Document ID: 3861

LHC Q1 LQXA Cryostat Final Assembly Traveler

333755 / Rev. D

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!!!

LQXA07-0

Document ID:

3861

Job No.:

248

Project/Task No.

300/1.1.1.6.2

Series:

LQXA

Serial No:

LQXA07

Rework ID:

0

Specification No.:

333755

Revision:

D

LQXA07-0

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: *300/1.1.1.6.2*

Released By: *John Szostak* | **Magnet/Device Series:** *LQXA*

Date Issued: *3/16/2005 9:54:58 AM* | **Scanned Pages:** 45

Prepared by: J. Szostak

Title	Signature	Date
TD / E&F Process Engineering	*Jamie Blowers* Bob Jensen / Designee	2/28/05
TD / LHC Production Supervisor	*Jim Rife* Jim Rife / Designee	2/28/05
TD / LHC Production Engineer	*Rodger Bossert* Rodger Bossert / Designee	2/28/05
TD / LHC Production Engineer Cryostat	*Tom Page* Tom Page / Designee	2/28/05
TD / LHC Project Engineer Cryostat	*Tom Nicol* Tom Nicol / Designee	2/28/05
TD / LHC Program Manager	*Jim Kerby* Jim Kerby / Designee	2/28/05

Revision Page (1 of 2)

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 2)

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.		

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.

J. Agostah
Process Engineering/Designee

3/16/05
Date

3.0 Vacuum Vessel Preparation and Painting

3.1 Record the Vacuum Vessel Serial Number.

Q1-3

Technician(s) Date 3/16/05

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

Technician(s) Date 3/16/05

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

Technician(s) Date 3/16/05

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

PART NO. 390122D		SCALE UNITS BEFORE HELIUM PROBE	SCALE UNITS WHILE ENCLOSURE FLOODING	Q1-3 DETERMINATION OF MINIMUM DETECTABLE LEAK				
DATE TIME	OPERATOR'S LAST NAME			MDS	(Response - Bckgnd)	Leak Value	= MDL	
9/25/02	Juarez	80	80	2	420	80	4.75E-8	2.71E-6
							___ x E-8	___ x E-___

Technician(s) Date 3/16/05

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.

Technician(s) _____ Date 12-22-04

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

Weldor(s) _____ Date 3/15/05

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

Technician(s) _____ Date 12-22-04

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

Technician(s) _____ Date 12-22-04

STOP

3.9 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.

SNG

Lead Person _____ Date 3/14/05

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

Technician(s) _____ Date 3/14/05

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 4-18-05

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

Technician(s) _____ Date April 18, 2005

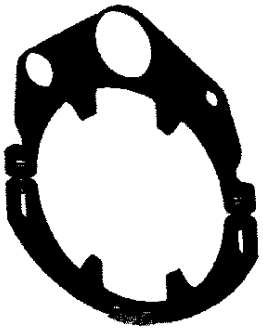
4.3 Install Cold Mass Insulation per Cold Mass Insulation Installation (ME-390524).

Technician(s) _____ Date April 18, 2005

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 April 18, 2005

4.5 Install Pipe Anchor (MC-390486) on the Cold Mass per Q1 Cryostat Assembly - Internal Piping (ME-390174).

Technician(s) _____ Date April 18, 2005

4.6 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 April 18, 2005

4.7 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.

Technician(s) _____ Date April 18, 2005

4.8 Install Pipe Supports (MD-390092) and Pipe Anchor (MC-390486) to same locations as in step 4.4 and 4.5 respectively.

Technician(s) _____ Date April 18, 2005

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 4/19/05

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 19 APR. '05

4.11 Install Q1 Installation Tie Rod Assembly (MC-390638) and Tie Bar Retaining Clamp (MB-390136) as per Q1 Cryostat Assembly - Internal Piping (ME-390174).

Technician(s) _____ Date 4/19/05

4.12 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 4/19/05

4.13 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 _____

4.14 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 April 19, 2005

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

Technician(s) _____ Date 4/19/05

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

Technician(s) _____ Date 4-19-05

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

Technician(s) _____ Date April 19, 2005

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

Technician(s) _____ Date April 19, 2005

4.19 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 4/19/05

4.20 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 4/19/05

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

Technician(s) _____ Date 4/19/05

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

Technician(s) _____ Date 4-19-05

4.23 Position Corrugated Tube Assembly (ME-390179).

Technician(s) _____ Date 4 19 05

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

Technician(s) _____ Date 4/19/05

4.25 Purge the assembly using Argon (Ar) gas.

Technician(s) _____ Date 4 19 05

4.26 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 4/20/05

4.27 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 4/20/05

4.28 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 4/20/05

4.29 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).

Weldor(s) _____ Date 4/20/05

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

Technician(s) _____ Date 4/20/05

4.31 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 4/20/05

4.32 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 4/20/05

4.33 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 4/20/05

4.34 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 4/20/05

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

Technician(s) _____ Date 4/20/05

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

Weldor(s) _____ Date 4/20/05

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

Technician(s) _____ Date 4-22-05

STOP

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

T. Pm
Responsible Authority/Physicist

4/22/05
Date

STOP

4.39 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.

T. Pm
Responsible Authority/Physicist

4/22/05
Date

OK pr DAMON

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

E. [illegible]
Technician(s)

april 22, 2005
Date

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

E. [illegible] / M. Shorn
Technician(s)

april 23, 2005
Date

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

E. [illegible] / M. Shorn
Technician(s)

april 21, 2005
Date

4.43 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 4/23/05

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

Technician(s) _____ Date April 22, 2005

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

Technician(s) _____ Date 4/22/05

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

Technician(s) _____ Date April 22, 2005

4.47 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 4/23/05

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

Technician(s) _____ Date April 23, 2005

4.49 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 4/23/05

4.50 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 4/23/05

4.51 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 4/23/05

4.52 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 4/23/05

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

Technician(s) _____ Date 4/25/05

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

Responsible Authority/Physicist _____ Date 4/25/05

4.55 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.

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 _____ Date 4/25/05

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

Part No. cold mass assem.	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
Wilson	60X1	60X1	2	48X5	60X1	3.91 xE-8	4.34 xE-10

Technician(s) Date 4-29-05

Tube # 1

4.57 Leak check 4.5k Intercept Lines (MB-390192).

Part No. intercept line #1	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
Wilson	18X1	18X1	2	50X5	18X1	3.91 xE-8	3.37 xE-10

Technician(s) Date 4-27-05

Tube # 2

Part intercept # line # 2		scale units Before Helium Probe	scale units while enclosure flooding	Determination of minimum Detectable leak				
Date Time	oper name			MDS	Res.	B.G.	Leak value	MDL
4-27-05	Wilson	17X1	17X1	2	50X5	17X1	3.91X10-8	3.35X10-10

Tube #3

Part intercept # tube # 3		Before Helium Probe	During Helium Probe					
Date Time	name			MDS	Res.	B.G.	leak value	MDL
4/27/05	Wilson	18X1	18X1	2	50X5	18X1	3.91X10-8	3.37X10-10

Notes:

tech. Date 4-27-05

5.0 Shield Assembly

5.1 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 4150 mm

Non-IP South to IP South 4150 mm

Technician(s) _____ Date April 27, 2005

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

Technician(s) _____ Date May 2, 2005

5.3 Lift the Cold Mass Assembly and place the IP End (ME-390433) and Non-IP End (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 5/2/05

5.4 Insert the Mid Section (ME-390435) and the Support Bands (MD-390083).

Technician(s) _____ Date 5-3-05

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

Technician(s) _____ Date 5-3-05

5.6 Assemble the Cooling Tubes (MD-390431) to the Bottom Half of the Shield.

Technician(s) _____ Date 5-3-05

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 5/3/05

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

Technician(s) _____ Date 5/3/05

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

Technician(s) _____ Date 5-3-05

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

Technician(s) _____ Date 5/3/05

5.11 Install the Upper Shield per Q1 Thermal Shield Assembly (ME-390429). Spray all screw threads with Molybdenum.

Technician(s) _____ Date 5/3/05

move to after 6.12 cannot leak if not welded!

5.12 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
						____ x E $^{-8}$	____ x E $^{-}$ ___

SEE AFTER STEP 6.12

N/A
Inspector

Date

FOR LEAK CHECK TICKET! TRR# 1722

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

Technician(s)

5/4/05
Date

6.0 Cold Mass Insertion into the Vacuum Vessel

JWE 6.1 Install Green Putty between the Vacuum Vessel and the Insertion Rails.

Technician(s) _____ Date 5/4/05

6.2 Install the Cold Mass Pull-in Tooling.

Technician(s) _____ Date 5/4/05

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

Technician(s) _____ Date 5/4/05

6.4 Connect the cable to the Pull-in Tooling.

Technician(s) _____ Date 5/4/05

6.5 Pull the Cold Mass Assembly into the Vacuum Vessel.

Technician(s) _____ Date 5/4/05

DR # HQP0459 (4214)

6.6 When the Cold Mass is fully inserted, install the Suspension System Adjusting Screws (MB-390039).

Technician(s) _____ Date 5/9/05

6.7 Adjust the Suspension System Adjusting Screw (MB-390039) as needed to center the Cold Mass in the Vacuum Vessel.

Technician(s) _____ Date 5/9/05

6.8 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 3-18-05

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 3-18-05

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

Technician(s) _____ Date 3-18-05

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

Technician(s) _____ Date 5/10/05

6.12 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).

Weldor(s) _____ Date 5/10/05

PART NO. LQXA07-0 Cooling Pipe Crossover		SCALE UNITS BEFORE HELIUM PROBE	SCALE UNITS WHILE ENCLOSURE FLOODING	DETERMINATION OF MINIMUM DETECTABLE LEAK				
DATE TIME	OPERATOR'S LAST NAME			MDS ÷ ((Response - Bckgnd) ÷ Leak Value) = MDL				
5-12-05	Wilson	18X1	18X1	2	50X5	18X1	3.91X10^-8	1d

Wilson
INSPECTOR

5-12-05
DATE

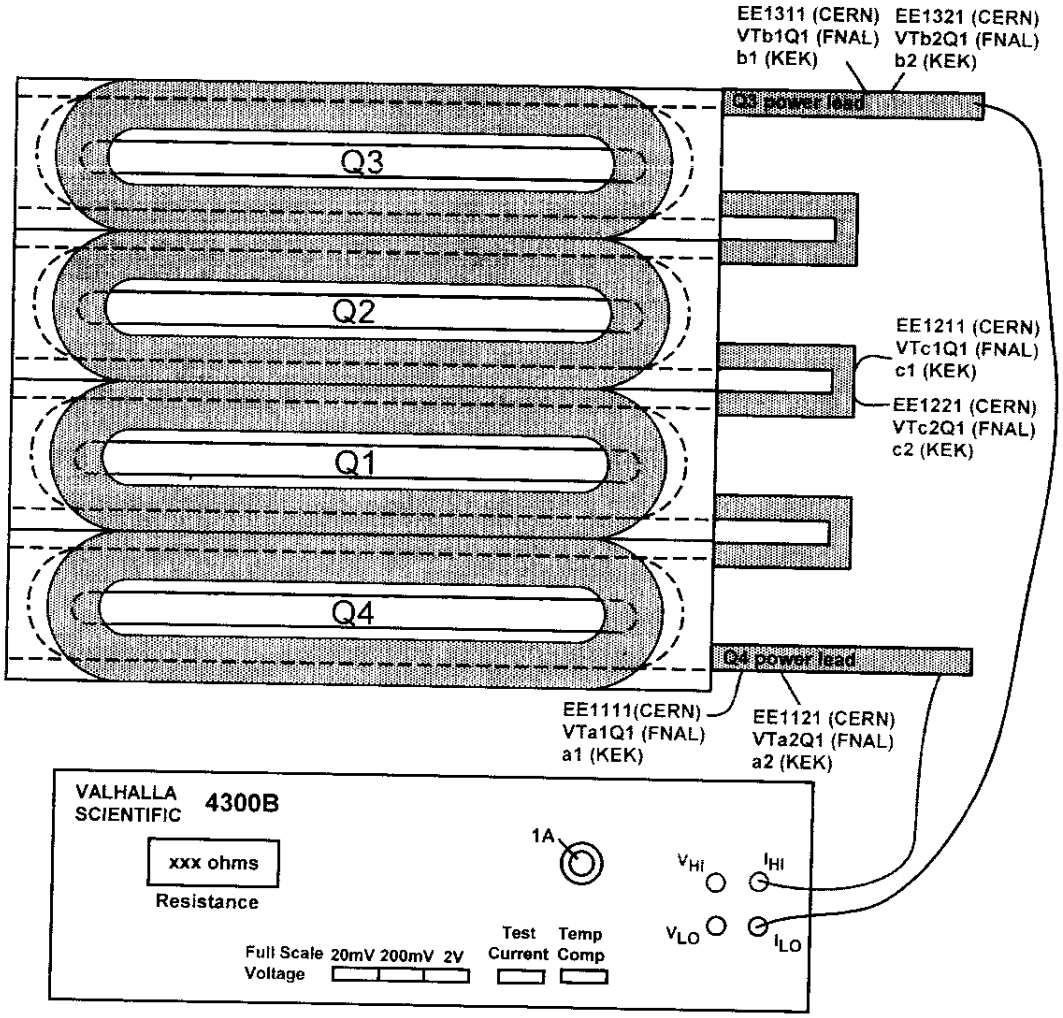
7.0 Final Electrical Inspection

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

To measure the Resistance of a 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



(Q1) Resistance				Nominal 3.35 to 3.45 Ω
Voltage Tap Serial Numbers				Total Resistance
Connect	Fermi	CERN	KEK	
V_{HI}	VTa1Q1	EE1111	a1	3.43 Ω
V_{LO}	VTc1Q1	EE1211	c1	
V_{HI}	VTc1Q1	EE1211	c1	3.43 Ω
V_{LO}	VTb1Q1	EE1311	b1	
V_{HI}	VTa1Q1	EE1111	a1	6.87 Ω
V_{LO}	VTb1Q1	EE1311	b1	

TRR 1763

move these 2 taps downhard (same thing) E. Sh 75-K

MATE together T/B

		Total Resistance with Leads
		Nominal 6.75 to 6.85 Ω
V_{HI}	Q4 Power Lead	6.87 Ω
V_{LO}	Q3 Power Lead	

Technician(s) _____ Date May 11, 2005

Check 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	3.43 Ω
V_{LO}	VTc2Q1	EE1221	c2	
V_{HI}	VTc2Q1	EE1221	c2	3.43 Ω
V_{LO}	VTb2Q1	EE1321	b2	

Technician(s) _____ Date May 11, 2005

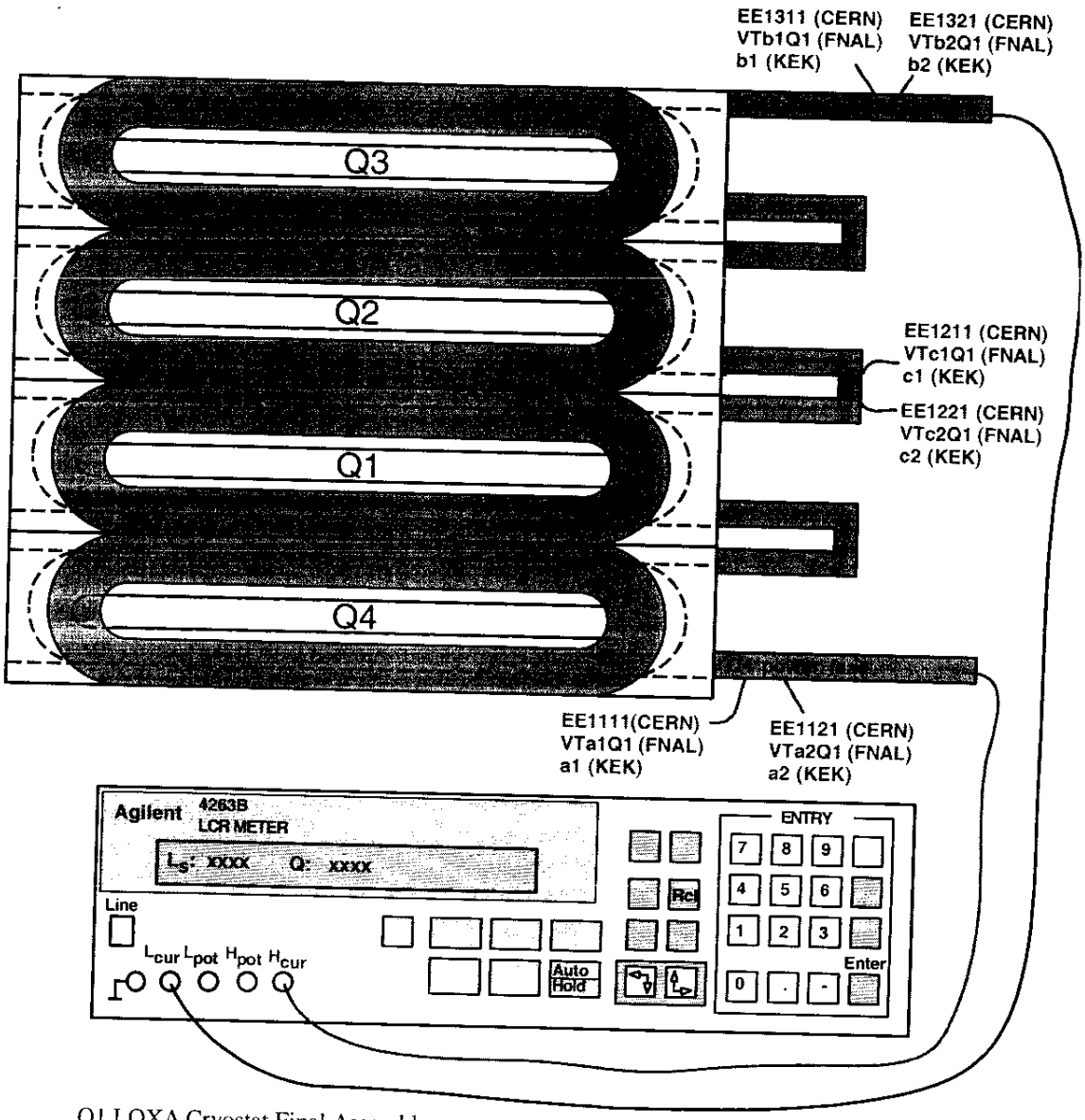
To measure Ls and Q of a Q1 Cold Mass:

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.



(Q1) Inductance				Nominal 15 to 16 mH
Voltage Tap Serial Numbers				Total Inductance
Connect	Fermi	CERN	KEK	
H_{POT}	VTa1Q1	EE1111	a1	15.545 mH
L_{POT}	VTc1Q1	EE1211	c1	
H_{POT}	VTc1Q1	EE1211	c1	15.535 mH
L_{POT}	VTb1Q1	EE1311	b1	

				Nominal 30 to 32 mH
				Total Inductance
H_{POT}	VTa1Q1	EE1111	a1	31.075 mH
L_{POT}	VTb1Q1	EE1311	b1	

(Q1) Q-Factor				Nominal 1.0 to 1.2
Voltage Tap Serial Numbers				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	

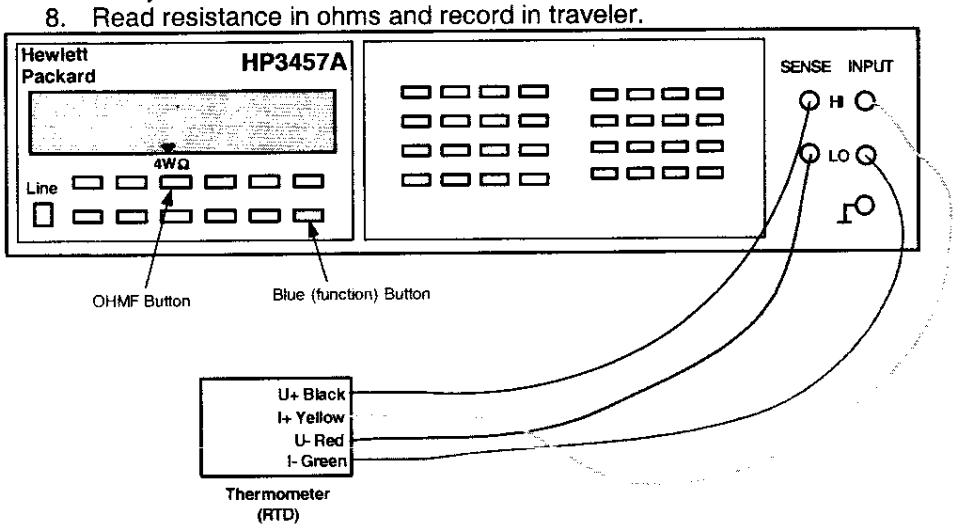
				Nominal 1.0 to 1.2
				Total Q
H_{POT}	VTa1Q1	EE1111	a1	1.1
L_{POT}	VTb1Q1	EE1311	b1	

Technician(s)

5-11-05
Date

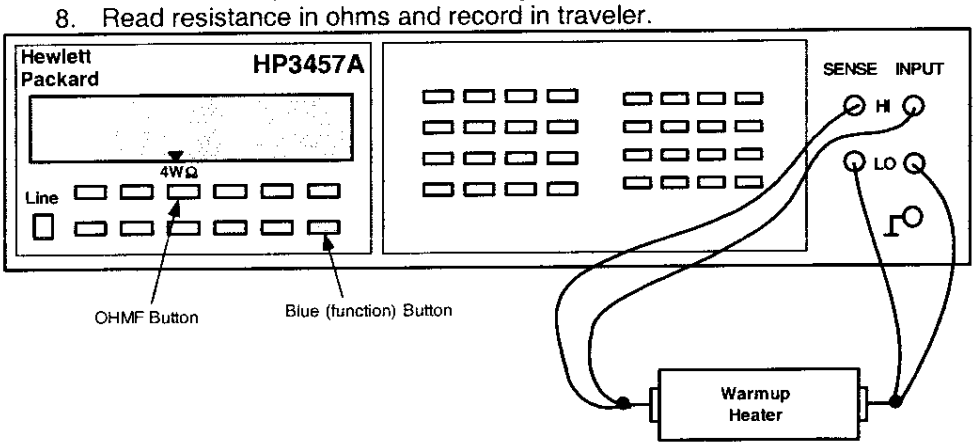
To measure the resistance of a Thermometer (RTD):

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



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

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



Q1 - RTD's and Cryogenic (warm-up) Heaters				
Temperature of Building (± 5°): 72°				
Component	**Fermi**	**CERN**	**Range**	**Resistance**
Q1 RTD, primary	TaQ1	TT8311	60 to 70 Ω	63.432 Ω
Q1 RTD, redundant	TbQ1	TT8321	60 to 70 Ω	65.309 Ω
Q1 Cryogenic (warm-up) Heater (LE) - wire at top (CERN #1 I+)	W1aQ1	EH8311+	16 to 18.5 Ω	17.5 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 18.5 Ω	17.8 Ω
Q1 Cryogenic (warm-up) Heater (Non-LE) - wire at bottom (CERN #2 I-)	W2bQ1	EH8321-		

Technician(s) _____ Date May 11, 2005

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	30.1 Ω
H2aQ1	YT1111-	HA2			
H1bQ1	YT1121+	HB1	Circuit B	28 to 32 Ω	30.1 Ω
H2bQ1	YT1121-	HB2			

Technician(s) _____ Date May 11, 2005

7.2 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
V1A	EE8111	V1A, V1B	.01 Ω
EE8111	V1B		17.549 Ω
V1A	V1B		17.549 Ω
H1A	EE8121	H1A, H1B	.03 Ω
EE8121	H1B		21.566 Ω
H1A	H1B		21.565 Ω

Technician(s) May 11, 2005
Date

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

Perform Stretched Wire Measurement?

Yes ☒

No ☐

J.D. →

Responsible Authority/Physicist May 11, 2005
Date

8.0 Final Preparations

8.1 Prepare the Power Leads 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 5/11/05

8.2 Cut the Power Leads as per Q1 Module Assembly (ME-369894).

Technician(s) _____ Date 5-11-05

8.3 Fuse the Ends of the Leads.

Weldor(s) _____ Date 5/11/05

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

Technician(s) _____ Date 5-11-05

Final helium press leak

TRR # 1722

PART NO. leaker w/ press.		SCALE UNITS BEFORE HELIUM PROBE	SCALE UNITS WHILE ENCLOSURE FLOODING	DETERMINATION OF MINIMUM DETECTABLE LEAK				
DATE TIME	OPERATOR'S LAST NAME			MDS = ((Response - Bckgnd) ÷ Leak Value) = MDL				
5-26-05	Wilson	72X1	72X1	2	36X5	72X1	3.91×10^{-8}	7.24×10^{-10}

Inspector _____ Date 5-26-05

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:

Process Engineering/Designee

Date 5/16/06

TD - Engineering Fabr tion Component Kit List

ORIGINA

Process Engineering

Component Serial No.: LQXA07

Kit submitted by: John Szostak | Ext. 2003

Fermi ID No.: 02943C

Date submitted: 22-Feb-05

Need date: 4-Mar-05

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. C**

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: 23-Feb-05

Parts issued

Issued by:

Fermi ID No.: 11929

Date issued: 2/28/05

Parts received by E&F: J. Szostak

Fermi ID No.: 02943C

Date received by E&F: 2/28/05

	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	8	IB4 Bin	8		81148	68 pcs.
2	VACUUM VESSEL ASSEMBLY	ME	390122	E	Ea	1	Site 38	1		78783	5 pcs.
3	TARGET HOLDER	MD	390211	B	EA	4	R10,1,1	4		74751	30 pcs.
4	COOLING PIPE BRACKET	MB	390316	A	EA	4	IB4 Bin	4	✓	77195	92 pcs.
5	COOLING PIPE CLAMP	MB	390317	*	EA	8	IB4 Bin	8	✓	77196	191 pcs.
6	Blank Non-Rotatable Conflat Flange, 4.62" OD 304 SS	MA	390374	*	EA	8	R8,3,4	8		78489	88 pcs.
7	COPPER GASKET	MA	390375	*	EA	8	IB4 Bin	8	✓	78429	90 pcs.
8	BOLT SET, HEX HEAD, 5/16 - 24 x 1.25 w/ WASHER	MA	390376	*	EA	80	IB4 Bin	80		72306	884 pcs.

ORIGINAL

TD - Engineering Fabr tion Component Kit List

	Description	Dwg Size	Number	Rev	Unit	Quantity Required	Location	Quantity Issued	E&F Verified	Routing Form Number	Spares Number / Comment
9	WASHER .656" ID x 1.38" OD x .13" THK, STN STEEL	MA	390377	*	EA	8	IB4 Bin	8	✓	77866	90 pcs.
10	REFERENCE SOCKET CUP (Furnished by CERN)	MA	390426	*	EA	8	R1,3,5	8	✓	77884	96 pcs.
11	VINYL FLANGE COVER FOR 75 MM FLANGE	MA	390491	*	EA	1	IB4 Bin	1	✓	78835	194 pcs.
12	VINYL FLANGE COVER FOR 114 MM FLANGE	MA	390492	*	EA	3	IB4 Bin	3	[illegible]	78836	196 pcs.
13	VINYL FLANGE COVER FOR 134 MM FLANGE	MA	390493	*	EA	4	IB4 Bin	4	✓	78837	264 pcs.
14	VINYL FLANGE COVER FOR 201 MM FLANGE	MA	390494	*	EA	1	IB4 Bin	1	✓	77834	82 pcs.
15	ALIGNMENT FIDUCIAL COVER	MA	390495	*	EA	8	IB4 Bin	8	✓	77957	174 pcs.
16	TARGET HOLDER, RIGHT	MD	390539	*	EA	2	R8,S1,L3	2	✓	79556	23 pcs.
17	TARGET HOLDER, LEFT	MD	390540	*	EA	2	R8,S1,L5	2	✓	79555	23 pcs.
18	Q1 NON-IP END ALIGNMENT FIDUCIAL SPACER	MD	390643	*	EA	2	R1,2,4	2	✓	80333	8 pcs.
19	Q1 VACUUM VESSEL HELIUM GUARD MOUNTING PLATE	MD	390724	*	EA	1	R7,1,3	1	[illegible]	81256	4 pcs.
20	FIDUCIAL MOUNTING BLOCKS	MB	390808	*	EA	2	R1,1,3	2	✓	82260	20 pcs.
21	M8 x 25.0mm LG SHCS, 18-8 STN STEEL	MA	393018	*	EA	8	IB4 Bin	8	✓	78888	139 pcs.
22	M8 x 45.0mm LG SHCS, 18-8 STN STEEL	MA	393019	*	EA	8	IB4 Bin	8	✓	76748	28 pcs.
23	M16-2 x 70.0 mm LG HEX SHCS, 18-8 STN STEEL	MA	393021	*	EA	8	IB4 Bin	8	✓	77840	117 pcs.
24	M8 HEX NUT, 18-8 STN STEEL	MA	393023	*	EA	16	IB4 Bin	16	✓	82857	48 pcs.
25	M6 FLAT WASHER, 18-8 STN STEEL	MA	393024	*	EA	32	IB4 Bin	32	✓	78891	340 pcs.
26	M8 FLAT WASHER, 18-8 STN STEEL	MA	393025	*	EA	16	IB4 Bin	16	✓	76745	790 pcs.

ORIGINAL

TD - Engineering Fabr tion Component Kit List

	Description	Dwg Size	Number	Rev	Unit	Quantity Required	Location	Quantity Issued	E&F Verified	Routing Form Number	Spares Number / Comment
27	M8 LOCK WASHER, 18-8 STN STEEL	MA	393027	*	EA	16	IB4 Bin	16	✓	393027	821 pcs.
28	M10-1.5 x 25mm LG HEX SHCS 18-8 STN STEEL	MA	393036	*	EA	24	IB4 Bin	24	✓	77899	306 pcs.
29	M6-1.0 x 35mm LG HEX SHCS 18-8 STN STEEL	MA	393045	*	EA	16	IB4 Bin	16	✓	78886	192 pcs.
30	M10-1.5 x 40mm LG HEX SHCS 18-8 STN STEEL	MA	393342	*	EA	6	IB4 Bin	6	✓	81501	78 pcs.
31	M8 x 30mm LG HEX SPRING PIN 18-8 STN STEEL	MA	393048	*	EA	8	IB4 Bin	8	✓	78887	110 pcs.
32	M10 LOCK WASHER, 18-8 STN STEEL	MA	393220	*	EA	24	IB4 Bin	24	✓	80024	428 pcs.
33	STD. SPRING PIN SLOTTED M4 x 20mm LG. PLAIN STEEL	MA	393360	E	EA	16	R2,2,3	16	✓	81763	184 pcs.
FIXED SUPPORT ASSEMBLY		ME	390041	D	EA	1	—				
34	SUSPENSION SYSTEM SUPPORT RING ASSEMBLY	ME	390043	B	EA	1	NT02408	1	RA	76906	17 pcs.
35	SUSPENSION SYSTEM SUPPORT PIN	MB	390047	B	EA	2	R8,S2,L1	2	RA	76914	54 pcs.
36	SUSPENSION SYSTEM SUPPORT PIN SHIM - 1mm	MA	390275	A	EA	8	IB4 Bin	8	✓	76918	30 pcs.
37	SUSPENSION SYSTEM SUPPORT PIN SHIM - 0.5mm	MA	390276	*	EA	8	IB4 Bin	8	✓	76910	20 pcs.
38	SUSPENSION SYSTEM SUPPORT PIN BOLTS	MA	390277	*	EA	8	IB4 Bin	8	✓	76913	208 pcs.
39	TWO PIECE CLAMP ON COLLAR	MA	390321	A	EA	4	IB4 Bin	4	✓	76912	44 pcs.
40	SUSPENSION SYSTEM SUPPORT PIN SHIM 0.13 mm	MA	390480	*	EA	8	R2,S2,L4	8	✓	79121	235 pcs.
41	SUSPENSION SYSTEM SUPPORT SHIM 0.25 mm	MA	390481	*	EA	12	R2,S2,L4	12	✓	79122	345 pcs.
SLIDING SUPPORT ASSEMBLY		ME	390042	C	EA	1	—				
42	SUSPENSION SYSTEM SUPPORT RING ASSEMBLY	ME	390043	B	EA	1	NT02408	1	RA	76906	17 pcs.

TD - Engineering Fabr tion Component Kit List

ORIGINAL

	Description	Dwg Size	Number	Rev	Unit	Quantity Required	Location	Quantity Issued	E&F Verified	Routing Form Number	Spares Number / Comment
43	SUSPENSION SYSTEM SUPPORT PIN	MB	390047	A	EA	2	R8,S2,L1	2	[illegible]	76914	54 pcs.
44	SUSPENSION SYSTEM SUPPORT PIN SHIM - 1mm	MA	390275	A	EA	8	IB4 Bin	8	[illegible]	76911	30 pcs.
45	SUSPENSION SYSTEM SUPPORT PIN SHIM - 0.5mm	MA	390276	*	EA	8	IB4 Bin	3	✓	76910	20 pcs.
46	SUSPENSION SYSTEM SUPPORT PIN BOLTS	MA	390277	*	EA	8	IB4 Bin	8	✓	76913	208 pcs.
47	SUSPENSION SYSTEM SUPPORT PIN SHIM 0.13 mm	MA	390480	*	EA	8	R2,S2,L4	8	✓	79121	235 pcs.
48	SUSPENSION SYSTEM SUPPORT SHIM 0.25 mm	MA	390481	*	EA	12	R2,S2,L4	12	✓	79122	345 pcs.
Q1 INSULATED SHIELD AND PIPING ASSEMBLY		ME	390173	A	EA	1					
49	Q1 SHIELD MLI INNER BLANKET	ME	390487	*	EA	1	Site 38	1	[illegible]	79869	4 pcs.
50	Q1 SHIELD MLI OUTER BLANKET	ME	390488	*	EA	1	Site 38	1	[illegible]	79870	4 pcs.
Q1 THERMAL SHIELD ASSEMBLY		ME	390429	D	EA	1					
51	SUPPORT BAND	ME	390083	A	EA	4	P/N	4	[illegible]	77146	44 pcs.
52	RETAINER	MA	390086	*	EA	16	IB4 Bin	16	✓	78914	210 pcs.
53	ALUMINUM SPACER	MA	390373	*	EA	32	IB4 Bin	32	✓	79001	385 pcs.
54	RETAINING WASHER	MA	390378	*	EA	232	IB4 Bin	232	✓	79002	2749 pcs.
55	COOLING TUBE WELDMENT	MD	390431	A	EA	2	P/N	2	[illegible]	79280	8 pcs.
56	IP END SECTION	ME	390433	*	EA	2	Site 38	2	[illegible]	79621	8 pcs.
57	NON-IP END SECTION	ME	390434	*	EA	2	P/N	2	[illegible]	79611	8 pcs.
58	Q1 - Q3 CENTER SECTION	ME	390435	*	EA	2	P/N	2	[illegible]	79382	22 pcs.

TD - Engineering Fabr tion Component Kit List

ORIGINAL

	Description	Dwg Size	Number	Rev	Unit	Quantity Required	Location	Quantity Issued	E&F Verified	Routing Form Number	Spares Number / Comment
59	COOLING PIPE CROSSOVER	MD	390466	A	EA	1	R8,S1,L2	1		79201	4 pcs.
60	COOLING PIPE CROSSOVER CONNECTOR	MA	390467	*	EA	2	IB4 Bin	2	✓	78930	13 pcs.
61	THERMAL SHIELD EXTRUSION SUPPORT BRACKET ASSEMBLY	MD	390783	A	EA	4	R7,1,4	4		81981	60 pcs.
62	SUPPORT BRACKET INSULATION SPACER	MA	390722	*	EA	8	IB4 Bin	8		81319	207 pcs.
63	BUTTON HEAD CAP SCREW, M5 x 16.0 LG	MA	393028	*	EA	232	IB4 Bin	232		74003	2583 pcs.
Q1 INTERNAL PIPING ASSEMBLY		ME	390174	C	EA	1					
64	TIE BAR RETAINING CLAMP	MB	390136	*	EA	4	IB4 Bin	4		77132	41 pcs.
65	Q1 4.5K INTERCEPT LINE TUBE	MB	390192	*	EA	3	P/N	3		81302	12 pcs.
66	WELD CONNECTOR ADAPTER	MC	390278	*	EA	1	R1,S1,L3	1		79471	11 pcs.
67	INTERCEPT LINE PIPE STOP	MA	390379	A	EA	6	IB4 Bin	6		78894	119 pcs.
68	Q1/Q3 PIPE ANCHOR	MC	390486	*	EA	1	R8,S1,L4	1		79387	12 pcs.
69	M6 x 45.0mm LG HEX SHCS, 18-8 STN STEEL	MA	393017	*	EA	4	IB4 Bin	4		82690	50 pcs.
70	M6 HEX NUT, 18-8 STN STEEL	MA	393022	A	EA	4	IB4 Bin	4		82689	102 pcs.
71	M6 FLAT WASHER 18-8 STN STEEL	MA	393024	*	EA	4	IB4 Bin	4		78891	340 pcs.
72	M6 LOCK WASHER 18-8 STN STEEL	MA	393026	*	EA	4	IB4 Bin	4		82451	236 pcs.
73	COOLDOWN LINE END FLANGE	MB	390033	B	EA	1	IB4 Bin	1		77208	34 pcs.
74	Q1-Q3 PIPE SUPPORT ASSEMBLY	MD	390092	A	EA	3	P/N	3		76617	33 pcs.
75	RETAINING CLIP	MA	390103	*	EA	12	IB4 Bin	12	✓	76785	147 pcs.

ORIGINAL

TD - Engineering Fabr tion Component Kit List

	Description	Dwg Size	Number	Rev	Unit	Quantity Required	Location	Quantity Issued	E&F Verified	Routing Form Number	Spares Number / Comment
76	Q1 COOLDOWN LINE WELDMENT	MD	390193	A	EA	1	P/N	1		80001	4 pcs.
77	Q1 COLD MASS ASSEMBLY	ME	390526	D		ICB HAS					
	Q1 / Q3 INSTALLATION TIE ROD ASSEMBLY	MC	390638	*	EA	2					
78	Q1 & Q3 INSTALLATION TIE-ROD SHORT THREADED ROD	MA	390639	*	EA	2	R2,2,2	2		81098	10 pcs.
79	JAM NUT (LH)	MA	393046	*	EA	4	IB4 Bin	4		80074	50 pcs.
80	STD ANSI HEX THIN JAM NUT 1/2-13 UNC	MA	393225	*	EA	8	IB4 Bin	8		80073	132 pcs.
81	STD HEX COUPLING NUT 1/2-13 UNC (RH-LH)	MA	393226	*	EA	4	IB4 Bin	4		80075	44 pcs.
82	THREADED ROD 1/2-13 UNC - 24 x 6 FT LONG	MA	393227	*	EA	2	R7,2,4	2		80061	22 pcs.
83	THREADED ROD 1/2-13 UNC - 24 (LH) x 3 FT LONG	MA	393228	*	EA	2	R1,2,3	2		80072	20 pcs.
	Q1 HEAT EXCHANGER ASSEMBLY	ME	390175	*	EA	1					
	OUTER TUBE WELDMENT	ME	390176	*	EA	1					
84	END FLANGE	MC	390031	B	EA	1	IB4 Bin	1		77209	48 pcs.
85	OUTER SHELL PIPE	MD	390177	*	EA	1	P/N	1		74998	4 pcs.
86	END PLATE	MB	390178	*	EA	1	R1,2,3	1		79644	11 pcs.
	CORRUGATED TUBE ASSEMBLY	ME	390179	*	EA	1					
87	CORRUGATED TUBE SUPPORT	MC	390028	*	EA	6	R9,S1,L4	6		78144	27 pcs.
88	CORRUGATED TUBE RESTRICTOR	MC	390029	A	EA	1	R9,S1,L4	1		77724	45 pcs.
89	CORRUGATED TUBE WELDMENT	ME	390393	*	EA	1	P/N	1		79282	4 pcs.

TD - Engineering Fabr tion Component Kit List

ORIGINAL

	Description	Dwg Size	Number	Rev	Unit	Quantity Required	Location	Quantity Issued	E&F Verified	Routing Form Number	Spares Number / Comment
	Q1 PUMPING LINE WELDMENT	ME	390182	*	EA	1					
90	Q1 PUMPING LINE PIPE	MB	390183	*	EA	1	P/N	1		80000	4 pcs.
91	Q1 PUMPING LINE RETURN FITTING	MC	390184	A	EA	1	R7,3,2	1		81587	5 pcs.
92	Q1 IP END COLLECTION POT WELDMENT	MD	390185	A	EA	1	R7,S2,L2	1		79584	4 pcs.
	Q1 PIPING INSULATION	ME	390541	*	EA	1					
93	PUMPING LINE END FLANGE	MB	390032	B	EA	1	IB4 Bin	1		77210	53 pcs.
94	Q1 / Q3 MLI END BLANKET	ME	390542	*	EA	1	Site 38	1		79877	18 pcs.
95	Q1 / Q3 MLI MID BLANKET	ME	390543	*	EA	1	Site 38	1		79878	10 pcs.
96	Q1 MLI IP END BLANKET	ME	390544	*	EA	1	Site 38	1		81332	4 pcs.
	Q1 SUSPENSION SYSTEM INSTALLATION COLD MASS ASSEMBLY	*ME*	*390525*	*A*	*EA*	*1*					
97	*TIE BAR SHIM, 6.4 mm*	*MB*	*390118*	*	*EA*	*4*	IB4 Bin	4	✓	77204	40 pcs.
98	*TIE BAR SHIM, 2.4 mm*	*MB*	*390119*	*	*EA*	*4*	IB4 Bin	4	✓	77203	13 pcs.
99	*TIE BAR SHIM, 0.8 mm*	*MB*	*390120*	*	*EA*	*4*	IB4 Bin	4	✓	77202	24 pcs.
100	*SUSPENSION MTG BRACKET*	*MD*	*390279*	*	*EA*	*4*	R9,S1,L1	4		77130	44 pcs.
101	*Q1 / Q3 TIE BAR ASSEMBLY*	*MC*	*390400*	*	*EA*	*2*	P/N	2		77976	22 pcs.
102	*Q1 COLD MASS WELDED ASSEMBLY*	*ME*	*390526*	*D*		*ICB HAS*					
103	*SHIELDING BLOCK*	*MB*	*390534*	*A*	*EA*	*2*	R7,1,3	2		79708	8 pcs.
104	*M8 x 50.0 mm LG SHCS 18-8 STN STEEL*	*MA*	*393020*	*	*EA*	*12*	IB4 Bin	12	✓	82378	136 pcs.

ORIGINAL

TD - Engineering Fabr tion Component Kit List

	Description	Dwg Size	Number	Rev	Unit	Quantity Required	Location	Quantity Issued	E&F Verified	Routing Form Number	Spares Number / Comment
105	***M8 HEX NUT, 18-8 STN STEEL***	***MA***	***393023***	*	***EA***	***12***	**IB4 Bin**	12	[illegible]	82857	**48 pcs.**
106	***M8 FLAT WASHER, 18-8 STN STEEL***	***MA***	***393025***	*	***EA***	***12***	**IB4 Bin**	12	[illegible]	76745	**790 pcs.**
107	***M8 LOCK WASHER, 18-8 STN STEEL***	***MA***	***393027***	*	***EA***	***12***	**IB4 Bin**	12	[illegible]	76744	**821 pcs.**
	COLD MASS INSULATION ASSEMBLY	*ME*	*390524*	*A*	*EA*	*1*					
108	***MOUNTING LUG BLANKET***	***MC***	***390496***	*	***EA***	***8***	**Site 38**	8	[illegible]	79873	**167 pcs.**
109	***Q1/Q3 END BLANKET***	***ME***	***390521***	*	***EA***	***1***	**Site 38**	1	[illegible]	79874	**18 pcs.**
110	***Q1/Q3 MID BLANKET***	***ME***	***390522***	*	***EA***	***1***	**Site 38**	1	[illegible]	79875	**11 pcs.**
111	***Q1 IP END BLANKET***	***ME***	***390523***	*	***EA***	***1***	**Site 38**	1	[illegible]	79876	**5 pcs.**

Revision Request Control Number: 1722

Specification Number: 5520 - TR - 333755 Current Revision: D

Traveler or Document Title LHC Q1 LQXA Cryostat Final Assembly Traveler

Step #/Description of Revision:

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.
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 NO INTERFERENCE 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".
8.5 Added Step. "Perform a pressurized Helium Leak Check of the Cryostat Assembly."
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.

John Szostak	Jim Rife	4/6/2005
Originator	Responsible Authority	Date
Revision Incorporated into the Traveler:	John Szostak	5/25/2005
	Revision Incorporated By	Date
Process Engineering Final Review:	Jamie Blowers	5/25/2005
	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: 1763

Specification Number: 5520 - TR - 333755 Current Revision: E

Traveler or Document Title LHC Q1 LQXA Cryostat Final Assembly Traveler

Step #/Description of Revision:

4.58 Modified Step. Changed Drawings to reflect proper location of missing 4.5k Intercept Line.
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.
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.)
7.1 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.
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.

John Szostak	Jim Rife	8/3/2005
Originator	Responsible Authority	Date

Revision Incorporated into the Traveler:

John Szostak	5/25/2005
Revision Incorporated By	Date

Process Engineering Final Review:

Bob Jensen	5/25/2005
Process Engineering/Designee	Date

Instructions for the completion of the Revision Request Form

Note(s):

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

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

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

Originator Instructions:

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

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

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

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

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

Process Engineering Office Instructions:

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

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

Traveler Title:	Specification No:	Revision:	DR No:
LHC Q1 LQXA Cryostat Final Assembly Traveler	333755	D	4214

Step No:	Drawing No:	Routing Form No:	Serial No:	Rework ID:
6.6	ME-390127		LQXA07	0

Discrepancy Description:

During the installation and adjustment of Suspension System Adjusting Screws the screw on the Non-IP end bottom galled and became stuck. Looking at the Non-IP end towards the IP end it was the bottom right screw. The screw was cut out and the hole re-tapped to accept a new adjusting screw. All of the bottom screws were removed and replaced with a screw of the same size but made from a different material. The material used for these (4) prototype adjusting screw is C936 Bearing Bronze.

Originator: Jim Rife

Date: 5/10/2005

Cause of Nonconformance:

The bottom four steel lugs were replaced with lugs made from C936 Bearing Bronze. This material was chosen to reduce the galling of the lug in the vacuum vesel.

Responsible Authority: Thomas Page

Date: 5/17/2005

Disposition:

The new lugs were used in the bottom 4 ports of this magnet.

Responsible Authority: Thomas Page

Date: 5/17/2005

Corrective Action to Prevent Recurrence:

It is recommended to use new bronze lugs on all new magnet assemblies. A drawing has been released and the order will be written and sent for approval.
Disposition verify notes: New Part added to Traveler and Parts Kit: ADJUSTING SCREW - VERSION 2 (BRONZE) (MC-390878) (TRR No. 1763)

Responsible Authority: Thomas Page

Date: 5/17/2005

Corrective Action/Disposition Verified By: John Szostak

Date: 9/19/2005 7:35:29 AM

Will Configuration be affected?: ☐ YES ☑ NO

Identified problem area:

☑ Material ☐ Manpower ☐ Method ☐ Machine ☐ Measurement

Reviewed By: Bob Jensen

Date: 9/19/2005