4	4	Q2a Voltage Tap, Lead "b", redundant
EE811H2	VTH2	M8	3	Q2 MCBXH, Lead "a" Voltage Tap
EE811V2	VTV2	M8	4	Q2 MCBXV, Lead "a" Voltage Tap
EH111Q2a	W1aQ2a	M11	1	Q2a Warm-up Heater, Lead "1", lead end heater
EH151Q2a	W2aQ2a	M11	2	Q2a Warm-up Heater, Lead "2", lead end heater
EH112Q2a	W1bQ2a	M11	3	Q2a Warm-up Heater, Lead "1", return end heater
EH152Q2a	W2bQ2a	M11	4	Q2a Warm-up Heater, Lead "2", return end heater
EH112Q2b	W1bQ2b	M12	3	Q2b Warm-up Heater, Lead "1", return end heater
EH152Q2b	W2bQ2b	M12	4	Q2b Warm-up Heater, Lead "2", return end heater
YT111Q2a	H1aQ2a	M15	2	Q2a Protection Heater, Lead "1", heater circuit "a"
YT151Q2a	H2aQ2a	M16	1	Q2a Protection Heater, Lead "2", heater circuit "a"
YT112Q2a	H1bQ2a	M16	3	Q2a Protection Heater, Lead "1", heater circuit "b"
YT152Q2a	H2bQ2a	M16	5	Q2a Protection Heater, Lead "2", heater circuit "b"
TT131Q2a	TaQ2a_V+	M20	7	
TT141Q2a	TaQ2a_I-	M20	8	
TT111Q2a	TaQ2a_I+	M20	9	Q2a RTD, primary
TT141Q2a	TaQ2a_V-	M20	12	
TT112Q2a	TbQ2a_I+	M20	13	Q2a RTD, redundant
TT122Q2a	TbQ2a_I-	M20	14	
TT132Q2a	TbQ2a_V+	M20	15	
TT142Q2a	TbQ2a_V-	M20	16	
TT111Q2b	TaQ2b_I+	M21	1	Q2b RTD, primary
TT121Q2b	TaQ2b_I-	M21	2	
TT131Q2b	TaQ2b_V+	M21	3	
TT141Q2b	TaQ2b_V-	M21	4	
TT112Q2b	TbQ2b_I+	M21	5	Q2b RTD, redundant
TT122Q2b	TbQ2b_I-	M21	6	
TT142Q2b	TbQ2b_V-	M21	10	
TT132Q2b	TbQ2b_V+	M21	11	

Technician(s)

8/22/03
Date

XXX 14.3 Check installation of Hypertronics. Ensure Hypertronics were installed as per Q2 Module Assembly (ME-369895) and Hypertronics Connector Assembly Procedure ES-XXXXXX.

Technician(s) — Date: 8/22/03

Responsible Authority/Physicist — Date: 8/26/03

15.0 Final Electrical Inspection

15.1 Perform an electrical inspection on each of the individual Quadrants and the Cold Masses. 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 32-858

HP 4284 2848J00913

HP 3457A 2703 41165

Q2a 72.6°

(Q2a) Resistance			Total
Nominal			560 to 585 mΩ
Quadrant 1			.5803 mΩ
Quadrant 2			.5806 mΩ
Quadrant 3			.5919 mΩ
Quadrant 4			.5853 mΩ
Total Cold Mass	**Nominal**	2.305 Ω	2.339 Ω

(Q2a) Inductance			Total
Nominal			2.880 to 2.935 mH
Quadrant 1			3.44369 mH
Quadrant 2			3.38062 mH
Quadrant 3			3.45667 mH
Quadrant 4			3.30845 mH
Total Cold Mass	**Nominal**	13.3376 mH	13.2519 mH

(Q2a) Q-Factor			Total
Nominal			4.5 to 5.2
Quadrant 1			3.6
Quadrant 2			3.8
Quadrant 3			3.28
Quadrant 4			4.04
Total Cold Mass	**Nominal**	5.036	4.02

Technician(s)

8-22-03
Date

(Q2a) Resistance Test	Limit	Actual Measurement
(Q2a) Heater Circuit A	18.20 to 21 Ω	19.794 Ω
(Q2a) Heater Circuit B	18.20 to 21 Ω	19.718 Ω ?

Technician(s)

8-22-03
Date

Q2b

(Q2b) Resistance			Total
Nominal			560 to 585 mΩ
Quadrant 1			.5766 mΩ
Quadrant 2			.5769 mΩ
Quadrant 3			.5771 mΩ
Quadrant 4			.5773 mΩ
Total Cold Mass	**Nominal**	2.305 Ω	2.311 Ω

(Q2b) Inductance			Total
Nominal			2.880 to 2.935 mH
Quadrant 1			3.4489 mH
Quadrant 2			3.39099 mH
Quadrant 3			3.48009 mH
Quadrant 4			3.31923 mH
Total Cold Mass	**Nominal**	13.3376 mH	13.2698 mH

(Q2b) Q-Factor			Total
Nominal			4.5 to 5.2
Quadrant 1			3.64
Quadrant 2			3.83
Quadrant 3			3.29
Quadrant 4			4.10
Total Cold Mass	**Nominal**	5.036	4.12

Technician(s)

8-22-05
Date

Heater Resistance		
(Q2b) Resistance Test	**Limit**	**Actual Measurement**
(Q2b) Heater Circuit A	18.20 to 21 Ω	19.592 Ω
(Q2b) Heater Circuit B	18.20 to 21 Ω	19.441 Ω

Technician(s) 8/22/03 Date

Instrumentation Q2a			
Component	**Wire Labels**	**Resistance**	
¼ Coil Tap	VTdQ2a	590.2	
¼ Coil Tap	VTeQ2a	1749.4	
½ Coil Tap	VTc1Q2a	1169.6	
½ Coil Tap	VTc2Q2a	1169.5	
Lead Tap	VTa1Q2a	2.327	
Lead Tap	VTb1Q2a	2.325	
Lead Tap	VTa2Q2a	2.328	
Lead Tap	VTb2Q2a	2.325	
RTD (Non-LE)	TaQ2a	72.067	HP
RTD (Non-LE)	TbQ2a	66.825	HP
Warm-up Heater (LE)	W1aQ2a (toward end) W2aQ2a (toward middle)	~~17.996~~ 18.1155	HP
Warm-up Heater (Non-LE)	W1bQ2a (toward end) W2bQ2a (toward middle)	17.7939	HP

TRR# 1578 TRR NEEDED HERE

Technician(s) 8/22/03 Date

AS NOTED THROUGHOUT 13.1 +15.1, SEPARATE COLUMNS FOR MEASUREMENTS DONE W/ HEWLETT PACKARD (H.P.) TJB

Instrumentation Q2b		
Component	**Wire Labels**	**Resistance**
¼ Coil Tap	VTdQ2b	.5789
¼ Coil Tap	VTeQ2b	1731.4
½ Coil Tap	VTc1Q2b	1154.9
½ Coil Tap	VTc2Q2b	1154.8
Lead Tap	VTa1Q2b	2.2
Lead Tap	VTb1Q2b	2.309
Lead Tap	VTa2Q2b	2.306
Lead Tap	VTb2Q2b	2.308
RTD	TaQ2b	70,828 HP
RTD	TbQ2b	69.110 HP
Warm-up Heaters (LE)	W1aQ2b (toward end) W2aQ2b (toward middle)	17.483 HP
Warm-up Heaters (Non-LE)	W1bQ2b (toward end) W2bQ2b (toward middle)	17.915 HP

Technician(s)

5/22/03
Date

MCBX Corrector Coil Taps		
Component	**Wire Labels**	**Resistance**
Tap 1	VTH2	1505
Tap 2	VTV2	1507

Technician(s)

8/22/03
Date

XXX 15.2 Hipot according to table below. Hipot to 600V. Maximum leakage is 3μA. Hipot using pins in Hypertronics Connectors. Isolate the Hypertronics Connectors in gas Helium (He) at room temperature during Hipot.

Hipot Heaters to Coil and Ground.

High Potential	Grounded	Floating	Leakage
All Strip Heaters	Coils, Yoke, Q1 Instrumentation Bus, Lead and Corrector Coil Busses.	RTD's and Warm-up Heaters	.314 uA

Hipot Coil to Heaters and Ground.

High Potential	Grounded	Floating	Leakage
All Coils	Strip Heaters, Yoke, Q1 Instrumentation Bus, 8kA and 5kA Lead Busses and Corrector Coil Busses.	RTD's and Warm-up Heaters	.025 uA

Technician(s) — Date: 8/26/03

XXX 15.3 Verify that the results in Step 15.0 are acceptable.
Approved for next Assembly Procedure.

Responsible Authority/Physicist — Date: 8/26/03

16.0 Production Complete

XXX 16.1 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:

J. Agostini
Process Engineering/Designee

1/31/05
Date

ORIGINAL

TD/ENGINEERING & FABRICATION

PARTS KIT REQUEST

IMPORTANT NOTES:
1) MAGNET NUMBER MUST BE FILLED IN.
2) ONLY ONE FORM PER MAGNET.
3) PARTS COORDINATOR OR DESIGNEE MUST SIGN THIS FORM.
4) MATERIAL CONTROL WILL ISSUE PARTS AND RECORD ROUTING NUMBER.
5) ANY QUANTITIES NOT AVAILABLE WILL HAVE COMMENTS RETURNED TO THE PARTS COORDINATOR FOR REVIEW.

MAGNET NUMBER: LMQXB03

RELEASED BY — PRODUCTION SIGNATURE: J. Szostak x2003

TODAYS DATE: 31-Mar-03

NEED DATE: 2-Apr-03

DELIVER TO _____ ICB

BUDGET CODE: LCI

Project/Task Number: *300/1.1.1.3.3*

ISSUE VERIFICATION — MATERIAL CONTROL SIGNATURE: [signature]

DATE ISSUED TO STOCKROOM: 3/3/03

THIS KIT LIST IS FOR

ME-390309		Q2 COLD MASS WELDED ASSEMBLY

					MATERIAL CONTROL				PROD	SUPT.
				QTY FILLED OUT BY STOCK ROOM			FILLED OUT BY EXPEDITER		VERIFY	VERIFY
PART NUMBER	REV	DESCRIPTION	REQUIRED QTY/ASS'Y	ISSUED	ROUTE FORM	NOT AVAIL	DATE AVAIL	COMMENTS TO PRODUCTION MANAGER	PART	PART
369655	C	COLD MASS ASSEMBLY	ICB HAS				—			
369417	-	INSULATING VARNISH & ADHESIVE	A/R				—			
369802	-	INSULATED BEAM TUBE	ICB HAS				—			
369826	C	BUSS ASSEMBLY	ICB HAS				—			
369835	A	RTD TEMPERATURE SENSOR	4 EA	4	79151		3/3/03			
369893	B	RTD MOUNTING BLOCK	4 EA	4	79114		↓			
390112	B	CENTER BODY TUBE	1 EA	1	78283		3/3/03			
390197	B	IP END DOME WELDMENT	1 EA	1	78072		↓			
390203	-	MCBX CORRECTOR MOUNTING SPACER	4 EA	4	77194					
390228	-	MCBX CORRECTOR MTG. FLAT WASHER	4 EA	4	77130					
390230	A	TRANSPORTATION RESTRAINT ADJUSTING SCREW	4 EA	4	76604					
390248	-	1/2 - 20 x 3.5" SILVER PLATED SCREW	4 EA	4	74623					
390253	A	NON IP END DOME WELDMENT	1 EA	1	N/A					
390294	-	MCBX TRANSPORTATION RESTRAINT NUT	4 EA	4	76606					
390300	B	BEAM TUBE FLANGE	2 EA	2	77028		↓			
390312	-	MCBX CORRECTOR MAGNET WELDMENT	ICB HAS				—			
390482	-	CORRECTOR SHIM, 0.002"	4 EA	4	79123		3/3/03			
390483	-	CORRECTOR SHIM, 0.005"	4 EA	4	79124					
390484	-	CORRECTOR SHIM, 0.010"	4 EA	4	79125					
390485	-	CORRECTOR SHIM, 0.015"	4 EA	4	79126		↓			
393029	-	1/4 - 28 x 1" HEX SHCS, S.S.	16 EA	16	77851		3/3/03			
393030	-	#10 - 32 x 0.188" CUP POINT SET SCREW, S.S.	8 EA	8	77539					
393180	-	SHCS M4 x 10mm SS	8 EA	8	79519		↓			

RETURN THIS COMPLETED PARTS KIT REQUEST WITH THE ISSUED PARTS TO THE PARTS COORDINATOR.

[signature] 4/2/03 STOCKROOM SIGNATURE AND DATE

TRAVELER NO. TR-333643

KIT IS COMPLETE (PARTS COORDINATOR SIGNATURE): John J. Szostak BADGE # 92943C DATE 4/2/03

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 # *LMQXB03*
REQUESTED BY *Jim Rife*
DATE REQUESTED *7-15-03*
DELIVER TO *Jim Rife*
BUDGET CODE *LCI 300.1.1.1.3.3*
NEED BY DATE *7-15-03*
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 _____ **ID#** 4223 **DATE** 7/15/03

PLEASE INDICATE REVISION REQUIRED

LOCATION	PART #	REV	QTY	UOM	DESCRIPTION	RF #	SIR #
IB4BIN	MB-393181	0	8	Each	Plain Flat Washer M4#6	79519	
IB4 BIN	MA-393179	0	14	Each	SHCS 1/4-20 x 1/2" SS	79629	
IB4 BIN	MB-369937	0	1	Each	Q2 Lock-Instrum. Bus Channel	78587	
IB4 BIN	MA-369938	0	8	Each	SHCS 4-40x 1/4" SS	79032	
IB4 BIN	MA-369890	0	14	Each	6-32 x1" SHCS SS	79030	
IB4 BIN	MB-369981	0	2	Each	Lead Splice Cable Clamp Assy	79609	
IB4 BIN	MA-393178	0	8	Each	SHCS 1/4-20 x 1.25"	79632	
IB4 BIN	MB-369870	B	1	Each	Q2 Bus Housing Lock`	79684	

STOCKROOM SIGNATURE _____ **ID#** 2698 **DATE** 7/15/03

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

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

PARTS RECEIVED BY _____ **ID#** 4965 **DATE** 7/15/03

	LOCATION	PART #	REV	QTY	UOM	DESCRIPTION	RF #	SIR #
14	*R1 S1 L3*	*MC-369892*	*A*	*2*	*Each*	*Bus Housing End Support*	76943	
56	*IB4 BIN*	*MB-369829*	*0*	*4*	*Each*	*Warm Up Heater Base Plate*	79120	
59	*IB4 BIN*	*MA-369834*	*A*	*4*	*Each*	*Warm Up Heater*	79919	
6	*R1 S3 L2*	*ME-369872*	*B*	*1*	*Each*	*Q2A Bus Housing Ext*	79597	
7	*R1 S1 L3*	*MC-369873*	*A*	*1*	*Each*	*Q2A Bus Housing Ext Base*	78993	
14	*R2 S2 L4*	*MB-369874*	*A*	*2*	*Each*	*Q2 Bus Housing Ext Cover*	79598	
7	*IB4*	*MD-369867*	*0*	*1*	*Each*	*Bus Housing Extension*	78975	

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 # *LMQXB03*

DATE REQUESTED *4-14-03*

BUDGET CODE *300/1.1.1.6.2*

JOB TICKET # _____

MACHINE SHOP REQ. # _____

PURCHASE RELEASE # _____

REQUESTED BY *Jim Rife*

DELIVER TO *Jim Rife*

NEED BY DATE *4-15-03*

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 _____ **ID#** 1165 **DATE** 4/14/03

(for M. Schmidt)

PLEASE INDICATE REVISION REQUIRED

LOCATION	PART #	REV	QTY	UOM	DESCRIPTION	RF #	SIR #
R2S2L3	*MD-369971*	*0*	*1*	*Each*	*Notched Bus Housing-Bus Lock*	79527	
R2S2L3	*MD-369970*	*0*	*1*	*Each*	*Thin Cover for Bus Housing Lock*	79772	
IB4 BIN	*MA-369939*	*0*	*16*	*Each*	*FHCS 6-32 x 3/4 LG. SS*	79033	
IB4 BIN	*MA-369940*	*0*	*132*	*Each*	*Q2 Bus Housing Washer-Alum*	78596	
IB4 BIN	*MA-369891*	*0*	*16*	*Each*	*Slotted FHCS 6-32 x .5 LG*	79031	
IB4 BIN	*MA-369890*	*0*	*132*	*Each*	*SHCS 6-32 UNC x .875 LG SS*	79030	
IB4 BIN	*MC-369707*	*A*	*4*	*Each*	*Q2 Correct Coil Wire Ramp G-11*	78942	
R1S3L3	*MD-369869*	*B*	*1*	*Each*	*Bus Housing Ext-Base G-11*	79039	

STOCKROOM SIGNATURE _____ **ID#** 1139 **DATE** 4/14/03

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

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

PARTS RECEIVED BY _____ **ID#** 4895 **DATE** 4/14/03

PLEASE INDICATE REVISION REQUIRED

0102-ES-292302 Revision D

LOCATION	PART #	REV	QTY	UOM	DESCRIPTION	RF #	SIR #
R1S1L3	MD-369866	B	1	Each	Bus Housing Ext-Base G-11	78947	
R1S3L2	MD-369865	A	2	Each	Bus Housing Ext-Cover G-11	78931	
R1S1L3	MC-369670	A	1	Each	Bus Housing-Thin Cover G-11	78937	
IB4 BIN	MD-369935	0	16	Each	Thin Cover W/O C'Sink		
R2S2L2	MD-369668	C	18	Each	Bus Housing Base	79166	

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 # LM9XB03 — REQUESTED BY S. Gould

DATE 8/14/03 — DELIVER TO ICB

BUDGET CODE 3200/1.1.1.3.3 (LCI) — NEED BY DATE 8/14/03

JOB TICKET # _____ — MMR # _____

MACHINE SHOP REQUISITION # _____ — PO # _____

PURCHASE RELEASE # _____ — OTHER _____

PARTS STATUS (CHECK ONE)

____DEFECTIVE PARTS ISSUED ____PARTS SCRAPPED ____A/R ITEMS

____DEFECTIVE ASSEMBLY ____MISSING FROM KIT ALREADY ISSUED

X INDIVIDUAL PARTS ____CONSUMABLES ____PARTS LOST

ACQUISITIONER SIGNATURE [signature] **ID#** 4223 **DATE** 8/14/03

PLEASE INDICATE REVISION REQUIRED

	LOCATION	PART#	REV	QTY	UOM	DESCRIPTION	RF #	SIR#
IN STOCK 15	R1,1,2	418067	A	1	EA	13 UNIT CONNECTOR		
51	IB#4 BIN	418113	—	2	EA	GROMMET		
52	IB#4 BIN	418112	—	2	EA	CLAMPING BAR		
200	R1,1,2	418116	—	8	EA	6-32 x 3/8 PAN HD		
213	IB#4 BIN	418114	—	8	EA	M3 STUD ASSY		
16	R1,1,2	418067	A1	1	EA	23 UNIT CONNECTOR		
126	R1,1,2	418109	—	84	EA	TIEDOWN LINK		
10	IB#4 BIN	418080	A	1	EA	SUPPORT ARM WELDMENT		
200	R1,1,2	418117	—	4	EA	4-40 x 1/2" PAN HEAD		

STOCKROOM SIGNATURE _____ **ID#** _____ **DATE** _____

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

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

PARTS RECEIVED BY _____ **ID#** _____ **DATE** _____

CERN
CH-1211 Geneva 23
Switzerland

the **Large Hadron Collider** project

LHC ICP Document No.
LHC-MCBX-FR-0001 rev. **1.0**
EDMS Document No.
— — —

Certificate of Conformity

Part name:	MCBX Inner Triplet Dipole Corrector		
LHC Identification No.:	HCMCBX_001-SI000004	***Serial No.:***	HCMCBX_001-SI000004
Shipped To:	CERN	***Shipment No:***	***03***
		Shipment	***22/04/03***
Manufacturer:	SIGMAPHI	***Contract No.:***	F375/LHC/LHC
Related tech. Specification:	LHC-MCBX-CI-0001 and addenda		
Related drawings:	LHCMCBX_0012 (1525-CN-1001)		
Responsible person at CERN:	Mikko Karppinen	***Tel.***	+41 22 767 4305
		E-mail.	Mikko.Karppinen@cern.ch
Responsible person at SIGMAPHI:	Damien Neuvéglise	***Tel.***	+33 2 97 01 08 80
		E-mail.	dneuveglise@sigmaphi.fr
SIGMAPHI certifies that the delivered material conforms to the technical specification mentioned above:			
Date: 04/04/03	***Name: D.Neuvéglise***		***Signature: D.Neuvéglise***

Acceptance test results

		MCBXV (Inner)	***MCBXH (Outer)***	***Remarks:***
RT dc resistance (Ω):	***SIGMAPHI:***	***18***	***22.1***	
	CERN:	***18.14***	***22.2***	
	CMA:	17.7 Ω	21.75 Ω	Fermi
Inductance @1 kHz/100 Hz (mH)	***SIGMAPHI:***	***66 / 113***	***68.16 / 161.9***	
	CERN	***63.16 / 84.42***	***58.78 / 98.21***	
	CMA:	63.0825 mH	58.7109 mH	inner 4.47 Ω / 2.45 Ω
R.T. leakage current to ground @ 1.5 kV (μA):	***SIGMAPHI:***	***3***	***3***	
	CERN:	***0.011***	***0.022***	
	CMA:	21 nA	32 nA	

	Cold Mass Assembler
Visual inspection	
Name / Signature	
Date	

Accepted: ☒

Rejected: ☐

Comments (SigmaPhi):	

Comments (CERN):	***During cold tests both dipoles reached 700 A in individual powering, however the combined powering was limited to 85 % of the nominal current (geometric sum).***
	This magnet can be used in Q2 cold mass.

Comments (CMA):	

CERN
CH-1211 Geneva 23
Switzerland

[redacted]

LHC ICP Document No.
LHC-MCBX-FR-0001 rev. **1.0**

EDMS Document No.
---

the **Large Hadron Collider** project

Certificate of Conformity

Part name:	MCBX Inner Triplet Dipole Corrector		
LHC Identification No.:	HCMCBX_001-SI000004	***Serial No.:***	HCMCBX_001-SI000004
Shipped To:	CERN	***Shipment No:***	***03***
		Shipment	***22/04/03***
Manufacturer:	SIGMAPHI	***Contract No.:***	F375/LHC/LHC
Related tech. Specification:	LHC-MCBX-CI-0001 and addenda		
Related drawings:	LHCMCBX_0012 (1525-CN-1001)		
Responsible person at CERN:	Mikko Karppinen	***Tel.***	+41 22 767 4305
		E-mail.	Mikko.Karppinen@cern.ch
Responsible person at SIGMAPHI:	Damien Neuvéglise	***Tel.***	+33 2 97 01 08 80
		E-mail.	dneuveglise@sigmaphi.fr
SIGMAPHI certifies that the delivered material conforms to the technical specification mentioned above:			
Date: 04/04/03	***Name: D.Neuvéglise***		***Signature: D.Neuvéglise***

Acceptance test results

		MCBXV (Inner)	*MCBXH (Outer)*	*Remarks:*
RT dc resistance (Ω):	***SIGMAPHI:***	***18***	***22.1***	
	CERN:	***18.14***	***22.2***	
	CMA:	17.7 Ω	21.75 Ω	Fermi
Inductance @1 kHz/100 Hz (mH)	***SIGMAPHI:***	***66 / 113***	***68.16 / 161.9***	
	CERN	***63.16 / 84.42***	***58.78 / 98.21***	
	CMA:	63.0825 mH	58.7109 mH	INNER 4.47 Ω / OUTER 2.45 Ω
R.T. leakage current to ground @ 1.5 kV (μA):	***SIGMAPHI:***	***3***	***3***	
	CERN:	***0.011***	***0.022***	
	CMA:	21 nA	32 nA	

	Cold Mass Assembler
Visual inspection	
Name / Signature	
Date	

Accepted: ☒

Rejected: ☐

CERN
CH-1211 Geneva 23
Switzerland

the **Large Hadron Collider** project

LHC ICP Document No.
LHC-MCBX-FR-0001 rev. **1.0**

EDMS Document No.
———

Certificate of Conformity

Part name:	MCBX Inner Triplet Dipole Corrector		
LHC Identification No.:	HCMCBX_001-SI000004	***Serial No.:***	HCMCBX_001-SI000004
Shipped To:	CERN	***Shipment No:***	***03***
		Shipment	***22/04/03***
Manufacturer:	SIGMAPHI	***Contract No.:***	F375/LHC/LHC
Related tech. Specification:	LHC-MCBX-CI-0001 and addenda		
Related drawings:	LHCMCBX_0012 (1525-CN-1001)		
Responsible person at CERN:	Mikko Karppinen	***Tel.***	+41 22 767 4305
		E-mail.	Mikko.Karppinen@cern.ch
Responsible person at SIGMAPHI:	Damien Neuvéglise	***Tel.***	+33 2 97 01 08 80
		E-mail.	dneuveglise@sigmaphi.fr
SIGMAPHI certifies that the delivered material conforms to the technical specification mentioned above:			
Date: 04/04/03	***Name: D.Neuvéglise***		***Signature: D.Neuvéglise***

Acceptance test results

		MCBXV (Inner)	***MCBXH (Outer)***	***Remarks:***
RT dc resistance (Ω):	***SIGMAPHI:***	***18***	***22.1***	
	CERN:	***18.14***	***22.2***	
	CMA:			
Inductance @1 kHz/100 Hz (mH)	***SIGMAPHI:***	***66 / 113***	***68.16 / 161.9***	
	CERN	***63.16 / 84.42***	***58.78 / 98.21***	
	CMA:			
R.T. leakage current to ground @ 1.5 kV (μA):	***SIGMAPHI:***	***3***	***3***	
	CERN:	***0.011***	***0.022***	
	CMA:			

	Cold Mass Assembler
Visual inspection	
Name / Signature	
Date	

Accepted: ☐

Rejected: ☐

Comments (SigmaPhi):	

Comments (CERN):	***During cold tests both dipoles reached 700 A in individual powering, however the combined powering was limited to 85 % of the nominal current (geometric sum).***
	This magnet can be used in Q2 cold mass.

Comments (CMA):	

CERN
CH-1211 Geneva 23
Switzerland

the **Large Hadron Collider** project

LHC Project Document No.	CERN Part Identifier (19 chars)
LHC-MCBX-QN-001.00	HCMCBX_001-SI000004
CERN Div/Group or Supplier/Contractor Doc No	**Test Procedure Number**
--	--
EDMS Document No.	
391089	

Non conformity Report

IDENTIFICATION

1. Originator's Name: M. Karppinen	5. Date: 12/6/03
2. Contractor/Supplier: Sigma Phi	6. Part description: MCBX #4
3. Contract No: F375/LHC/LHC	7. Qty: 1
4. Project Engineer: Mikko Karppinen	8. Dwg No: LHCMCBX_0012 (1525-CN-1001)

9. Found during what activity:

☐ Incoming inspection	☐ Final inspection
☒ In-process inspection	☐ Other:

10. Description of non conformity (use continuation page if necessary)

Module failed training test spec

Individual training: MCBXV (Inner dipole) reached 700 A, MCBXH (Outer) reached 700 A.

Combined powering: reached only 90 % of the nominal field.

11. Action taken to prevent misuse (use continuation page if necessary)

IMPORTANCE

12. ☒ Non critical ☐ Critical

DISPOSITION

13. ☒ Use-as-is ☐ Repair ☐ Reject ☐ Rework ☐ Return to supplier

Description of proposed action (use continuation page if necessary)

As a result of CERN internal meeting on 6 June this magnet can be used in Q2 cold mass.

CORRECTIVE/PREVENTIVE ACTION

14. Description of proposed action (use continuation page if necessary)

APPROVAL OF NON CRITICAL NON CONFORMITIES

15	Project Engineer: Mikko Karppinen	Date: 12/6/03

APPROVAL OF CRITICAL NON CONFORMITIES

16	Project Management:	Date:

CLOSURE OF THE NON CONFORMITY

Planned actions have been completed and corrective/preventive actions have been initiated

	For non critical non conformities Quality Manager or Project Engineer	For critical non conformities Project Engineer
17	Name: Date:	Name: Mikko Karppinen Date: 12/6/03

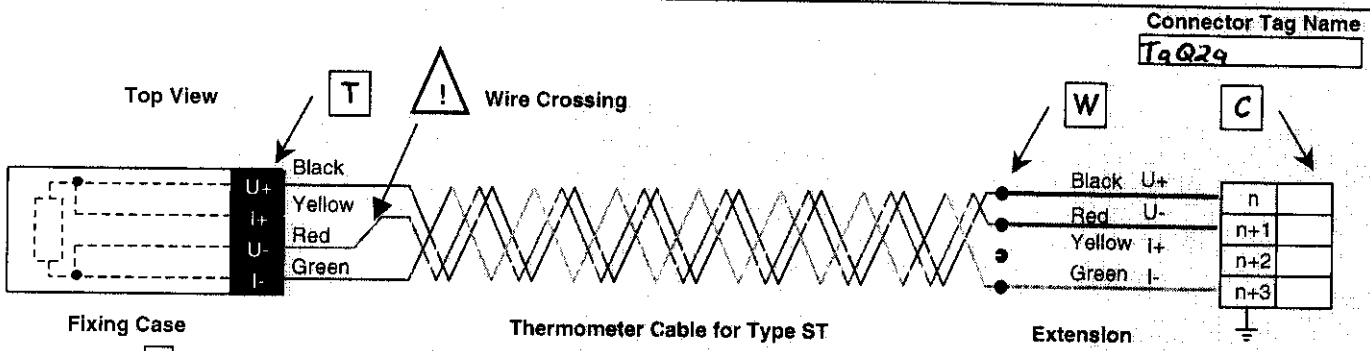
CERN Part Identifier (19 chars)
--

Cryogenic Thermometer Traveller

DESCRIPTION

Part description:	Cryogenic thermometer	**Top Assembly Identification:**	LMQXB03
Part Identification:	HCQITESCXT-CR012410	**Manufactured By:**	Fermilab
Serial Number:	CX_LS_X16772		

CABLING



Fixing Case

Thread ☐
Hole ☐
Stud ☐

Thermometer Cable for Type ST

ρ (300 K) = 0.32 Ohm/m
Copper AWG 30
Length = ☐ m

Extension

ρ (300 K) = 0.07 Ohm/m
Copper AWG 24
Length: 0.8 m

CHECKS

Intervention	Date/ DD-MMM-YYYY	Check Point	R(U+,U-,I+,I-) [Ohm] 4W	R(U-,I-) [Ohm] 2W	R(U+,I+) [Ohm] 2W	R(U+,GND) [Ohm] 2W	Temperature [K]	Firm/Laboratory	Checked by
Calibration	*21-Jan-2002*	T	*71.97*	*n.a*	*n.a*	*OVL*	*Ambient*	*IPN*	*Joly*
Expedition	*12-Mar-2003*	T	*70.587*	*0.1*	*0.1*	*OVL*	*293*	*CERN*	*Grivat*
Reception	5 Aug 03	T W C	71.955				73°F	Fermi	Gould
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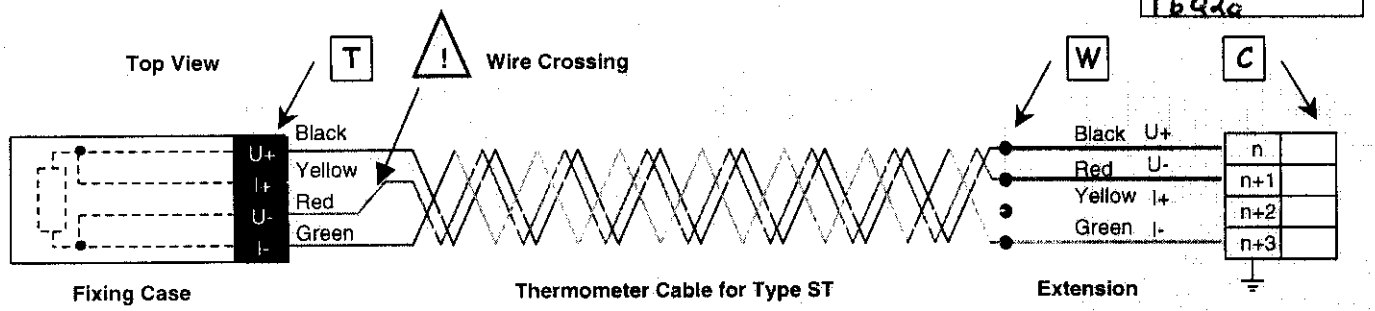
Cryogenic Thermometer Traveller

DESCRIPTION

Part description:	Cryogenic thermometer	**Top Assembly Identification:**	LMQXB03
Part Identification:	HCQITESCXT-CR012640	**Manufactured By:**	Fermilab
Serial Number:	CX_LS_X16826		

CABLING

Connector Tag Name: Tb92a



Fixing Case
Thread ☐
Hole ☐
Stud ☐

Thermometer Cable for Type ST
ρ (300 K) = 0.32 Ohm/m
Copper AWG 30
Length = ☐ m

Extension
ρ (300 K) = 0.07 Ohm/m
Copper AWG 24
Length: 0.8 m

CHECKS

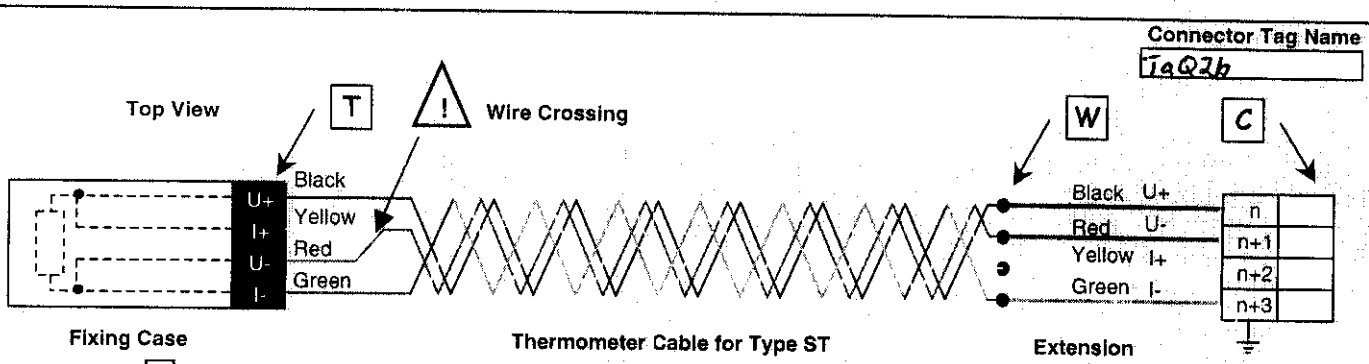
Intervention	Date/ DD-MMM-YYYY	Check Point	R(U+,U-,I+,I-) [Ohm] 4W	R(U-,I-) [Ohm] 2W	R(U+,I+) [Ohm] 2W	R(U+,GND) [Ohm] 2W	Temperature [K]	Firm/Laboratory	Checked by
Calibration	*21-Jan-2002*	T	*66.74*	*n.a*	*n.a*	*OVL*	*Ambient*	*IPN*	*Joly*
Expedition	*12-Mar-2003*	T	*65.242*	*0.1*	*0.1*	*OVL*	*293*	*CERN*	*Grivat*
Reception	5 Aug 03	T W C	66.78				73°F	Fermi	Gould
		T W C							
		T W C							
		T W C						

Cryogenic Thermometer Traveller

DESCRIPTION

Part description:	Cryogenic thermometer	**Top Assembly Identification:**	LMQXB03
Part Identification:	HCQITESCXT-CR012890	**Manufactured By:**	Fermilab
Serial Number:	CX_LS_X16905		

CABLING



Fixing Case

Thread ☐
Hole ☐
Stud ☐

Thermometer Cable for Type ST

ρ (300 K) = 0.32 Ohm/m
Copper AWG 30
Length = ☐ m

Extension

ρ (300 K) = 0.07 Ohm/m
Copper AWG 24
Length: 0.8 m

CHECKS

Intervention	Date/ DD-MMM-YYYY	Check Point	R(U+,U-,I+,I-) [Ohm] 4W	R(U-,I-) [Ohm] 2W	R(U+,I+) [Ohm] 2W	R(U+,GND) [Ohm] 2W	Temperature [K]	Firm/Laboratory	Checked by
Calibration	*04-Feb-2002*	T	*70.84*	*n.a*	*n.a*	*OVL*	*Ambient*	*IPN*	*Joly*
Expedition	*12-Mar-2003*	T	*69.187*	*0.1*	*0.1*	*OVL*	*293*	*CERN*	*Grivat*
Reception	5 Aug 03	T W C	70.69				73°F	Fermi	Gould
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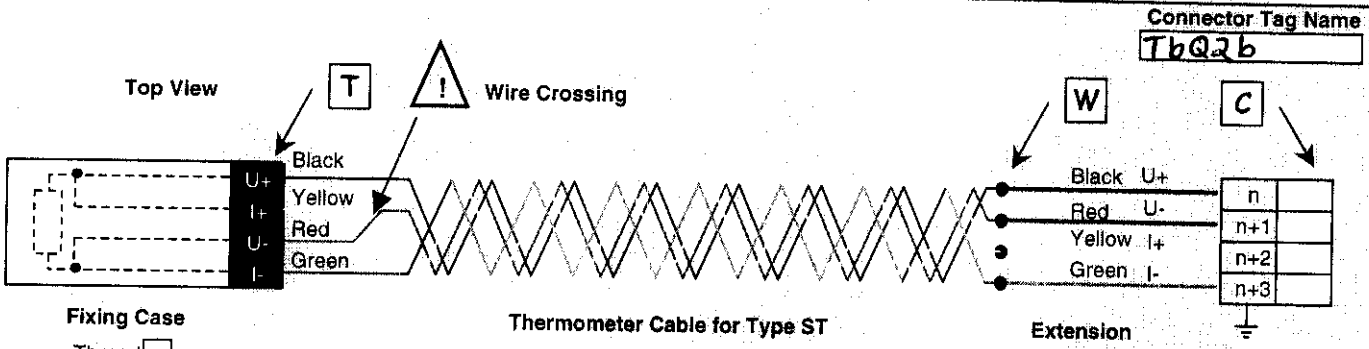
Cryogenic Thermometer Traveller

DESCRIPTION

Part description:	Cryogenic thermometer	**Top Assembly Identification:**	LMQXB03
Part Identification:	HCQITESCXT-CR012900		
Serial Number:	CX_LS_X16907	**Manufactured By:**	Fermilab

CABLING



Fixing Case

Thread ☐
Hole ☐
Stud ☐

Thermometer Cable for Type ST

ρ (300 K) = 0.32 Ohm/m
Copper AWG 30
Length = ☐ m

Extension

ρ (300 K) = 0.07 Ohm/m
Copper AWG 24
Length: 0.8 m

CHECKS

Intervention	Date/ DD-MMM-YYYY	Check Point	R(U+,U-,I+,I-) [Ohm] 4W	R(U-,I-) [Ohm] 2W	R(U+,I+) [Ohm] 2W	R(U+,GND) [Ohm] 2W	Temperature [K]	Firm/Laboratory	Checked by
Calibration	*04-Feb-2002*	T [redacted]	*68.94*	*n.a*	*n.a*	*OVL*	*Ambient*	*IPN*	*Joly*
Expedition	*12-Mar-2003*	T [redacted]	*67.468*	*0.1*	*0.1*	*OVL*	*293*	*CERN*	*Grivat*
Reception	5 Aug 03	T W C	68.994				73°F	Fermi	Gould
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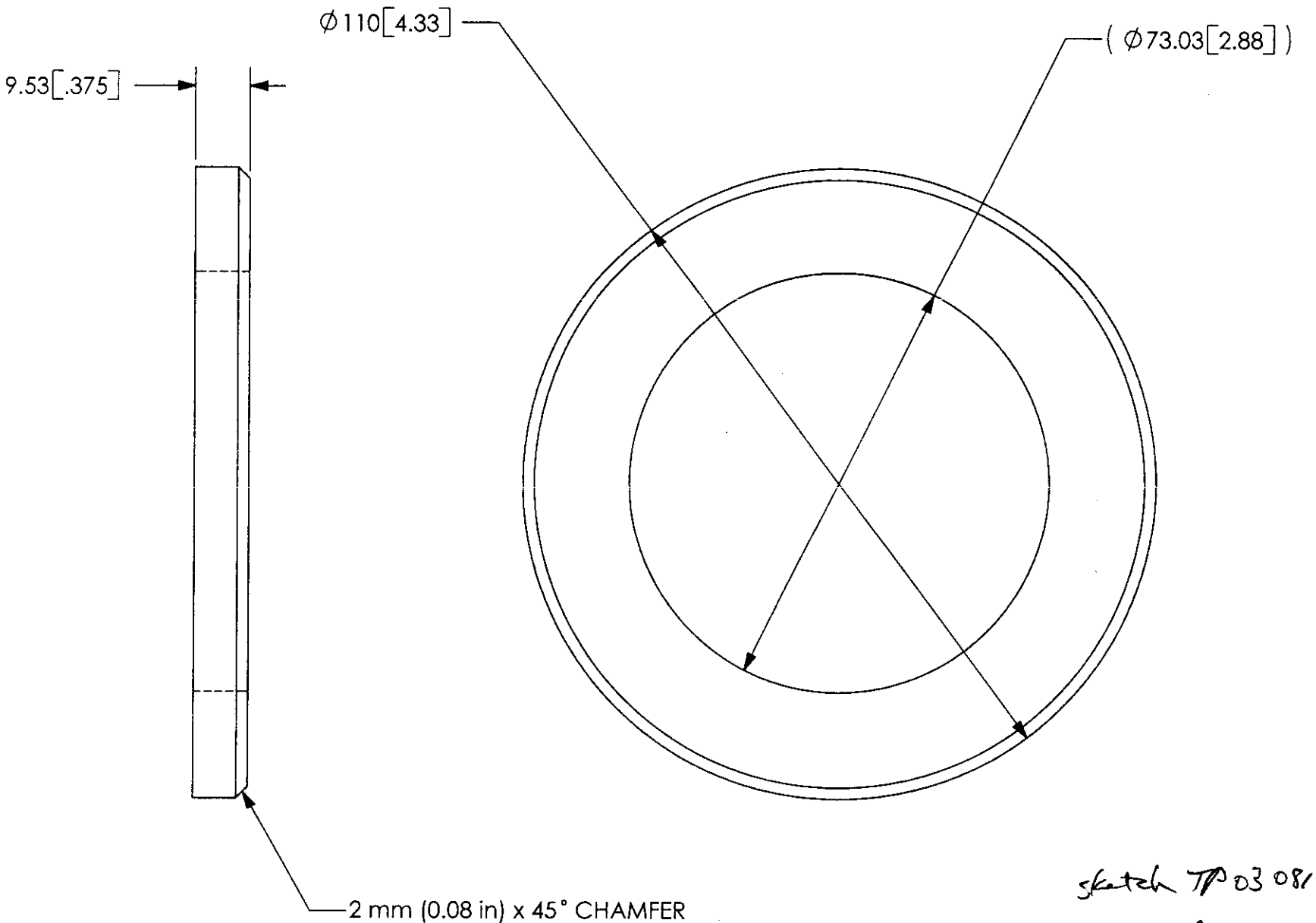
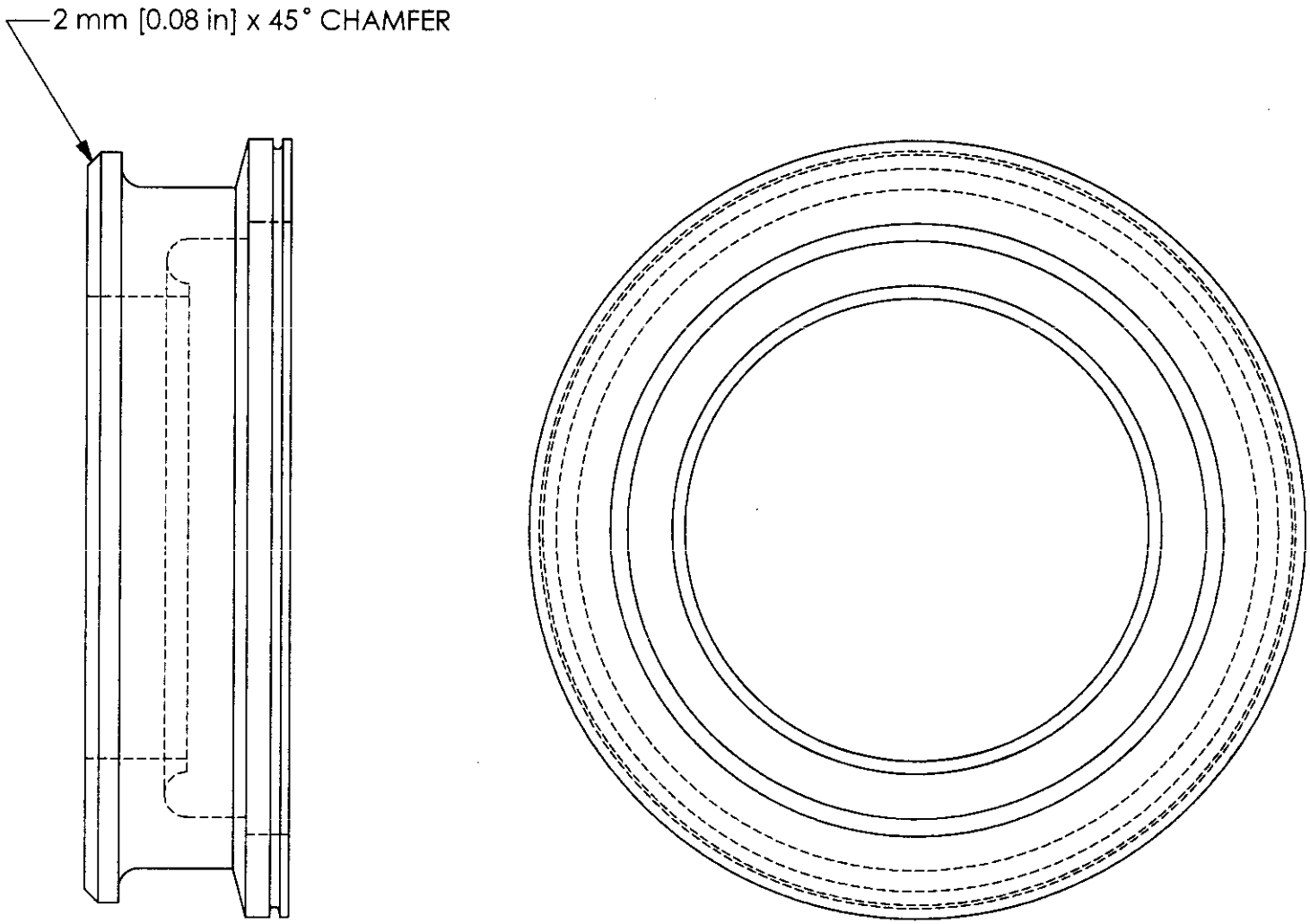


sketch TP 03 08 12-01

Approved: T. Page

NOTES:
1) CUT SPACER FROM 390425
2) 2 PCS. REQ'D

LMQXB02 BEAM TUBE SPACER
08/12/2003
T. PAGE



sketch TP030812-02

Approved T. Page

Beam Tube Flange Modification:
Add Chamfer
T. Page

Traveler Title:	Specification No:	Revision:	DR No:
Q2 LMQXB Cold Mass Module Assembly Traveler	5520-TR-333643	None	HGQ-0418

Step No:	Drawing No:	Routing Form No:	Serial No:	Rework ID:
7.27	369895		LMQXB03	0

Discrepancy Description:

The Fasteners for part # MB-369937 are the wrong size.

Originator: Steve Gould

Date: 7/22/2003

Cause of Nonconformance:

Numerous Fasteners for Bus Channel MB-369937 were incorrect length and head type. Drawing ME-369895 was incorrect.

Responsible Authority: Fred Nobrega

Date: 4/5/2004

Disposition:

Order correct Fasteners.

Responsible Authority: Fred Nobrega

Date: 4/5/2004

Corrective Action to Prevent Recurrence:

Revise Drawing ME-369895 to include the appropriate fasteners. ECO 5570. No Traveler Change.

Responsible Authority: Fred Nobrega

Date: 4/5/2004

Corrective Action/Disposition Verified By: Jamie Blowers

Date: 1/10/2005

Will Configuration be affected?: ☐ YES ☑ NO

Identified problem area:

☐ Material ☐ Manpower ☑ Method ☐ Machine ☐ Measurement

Reviewed By: Jamie Blowers

Date: 1/10/2005

Traveler Title:	Specification No:	Revision:	DR No:
Q2 LMQXB Cold Mass Module Assembly Traveler	5520-TR-333643	None	HGQ-0422

Step No:	Drawing No:	Routing Form No:	Serial No:	Rework ID:
7.27	ME-369895	78975	LMQXB03	0

Discrepancy Description:

Part No. MD-369867 needs to be modified. The length of this part needs to be shortened by .375" to allow enough space between the part and the magnet end plate for thermal contraction.

Originator: Jim Rife

Date: 8/5/2003

Cause of Nonconformance:

Upon further inspection, parts actually have sufficient clearance w/o safety margin.

Responsible Authority: Fred Nobrega

Date: 4/7/2004

Disposition:

Modify Part No. MD-369867 to acceptable specifications.

Responsible Authority: Fred Nobrega

Date: 4/7/2004

Corrective Action to Prevent Recurrence:

Use part as is. Ensure part has 3/4" clearance from Magnet. If not, modify part as necessary. No Traveler Change.

Responsible Authority: Fred Nobrega

Date: 4/7/2004

Corrective Action/Disposition Verified By: John Szostak

Date: 12/6/2004

Will Configuration be affected?: ☐ YES ☑ NO

Identified problem area:

☑ Material ☐ Manpower ☐ Method ☐ Machine ☐ Measurement

Reviewed By: Bob Jensen

Date: 12/6/2004

Traveler Title:	Specification No:	Revision:	DR No:
Q2 LMQXB Cold Mass Module Assembly Traveler	5520-TR-333643	None	HGQ-0424

Step No:	Drawing No:	Routing Form No:	Serial No:	Rework ID:
9.12	369895		LMQXB03	0

Discrepancy Description:

When the non-IP end dome was removed, the quadrant splice covers on the cold mass were damaged from the end dome.

Originator: Steve Gould

Date: 8/6/2003

Cause of Nonconformance:

There is a tolerance stack up that occurs occasionally which results in a slight interference at assembly.

Responsible Authority: Rodger Bossert

Date: 4/5/2004

Disposition:

Fit and file at assembly.

Responsible Authority: Rodger Bossert

Date: 4/5/2004

Corrective Action to Prevent Recurrence:

File to fit, if necessary. Parts already exist. The cost of re-working the parts, exceeds the cost of filing an occasional part to fit. No traveler change required.

Responsible Authority: Rodger Bossert

Date: 4/5/2004

Corrective Action/Disposition Verified By: John Szostak

Date: 4/6/2004

Will Configuration be affected?: ☐ YES ☑ NO

Identified problem area:

☐ Material ☐ Manpower ☑ Method ☐ Machine ☐ Measurement

Reviewed By: Jamie Blowers

Date: 1/10/2005

Revision Request Control Number: 1513

Specification Number: 5520 - TR - 333643 Current Revision: None

Traveler or Document Title: Q2 LMQXB Cold Mass Module Assembly Traveler

Step #/Description of Revision:

6.5 Modified Step. Changed MiniLevel Tolerance to +/- 0.05 mm/m per Tom Page.
6.10 Modified Step. Changed MiniLevel Tolerance to +/- 0.05 mm/m per Tom Page.
7.18 Modified Step. Changed to "Cut Q2b Quadrant 4 Lead at end of splice per Drawing (ME-369895)."
7.22 Modified Step. Added Picture to show all three Bus Leads. (13kA, 5kA 8kA)
7.29.2 Modified Step. Changed End of step to read "...Figure 7.29.2-A below." Corrected Picture to reflect accurate wiring diagram. Per DR No. HGQ-0374.
7.36 Modified Step. Changed MiniLevel Tolerance to +/- 0.05 mm/m per Tom Page.
8.1 Modified Step. Added Voltage Tap Serial Numbers to Tables.
11.11 Added Step. "Tack weld the corrector mounting hardware in place as per Q2 Coldmass welded assembly (ME-390309)."
11.13 Added Step. "Mount and adjust the Shipping restraint screws."
13.1 Modified Step. Added Voltage Tap Serial Numbers to Tables.
14.1 Modified Step. Added new wire information for installation of Hypertronics per Mike Lamm.
14.2 Modified Step. Added new wire information for installation of Hypertronics per Mike Lamm.

John Szostak	Jim Rife	3/31/2003
Originator	Responsible Authority	Date
Revision Incorporated into the Traveler:	John Szostak	7/17/2003
	Revision Incorporated By	Date
Process Engineering Final Review:	Bob Jensen	7/17/2003
	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.

Revision Request Control Number: 1578

Specification Number: 5520 - TR - 333643 Current Revision: A

Traveler or Document Title: Q2 LMQXB Cold Mass Module Assembly Traveler

Step #/Description of Revision:

6.11 Added Step. "Perform a Stretched Wire Verification Measurement."
7.1 Removed Step. "Obtain Lead Bus (ME-369825). Inspect Bus for damaged or broken areas. Clean Bus using lint free Heavy Duty Wipers (Fermi stock 1660-0150) and Isopropyl Alcohol (Fermi stock 1920-0300)." Moved to Q2 Insulated Bus Assembly Traveler (333721) per LMQXB04. Step 5.3
7.2 Removed Step. "Obtain parts for Bus Assembly (ME-369826) and assemble per Q2 Module Assembly Insulated Bus Assembly (ME-369826)." Moved to Q2 Insulated Bus Assembly Traveler (333721) per LMQXB04. Step 5.4
7.3 Removed Step. "Verify Bus Assembly (ME-369826) is assembled correctly per Q2 Module Assembly Insulated Bus Assembly (ME-369826)." Moved to Q2 Insulated Bus Assembly Traveler (333721) per LMQXB04. Step 5.5
7.4 Removed Step. "Hipot the 5kA Lead Bus to the 8kA and 13 kA Lead Busses on table before inserting into magnets. Power the 5kA bus to 5000V and ground the 13kA Lead Bus and the 8kA Lead Bus.(Max. Leakage < 0.5A)." Moved to Q2 Bus Assembly Traveler (333721) per LMQXB04. Step 5.6
7.5 Removed Step. "Hipot the Corrector Magnet (MD-390312) Busses at 5kV before inserting into magnet in both the parallel and checkerboard configurations as shown below. Corrector Wires not shaded should be at high potential, while those shaded should be connected to each other and grounded. (Max. Leakage < 0.5mA)" Moved to Q2 Bus Assembly Traveler (333721) per LMQXB04. Step 5.7
7.22 Modified Step. Added a "Floating" Column Header to Table 7.22 and "RTD's and Warm-up Heaters" in that column.
7.23 Modified Step. Added Note. "All wires in this table have been previously soldered to the Magnet except for the Cryogenic (warm-up) Heater Wires." Modified Table 7.23. Added CERN Labels per Rodger Bossert. Added Technician Signoff per LQXB04.
7.27 Modified Step. Added "Attach Instrumentation Bus Channel Lock(MB-369937) to Q2b Non Lead End as per Q2 Module Assembly(ME-369895, page 4 of 4)"
7.30 Modified Step. Changed resistance check of RTD's and Warm-up Heaters per Rodger Bossert. New Step 7.25.
7.31 Modified Step. Changed hipot of RTD's and Warm-up Heaters per Rodger Bossert. New Step 7.26.
8.0 Modified Step. Changed electrical procedure specifications per Rodger Bossert. Added new tables with CERN Labels and new pictures.
11.3 Modified Step. Changed to "Install Spider Assembly (MC-430044) to protect wires." Removed checkboxes and added Responsible Authority signoff.

John Szostak	Jim Rife	10/27/2003
Originator	Responsible Authority	Date

Revision Incorporated into the Traveler:

John Szostak	1/15/2004
Revision Incorporated By	Date

Process Engineering Final Review:

Bob Jensen	1/15/2004
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:
Q2 LMQXB Cold Mass Module Assembly Traveler	5520-TR-333643	None	HGQ-0416

Step No:	Drawing No:	Routing Form No:	Serial No:	Rework ID:
7.8/7.9	369895		LMQXB03	0

Discrepancy Description:

The angled part of 369892 support does not fit.

Originator: Steve Gould

Date: 7/22/2003

Cause of Nonconformance:

The designed angle of block was not correct

Responsible Authority: Fred Nobrega

Date: 4/6/2004

Disposition:

Modify Part No. (MC-369892 Q2 Module Assembly / Bus Hosing End Support) to correct specifications.

Responsible Authority: Fred Nobrega

Date: 4/6/2004

Corrective Action to Prevent Recurrence:

Revised Drawing & Modified Part. (MC-369892 Q2 Module Assembly / Bus Hosing End Support). ECO #5438

Responsible Authority: Fred Nobrega

Date: 4/6/2004

Corrective Action/Disposition Verified By: John Szostak

Date: 6/10/2004

Will Configuration be affected?: ☐ YES ☑ NO

Identified problem area:

☑ Material ☐ Manpower ☐ Method ☐ Machine ☐ Measurement

Reviewed By: Bob Jensen

Date: 6/11/2004

Traveler Title:	Specification No:	Revision:	DR No:
Q2 LMQXB Cold Mass Module Assembly Traveler	5520-TR-333643	None	HGQ-0423

Step No:	Drawing No:	Routing Form No:	Serial No:	Rework ID:
9.7	369895	78330	LMQXB03	0

Discrepancy Description:

The bellows where the hypertronics connector attaches has been damaged.

Originator: Steve Gould

Date: 8/6/2003

Cause of Nonconformance:

The inside of the bellows was damaged due to the convolutions hitting against the hypertronics connector bracket. It is not known when this damage occurred. There were two pieces pulled from stock and both were damaged.

Responsible Authority: Thomas Page

Date: 8/7/2003

Disposition:

Leak check the dome assemblies and ensure that the assembly is still leak tight.

Responsible Authority: Thomas Page **Date:** 8/7/2003

Corrective Action to Prevent Recurrence:

A protective sleeve should be placed inside the bellows between the convolutions and the bracket to prevent any further damage to the convolutions. This option will have to be studied. (TRR No. 1636)

Responsible Authority: Thomas Page **Date:** 8/7/2003

Corrective Action/Disposition Verified By: John Szostak **Date:** 6/10/2004

Will Configuration be affected?: ☐ YES ☑ NO

Identified problem area:

☐ Material ☐ Manpower ☑ Method ☐ Machine ☐ Measurement

Reviewed By: Bob Jensen **Date:** 7/23/2004

Revision Request Control Number: 1636

Specification Number: 5520 - TR - 333643 Current Revision: C

Traveler or Document Title Q2 LMQXB Cold Mass Module Assembly Traveler

Step #/Description of Revision:

7.23 Modified Step. Changed to "Install Warm-up Heaters (ME-369834) to the Lead Ends and Non-Lead Ends of Q2a and Q2b as per Q2 Module Assembly (ME-369895)." Per LMQXB06.
7.26 Modified Step. Changed Max Leakage Current to < .5 mA. Added "Use Droege Serial No. 910 (FNAL Part No. 51330) or equivalent." Modified Tables.
8.1 Modified Step. Added new method of measuring Ls &Q per Rodger Bossert.
8.4 Modified Step. Added Responsible Authority signoff per LMQXB06.
9.4 Removed Step. Moved to 9.1.
9.10 Removed Step. Moved to new 9.6.
11.0 Added Note. "Ensure that a protective sleeve is placed inside the bellows between the convolutions and the bracket to prevent damage to the convolutions." per DR No. HGQ-0423.
11.3 Removed Step. "Install Spider Assembly (MC-430044) to protect wires." Per LMQXB06/Rodger Bossert.
13.1 Modified Step. Added new method of measuring Ls &Q per Rodger Bossert.
13.3 Modified Step. Added "Have Crew Chief verify setup and sign below before continuing."
13.4 Modified Step. Added Responsible Authority signoff per LMQXB06.
14.2 Modified Step. Added Technician Signoff per LMQXB06.
15.1 Modified Step. Added new method of measuring Ls &Q per Rodger Bossert.
15.3 Modified Step. Modified Table.

Damon Bice	Jim Rife	5/17/2004
Originator	Responsible Authority	Date
Revision Incorporated into the Traveler:	John Szostak	7/14/2004
	Revision Incorporated By	Date
Process Engineering Final Review:	Jamie Blowers	7/14/2004
	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.