Document ID: 8535

LHC Q1 LQXA Cryostat Final Assembly Traveler

333755 / Rev. F

Job No:	**389**
MSD Project/Task No.:	**300/1.1.1.6.3**
M + S Project/Task No.:	**300/1.1.1.6.3**

Place This Side Down For Scanning!!!

Magnet Travelers

LQXA09-0

Document ID:

8535

Job No.:

389

Project/Task No.

300/1.1.1.6.3

Series:

LQXA

Serial No:

LQXA09

Rework ID:

0

Specification No.:

333755

Revision:

F

LQXA09-0

Fermi National Accelerator Laboratory
Batavia, IL 60510

LARGE HADRON COLLIDER
Q1-LQXA
CRYOSTAT FINAL ASSEMBLY TRAVELER

Reference Drawing(s):
Q1 Cryostat General Assembly (ME-390127)
Q1 Cryostat Internal Piping (ME-390174)

Project/Task Number: *300/1.1.1.6.3*

Released By: *Bob Jensen* | **Magnet/Device Series:** *LQXA*

Date Issued: *2/21/2006 9:35:23 AM* | **Scanned Pages:** 59

Prepared by: J. Szostak

Title	Signature	Date
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TD / LHC Production Engineer Cryostat	*Tom Nicol* Tom Page / Designee	*10/18/05*
TD / LHC Project Engineer Cryostat	*Tom Nicol* Tom Nicol / Designee	*10/18/05*
TD / LHC Program Manager	*Jim Kerby* Jim Kerby / Designee	*10/19/05*

Revision Page (1 of 4)

Revision	Step No.	Revision Description	TRR No.	Date
None	N/A	Initial Release	N/A	2/10/04
A	1.4	Removed Step. "All personnel performing steps in this traveler must have documented training for this traveler and associated operating procedures."	1617	7/14/04
	3.6	Added Step. "Weld the Helium Guard Mounting Plate (MD-390724) to the Vacuum Vessel (ME-390122) as per Q1 Vacuum Vessel Assembly (ME-390122)." per LQXA01 and Tom Page.		
	4.0	Removed Step. "Suspension System Assembly" Moved to Q1 Module Assembly Traveler per Jim Rife and Tom Page. (Subsequent added steps reflect New Step Numbers)		
	4.0	Modified Steps. Modified "Piping Assembly" steps from step 4.11 to 4.53 per Tom Page.		
	5.7	Modified Step. Changed to "Remove Pipe Supports (MD-390092), Pipe Anchor (MC-390486) and blankets. Wrap blankets in plastic bag to keep clean for later use. Label blankets as they are removed for later positioning." (New Step 4.7)		
	5.8	Modified Step. Changed to "Install Pipe Supports (MD-390092) and Pipe Anchor (MC-390486) to same locations as in step 4.4 and 4.5 respectively." (New Step 4.8)		
	5.11	Added Step. "Leak Check the Q1 Thermal Shield Cooling Pipe Crossover (MD-390466) to the Q1 Thermal Shield Cooling Tube Weldment (MD-390431) per ES-107240 and record results in table below." per LQXA01.		
	6.8	Added Step. "Install Conflat Flanges (MA-390374) w/ Copper Gaskets (MA-390375) and Bolt Set (MA-390376) to Cryostat as per Q1 Cryostat General Assembly (ME-390127)." per LQXA01.		
	6.9	Added Step. "Install Target Holders (MD-390539), (MD-390540) and (MD-390211) as per Q1 Cryostat General Assembly (ME-390127)." per LQXA01.		
	6.10	Added Step. "Install Reference Socket Cup (MA-390426) as per Q1 Cryostat General Assembly (ME-390127)." per LQXA01.		
	6.11	Modified Step. Deleted "...Cutouts will have to be made for the Upper Support Lugs." per LQXA01. (Already cut.) (New Step 5.12)		
	6.11	Added Step. "Install Q1 Thermal Shield Cooling Pipe Crossover (MD-390466) to Q1 Thermal Shield Cooling Tube Weldment (MD-390431)."		
	6.12	Added Step. "Weld the Cooling Pipe Crossover Connectors (MA-390467) to the Cooling Tube Weldment (MD-390431) and the Cooling Pipe Crossover (MD-390466) as per Q1 Thermal Shield Assembly (ME-390429)." per LQXA01.		
	7.1	Modified Step. Added new method of measuring Ls &Q per Rodger Bossert.		
	8.0	Added Step. Final Preparations		
B	4.9	Added Step. "Clean the Cold Mass and the Retainer Clips (MA-390103) with Ethyl Alcohol (Fermi stock 1920-0550) and Kimwipes (Fermi stock 1660-2500) or equivalent."	1654	8/20/04
	4.10	Added Step. "Weld the Retainer Clips (MA-390103) to the Cold Mass Outer Shell as per the Q2 Pipe Support Assembly (ME-390087) or Q1 Internal Piping Assembly (ME-390174)."		
	7.0	Modified Step. Added new Electrical ranges / nominals per Rodger Bossert.		
	7.1	Modified Step. Changed to "2. Set test current to **0.1** amp." per LMQXA04.		

Revision Page (2 of 4)

Revision	Step No.	Revision Description	TRR No.	Date
C	5.1	Added Step. "Install the Threaded Rods (Tie Rod Assembly) (MC-390635). See copy of step 10.9 (Q1 Module Assembly Traveler, TR-333754) in designated book, for the distance between the Suspension Rings. Record the previously recorded measurements below." per TR-333730, LQXC01 and Tom Page.	1692	12/15/04
	5.8	Moved Step. "Install the Cold Mass Insulation Mounting Lug Covers (MC-390496)." per TR-333730, LQXC01 and Tom Page. New Step 5.2.		
	7.2	Modified Step. Added Picture of Corrector Bus Leads. Modified Table.		
D	1.6	Added Step. "Protect the bellows during all stages of production." **DR No. HGQ-0500.**	1705	2/28/05
	3.4	Modified Step. Changed to "Attach the Leak Check sticker for the Vacuum Vessel Assembly (ME-390122) per ES-107240 to the table below." Per **DR No. HGQ-0469.**		
	4.10	Modified Step. Changed to "Weld the Retainer Clips (MA-390103) to the Cold Mass Outer Shell as per Q1 Internal Piping Assembly (ME-390174)." Per LQXA03.		
	4.12	Modified Step. Changed to "Clean the Heat Exchanger Outer Shell Pipe (MD-390176), Pumping Line Pipe (MB-390147), Cool Down Pipe (MB-390146) <u>and the 4.5K Intercept Line Tubes (MB-390192)</u> with Ethyl Alcohol (Fermi stock 1920-0550) and Kimwipes (Fermi stock 1660-2500) or equivalent." **DR No. HGQ-0479.**		
	4.35	Added Step. "Install the Fiducial Mounting Blocks (MB-390808) per Q1 Cold Mass Welded Assembly (ME-390526)."		
	4.36	Added Step. "Weld the Fiducial Mounting Blocks (MB-390808) per Q1 Cold Mass Welded Assembly (ME-390526)."		
	7.3	Added Step. "If needed, perform a stretched wire measurement of the system, noting the relative position and roll of the three magnetic elements to each other."		
	8.5	Removed Step. "Install the Vinyl Flange Covers (MA-390491), (MA-390492), (MA-390493), (MA-390494), & the Alignment Fiducial Covers (MA-390495)." Moved to Q1 Shipping Traveler.		
E	4.11	Modified Step. Changed to "Install Q1 Installation Tie Rod Assembly (MC-390638) as per Q1 Cryostat Assembly - Internal Piping (ME-390174)." Per **DR No. HGQ-0482.**	1722	5/25/05
	4.12	Added Step. Changed to "Install Tie Bar Retaining Clamps (Qty.8) (MB-390136) as per Q1 Cryostat Assembly - Internal Piping (ME-390174)." Per **DR No. HGQ-0482.**		
	4.58	Added Step. "Leak check the three Q3 4.5k Intercept Lines (MB-390226)."		
	4.59	Added Step. "Leak Check the Cooldown Line (MD-390225)."		
	4.60	Added Step. "Leak Check the Pumping Line (MB-390224)."		
	5.12	Modified Step. Moved step "Leak Check the Q1 Thermal Shield Cooling Pipe Crossover (MD-390466) to the Q1 Thermal Shield Cooling Tube Weldment (MD-390431) per ES-107240 and record results in table below." **(New step 6.14)**		
	6.12	Added Step. "Mark the position that the Thermal Strap Crossover Pad (MC-390792) will be welded to the Thermal Shield Cooling Pipe Crossover (MD-390466)." **Note(s): Ensure that there will be <u>NO INTERFERENCE</u> between the Thermal Strap Crossover Pad (MC-390792) and the Collection Pot Weldment (MD-390185).**		
	7.1	Modified Step. Modified Electrical Table. Removed "Voltage Tap Serial Numbers".		

Revision Page (3 of 4)

Revision	Step No.	Revision Description	TRR No.	Date
E (Continued)	8.5	Added Step. "Perform a pressurized Helium Leak Check of the Cryostat Assembly."	1722 (Continued)	5/25/05
	8.6	Added Step. "Ensure all Pipe Supports are in place." Per LHC Project Engineer Cryostat.		
	8.7	Added Step. "Perform a Final Stretched Wire measurement." Per TR-333755 - LQXA04.		
	8.8	Added Step. "Perform a Final Cryostat Pipe Survey measurement." Per TR-333755 - LQXA04.		
F	3.6	Added Step. "Prepare Vacuum Vessel for Helium Guard Plate mounting and welding. If vessel is painted, remove paint from areas to be welded and mark weld pattern." Per Damon Bice.	1763	10/18/05
	3.11	Added Step. "Verify that the Adjusting Screws (MA-393039 and MA-390878) will thread easily into the appropriate holes in the Vacuum Vessel (ME-390122)." Per Damon Bice.		
	4.5	Remove Step. "Install Pipe Anchor (MC-390486) on the Cold Mass per Q1 Cryostat Assembly - Internal Piping (ME-390174)." Per Damon Bice.		
	4.7	Modified Step. Changed to "Remove Pipe Supports (MD-390092)." (New Step 4.6.)		
	4.7	Added Step. "Starting from the North Side of IP (or East) End of Magnet, mark the East End of the 1st blanket "1E" (1 East) and "1W" (1 West) as per Figure 4.7-A below. Label the next blanket in this fashion, incrementing the numerical value for each blanket as per Figure 4.7-A. When all blankets are installed on Cold Mass, blanket designations should be placed near the "Top" of the North side of the magnet as per Figure 4.7-A." per Damon Bice.		
	4.8	Modified Step. Changed to "Install Pipe Supports (MD-390092) to same locations as in step 4.4" Per Damon Bice.		
	4.36	Modified Step. Changed to "Mark the Installation Location for the Fiducial Mounting Blocks (MB-390808) per Q1 Cold Mass Welded Assembly (ME-390526)." Per Damon Bice. (New Step 4.37)		
	4.53	Added Step. "Record the Serial Numbers and locations of the RTD's in the table below."		
	4.56	Modified Step. Removed Warning "The test is to be performed after normal working hours and only personnel directly involved with the test will be present." Per Damon Bice. (New Step 4.57)		
	4.58	Modified Step. Changed Drawings to reflect proper location of missing 4.5k Intercept Line.		
	5.1	Removed Step. Moved to New Step 4.11.		
	5.3	Modified Step. Changed "Lift the Cold Mass Assembly and place the IP End (ME-390433) and Non-IP End Shield Sections (ME-390434) on the Insertion Rails." Per Damon Bice.		
	5.4	Modified Step. Changed to "Insert the Q1 Thermal Shield Mid Section (Middle Shield Section) (ME-390435) and the Support Bands (MD-390083)." Per Damon Bice.		
	5.6	Modified Step. Changed to "Assemble the Cooling Tubes (MD-390431) to the Bottom Half of the Shield, leaving all screws loose." Per Damon Bice. (New Step 5.5)		
	5.6	Added Step. "Tighten all screws on lower half of shield. (Screws on lower half of shield will be inaccessible after blankets are installed.)" Per Damon Bice.		

Revision Page (4 of 4)

Revision	Step No.	Revision Description	TRR No.	Date
F (Continued)	5.11	Modified Step. Changed to "Install the IP and Non-IP End Shields per Q1 Thermal Shield Assembly (ME-390429). Spray all screw threads with Molybdenum. Leave screws loose." Per Damon Bice.	1763 (Continued)	10/18/05
	5.12	Added Step. "Install the Q1 Center Section (Shield) (ME-390435). Leave all screws loose." Per Damon Bice.		
	5.13	Added Step. ""		
	5.14	Removed Step. Moved to after 5.15. New Step 5.15.		
	6.1	Modified Step. Changed to "Install Pig Steel Repair Putty, or equivalent, between the Vacuum Vessel and the Insertion Rails." Per Damon Bice.		
	6.6	Modified Step. Changed to "When the Cold Mass is fully inserted, install the "Top" Suspension System Adjusting Screws (MB-390039) and the "Bottom" (C936 Bearing Bronze) Suspension System Adjusting Screws (MB-390878)." **Per DR No. 4214.**		
	6.7	Modified Step. Changed to "Using Lower Suspension System Adjusting Screws, raise Cold Mass two (2) full turns." Per Damon Bice.		
	6.8	Added Step. "Ensure Cold Mass has been adjusted in the Vacuum Vessel and that all eight (8) Adjusting Screw Holes are aligned with threaded holes of Suspension System." (Crew Chief Signoff) Per Damon Bice.		
	6.8	Removed Step. "Install Conflat Flanges (MA-390374) w/ Copper Gaskets (MA-390375) and Bolt Set (MA-390376) to Cryostat as per Q1 Cryostat General Assembly (ME-390127)." Moved to after Final Cryostat Pipe Survey Measurement. New Step 8.8. Per Damon Bice.		
	6.11	Added Step. "Install the Support Bracket Assemblies (Qty. 4) (MD-390783) as per Q1 Thermal Shield Assembly (ME-390429)." Per Damon Bice.		
	6.13	Modified Step. Changed to "Weld the Cooling Pipe Crossover (MD-390466) Connectors (MA-390467) to the Cooling Tube Weldment (MD-390431) as per Q1 Thermal Shield Assembly (ME-390429)." Per Damon Bice. (New Step 6.14.)		
	7.0	Modified Steps. Added Step Numbers and instructions to each individual signoff.		
	7.1	Modified Step. Changed Q1 Resistance table. Moved KEK label resistance check a1-b1 to Nominal resistance group 6.75 Ω to 6.85 Ω. Added MFR Ω column to RTD Table, per Damon Bice.		
	7.3	Removed Step. "If needed, perform a stretched wire measurement of the system, noting the relative position and roll of the three magnetic elements to each other." Per Damon Bice.		
	8.1	Modified Step. Changed to "Prepare the Power Leads and corrector bus to be cut by measuring and marking the appropriate cutoff location as per Q1 Module Assembly (ME-369894). ..."		
	8.2	Added Step. "Verify the mark has been placed at the appropriate cutoff location as per Q1 Module Assembly (ME-369894)."		
	8.2	Modified Step. Changed to "**IN THE PRESENCE OF THE RESPONSIBLE AUTHORITY**, cut the Power Leads and the corrector bus at the appropriate cutoff location (mark) as per Q1 Module Assembly (ME-369894)." (New Step 8.3)		
	8.7	Removed Step. "Perform a Final Stretched Wire measurement." Moved to New step 8.6.		
	8.8	Removed Step. "Perform a Final Cryostat Pipe Survey measurement." Moved to New step 8.7.		
	8.10	Modified Step. Changed signoff to "Responsible Authority/Physicist" per Damon Bice.		

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

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

1.6 Protect the Bellows during all stages of production.

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.

Bob Lee _____ 3/2/06 _____

Process Engineering/Designee Date

3.0 Vacuum Vessel Preparation and Painting

3.1 Record the Vacuum Vessel Serial Number.

Q1-9

Technician(s) Date 3/14/06

3.2 Inspect the transition area between the Support Sections and Tube Sections. Grind smooth if necessary.

Technician(s) Date 3-15-06

3.3 Clean the Vacuum Vessel (ME-390122) using a vacuum cleaner or equivalent.

Technician(s) Date 3-15-06

SEE DR# 4005

3.4 Attach the Leak Check sticker for the Vacuum Vessel Assembly (ME-390122) per ES-107240 to the table below.

Part No.	DETERMINATION OF DETECTABLE LEAK						
	M.D.S. ÷ ((Response – Background) ÷ Leak value) = MDL						
OPERATOR'S LAST NAME	SCALE UNITS BEFORE HELIUM PROBE	SCALE UNITS WHILE ENCLOSURE FLOODING	MDS	Response	Background	Leak Value	MDL
						____ x E^{-8}	____ x E^{-}___

Technician(s) Date 3/14/06

3.5 Prepare the outside of the Vacuum Vessel (ME-390122) for painting. Clean using Ethyl Alcohol (Fermi stock 1920-0550) and Kimwipes (Fermi stock 1660-2500) or equivalent.

ELLIE

Technician(s) _____ Date 3/14/06

3.6 Prepare Vacuum Vessel for Helium Guard Plate mounting and welding. If vessel is painted, remove paint from areas to be welded and mark weld pattern.

Technician(s) _____ Date 3/14/06

3.7 Weld the Helium Guard Mounting Plate (MD-390724) to the Vacuum Vessel (ME-390122) as per Q1 Vacuum Vessel Assembly (ME-390122).

BOB W

Weldor(s) _____ Date 3/14/06

3.8 Mask the Stainless Steel Components of the Vacuum Vessel for painting.

ELLIE

Technician(s) _____ Date 3/14/06

3.9 Prime the Vacuum Vessel using Rust-o-leum (Fermi stock 1825-4000).

ELLIE

Technician(s) _____ Date 3/14/06

3.10 Verify that the Screws (MA-393036) will thread easily into the appropriate holes in the Vacuum Vessel (ME-390122). If necessary, tap out holes with M10 – 1.5 Tap. Move Vacuum Vessel (ME-390122) to Table.

Lead Person _____ Date 3/14/06

3.11 Verify that the Adjusting Screws (MA-393039 and MA-390878) will thread easily into the appropriate holes in the Vacuum Vessel (ME-390122).

Crew Chief _____ Date 3/14/06

3.11 Paint the Vacuum Vessel using Flambeau Red (Fermi stock 1825-3710).

Technician(s) _____ Date 3/15/06

4.0 Piping Assembly

Note(s):
Do not use a Strap Wrench on the Pipes.

4.1 Place the Cold Mass assembly on the insertion rail system.

Technician(s) _____ Date 3/15/06

4.2 Clean the Pipe Supports with Ethyl Alcohol (Fermi stock 1920-0550) and Kimwipes (Fermi stock 1660-2500) or equivalent.

Technician(s) _____ Date 3/18/06

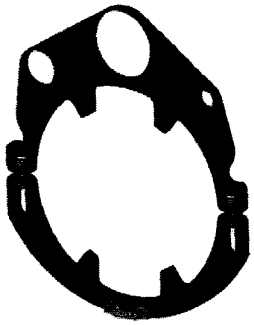
4.3 Install Cold Mass Insulation per Cold Mass Insulation Installation (ME-390524).

Technician(s) _____ Date 3/18/06

4.4 Install the Pipe Supports (MD-390092)(Qty. 3) on the Cold Mass per Q1 Cryostat Assembly Internal Piping (ME-390174).

Note(s):
A Tie Bar may be disconnected, if necessary, from the Fixed Support Assembly to install the central two pipe supports.

PIPE SUPPORT ASSEMBLY



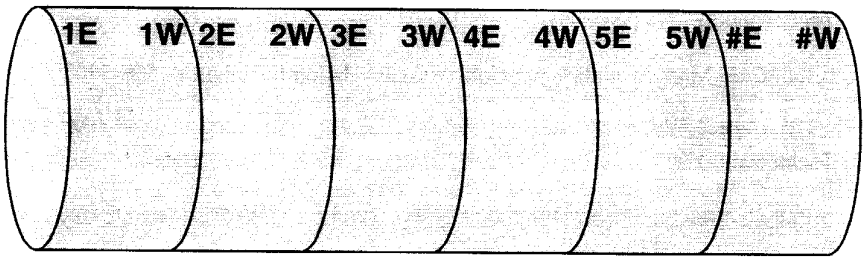
Technician(s) _____ Date 3/18/06

4.5 Using Pipe Supports (MD-390092) as a template, cut the blankets around the Pipe Support Feet and slit blankets circumferentially at the Pipe Supports.

Technician(s) _____ Date 3/18/06

4.6 Starting from the North Side of IP (or East) End of Magnet, mark the East End of the 1st blanket "1E" (1 East) and "1W" (1 West) as per Figure 4.6-A below. Label the next blanket in this fashion, incrementing the numerical value for each blanket as per Figure 4.6-A. When all blankets are installed on Cold Mass, blanket designations should be placed near the "Top" of the North side of the magnet as per Figure 4.6-A.

INSTALLING BLANKETS



IP END **NON-IP END**

(View from "North" End of Magnet looking "South")

Figure 4.6-A

Technician(s) _____ Date 3/20/06

4.7 Remove Pipe Supports (MD-390092) and blankets. Wrap blankets in plastic bag to keep clean for later use. Label blankets as they are removed for later positioning.

Technician(s) _____ Date 3/20/06

4.8 Install Pipe Supports (MD-390092) to same locations as in step 4.4.

Technician(s) _____ Date 3/20/06

4.9 Clean the Cold Mass and the Retainer Clips (MA-390103) with Ethyl Alcohol (Fermi stock 1920-0550) and Kimwipes (Fermi stock 1660-2500) or equivalent.

Technician(s) _____ Date 3/20/06

4.10 Weld the Retainer Clips (MA-390103) to the Cold Mass Outer Shell as per Q1 Internal Piping Assembly (ME-390174).

Weldor(s) _____ Date 3/20/06

4.11 Install the Threaded Rods (Tie Rod Assembly) (MC-390638). See copy of step 10.9 (Q1 Module Assembly Traveler, TR-333754) in designated book, for the distance between the Suspension Rings. Record the previously recorded measurements below.

Non-IP North to IP North 4148 mm

Non-IP South to IP South 4149 mm

Technician(s) _____ Date 3/20/06

4.12 Install Q1 Installation Tie Rod Assembly (MC-390638) as per Q1 Cryostat Assembly - Internal Piping (ME-390174).

Technician(s) _____ Date 3/20/06

4.13 Install Tie Bar Retaining Clamps (Qty.8) (MB-390136) as per Q1 Cryostat Assembly - Internal Piping (ME-390174).

Technician(s) _____ Date 3/20/06

4.14 Clean the Heat Exchanger Outer Shell Pipe (MD-390176), Pumping Line Pipe (MB-390147), Cool Down Pipe (MB-390146) and the 4.5K Intercept Line Tubes (MB-390192) with Ethyl Alcohol (Fermi stock 1920-0550) and Kimwipes (Fermi stock 1660-2500) or equivalent.

Technician(s) _____ Date 3/21/06

4.15 Clean the Pumping Line End Flange (MB-390032), the Cool Down Line End Flange (MB-390033) and the Heat Exchanger Outer Shell Flange (MB-390031) with Ethyl Alcohol (Fermi stock 1920-0550) and Kimwipes (Fermi stock 1660-2500) or equivalent.

Technician(s) _____ Date 3/21/06

4.16 Slide the Heat Exchanger Outer Shell Pipe (ME-390176) through all five supports.

Note(s):

Ensure the cross over hole in the Heat Exchanger Pipe is lined up with the elbow on the End Dome.

Technician(s) _____ Date 3/20/06

4.17 Position the Q1 Pipe Anchor (MC-390486).

Technician(s) _____ Date 3/21/06

4.18 Position the Heat Exchanger Weld Connector Adapter (MC-390278).

Technician(s) _____ Date 3/21/06

4.19 Position the Heat Exchanger Outer Shell Pipe (ME-390176).

Technician(s) _____ Date 3/21/06

4.20 Position the Q1 Cool Down Line Weldment (MB-390193).

Technician(s) _____ Date 3/21/06

4.21 Weld the Heat Exchanger Outer Shell Flange (MB-390031) to the Heat Exchanger Outer Shell Pipe (ME-390177) as per Q1 Heat Exchanger Outer Shell Weldment (ME-390176).

Weldor(s) _____ Date 3/21/06

4.22 Weld the Cool Down Line End Flange (MB-390033) to the Q1 Cool Down Line Weldment (MB-390193) as per Q1 Cryostat Assembly Internal Piping (ME-390174).

Weldor(s) _____ Date 3/21/06

4.23 Assemble the Corrugated Tube Assembly (ME-390179).

Technician(s) _____ Date 3/31/06

4.24 Insert the Corrugated Tube Assembly (ME-390179).

Technician(s) _____ Date 3/21/06

4.25 Position Corrugated Tube Assembly (ME-390179).

Technician(s) _____ Date 3/21/06

4.26 Position the Heat Exchanger End Plate (MD-390178).

Technician(s) _____ Date 3/21/06

4.27 Purge the assembly using Argon (Ar) gas.

Technician(s) _____ Date 3/21/06

4.28 Weld the Heat Exchanger Outer Shell Pipe (ME-390177 of Q1 Heat Exchanger Assembly ME-390175) to the Heat Exchanger Weld Connector Adapter (MC-390278) as per Q1 Cryostat Assembly Internal Piping (ME-390174).

Weldor(s) _____ Date 3/22/06

4.29 Weld the IP End Dome 90° Elbow (MC-390200 of IP End Dome Weldment MD-390172) to the Heat Exchanger Weld Connector Adapter (MC-390278) as per Q1 Cryostat Assembly Internal Piping (ME-390174).

Weldor(s) _____ Date 3/22/06

4.30 Weld the Cool Down Pipe (MC-390193) to the Q1 Heat Exchanger Assembly (ME-390175) as per Q1 Cryostat Assembly Internal Piping (ME-390174).

Weldor(s) _____ Date 3/22/06

4.31 Weld the Heat Exchanger End Plate (MD-390178) to the Outer Shell Pipe (MD-390177) as per Q1 Heat Exchanger Outer Shell Weldment (ME-390176).

Boom! Weldor(s) _____ Date 3/21/06

4.32 Position the Corrugated Tube Assembly (ME-390179).

Technician(s) _____ Date _____

4.33 Weld the Corrugated Tube Assembly (ME-390179) to the Outer Tube Weldment (ME-390176) as per Q1 Heat Exchanger Assembly (ME-390175).

Weldor(s) _____ Date 3/22/06

4.34 Weld the Cool Down Pipe (MC-390193) and the Heat Exchanger Outer Shell Pipe (ME-390176) to the Q1 Pipe Anchor (MC-390486) as per Q1 Cryostat Assembly Internal Piping (ME-390174).

Weldor(s) _____ Date 3/22/06

4.35 Weld the Pipe Anchor (MC-390486) to the Cold Mass Assembly (ME-390525) as per Q1 Cryostat Assembly Internal Piping (ME-390174).

Weldor(s) _____ Date 3/22/06

4.36 Weld the Pumping Line End Flange (MB-390032) to the Corrugated Tube Assembly (ME-390175) as per Q1 Cryostat Assembly Internal Piping (ME-390174).

Weldor(s) _____ Date 3/22/06

4.37 Mark the Installation Location for the Fiducial Mounting Blocks (MB-390808) per Q1 Cold Mass Welded Assembly (ME-390526).

Technician(s) N/A Date _____

DONE IN MODULE ASSY!

4.38 Weld the Fiducial Mounting Blocks (MB-390808) per Q1 Cold Mass Welded Assembly (ME-390526).

Weldor(s) N/A Date _____

4.39 Prepare Cold Mass Assembly for Pressure Test at 363 psi.

Technician(s) _____ Date 3/22/06

STOP

4.40 Verify Cold Mass Assembly is ready for Pressure Test at 363 psi.

Responsible Authority/Physicist _____ Date 3/22/06

STOP

4.41 Perform a Pressure Test of the Cold Mass Assembly at 363 psi Nitrogen per Section 5034 of the Fermilab ES&H Manual and UG-100 of the Code.

Warning:

The test is to be performed after normal working hours and only personnel directly involved with the test will be present.

Responsible Authority/Physicist T. Pm Date 3/22/06

4.42 Remove Pressure Test Fitting from Corrugated Tube Assembly (ME-390179).

Technician(s) _____ Date 3/23/06

4.43 Insert the Q1 Pumping Line Assembly (MB-390182).

Technician(s) _____ Date 3/23/06

4.44 Insert 4.5k Intercept Line Pipes (MB-390192) as per Q1 Heat Exchanger Assembly (ME-390175).

Technician(s) _____ Date 3/23/06

4.45 Weld the Pumping Line End Flange (MB-390032) to the Q1 Pumping Line Assembly (MB-390182) as per Q1 Cryostat Assembly Internal Piping (ME-390174).

Weldor(s) _____ Date 3/23/06

4.46 Position the Q1 Pumping Line Assembly (MB-390182).

Technician(s) _____ Date 3/23/06

4.47 Position the Q1 Pumping Line Return Fitting (MC-390184).

Technician(s) _____ Date 3/23/06

4.48 Position the Q1 IP End Collection Pot Weldment (MD-390185).

Technician(s) _____ Date _____

4.49 Tack weld the Q1 Pumping Line Return Fitting (MC-390184) and the Q1 IP End Collection Pot Weldment (MD-390185) in place.

Weldor(s) _____ Date 3/23/06

4.50 Purge the Cold Mass Assembly, using Argon, including the 4.5k Intercept Line Pipes (MB-390192).

Technician(s) _____ Date 3/23/06

4.51 Weld the Q1 Pumping Line Return Fitting (MC-390184) to the Q1 Heat Exchanger Assembly (ME-390175) as per Q1 Cryostat Assembly Internal Piping (ME-390174).

Weldor(s) _____ Date 3/23/06

4.52 Weld the Q1 IP End Collection Pot Weldment (MD-390185) to Q1 Pumping Line Pipe (MB-390183) as per Q1 Pumping Line Assembly (ME-390182)

Weldor(s) _____ Date 3/26/06

4.53 Record the Serial Numbers and locations of the RTD's in the table below.

Top Set - Top Thermometer: CX_LS_X14579

Top Set - Botttom Thermometer: CX_LS_X15161

Botttom Set - Top Thermometer: CX_LS_X14537

Botttom Set - Botttom Thermometer: CX_LS_X15162

Technician(s) _____ Date 4-4-06

STOP

Crew Chief _____ Date 4/4/06

4.54 Weld the Q1 Pumping Line Assembly (ME-390182) to the Q1 Pipe Anchor (MC-390486) as per Q1 Cryostat Assembly Internal Piping (ME-390174).

Weldor(s) _____ Date 3/23/06

4.55 Ensuring that the 4.5k Intercept Line Pipes (MB-390192) have been purged, weld the Intercept Line Pipe Stops (MA-390379) as per Q1 Cryostat Assembly Internal Piping (ME-390174).

Weldor(s) _____ Date 3/23/06

4.56 Prepare the Power Leads and corrector bus to be cut by measuring and marking the appropriate cutoff location as per Q1 Module Assembly (ME-369894). Remove any Kapton insulation from the end of the lead to approximately 4 inches beyond the cutoff mark. Clamp the Leads, individually, using the "Lead Clamp Block Tooling".

Technician(s) _____ Date 4-4-06

4.57 Verify the mark has been placed at the appropriate cutoff location as per Q1 Module Assembly (ME-369894).

STOP

Responsible Authority/Physicist — Date: 4/4/06

STOP

4.58 **IN THE PRESENCE OF THE RESPONSIBLE AUTHORITY**, cut the Power Leads and the corrector bus at the appropriate cutoff location (mark) as per Q1 Module Assembly (ME-369894).

Technician(s) — Date: 4.4.06

STOP

Responsible Authority/Physicist — Date: 4/4/06

4.59 Fuse the Ends of the Leads.

Weldor(s) — Date: 4/4/06

4.60 Remove Clamps when fusing is complete and it is safe to do so.

Technician(s) — Date: 4.4.06

4.61 Prepare Cold Mass Assembly for Pressure Test at 75 psi.

Technician(s) _____ Date 3/23/06

STOP

4.62 Verify Cold Mass Assembly is ready for Pressure Test at 75 psi.

Responsible Authority/Physicist _____ Date 3/24/06

STOP

4.63 Perform a Pressure test of the Cold Mass Assembly at 75 psi Nitrogen per Section 5034 of the Fermilab ES&H Manual and UG-100 of the Code.

Responsible Authority/Physicist _____ Date 3/24/06

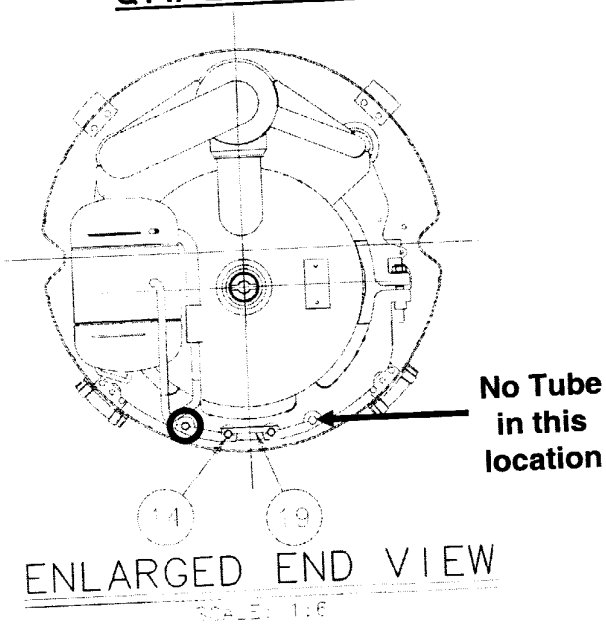
4.64 Leak Check the Cold Mass Assembly. (This will include the Outer Shell Pipe (MD-390177)).

Part No.	DETERMINATION OF DETECTABLE LEAK						
	M.D.S. ÷ ((Response – Background) ÷ Leak value) = MDL						
OPERATOR'S LAST NAME	SCALE UNITS BEFORE HELIUM PROBE	SCALE UNITS WHILE ENCLOSURE FLOODING	MDS	Response	Background	Leak Value	MDL
SDL	20x1	20x1	2	68x5	2x1	3.9 x E-8	2.8 x E10

Technician(s) _____ Date 3-27-06

4.65 Leak Check the three Q1 4.5k Intercept Lines (MB-390226).

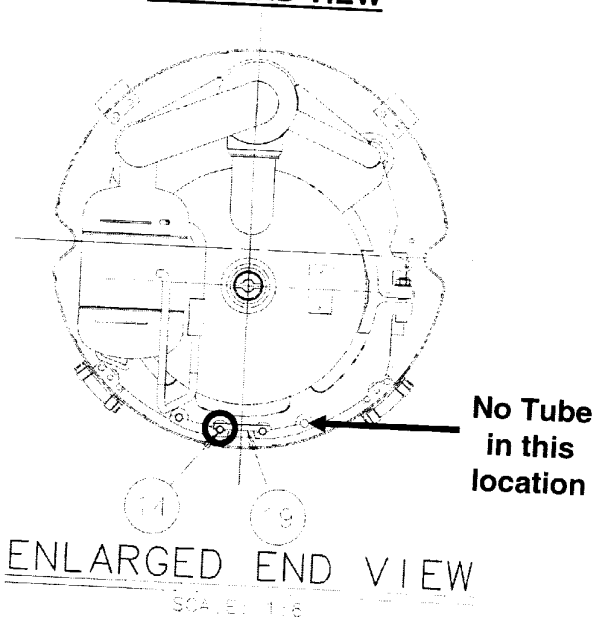
Q1 IP END VIEW



4.5k Intercept Line - #1

Part No.	DETERMINATION OF DETECTABLE LEAK						
	M.D.S. ÷ ((Response – Background) ÷ Leak value) = MDL						
OPERATOR'S LAST NAME	SCALE UNITS BEFORE HELIUM PROBE	SCALE UNITS WHILE ENCLOSURE FLOODING	MDS	Response	Background	Leak Value	MDL
SZAL	20X1	20X1	2	70x5	20x1	3.9 x E-8	2.36 x E-10

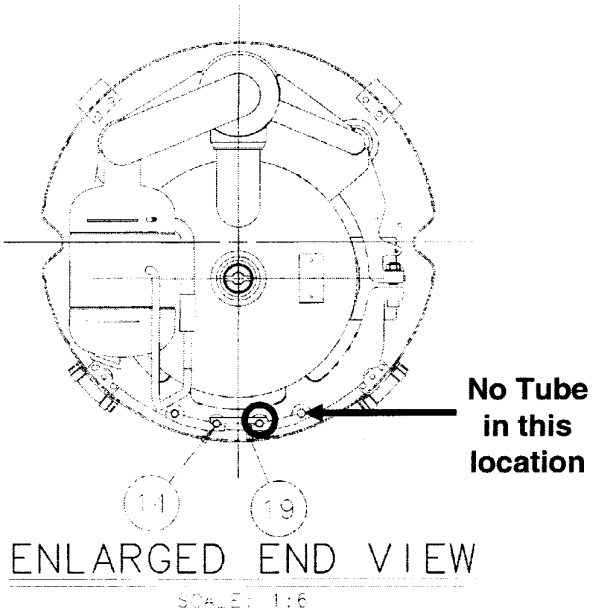
Q1 IP END VIEW



4.5k Intercept Line - #2

Part No.	DETERMINATION OF DETECTABLE LEAK						
	M.D.S. ÷ ((Response – Background) ÷ Leak value) = MDL						
OPERATOR'S LAST NAME	SCALE UNITS BEFORE HELIUM PROBE	SCALE UNITS WHILE ENCLOSURE FLOODING	MDS	Response	Background	Leak Value	MDL
[illegible]	20x1	20x1	2	70x5	20x1	3.91 x E -8	2.36 x E -10

Q1 IP END VIEW



4.5k Intercept Line - #3

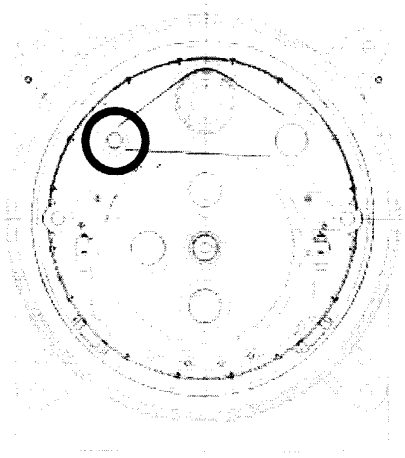
Part No.	DETERMINATION OF DETECTABLE LEAK						
	M.D.S. ÷ ((Response – Background) ÷ Leak value) = MDL						
OPERATOR'S LAST NAME	SCALE UNITS BEFORE HELIUM PROBE	SCALE UNITS WHILE ENCLOSURE FLOODING	MDS	Response	Background	Leak Value	MDL
[illegible]	20x1	20x1	2	70x5	20x1	3.91 x E-8	2.36 x E-10

[illegible]
Inspector

3-27-06
Date

4.66 Leak Check the Cooldown Line (MD-390193).

Q1 NON-IP END VIEW



Cooldown Line (MD-390193)

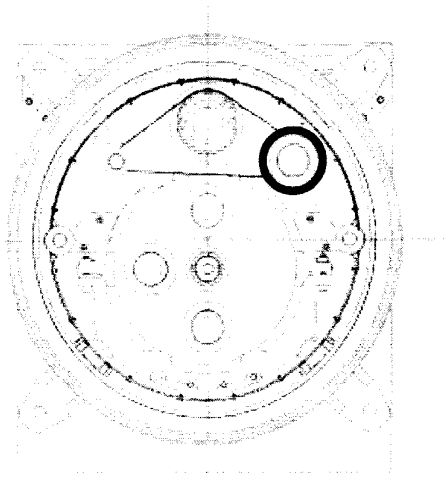
Part No.	DETERMINATION OF DETECTABLE LEAK						
_____	M.D.S. ÷ ((Response – Background) ÷ Leak value) = MDL						
OPERATOR'S LAST NAME	SCALE UNITS BEFORE HELIUM PROBE	SCALE UNITS WHILE ENCLOSURE FLOODING	MDS	Response	Background	Leak Value	MDL
						____ x E $^{-8}$	____ x E $^{-}$ ___

N/A

Technician(s) _____ Date _____

4.67 Leak Check the Pumping Line (MB-390182).

Q1 NON-IP END VIEW



Pumping Line (MB-390182)

Part No.	DETERMINATION OF DETECTABLE LEAK						
_____	M.D.S. ÷ ((Response – Background) ÷ Leak value) = MDL						
OPERATOR'S LAST NAME	SCALE UNITS BEFORE HELIUM PROBE	SCALE UNITS WHILE ENCLOSURE FLOODING	MDS	Response	Background	Leak Value	MDL
						____ x E $^{-8}$	____ x E $^{-}$ ___

N/A

Technician(s) _____ Date _____

NOTE: STEP 4.66 + 4.67 IS PART OF COLD MASS ASSEMBLY.

5.0 Shield Assembly

5.1 Install the Cold Mass Insulation Mounting Lug Covers (MC-390496).

Technician(s) _____ Date 3-28-06

5.2 Lift the Cold Mass Assembly and place the IP End (ME-390433) and Non-IP End Shield Sections (ME-390434) on the Insertion Rails. Lower the Cold Mass back onto the rails ensuring the holes in the Shield Sections line up with Support Rollers.

Technician(s) _____ Date 3-28-06

5.3 Insert the Q1 Thermal Shield Mid Section (Middle Shield Section) (ME-390435) and the Support Bands (MD-390083).

Technician(s) _____ Date 3-28-06

5.4 Assemble the bottom half of the shield. Leave all bolts loose. Spray all screw threads with Molybdenum.

Technician(s) _____ Date 3-28-06

5.5 Assemble the Cooling Tubes (MD-390431) to the Bottom Half of the Shield, leaving all screws loose.

Technician(s) _____ Date 3-28-06

5.6 Tighten all screws on Bottom Half of the Shield. (Screws on Bottom Half of Shield will be inaccessible after blankets are installed.)

Technician(s) _____ Date 3-28-06

5.7 Lift the Cold Mass and place the Shield Inner and Outer MLI Blankets (ME-390487 & ME-390488) onto the Insertion Rails in the correct orientation.

Note(s):
Place the Outer Blanket (ME-390488) on the Rails first.

Technician(s) _____ Date 3-29-06

5.8 Lower the Cold Mass onto the rails. Ensure the slits in the blankets line up with Support Rollers.

Technician(s) _____ Date 3-29-06

5.9 Install the Cold Mass MLI Blankets per (ME-390524) and in the same position as Step 4.6.

Technician(s) _____ Date 3-29-06

5.10 Cut and install the pipe MLI blankets per Q1 Piping Insulation (ME-390541).

Technician(s) _____ Date 5-31-06

5.11 Install the IP and Non-IP End Shields per Q1 Thermal Shield Assembly (ME-390429). Spray all screw threads with Molybdenum. Leave screws loose.

Technician(s) _____ Date 3-31-06

5.12 Install the Q1 Center Section (Shield) (ME-390435). Leave all screws loose.

Technician(s) _____ Date 3-31-06

5.13 Tighten all Shield Screws (MA-393028).

Technician(s) _____ Date 3-31-06

5.14 Install the Shield Blankets (ME-390487 & ME-390488).

Technician(s) _____ Date 3-31-06

5.15 Tie Kevlar string around blankets on each side of Suspension Ring Wheels at all locations.

Technician(s) _____ Date 3-31-06

6.0 Cold Mass Insertion into the Vacuum Vessel

6.1 Install Pig Steel Repair Putty, or equivalent, between the Vacuum Vessel and the Insertion Rails.

Technician(s) _____ Date 4-1-06

6.2 Install the Cold Mass Pull-in Tooling.

Technician(s) _____ Date 4/1/06

6.3 Mount the Pneumatic Winch to floor on the West side of the Vacuum Vessel.

Technician(s) _____ Date 4/1/06

6.4 Connect the cable to the Pull-in Tooling.

Technician(s) _____ Date 4/1/06

6.5 Pull the Cold Mass Assembly into the Vacuum Vessel.

Technician(s) _____ Date 4/1/06

6.6 When the Cold Mass is fully inserted, install the "Top" Suspension System Adjusting Screws (MB-390039) and the "Bottom" (C936 Bearing Bronze) Suspension System Adjusting Screws (MB-390878).

[redacted]

Technician(s) _____ Date 4-1-06

6.7 Using Lower Suspension System Adjusting Screws, raise Cold Mass two (2) full turns.

Technician(s) _____ Date 4-1-06

6.8 Ensure Cold Mass has been adjusted in the Vacuum Vessel and that all eight (8) Adjusting Screw Holes are aligned with threaded holes of Suspension System.

Crew Chief _____ Date 4/1/06

6.9 Install Target Holders (Right, MD-390539), (Left, MD-390540) and (MD-390211) as per Q1 Cryostat General Assembly (ME-390127).

Technician(s) _____ Date 3/16/06

6.10 Install Reference Socket Cup (MA-390426) as per Q1 Cryostat General Assembly (ME-390127).

Technician(s) _____ Date 3/16/06

6.11 Install the Support Bracket Assemblies (Qty. 4) (MD-390783) as per Q1 Thermal Shield Assembly (ME-390429).

Technician(s) _____ Date 4/3/06

6.12 Install Q1 Thermal Shield Cooling Pipe Crossover (MD-390466) to Q1 Thermal Shield Cooling Tube Weldment (MD-390431).

Technician(s) _____ Date 4/3/06

6.13 Mark the position that the Thermal Strap Crossover Pad (MC-390792) will be welded to the Thermal Shield Cooling Pipe Crossover (MD-390466).

Note(s):

Ensure that there will be <u>NO INTERFERENCE</u> between the Thermal Strap Crossover Pad (MC-390792) and the Collection Pot Weldment (MD-390185).

Technician(s) _____ Date 4/3/06

6.14 Weld the Cooling Pipe Crossover (MD-390466) Connectors (MA-390467) to the Cooling Tube Weldment (MD-390431) as per Q1 Thermal Shield Assembly (ME-390429).

Weldor(s) _____ Date 4/3/06

6.15 Leak Check the Q1 Thermal Shield Cooling Pipe Crossover (MD-390466) to the Q1 Thermal Shield Cooling Tube Weldment (MD-390431) per ES-107240 and record results in table below.

Part No.	DETERMINATION OF DETECTABLE LEAK						
_____	M.D.S. ÷ ((Response – Background) ÷ Leak value) = MDL						
OPERATOR'S LAST NAME	SCALE UNITS BEFORE HELIUM PROBE	SCALE UNITS WHILE ENCLOSURE FLOODING	MDS	Response	Background	Leak Value	MDL
GDW	4001	4001	2	4005	4001	3.91 x E^{-8}	2.4 x E^{-10}

D. GDW
Inspector

4-3-2006
Date

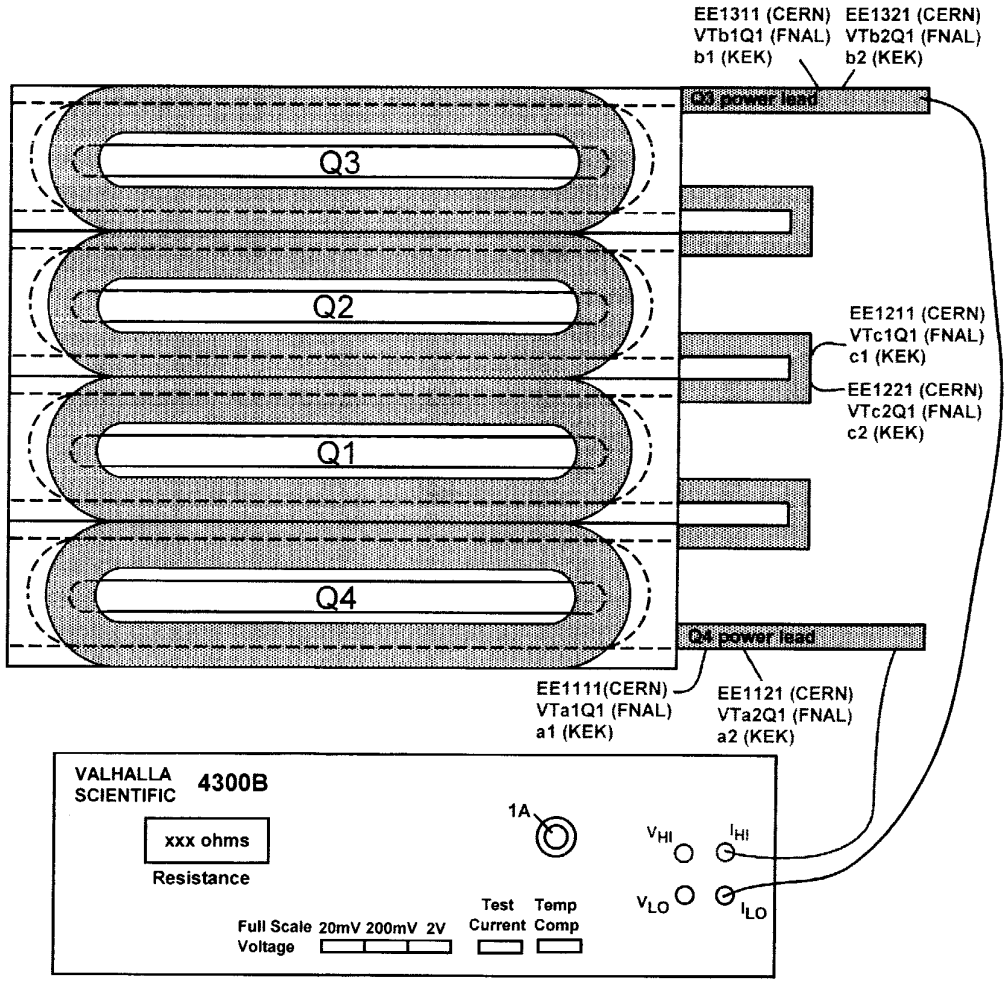
7.0 Final Electrical Inspection

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

To measure the Resistance of a Q1 Cold Mass:

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

Q1 Cold Mass Electrical Measurements



7.1 Measure the Resistance of the Q1 Cold Mass.

(Q1) Resistance				Nominal 3.35 to 3.45 Ω
				Total Resistance
Connect	Fermi	CERN	KEK	
V_{HI}	VTa1Q1	EE1111	a1	3.42 Ω
V_{LO}	VTc1Q1	EE1211	c1	
V_{HI}	VTc1Q1	EE1211	c1	3.42 Ω
V_{LO}	VTb1Q1	EE1311	b1	

				Total Resistance with Leads
				Nominal 6.75 to 6.85 Ω
V_{HI}	VTa1Q1	EE1111	a1	6.83 Ω
V_{LO}	VTb1Q1	EE1311	b1	
V_{HI}	Q4 Power Lead			6.84 Ω
V_{LO}	Q3 Power Lead			

Technician(s) Date 4-4-06

7.2 Measure the resistance of Redundant Voltage Taps.

Q1 Redundant Voltage Taps				Nominal 3.35 to 3.45 Ω
Connect	Fermi	CERN	KEK	Resistance
V_{HI}	VTa2Q1	EE1121	a2	3.41 Ω
V_{LO}	VTc2Q1	EE1221	c2	
V_{HI}	VTc2Q1	EE1221	c2	3.42 Ω
V_{LO}	VTb2Q1	EE1321	b2	

Technician(s) Date 4-4-06

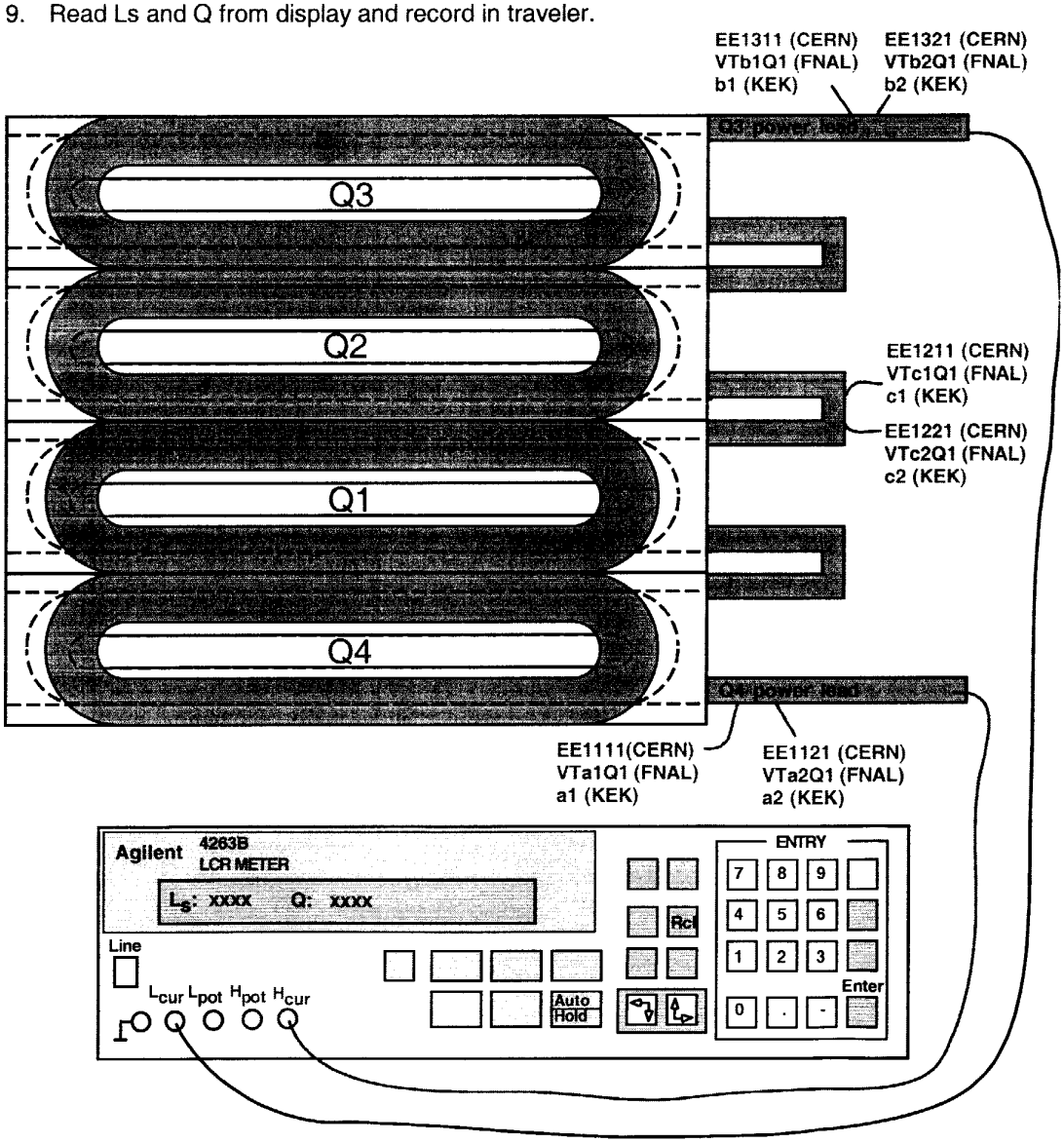
To measure Ls and Q of a Q1 Cold Mass:

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

To measure Q1:

- To measure Quadrants 1&4, connect H_{pot} to VTa1 (EE1111 for Q1), and L_{pot} to VTc1 (EE1211 for Q1).
- To measure Quadrants 2&3, connect H_{pot} to VTc1 (EE1211 for Q1), and L_{pot} to VTb1 (EE1311 for Q1).
- To measure total, connect H_{pot} to VTa1 (EE1111 for Q1), and L_{pot} to VTb1 (EE1311 for Q1).

9. Read Ls and Q from display and record in traveler.



7.3 Measure the Inductance (Ls) of a Q1 Cold Mass.

(Q1) Inductance				Nominal 15 to 16 mH
				Total Inductance
Connect	Fermi	CERN	KEK	
H_{POT}	VTa1Q1	EE1111	a1	15,532 mH
L_{POT}	VTc1Q1	EE1211	c1	
H_{POT}	VTc1Q1	EE1211	c1	15,434 mH
L_{POT}	VTb1Q1	EE1311	b1	

				Nominal 30 to 32 mH
				Total Inductance
H_{POT}	VTa1Q1	EE1111	a1	30.577 mH
L_{POT}	VTb1Q1	EE1311	b1	

Technician(s) 4-4-06 Date

7.4 Measure the Q-Factor (Q) of a Q1 Cold Mass.

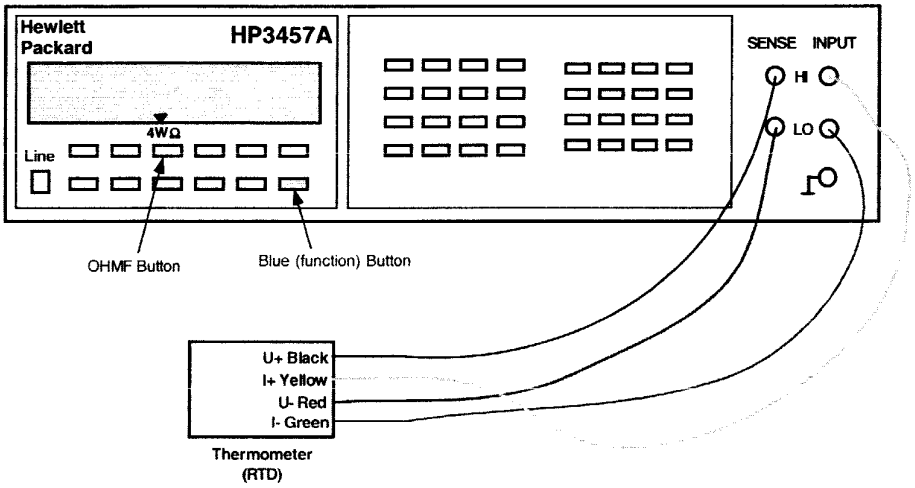
(Q1) Q-Factor				Nominal 1.0 to 1.2
				Total Q
Connect	Fermi	CERN	KEK	
H_{POT}	VTa1Q1	EE1111	a1	1.1
L_{POT}	VTc1Q1	EE1211	c1	
H_{POT}	VTc1Q1	EE1211	c1	1.1
L_{POT}	VTb1Q1	EE1311	b1	

				Nominal 1.0 to 1.2
				Total Q
H_{POT}	VTa1Q1	EE1111	a1	1.2
L_{POT}	VTb1Q1	EE1311	b1	

Technician(s) 4-4-06 Date

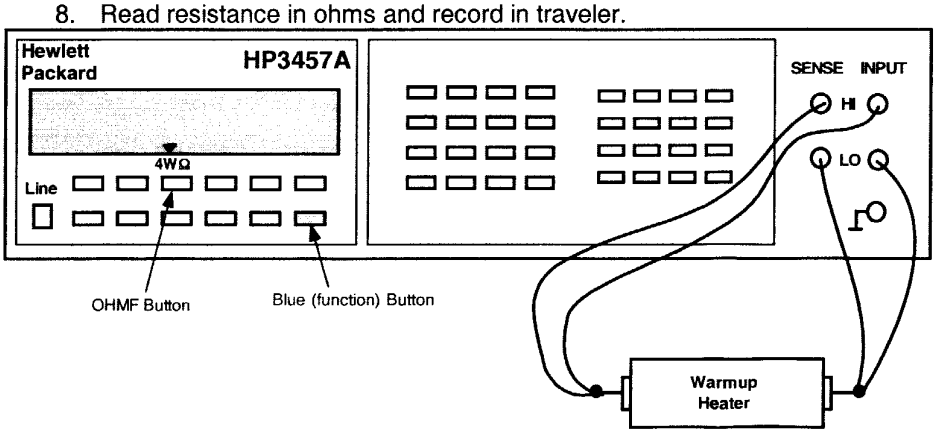
To measure the resistance of a Thermometer (RTD):

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



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

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



7.5 Measure the resistance of the RTD's and Cryogenic (Warm-up) Heaters. Record MFR Resistance (Expedition) for RTD's.

Q1 - RTD's and Cryogenic (warm-up) Heaters					
Temperature of Building (± 5°): 70					
Component	**Fermi**	**CERN**	**Range**	**Resistance**	**Mfr. Resistance (Expedition)**
Q1 RTD, primary	TaQ1	TT8311	**60 to 70Ω**	63.30 Ω	61.30 Ω
Q1 RTD, redundant	TbQ1	TT8321	**60 to 70Ω**	65.27 Ω	63.20 Ω
Q1 Cryogenic (warm-up) Heater (LE) - wire at top (CERN #1 I+)	W1aQ1	EH8311+	**16 to 18.5Ω**	17.54 Ω	
Q1 Cryogenic (warm-up) Heater (LE) - wire at bottom (CERN #1 I-)	W2aQ1	EH8311-			
Q1 Cryogenic (warm-up) Heater (Non-LE) - wire at top (CERN #2 I+)	W1bQ1	EH8321+	**16 to 18.5Ω**	17.72 Ω	
Q1 Cryogenic (warm-up) Heater (Non-LE) - wire at bottom (CERN #2 I-)	W2bQ1	EH8321-			

Technician(s) 4-4-06 Date

7.6 Using the Hewlett Packard HP3457A digital multimeter, measure the Protection (Strip) Heater Resistance for Q1.

Q1 Protection (Strip) Heater Resistance					
Fermi	**CERN**	**KEK**	**Description**	**Limit**	**Resistance**
H1aQ1	**YT1111+**	**HA1**	**Circuit A**	**28 to 32 Ω**	29.8 Ω
H2aQ1	**YT1111-**	**HA2**			
H1bQ1	**YT1121+**	**HB1**	**Circuit B**	**28 to 32 Ω**	30.1 Ω
H2bQ1	**YT1121-**	**HB2**			

Technician(s) 4-4-06 Date

7.7 Using the HP4284A, connect power thru the corrector Power Leads (H1B and H1A to measure Q1-H1 or V1B and V1A to measure Q1-V1). Connect the Sense Leads as shown in table below and record resistance.

Corrector Bus Leads

	V1A	V1B	H1A	H1B

(View Looking into Q1)

Readout Labels		Power Labels	Resistance	Nominal Resistance
V1A	EE8111	V1A, V1B	.01 Ω	< 5 Ω
EE8111	V1B		17.36 Ω	17 - 20 Ω
V1A	V1B		17.57 Ω	17 - 20 Ω
H1A	EE8121	H1A, H1B	.01 Ω	< 5 Ω
EE8121	H1B		21.28 Ω	20 - 23 Ω
H1A	H1B		21.29 Ω	20 - 23 Ω

Technician(s) _____ Date 4-4-06

8.0 Final Preparations

8.1 Perform a Final Stretched Wire measurement.

Responsible Authority/Physicist — Date: 4/17/06

8.2 Perform a Final Cryostat Pipe Survey measurement.

Responsible Authority/Physicist — Date: 4/17/06

8.3 Install Conflat Flanges (MA-390374) w/ Copper Gaskets (MA-390375) and Bolt Set (MA-390376) to Cryostat as per Q1 Cryostat General Assembly (ME-390127).

Technician(s) — Date: 4/11/06

8.4 Perform a pressurized Helium Leak Check of the Cryostat Assembly.

Part No.	DETERMINATION OF DETECTABLE LEAK						
	M.D.S. ÷ ((Response – Background) ÷ Leak value) = MDL						
OPERATOR'S LAST NAME	SCALE UNITS BEFORE HELIUM PROBE	SCALE UNITS WHILE ENCLOSURE FLOODING	MDS	Response	Background	Leak Value	MDL
SZAL	20x1	20x1	2	8x5	20x1	3.91 x E-8	2.06 x E-10

Inspector — Date: 4-22-06

8.5 Ensure all Pipe Supports are in place.

Responsible Authority/Physicist — Date: 4-22-06

9.0 Production Complete

9.1 Process Engineering verify that the LHC Cryostat Assembly Traveler (5520-TR-333755) 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:

_____

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Process Engineering/Designee

3/26/07
Date

TD - Engineering Fabrication Component Kit List

Process Engineering

Component Serial No.	LQXA09	
Kit submitted by:	Bob Jensen	3173
Fermi ID No.	315	
Date submitted:	20-Feb-06	
Need date:	22-Feb-06	
Deliver to:	ICB	
Use with Traveler No.	333755	
Job No.	248	
M&S task number:	300	1.1.1.3.4
Drawing Title:	Q1 CRYOSTAT GENERAL ASSEMBLY	
Drawing No.	ME-390127	Rev. H
Drawing Title:	Q1 CRYOSTAT ASSEMBLY - INTERNAL PIPING	
Drawing No.	ME-390174	Rev. D
Drawing Title:	*Q1 SUSPENSION SYSTEM INSTALLATION*	
Drawing No.	*ME-390525*	*Rev. A*

Material Control

Parts available

Verified by:	M. Schmidt
Fermi ID No.	04223N
Date submitted to stockroom:	20-Feb-06

Parts issued

Issued by:	
Fermi ID No.	12648
Date issued:	3/2/06
Parts received by E&F:	Bob Jenson
Fermi ID No.	0315
Date received by E&F:	3/2/06

	Description	Dwg Size	Number	Rev	Unit	Quantity Required	Location	Quantity Issued	E&F Verified	Routing Form Number	Spares Number / Comment
1	ADJUSTING SCREW	MB	390039	C	EA	4	21A4	4	✓	83432	9 pcs.
2	VACUUM VESSEL ASSEMBLY	ME	390122	E		ICB HAS	[redacted]				
3	TARGET HOLDER	MD	390211	B	EA	4	R10,1,1	4	✓	84258	6 pcs. / 4 pcs. - In QC
4	Blank Non-Rotatable Conflat Flange, 4.62" OD 304 SS	MA	390374	*	EA	8	R8,3,4	5	✓	78987	5 pcs. / 2 pcs. ICB
5	COPPER GASKET	MA	390375	*	EA	8	22A2	8	✓	84007	17 pcs.
6	BOLT SET, HEX HEAD, 5/16 - 24 x 1.25 w/ WASHER	MA	390376	*	EA	80	22A3	80	✓	84245	87 pcs.
7	WASHER .656" ID x 1.38" OD x .13" THK, STN STEEL	MA	390377	*	EA	8	22A3				APR
8	REFERENCE SOCKET CUP (Furnished by CERN)	MA	390426	*	EA	8	R1,3,5	8	✓	77884	16 pcs.

TD - Engineering Fabric..ion Component Kit List

	Description	Dwg Size	Number	Rev	Unit	Quantity Required	Location	Quantity Issued	E&F Verified	Routing Form Number	Spares Number / Comment
9	VINYL FLANGE COVER FOR 75 MM FLANGE	MA	390491	*	EA	1	22A6	1	✓	78835	170 pcs.
10	VINYL FLANGE COVER FOR 114 MM FLANGE	MA	390492	*	EA	3	22A7	3	✓	78836	161 pcs.
11	VINYL FLANGE COVER FOR 134 MM FLANGE	MA	390493	*	EA	4	22A7	4	✓	78837	201 pcs.
12	VINYL FLANGE COVER FOR 201 MM FLANGE	MA	390494	*	EA	1	22A8	1	✓	78834	68 pcs.
13	ALIGNMENT FIDUCIAL COVER	MA	390495	*	EA	8	22A8	8	✓	78957	98 pcs.
14	TARGET HOLDER, RIGHT	MD	390539	*	EA	2	R8,1,2	2	✓	79556	3 pcs.
15	TARGET HOLDER, LEFT	MD	390540	*	EA	2	R8,1,4	2	✓	79555	3 pcs.
16	Q1 NON-IP END ALIGNMENT FIDUCIAL SPACER	MD	390643	*	EA	2	R1,2,4	2	✓	80333	2 pcs.
17	Q1 IP END PRESSURE TAP COIL ASSEMBLY	ME	390716	B	EA	1	M13,2	1	✓	81722	1 pc.
18	Q1 IP END PRESSURE TAP COIL CLAMP ASSEMBLY	MC	390717	*	EA	1	R2,2,2	1	✓	81315	1 pc.
19	Q1 VACUUM VESSEL HELIUM GUARD MOUNTING PLATE	MD	390724	*	EA	1	R7,1,3	1	✓	81256	1 pc.
20	Q1 IP END THERMAL STRAP CROSSOVER PAD	MC	390792	*	EA	2	R2,2,3	2	✓	81954	2 pcs.
21	Q1 IP END LOW POWER THERMAL STRAP	MC	390794	*	EA	1	R2,3,3	1	✓	82130	2 pcs.
22	Q1 IP END HIGH POWER THERMAL STRAP	MC	390795	*	EA	1	R2,3,3	1	✓	82131	2 pcs.
23	Q1 IP END THERMAL STRAP LOW POWER HEATER TAB ASSEMBLY	MD	390799	*	EA	1	R2,3,3	1	✓	82096	2 pcs.
24	Q1 IP END THERMAL STRAP HIGH POWER HEATER TAB ASSEMBLY	MD	390801	*	EA	1	R2,3,3	1	✓	82097	2 pcs.
25	FIDUCIAL MOUNTING BLOCK (On Q1 Welded Assembly ME-390526)	MB	390808	*	EA	2	R1,1,3	2	✓	82260	0
26	ADJUSTING SCREW - VERSION 2 (BRONZE)	MC	390878	*	EA	4	R7,1,2	4	✓	84271	2 pcs. / 6 pcs. In QC

TD - Engineering Fabri..ion Component Kit List

	Description	Dwg Size	Number	Rev	Unit	Quantity Required	Location	Quantity Issued	E&F Verified	Routing Form Number	Spares Number / Comment
27	M5 LOCK WASHER	MA	393056	*	EA	16	23A1	16	✓	83627	65 pcs.
28	M5 FLAT WASHER	MA	393057	*	EA	16	23A1	16	✓	81493	89 pcs.
29	M4 FLAT WASHER, 18-8 S.S.	MA	393181	*	EA	16	23B3	16	✓	81827	46 pcs.
30	M4 LOCK WASHER, 18-8 S.S.	MA	393308	*	EA	16	23D6	16	✓	81225	124 pcs.
31	M4 - .7 x 20mm LG STD. ISO SOCKET HEAD CAP SCREW, 18-8 STN STEEL	MA	393307	*	EA	8	23D5	8	✓	83823	102 pcs.
32	STD ISO HEX NUT M5 - .8 18-8 S.S.	MA	393310	*	EA	16	23D7	16	✓	83628	113 pcs.
33	CERN CRYOGENIC THERMOMETER TYPE LT	MA	393368	*	EA	4	ICB Has				
34	M4 - .7 -6H STD. ISO HEX NUT, 18-8 STN STEEL	MA	393369	*	EA	8	21A8	8	✓	82866	72 pcs.
35	M5 - .8 x 25mm LG STD. ISO HEX SOCKET HEAD CAP SCREW, 18-8 STN STEEL	MA	393392	*	EA	8	24B5	8	✓	83000	44 pcs.
36	M5 - .8 x 30mm LG STD. ISO HEX HEAD CAP SCREW, 18-8 STN STEEL	MA	393398	*	EA	8	24B6	8	✓	83001	73 pcs.
37	M8 x 25.0mm LG SHCS, 18-8 STN STEEL	MA	393018	*	EA	8	22B8	8	✓	76747	86 pcs.
38	M8 x 45.0mm LG SHCS, 18-8 STN STEEL	MA	393019	*	EA	8	22C3	8	✓	82999	219 pcs.
39	M16-2 x 70.0 mm LG HEX SHCS, 18-8 STN STEEL	MA	393021	*	EA	8	22C4	8	✓	77840	38 pcs.
40	M8 HEX NUT, 18-8 STN STEEL	MA	393023	*	EA	16	22C5	16	✓	83659	319 pcs.
41	M6 FLAT WASHER, 18-8 STN STEEL	MA	393024	*	EA	32	22C5	22	✓	78891	20 pcs. / 6 pcs. ICB
42	M8 FLAT WASHER, 18-8 STN STEEL	MA	393025	*	EA	16	22C6	16	✓	82858	302 pcs.
43	M8 LOCK WASHER, 18-8 STN STEEL	MA	393027	*	EA	16	22C7	16	✓	76744	495 pcs.
44	M10-1.5 x 25mm LG HEX SHCS 18-8 STN STEEL	MA	393036	*	EA	24	22D3	24	✓	77899	22 pcs.

TD - Engineering Fabric ion Component Kit List

	Description	Dwg Size	Number	Rev	Unit	Quantity Required	Location	Quantity Issued	E&F Verified	Routing Form Number	Spares Number / Comment
45	M6-1.0 x 35mm LG HEX SHCS 18-8 STN STEEL	MA	393045	*	EA	16	22D5	16	✓	78886	38 pcs.
46	M10-1.5 x 40mm LG HEX SHCS 18-8 STN STEEL	MA	393342	*	EA	6	24A6	6	✓	81782	62 pcs.
47	M8 x 30mm LG HEX SPRING PIN 18-8 STN STEEL	MA	393048	*	EA	8	22D7	8	✓	78887	12 pcs.
48	M10 LOCK WASHER, 18-8 STN STEEL	MA	393220	*	EA	24	23B5	24	✓	80024	152 pcs.
49	STD. SPRING PIN SLOTTED M4 x 20mm LG. PLAIN STEEL	MA	393360	E	EA	16	R2,2,3	16	✓	83975	86 pcs.
Q1 IP END 4.5K INTERCEPT HEATER/THERMOMETER ASSEMBLY		ME	390823	*	EA	1	[redacted]				Moved to Q1-IP Interconnect Kit - Installed at CERN
50	Q1 IP END 4.5K INTERCEPT CC SUPPLY TUBE FITTING	MD	390805	A	EA	1	[redacted]				
51	Q1 IP END 4.5K INTERCEPT CC SUPPLY TUBE ADAPTER	MB	390813	*	EA	1	[redacted]				
52	Q1 IP END 4.5K INTERCEPT CC SUPPLY BEAM SCREEN COOLING FLEX-HOSE	MB	390814	B	EA	1	[redacted]				
53	Q1 IP END CERN HEAT-THERMOMETER ASSEMBLY	MD	390815	*	EA	1	[redacted]				
54	TRULY TUBULAR FEMALE UNION FOR .625 O.D. TUBE	MA	393402	*	EA	1	[redacted]				
FIXED SUPPORT ASSEMBLY		ME	390041	D	EA	1	[redacted]				
55	SUSPENSION SYSTEM SUPPORT RING ASSEMBLY	ME	390043	B	EA	1	NT02409	1	✓	83964	2 pcs.
56	SUSPENSION SYSTEM SUPPORT PIN	MB	390047	B	EA	2	R8,2,1	2	✓	76914	12 pcs.
57	SUSPENSION SYSTEM SUPPORT PIN SHIM - 1mm	MA	390275	A	EA	8	21D1	8	✓	83795	277 pcs.
58	SUSPENSION SYSTEM SUPPORT PIN SHIM - 0.5mm	MA	390276	*	EA	8	21D1	8	✓	82896	200 pcs.
59	SUSPENSION SYSTEM SUPPORT PIN BOLTS	MA	390277	*	EA	8	21D1	8	✓	76913	42 pcs.
60	TWO PIECE CLAMP ON COLLAR	MA	390321	A	EA	4	22A1	4	✓	76912	4 pcs.

TD - Engineering Fabri .ion Component Kit List

	Description	Dwg Size	Number	Rev	Unit	Quantity Required	Location	Quantity Issued	E&F Verified	Routing Form Number	Spares Number / Comment
61	SUSPENSION SYSTEM SUPPORT PIN SHIM 0.13 mm	MA	390480	*	EA	8	R2,2,4	8	✓	79121	267 pcs.
62	SUSPENSION SYSTEM SUPPORT SHIM 0.25 mm	MA	390481	*	EA	12	R2,2,4	12	✓	79122	337 pcs.
SLIDING SUPPORT ASSEMBLY		ME	390042	C	EA	1					
63	SUSPENSION SYSTEM SUPPORT RING ASSEMBLY	ME	390043	B	EA	1	ICB Has				
64	SUSPENSION SYSTEM SUPPORT PIN	MB	390047	B	EA	2	R8,2,1	2	✓	76914	12 pcs.
65	SUSPENSION SYSTEM SUPPORT PIN SHIM - 1mm	MA	390275	A	EA	8	21D1	8	✓	83275	277 pcs.
66	SUSPENSION SYSTEM SUPPORT PIN SHIM - 0.5mm	MA	390276	*	EA	8	21D1	8	✓	82896	200 pcs.
67	SUSPENSION SYSTEM SUPPORT PIN BOLTS	MA	390277	*	EA	8	21D1	8	✓	76913	42 pcs.
68	SUSPENSION SYSTEM SUPPORT PIN SHIM 0.13 mm	MA	390480	*	EA	8	R2,2,4	8	✓	79121	267 pcs.
69	SUSPENSION SYSTEM SUPPORT SHIM 0.25 mm	MA	390481	*	EA	12	R2,2,4	12	✓	79122	337 pcs.
Q1 INSULATED SHIELD AND PIPING ASSEMBLY		ME	390173	A	EA	1					
70	Q1 SHIELD MLI INNER BLANKET	ME	390487	*	EA	1	ICB Has				
71	Q1 SHIELD MLI OUTER BLANKET	ME	390488	*	EA	1	ICB Has				
Q1 THERMAL SHIELD ASSEMBLY		ME	390429	D	EA	1					
72	SUPPORT BAND	ME	390083	A	EA	4	P/N	4	✓	84143	3 pcs. P/N - 2 pcs. IB4
73	RETAINER	MA	390086	*	EA	16	21B1	13	✓	77131	29 pcs.
74	ALUMINUM SPACER	MA	390373	*	EA	32	22A1	32	✓	83629	526 pcs.
75	RETAINING WASHER	MA	390378	*	EA	232	22A4	232	✓	83630	2482 pcs.

TD - Engineering Fabrication Component Kit List

	Description	Dwg Size	Number	Rev	Unit	Quantity Required	Location	Quantity Issued	E&F Verified	Routing Form Number	Spares Number / Comment
76	COOLING TUBE WELDMENT	MD	390431	A	EA	2	P/N	2	✓	79280	2 pcs.
77	IP END SECTION	ME	390433	*	EA	2	Site 38	2	✓	76621	2 pcs.
78	NON-IP END SECTION	ME	390434	*	EA	2	P/N	2	✓	79611	2 pcs.
79	Q1 - Q3 CENTER SECTION	ME	390435	*	EA	2	P/N	2	✓	N/A	4 pcs.
80	COOLING PIPE CROSSOVER	MD	390466	A	EA	1	R8,1,2	1	✓	79201	1 pc.
81	COOLING PIPE CROSSOVER CONNECTOR	MA	390467	*	EA	2	22A5	2	✓	78930	7 pcs.
82	THERMAL SHIELD EXTRUSION SUPPORT BRACKET ASSEMBLY	MD	390783	A	EA	4	R7,1,4	4	✓	81981	12 pcs.
83	BUTTON HEAD CAP SCREW, M5 x 16.0 LG	MA	393028	*	EA	232	22C7	232	✓	83626	2401 pcs.
Q1 INTERNAL PIPING ASSEMBLY		ME	390174	C	EA	1					
84	PUMPING LINE END FLANGE	MB	390032	B	EA	1	21A3	1	✓	77210	37 pcs.
85	COOLDOWN LINE END FLANGE	MB	390033	B	EA	1	21A4	1	✓	77208	19 pcs.
86	Q1-Q3 PIPE SUPPORT ASSEMBLY	MD	390092	A	EA	3	P/N	3	✓	76617	3 pcs.
87	RETAINING CLIP (4x QTY OF 390092)	MA	390103	*	EA	12	21B3	12	✓	76785	31 pcs.
88	TIE BAR RETAINING CLAMP	MB	390136	*	EA	4	21B5	1	✓	77132	1 pc.
89	Q1 4.5K INTERCEPT LINE TUBE	MB	390192	*	EA	3	P/N	3	✓	81302	3 pcs.
90	Q1 COOLDOWN LINE WELDMENT	MD	390193	A	EA	1	P/N	1	✓	80001	1 pc.
91	WELD CONNECTOR ADAPTER	MC	390278	*	EA	1	R1,1,3	1	✓	79471	1 pc.
92	INTERCEPT LINE PIPE STOP	MA	390379	A	EA	6	22A4	6	✓	78894	57 pcs.

TD - Engineering Fabri tion Component Kit List

	Description	Dwg Size	Number	Rev	Unit	Quantity Required	Location	Quantity Issued	E&F Verified	Routing Form Number	Spares Number / Comment
93	Q1/Q3 PIPE ANCHOR	MC	390486	*	EA	1	R8,1,4	1	✓	79387	1 pc.
94	Q1 COLD MASS ASSEMBLY	ME	390526	D		ICB HAS					
95	4.5K INTERCEPT TUBE BRACE BAR	MB	390816	*	EA	2	22B7	2	✓	83782	9 pcs.
96	M6 x 45.0mm LG HEX SHCS, 18-8 STN STEEL	MA	393017	*	EA	4	22B8	4	✓	73268	25 pcs.
97	M6 HEX NUT, 18-8 STN STEEL	MA	393022	A	EA	4	22C5	4	✓	73269	31 pcs.
98	M6 FLAT WASHER 18-8 STN STEEL	MA	393024	*	EA	4	22C5	4	✓	78891	20 pcs.
99	M6 LOCK WASHER 18-8 STN STEEL	MA	393026	*	EA	4	22C6	4	✓	83571	59 pcs.
	Q1 / Q3 INSTALLATION TIE ROD ASSEMBLY	MC	390638	*	EA	2					
100	Q1 & Q3 INSTALLATION TIE-ROD SHORT THREADED ROD	MA	390639	*	EA	2	R2,2,2	2	✓	81098	3 pcs.
101	JAM NUT (LH)	MA	393046	*	EA	4	22D6	4	✓	80074	4 pcs.
102	STD ANSI HEX THIN JAM NUT 1/2-13 UNC	MA	393225	*	EA	8	23B5	8	✓	80073	51 pcs.
103	STD HEX COUPLING NUT 1/2-13 UNC (RH-LH)	MA	393226	*	EA	4	23B6	4	✓	80075	11 pcs.
104	THREADED ROD 1/2-13 UNC - 24 x 6 FT LONG	MA	393227	*	EA	2	R7,2,4	2	✓	84004	2 pcs.
105	THREADED ROD 1/2-13 UNC - 24 (LH) x 3 FT LONG	MA	393228	*	EA	2	R1,2,3	2	✓	80072	2 pcs.
	Q1 HEAT EXCHANGER ASSEMBLY	ME	390175	*	EA	1					
	OUTER TUBE WELDMENT	ME	390176	*	EA	1					
106	END FLANGE	MC	390031	B	EA	1	21A3	1	✓	77209	39 pcs.
107	OUTER SHELL PIPE	MD	390177	*	EA	1	P/N	1	✓	79998	1 pc

TD - Engineering Fabri .ion Component Kit List

	Description	Dwg Size	Number	Rev	Unit	Quantity Required	Location	Quantity Issued	E&F Verified	Routing Form Number	Spares Number / Comment
108	**END PLATE**	**MB**	**390178**	*	**EA**	**1**	**R1,2,3**	1	✓	79644	**1 pc**
	CORRUGATED TUBE ASSEMBLY	ME	390179	*	EA	1					
109	**CORRUGATED TUBE SUPPORT**	**MC**	**390028**	*	**EA**	**6**	**R9,1,4**	6	✓	83314	**22 pcs.**
110	**CORRUGATED TUBE RESTRICTOR**	**MC**	**390029**	**A**	**EA**	**1**	**R9,1,4**	1	✓	77724	**35 pcs.**
111	**CORRUGATED TUBE WELDMENT**	**ME**	**390393**	*	**EA**	**1**	**P/N**	1	✓	79282	**1 pc**
	Q1 PUMPING LINE WELDMENT	ME	390182	*	EA	1					
112	**Q1 PUMPING LINE PIPE**	**MB**	**390183**	*	**EA**	**1**	**P/N**	1	✓	80000	**1 pc**
113	**Q1 PUMPING LINE RETURN FITTING**	**MC**	**390184**	**A**	**EA**	**1**	**R7,3,2**	1	✓	81587	**2 pcs.**
114	**Q1 IP END COLLECTION POT WELDMENT**	**MD**	**390185**	**A**	**EA**	**1**	**R7,2,2**	1	✓	79584	**1 pc**
	Q1 PIPING INSULATION	ME	390541	*	EA	1					
115	**Q1 / Q3 MLI END BLANKET**	**ME**	**390542**	*	**EA**	**1**	**ICB Has**				
116	**Q1 / Q3 MLI MID BLANKET**	**ME**	**390543**	*	**EA**	**1**	**ICB Has**				
117	**Q1 MLI IP END BLANKET**	**ME**	**390544**	*	**EA**	**1**	**ICB Has**				
	Q1 SUSPENSION SYSTEM INSTALLATION COLD MASS ASSEMBLY	*ME*	*390525*	*A*	*EA*	*1*					
118	***TIE BAR SHIM, 6.4 mm***	***MB***	***390118***	*	***EA***	***4***	**21B3**	4	✓	77204	**35 pcs.**
119	***TIE BAR SHIM, 2.4 mm***	***MB***	***390119***	*	***EA***	***4***	**21B4**	4	✓	83092	**31 pcs.**
120	***TIE BAR SHIM, 0.8 mm***	***MB***	***390120***	*	***EA***	***4***	**21B4**	4	✓	83755	**17 pcs.**
121	***SUSPENSION MTG BRACKET***	***MD***	***390279***	*	***EA***	***4***	**R9,1,1**	4	✓	77180	**4 pcs.**

TD - Engineering Fabri..ion Component Kit List

	Description	Dwg Size	Number	Rev	Unit	Quantity Required	Location	Quantity Issued	E&F Verified	Routing Form Number	Spares Number / Comment
122	*Q1 / Q3 TIE BAR ASSEMBLY*	*MC*	*390400*	*	*EA*	*2*	P/N	2	✓	78086	2 pcs.
123	*Q1 COLD MASS WELDED ASSEMBLY*	*ME*	*390526*	*D*		*ICB HAS*					
124	*SHIELDING BLOCK*	*MB*	*390534*	*A*	*EA*	*2*	R7,2,2	2	✓	79708	2 pcs.
125	*M8 x 50.0 mm LG SHCS 18-8 STN STEEL*	*MA*	*393020*	*	*EA*	*12*	22C3	12	✓	82378	14 pcs.
126	*M8 HEX NUT, 18-8 STN STEEL*	*MA*	*393023*	*	*EA*	*12*	22C5	12	✓	83610	319 pcs.
127	*M8 FLAT WASHER, 18-8 STN STEEL*	*MA*	*393025*	*	*EA*	*12*	22C6	12	✓	82858	302 pcs.
128	*M8 LOCK WASHER, 18-8 STN STEEL*	*MA*	*393027*	*	*EA*	*12*	22C7	12	✓	76744	495 pcs.
	COLD MASS INSULATION ASSEMBLY	*ME*	*390524*	*A*	*EA*	*1*					
129	*MOUNTING LUG BLANKET*	*MC*	*390496*	*	*EA*	*8*	Site 38	8	✓	79873	
130	*Q1/Q3 END BLANKET*	*ME*	*390521*	*	*EA*	*1*	ICB Has				
131	*Q1/Q3 MID BLANKET*	*ME*	*390522*	*	*EA*	*1*	ICB Has				
132	*Q1 IP END BLANKET*	*ME*	*390523*	*	*EA*	*1*	ICB Has	1	✓	N/A	

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TECHNICAL DIVISION PARTS ROUTING FORM

84318

HOT -28

Part Number	MA 390086	Revision		Date	Feb 28, 2006
P.O. Number	MSV2036	QC Task#	300/1.1.1.3.4		
Vendor	VMS	Amount of part received		3	
Task Contract #		Description	RETAINER		
Requisitioner	MS				
Intials	GV				

Inspect? **Yes** Cert No Rework? No Ref: QCR#

Number of Packages 1 Type of Container BAG Location Insp. Shelf

Disposition ROUTE: INSPECT, DELIVER TO J. RIFE, KIT LQXA09

Notes

Sign Off Person [signature] ID # 4895 Date 3/1/06

INSPECTION RECORD

Date Inspected 2-28-06 Mech. Insp. Init A.K. Leak Chk. Init N/A

Amount of part accepted 3 Amount of rejected due to deviation 0

QCR DISPOSITION

Deviation report attached ☐ Date

Project Engineer(designee): accepts amount rejects amount

QCR # MMR #

PARTS DISPOSITION

Amount 3

Name / ID# P. MAYER

Location LCB

Date 3-1-06

Early Issue

Amount

Name/ID#

Date

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TECHNICAL DIVISION PARTS ROUTING FORM

84319

HOT -JH

Part Number	MB 390136	Revision		Date	Feb 28, 2006
P.O. Number	MSV2036	QC Task#	300/1.1.1.3.4		
Vendor	VMS	Amount of part received	3		
Task Contract #		Description	TIE BAR RETAINING CLAMP		
Requisitioner	MS				
Intials	GV				

Inspect? **Yes** Cert No Rework? No Ref: QCR#

Number of Packages 1 Type of Container BAG Location Insp. Shelf

Disposition ROUTE: INSPECT, DELIVER TO J. RIFE, KIT LQXA09

Notes

Sign Off Person [signature] ID # 4895 Date 3/1/06

INSPECTION RECORD

Date Inspected 03/01/06 Mech. Insp. Init O.L. Leak Chk. Init N/A

Amount of part accepted 3 Amount of rejected due to deviation Ø

QCR DISPOSITION

Deviation report attached ☐ Date

Project Engineer(designee): accepts amount rejects amount

QCR # MMR #

PARTS DISPOSITION

Amount 3

Name / ID# P. MAYER

Location ICB

Date 3-1-06

Early Issue

Amount

Name/ID#

Date

Cryogenic Thermometer Traveller

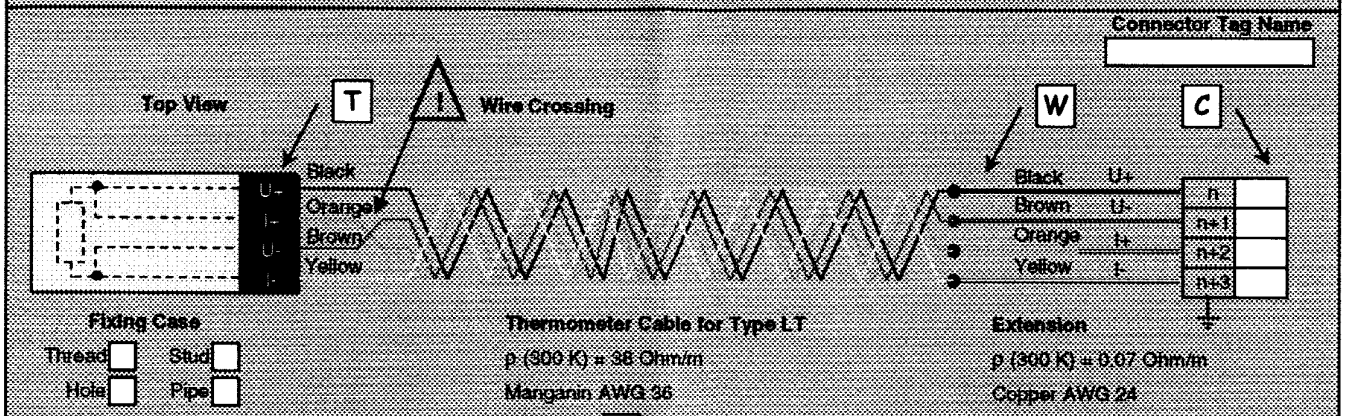
BOTTOM / TOP
BRACKET / RTP

DESCRIPTION*

Part Description:	Cryogenic thermometer	**Instrument Name:**	LQXA-09
CERN Part Identifier:	HCQITELCXT-CR002520	**Top Assembly:**	
Other Identification:	CX_LS_X14537	**Functional Equipment Identifier:**	

* In accordance with LHC-QIT-QA-0002

CABLING



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(I+,GND) [Ohm] 2W	Temperature [K]	Firm/Laboratory	Checked by
Calibration	*29-Jun-2001*	T			*57.30*	*16.51*	*16.33*	*OVL*	*300*	*IPN*	*Joly*
Expedition	*15-Sep-2003*	T			*58.70*	*16.51*	*16.33*	*OVL*	*293.00*	*CERN*	*Vauthier*
Reception	03-April 2006	T	W	C	58.97				70°F	FERMI	[illegible]
		T	W	C							
		T	W	C							
		T	W	C							
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		T	W	C							

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BRACKET / RTD

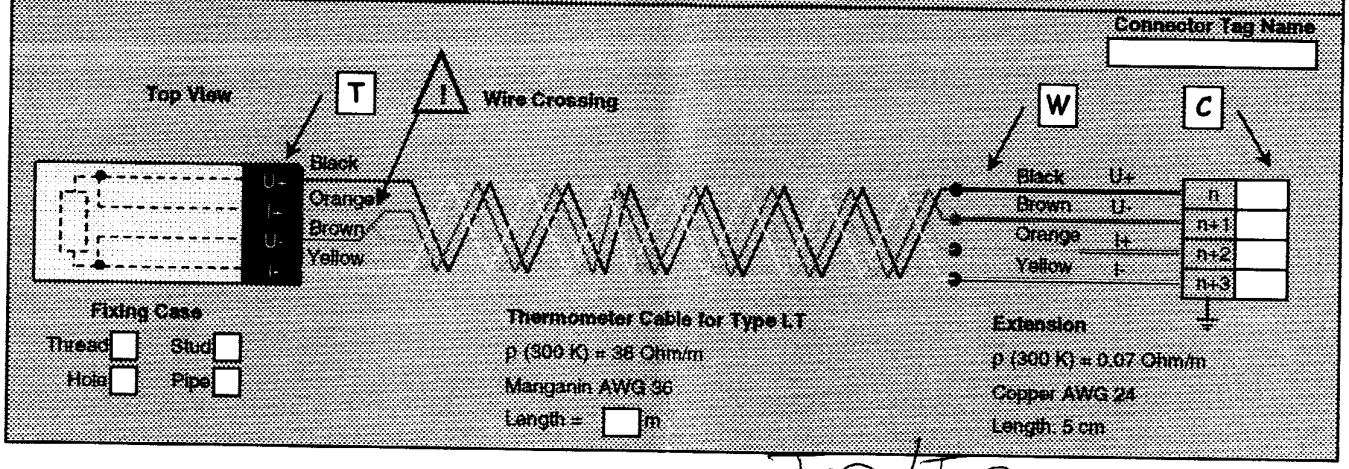
Cryogenic Thermometer Traveller

DESCRIPTION*

Part Description:	Cryogenic thermometer	**Instrument Name:**	
CERN Part Identifier:	HCQITELCXT-CR002790	**Top Assembly:**	LQXA-09
Other Identification:	CX_LS_X14579	**Functional Equipment Identifier:**	

* In accordance with LHC-QIT-QA-0002

CABLING



TOP / TOP

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	*29-Jun-2001*	T	*58.00*	*20.05*	*20.02*	*OVL*	*300*	*IPN*	*Joly*
Expedition	*15-Sep-2003*	T	*59.52*	*20.05*	*20.02*	*OVL*	*293.00*	*CERN*	*Vauthier*
Reception	03 April-2006	T W C	59.57				70° F	FERMI	Bruce
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Cryogenic Thermometer Traveller

BRACKET/

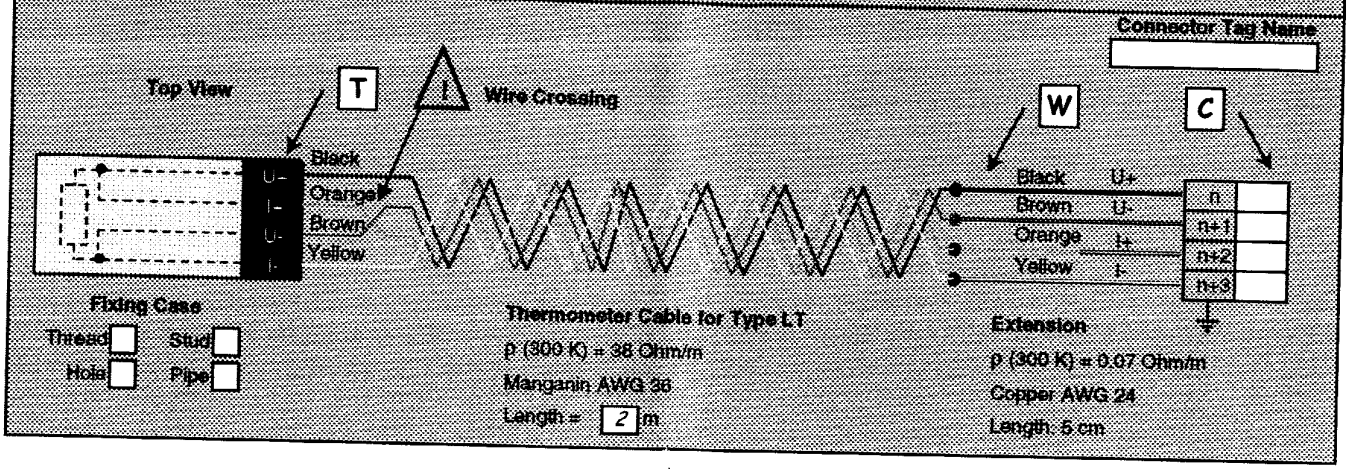
DESCRIPTION*

Part Description:	Cryogenic thermometer	**Instrument Name:**	
CERN Part Identifier:	HCQITELCXT-CR005740	**Top Assembly:**	LQXA-09
Other Identification:	CX_LS_X15161	**Functional Equipment Identifier:**	

* In accordance with LHC-QIT-QA-0002

TOP / ~~TOP~~ BOTTOM
BRACKET

CABLING



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	*10-Oct-2001*	T	*58.47*	*17.17*	*17.09*	*OVL*	*300*	*IPN*	*Joly*
Montage Fil	*15-Sep-2003*	T	*59.25*	*17.17*	*17.09*	*OVL*	*293.00*	*CERN*	*Vauthier*
Expedition	*15-Sep-2003*	W	*59.26*	*188.80*	*188.10*	*OVL*	*293.00*	*CERN*	*Vauthier*
Reception	03-April-2006	T W C	59.79				70°F	FERMI	[illegible]
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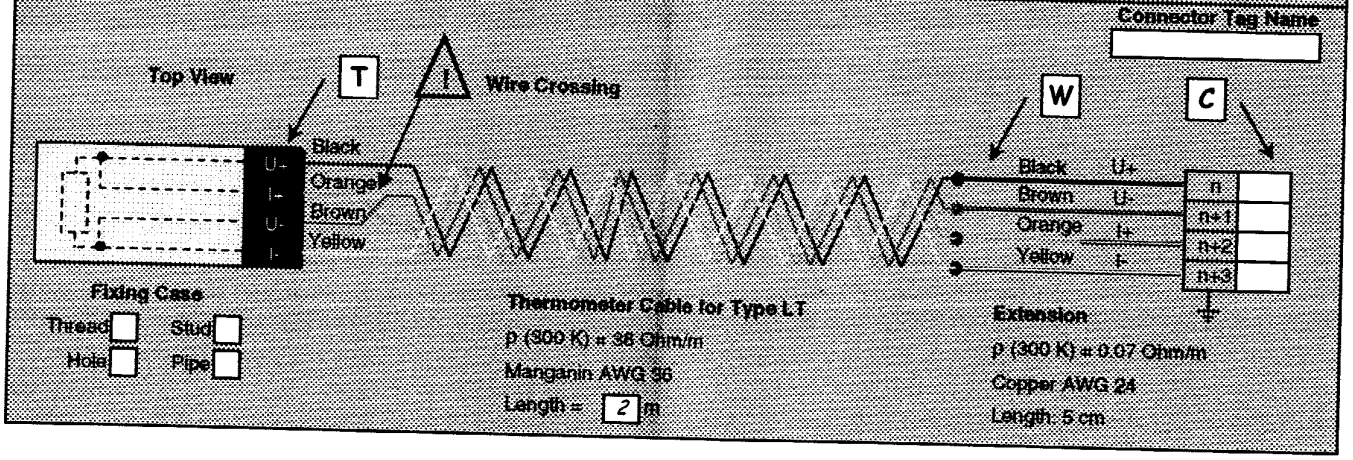
Cryogenic Thermometer Traveller

DESCRIPTION*

Part Description:	Cryogenic thermometer	**Instrument Name:**	LQXA-09
CERN Part Identifier:	HCQITELCXT-CR005750	**Top Assembly:**	
Other Identification:	CX_LS_X15162	**Functional Equipment Identifier:**	

* In accordance with LHC-QIT-QA-0002

CABLING



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	10-Oct-2001	T	59.67	16.82	16.73	OVL	300	IPN	Joly
Montage Fil	15-Sep-2003	T	60.53	16.82	16.73	OVL	293.00	CERN	Vauthier
Expedition	15-Sep-2003	W	60.50	187.90	185.80	OVL	293.00	CERN	Vauthier
Reception	3-April-2006	T W C	60.97				70°F	FERMI	[signature]
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D. EDDY
03/21/2006

FORM #1 FIXED VOLTAGE TAPS _1A_FORM LQXC09

Test of Q1 FVTs

Apply 1 A current between BUS #1 & BUS #2
Connect Current Source: BUS #1 to Negative and BUS #2 to Positive
Use a 3457 or equilvent DVM and record measurement to 4 decimal places
Use 2 wires Voltage Measurements Technique:
1. Connect DVM LO wire to BUS#1 (or Negative output of Power source)
2. HI wire of DVM will move through breakout box to measure V
DO NOT USE DC CURRENT LARGER THAN 2A.
DO NOT RUN DC CURRENT THROUGH MAGNET LONGER THAN 30MIN.

BUS #1
BUS #2

POWER BUS LOCATION

HYPERTRONICS CONNECTOR		FNAL Labels	Description	Break Box Labels	Expected Voltage, V	Measured, V
Module	Pin					
M2	1	VTa1Q1	Q1 Lead Voltage Tap "a", primary	EE1111	7.0000	6.838
M2	2	VTa2Q1	Q1 Lead Voltage Tap "a", redundant	EE1121	7.0000	6.837
M2	5	VTb1Q1	Q1 lead Voltage Tap "b", primary	EE1311	0.0030	0.0029
M3	5	VTb2Q1	Q1 Lead Voltage Tap "b" redundant	EE1321	0.0030	0.0029
M2	3	VTc1Q1	Q1 Center Voltage Tap "c", primary	EE1211	3.5000	3.422
M2	4	VTc2Q1	Q1 Center Voltage Tap "c", redundant	EE1221	3.5000	3.422

Across BUS #1 and BUS #2	6.839 V

Form #2 CRYO HEATER CHECK_OUT

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

Module	Pin		*Expected Resistance, OHM*	*Measured Resistance, OHM*	FNAL Label	Description
M7	*1*	**EH8311+**	**17**	**17.86**	W1aQ1	*Q1 Cryogenic Heater lead end - wire toward cold mass end plate (CERN #1 I+)*
M7	*2*	**EH8311-**			W2aQ1	*Q1 Cryogenic Heater lead end - wire toward cold mass mag center (CERN #1 I-)*
M7	*3*	**EH8321+**	**17**	**18.25**	W1bQ1	*Q1 Cryogenic Heater non-lead end- wire toward cold mass end plate (CERN #2 I+)*
M7	*4*	**EH8321-**			W2bQ1	*Q1 Cryogenic Heater non-lead end- wire toward cold mass mag center (CERN #2 I-)*

M7	*1*	**EH8311+**	**more than 20MOHM**	**Inf**	W1aQ1	*Q1 Cryogenic Heater lead end - wire toward cold mass end plate (CERN #1 I+)*
		GND				
M7	*3*	**EH8321+**	**more than 20MOHM**	**Inf**	W1bQ1	*Q1 Cryogenic Heater non-lead end- wire toward cold mass end plate (CERN #2 I+)*
		GND				

Form #3 PROTECTION STRIP HEATERS

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

M9	1	YT1111-	30	30.26	H2aQ1	Q1 Protection (Strip) Heater, 1-4 & 2-3 circuit (FNAL lead A-) (CERN lead #1-)
M9	3	YT1111+			H1aQ1	Q1 Protection (Strip) Heater, 1-4 & 2-3 circuit (FNAL lead A+) (CERN lead #1+)
M9	2	YT1121+	30	30.53	H1bQ1	Q1 Protection (Strip) Heater, 1-2 & 3-4 circuit (FNAL lead B+) (CERN lead#2+)
M9	4	YT1121-			H2bQ1	Q1 Protection (Strip) Heater, 1-2 & 3-4 circuit (FNAL lead B-) (CERN lead #2-)
M9	1	YT1111-	more than 20MOHM	INF	H2aQ1	Q1 Protection (Strip) Heater, 1-4 & 2-3 circuit (FNAL lead A-) (CERN lead #1-)
		GND				
M9	2	YT1121+	more than 20MOHM	INF	H1bQ1	Q1 Protection (Strip) Heater, 1-2 & 3-4 circuit (FNAL lead B+) (CERN lead#2+)
		GND				
M9	1	YT1111-	more than 20MOHM	INF	H2aQ1	Q1 Protection (Strip) Heater, 1-4 & 2-3 circuit (FNAL lead A-) (CERN lead #1-)
		COIL				
M9	2	YT1121+	more than 20MOHM	INF	H1bQ1	Q1 Protection (Strip) Heater, 1-2 & 3-4 circuit (FNAL lead B+) (CERN lead#2+)
		COIL				

Form#4 RTDs Measurements

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

Module	Pin	Breakout BOX Labels	Expected Resistance, OHM	Measured Resistance OHM	FNAL Label	Description
M12	1	TT8311 I+	57	63.61	TaQ1_I+	Q1 RTD, primary Wire color: Yellow
M12	2	TT8311 I-			TaQ1_I-	Q1 RTD, primary Wire color: Green
M12	3	TT8311 U+			TaQ1_V+	Q1 RTD, primary Wire color: Black
M12	4	TT8311 U-			TaQ1_V-	Q1 RTD, primary Wire color: Red
M12	5	TT8321 I+	57	65.58	TbQ1_I+	Q1 RTD, redundant: Wire color: Yellow
M12	6	TT8321 I-			TbQ1_I-	Q1 RTD, redundant: Wire color: Green
M12	11	TT8321 U+			TbQ1_V+	Q1 RTD, redundant: Wire color: Black
M12	10	TT8321 U-			TbQ1_V-	Q1 RTD, redundant: Wire color: Red
M12	1	TT8311 I+	more than 20MOHM	INF	TaQ1_I+	Q1 RTD, primary Wire color: Yellow
		GND				
M12	5	TT8321 I+	more than 20MOHM	INF	TbQ1_I+	Q1 RTD, redundant: Wire color: Yellow
		GND				
M12	1	TT8311 I+	more than 20MOHM	INF	TaQ1_I+	Q1 RTD, primary Wire color: Yellow
		COIL				
M12	5	TT8321 I+	more than 20MOHM	INF	TbQ1_I+	Q1 RTD, redundant: Wire color: Yellow
		COIL				

Ccoil bus #	NA	3	4	1	2
	XXX	V1A	V1B	H1A	H1B
	POSITION OF CCOIL BUS				

Form#5 Correction COILs

MEASURE RESISTANCE ACROSS BOTH CCOIL BUSES
MEASURE RESISTANCE FROM CCOIL TO GROUND
MEASURE RESISTANCE BETWEEN BOTH TAPS
MEASURE RESISTANCE FROM EACH TAP TO CCOIL BUS

			Expected	Measured		
	Horizontal Corrector Coil resistance					
	H1-A	CCOIL BUS #1	19 OHMS	22.06		
	H1-B	CCOIL BUS #2				
		Vertical Corrector Coil resistance				
	V1-A	CCOIL BUS #3	22 OHMS	18.12		
	V1-B	CCOIL BUS #4				
	H1-A	CCOIL BUS #1	more than 20MOHM	INFINITE		
		GND				
	V1-A	CCOIL BUS #3	more than 20MOHM	INFINITE		
		GND				
M5	1	**EE8121**	more than 20MOHM	INFINITE	*VTH1*	*Corrector voltage tap Q1-H1 (skew dipole) (on MCBX, MCBXH, A+ lead)*
M5	2	**EE8111**			*VTV1*	*Corrector voltage tap Q1-V1 (normal dipole) (on MCBX, MCBXV, A+ lead)*
M5	1	**EE8121**	less than 5 OHMS	1.55	*VTH1*	*Corrector voltage tap Q1-H1 (skew dipole) (on MCBX, MCBXH, A+ lead)*
		Ccoil Bus#1				
M5	2	**EE8111**	less than 5 OHMS	1.59	*VTV1*	*Corrector voltage tap Q1-V1 (normal dipole) (on MCBX, MCBXV, A+ lead)*
		Ccoil Bus#3				
M5	1	**EE8121**	more than 14 OHMS	22.79	*VTH1*	*Corrector voltage tap Q1-H1 (skew dipole) (on MCBX, MCBXH, A+ lead)*
		Ccoil Bus#2				
M5	2	**EE8111**	more than 14 OHMS	18.86	*VTV1*	*Corrector voltage tap Q1-V1 (normal dipole) (on MCBX, MCBXV, A+ lead)*
		Ccoil Bus#4				