Document ID:

2357

LHC Q1 LQXA Cryostat Final Assembly Traveler

333755 / Rev. A

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!!!

LQXA04-0

Document ID:

2357

Job No.:

248

Project/Task No.

300/1.1.1.6.2

Series:

LQXA

Serial No:

LQXA04

Rework ID:

0

Specification No.:

333755

Revision:

A

LQXA04-0

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*

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Prepared by: J. Szostak

Title	Signature	Date
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TD / LHC Production Engineer Cryostat	*Tom Page* Tom Page / Designee	*7/14/04*
TD / LHC Project Engineer Cryostat	*Tom Page* Tom Nicol / Designee	*7/14/04*
TD / LHC Program Manager	*Jim Strait* Jim Kerby / Designee	*7/14/04*

Revision Page

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		

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.

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. Spostak
Process Engineering/Designee

7/15/04
Date

Rev. None issued previously.
Signatures and dates transferred
to new Rev. A.

John J. Spostak
- LHC Process Engineer

3.0 Vacuum Vessel Preparation and Painting

3.1 Record the Vacuum Vessel Serial Number.

Q1-8

Technician(s) _____ Date 7/9/04

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

Technician(s) _____ Date 7/9/04

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

Technician(s) _____ Date 7/9/04

TRR#7105 NO DF QA NEEDED NO SUP

3.4 Leak Check the Vacuum Vessel Assembly (ME-390122) 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 $^{-}$ ___

Inspector N/A _____ Date _____

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 7/10/04

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 7/15/04

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

Technician(s) _____ Date 7/10/04

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

SNG

Technician(s) _____ Date 7/10/04

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.

Lead Person _____ Date 7/12/04

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

Technician(s) _____ Date 7/12/04

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 7/20/04

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

Technician(s) _____ Date 7-20-04

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

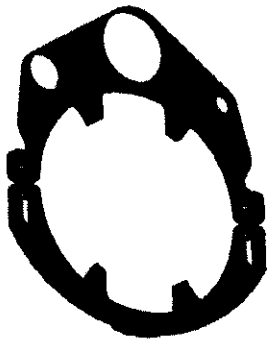
Technician(s) _____ Date 7/20/04

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 7/20/04

PLACE [redacted]

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

Technician(s) _____ Date 7/20/04

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 7/20/04

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 7/20/04

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 7/21/04

4.9 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 7/21/04

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

Technician(s) _____ Date 7/21/04

4.11 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 7/21/04

WELD ~~AT~~ PIPE SUPPORT CLIPS.

TRR# 1705

WELDER _____ DATE 7/21/04

4.12 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 7/21/04

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

Technician(s) _____ Date 7/21/04

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

Technician(s) _____ Date 7/21/04

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

Technician(s) _____ Date 7/21/04

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

Technician(s) _____ Date 7/21/04

4.17 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 7/22/04

4.18 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 7/22/04

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

Technician(s) _____ Date 7/22/04

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

Technician(s) _____ Date 7/22/04

4.21 Position Corrugated Tube Assembly (ME-390179).

Technician(s) _____ Date 7/22/04

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

Technician(s) _____ Date 7/22/04

4.23 Purge the assembly using Argon (Ar) gas.

Technician(s) _____ Date 7/23/04

4.24 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 7/23/04

4.25 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 7/23/04

4.26 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 7/23/04

4.27 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 7/23/04

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

Technician(s) _____ Date 7/23/04

4.29 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 7/23/04

4.30 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 7/23/04

4.31 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 7/23/04

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

SEE TCN PAGE, TRR# 1617

Weldor(s) _____ Date 7/23/04

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

Technician(s) _____ Date 7/26/04

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

Responsible Authority/Physicist _____ Date 7/28/04

4.35 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. Page for T. Nicol

Responsible Authority/Physicist _____ Date 7/28/04

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

Technician(s) _____ Date 7/28/04

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

Technician(s) _____ Date 7/28/04

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

Technician(s) _____ Date 7/28/04

DR# HGQ 0477

4.39 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).

Sub

Welder(s) _____ Date 7-28-04

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

Technician(s) _____ Date 7/28/04

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

Technician(s) _____ Date 7/28/04

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

Technician(s) _____ Date 7/28/04

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

Welder(s) _____ Date 7-28-04

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

Technician(s) _____ Date 7/28/04

4.45 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).

Jeff Rolseth — 7-28-04
Welder(s) — Date

4.46 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)

Jeff Rolseth — 7-28-04
Welder(s) — Date

4.47 Weld the Q1 Pumping Line Assembly (ME-390182) to the Q1 Pipe Anchor (MC-390186) as per Q1 Cryostat Assembly Internal Piping (ME-390174).

Jeff Rolseth — 7-28-04
Welder(s) — Date

4.48 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).

Jeff Rolseth — 7-28-04
Welder(s) — Date

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

[illegible] — 7/28/04
Technician(s) — Date

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

T Page — 7/28/04
Responsible Authority/Physicist — Date

4.51 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.

T. Page — 7/28/04
Responsible Authority/Physicist — Date

4.52 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
	VESSEL		MSLD SENSITIVITY				
GDu	4050	4050	2	5045	4041	3.85×10^{-8}	3.1×10^{-10}
			100	"	"	3.85 x E-8	1.6 x E-8

D. Gdu
Technician(s)

8-5-04
Date

DR# HGQ-0479
TRR# 1705

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

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
GDu	4041	4041	2	4045	4041	3.91 x E-8	4.8×10^{-10} x E-

D. Gdu
Technician(s)

8-5-04
Date

Tighten Tie Rods!

5.0 Shield Assembly

5.1 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 8/6/04

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

Technician(s) _____ Date 8/7/04

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

Technician(s) _____ Date 8/7/04

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

Technician(s) _____ Date 8/7/04

5.5 ~~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-390314) on the Rails first.

Technician(s) _____ Date 8/7/04

390314 is Q2 # Should BE 390488? changed in Rev. C

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

Technician(s) _____ Date 8/7/04

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

Technician(s) _____ Date 8/7/04

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

Technician(s) _____ Date 8/7/04

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

Technician(s) _____ Date 8/9/04

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

Technician(s) _____ Date 8/9/04

TRR# TRR# 1722 AFTER WELD JCP 6-12

5.11 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
[illegible]	50x1	50x1	2	48x5	50x1	3.85 xE-8	4.0 xE-10

Inspector

8-19-04
Date

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

Technician(s)

8/9/04
Date

6.0 Cold Mass Insertion into the Vacuum Vessel

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

Technician(s) _____ Date 8-10-04

6.2 Install the Cold Mass Pull-in Tooling.

Technician(s) _____ Date 8-10-04

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

Technician(s) _____ Date 8-10-04

6.4 Connect the cable to the Pull-in Tooling.

Technician(s) _____ Date 8-10-04

6.5 Pull the Cold Mass Assembly into the Vacuum Vessel.

Technician(s) _____ Date 8/10/04

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

Technician(s) _____ Date 8-10-04

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

Technician(s) _____ Date 8/11/04

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 8/12/04

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 8/13/04

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

Technician(s) _____ Date 8/13/04

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

Technician(s) _____ Date 8/17/04

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 8/17/04

LKCK COOLING PIPE CROSSOVER
MDC = 4X10 CC/SECOND
MS 30521

INSP. _____ DATE 8-19-04

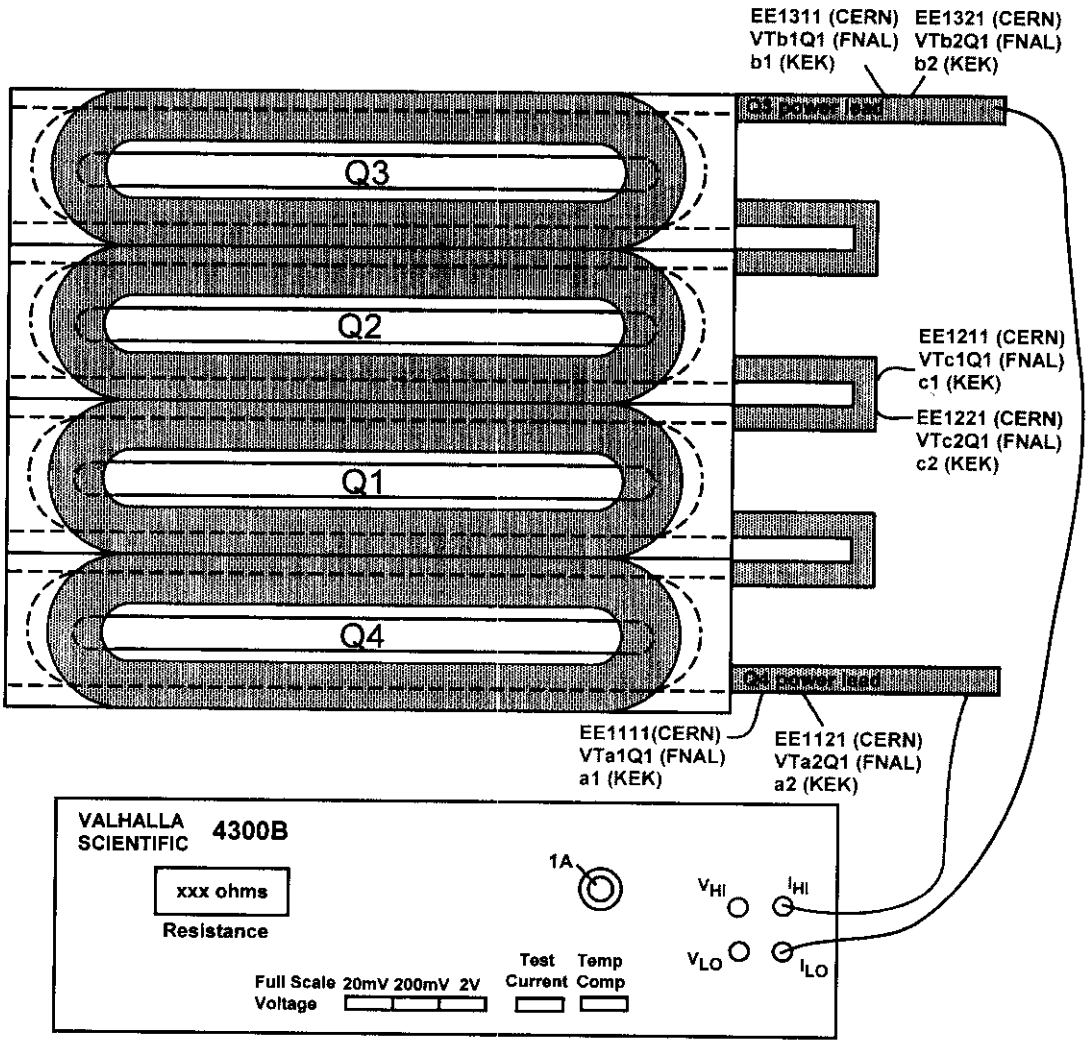
7.0 Final Electrical Inspection

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 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 to Ω
Voltage Tap Serial Numbers				Total Resistance
Connect	Fermi	CERN	KEK	
V_{HI}	VTa1Q1	EE1111	a1	342.1 Ω
V_{LO}	VTc1Q1	EE1211	c1	
V_{HI}	VTc1Q1	EE1211	c1	343.0 Ω
V_{LO}	VTb1Q1	EE1311	b1	
V_{HI}	VTa1Q1	EE1111	a1	685.1 Ω
V_{LO}	VTb1Q1	EE1311	b1	
				Total Resistance with Leads
V_{HI}	Q4 Power Lead			685.5 Ω
V_{LO}	Q3 Power Lead			

Technician(s)

8/17/04
Date

Check resistance of Redundant Voltage Taps.

Q1 Redundant Voltage Taps				
Connect	Fermi	CERN	KEK	Resistance
V_{HI}	VTa2Q1	EE1121	a2	342.2 Ω
V_{LO}	VTc2Q1	EE1221	c2	
V_{HI}	VTc2Q1	EE1221	c2	343.1 Ω
V_{LO}	VTb2Q1	EE1321	b2	

Technician(s)

8/17/04
Date

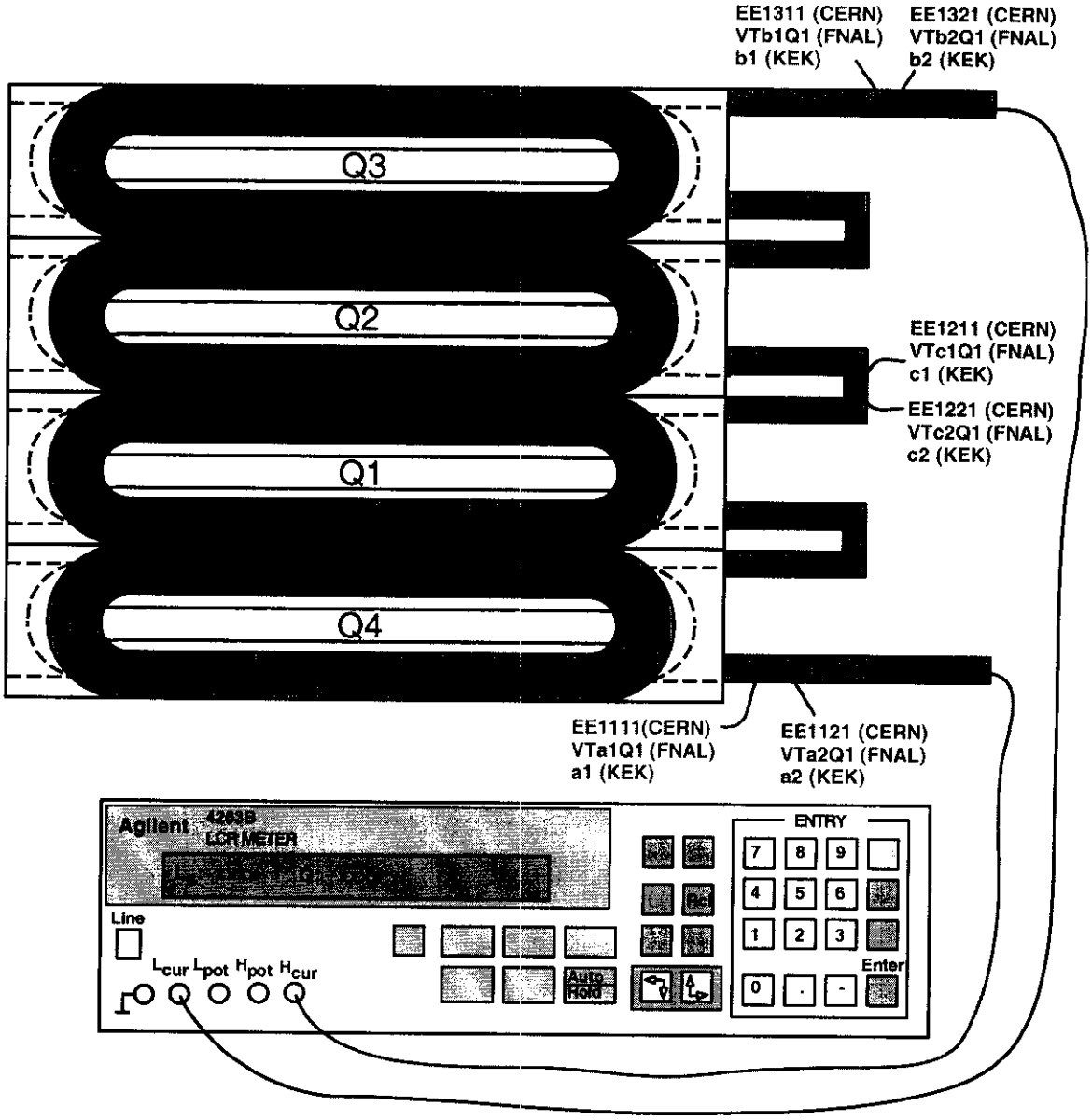
To measure Ls and Q of a Q1 Cold Mass:

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 ~ to mH
Voltage Tap Serial Numbers				Total Inductance
Connect	Fermi	CERN	KEK	
H_{POT}	VTa1Q1	EE1111	a1	15.451 mH
L_{POT}	VTc1Q1	EE1211	c1	
H_{POT}	VTc1Q1	EE1211	c1	15.435 mH
L_{POT}	VTb1Q1	EE1311	b1	

H_{POT}	VTa1Q1	EE1111	a1	30.880 H
L_{POT}	VTb1Q1	EE1311	b1	

(Q1) Q-Factor				Nominal ~ to
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	

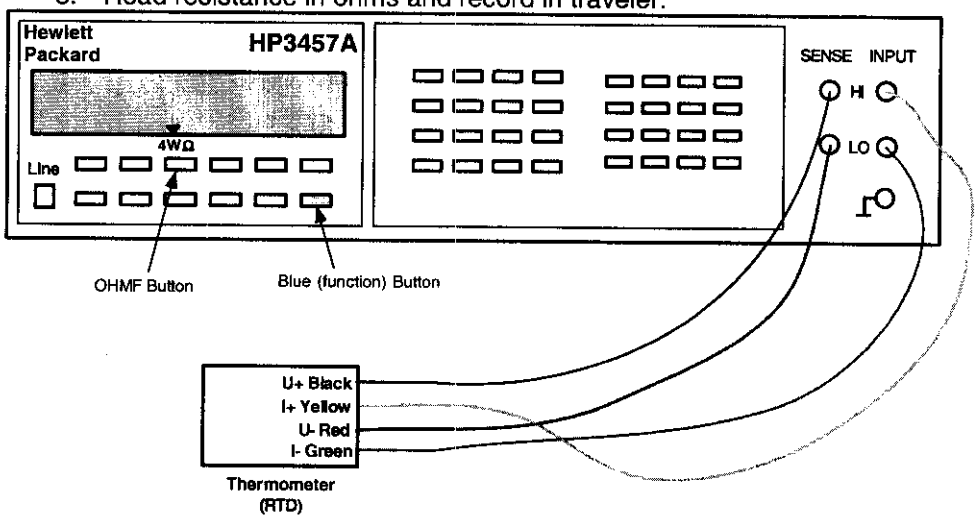
H_{POT}	VTa1Q1	EE1111	a1	1.1
L_{POT}	VTb1Q1	EE1311	b1	

Technician(s)

8/12/04
Date

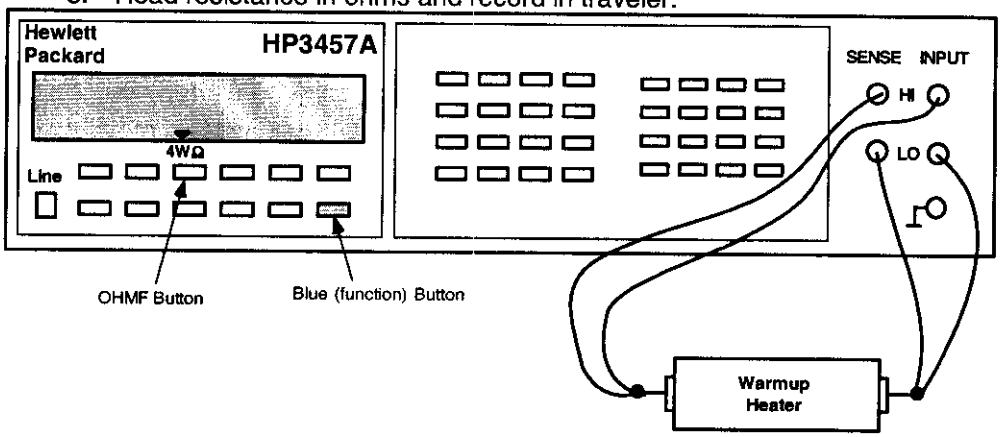
To measure the resistance of a Thermometer (RTD):

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.



74° in building

Q1 - RTD's and Cryogenic (warm-up) Heaters			
Component	**Fermi**	**CERN**	**Resistance**
Q1 RTD, primary	TaQ1	TT8311	65.314 Ω
Q1 RTD, redundant	TbQ1	TT8321	67.514 Ω
Q1 Cryogenic (warm-up) Heater (LE) - wire at top (CERN #1 I+)	W1aQ1	EH8311+	17.637 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+	18.080 Ω
Q1 Cryogenic (warm-up) Heater (Non-LE) - wire at bottom (CERN #2 I-)	W2bQ1	EH8321-	

Technician(s) _____ Date 8/17/04

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**	Ω	31.571 Ω
H2aQ1	**YT1111-**	**HA2**			
H1bQ1	**YT1121+**	**HB1**	**Circuit B**	Ω	31.556 Ω
H2bQ1	**YT1121-**	**HB2**			

Technician(s) _____ Date 8/17/04

7.2 Using the HP4284A, connect power thru the corrector Power Leads (HA1 and HB1 to measure Q1-H1 or VA1 and VB1 to measure Q1-V1). Connect the Sense Leads as shown in table below and record resistance.

MCBX Corrector Coil Taps			
Component	**FermiLab Label**	**CERN Label**	**Resistance**
Q1-H1	**VTH1**	**EE8121**	21.706 Ω
	HA1	**N/A**	
Q1-V1	**VTV1**	**EE8111**	17.677 Ω
	VA1	**N/A**	

Technician(s)

8/17/04
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 11-30-04

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

Technician(s) _____ Date 11-30-04

8.3 Fuse the Ends of the Leads.

Weldor(s) _____ Date 11/30/04

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

Technician(s) _____ Date 11-30-04

8.5 Install the Vinyl Flange Covers (MA-390491), (MA-390492), (MA-390493), (MA-390494), & the Alignment Fiducial Covers (MA-390495).

Technician(s) _____ Date 11/30/04

TRR# 1722 STRETCH WIRE & PIPE ALIGNMENT HERE.

FINAL HELIUM PRESSURIZATION HERE.

PART NO. LQXA-004		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				
11-29-04 FINAL CKTBT	GAW	60X1	60X1	2	38X5	60X1	2.85×10^{-8}	

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:

J. Lyostak
Process Engineering/Designee

5/24/05
Date

TD - Engineering Fabrication Component Kit List

ORIGINAL

Process Engineering

Component Serial No.	LQXA04
Kit submitted by:	John Szostak Ext. 2003
Fermi ID No.	02943C
Date submitted:	11-Jun-04
Need date:	25-Jun-04
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. E
Drawing Title:	Q1 CRYOSTAT ASSEMBLY - INTERNAL PIPING
Drawing No.	ME-390174 Rev. B
Drawing Title:	*Q1 SUSPENSION SYSTEM INSTALLATION*
Drawing No.	*ME-390525* *Rev. **

Material Control

Parts available

Verified by:	M. Schmidt MS
Fermi ID No.	4223
Date submitted to stockroom:	18-Jun-04

Parts issued

Issued by:	[illegible]
Fermi ID No.	11939
Date issued:	6/25/04
Parts received by E&F:	John J. Szostak
Fermi ID No.	02943C
Date received by E&F:	6/25/04

	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	JJS	81596	139 pcs.
2	VACUUM VESSEL ASSEMBLY	ME	390122	E	EA	1	Site 38	1	JJS	78783	S/N #8 (3 pcs.)
3	TARGET HOLDER	MD	390211	B	EA	4	R10,1,1	4	JJS	74751	64 pcs.
4	COOLING PIPE BRACKET	MB	390316	A	EA	4	IB4 Bin	4	JJS	77195	76 pcs.
5	COOLING PIPE CLAMP	MB	390317	*	EA	8	IB4 Bin	8	JJS	77196	159 pcs.
6	Blank Non-Rotatable Conflat Flange, 4.62" OD 304 SS	MA	390374	*	EA	8	R8,3,4	8	JJS	78987	156 pcs.
7	COPPER GASKET	MA	390375	*	EA	8	IB4 Bin	8	JJS	78429	167 pcs.
8	BOLT SET, HEX HEAD, 5/16 - 24 x 1.25 w/ WASHER	MA	390376	*	EA	80	IB4 Bin	80	JJS	72306	1564 pcs.

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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 SHIM - 0.5mm	MA	390276	*	EA	8	IB4 Bin	8	[illegible]	76910	72 pcs.
44	SUSPENSION SYSTEM SUPPORT PIN BOLTS	MA	390277	*	EA	8	IB4 Bin	8	[illegible]	76913	320 pcs.
45	SUSPENSION SYSTEM SUPPORT PIN SHIM 0.13 mm	MA	390480	*	EA	8	R2, S2,L4	8	[illegible]	79121	313 pcs.
46	SUSPENSION SYSTEM SUPPORT SHIM 0.25 mm	MA	390481	*	EA	12	R2, S2,L4	12	[illegible]	79122	477 pcs.
Q1 INSULATED SHIELD AND PIPING ASSEMBLY		ME	390173	A	EA	1	-		—		
47	Q1 SHIELD MLI INNER BLANKET	ME	390487	*	EA	1	Site 38	1	[illegible]	79869	6 pcs.
48	Q1 SHIELD MLI OUTER BLANKET	ME	390488	*	EA	1	Site 38	1	[illegible]	79870	6 pcs.
Q1 THERMAL SHIELD ASSEMBLY		ME	390429	C	EA	1	-		—		
49	SUPPORT BAND	ME	390083	A	EA	4	P/N	4	[illegible]	77146	84 pcs.
50	RETAINER	MA	390086	*	EA	16	IB4 Bin	16	[illegible]	77131	322 pcs.
51	ALUMINUM SPACER	MA	390373	*	EA	32	IB4 Bin	32	[illegible]	76874	780 pcs.
52	RETAINING WASHER	MA	390378	*	EA	232	IB4 Bin	232	[illegible]	76875	4980 pcs.
53	COOLING TUBE WELDMENT	MD	390431	A	EA	2	P/N	2	[illegible]	79280	12 pcs.
54	IP END SECTION	ME	390433	*	EA	2	Site 38	2	[illegible]	79610	12 pcs.
55	NON-IP END SECTION	ME	390434	*	EA	2	P/N	2	[illegible]	79611	12 pcs.
56	Q1 - Q3 CENTER SECTION	ME	390435	*	EA	2	P/N	2	[illegible]	79383	30 pcs.
57	COOLING PIPE CROSSOVER	MD	390466	A	EA	1	R8,S1,L2	1	[illegible]	79201	6 pcs.
58	COOLING PIPE CROSSOVER CONNECTOR	MA	390467	*	EA	2	IB4 Bin	2	[illegible]	78830	12 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	SUPPORT BRACKET ASSEMBLY	MD	390683	A	EA	4	R7,S1,L4	4	QA	80686	109 pcs.
60	SUPPORT BRACKET INSULATION SPACER	MA	390722	*	EA	8	IB4 Bin	8	QA	81319	223 pcs.
61	BUTTON HEAD CAP SCREW, M5 x 16.0 LG	MA	393028	*	EA	232	IB4 Bin	232	QA	76826	5061 pcs.
Q1 INTERNAL PIPING ASSEMBLY		ME	390174	B	EA	1	-		—		
62	TIE BAR RETAINING CLAMP	MB	390136	*	EA	4	IB4 Bin	4	QA	77132	81 pcs.
63	Q1 4.5K INTERCEPT LINE TUBE	MB	390192	*	EA	3	P/N	3	QA	81302	18 pcs.
64	WELD CONNECTOR ADAPTER	MC	390278	*	EA	1	R1,S1,L3	1	QA	79471	15 pcs.
65	INTERCEPT LINE PIPE STOP	MA	390379	A	EA	6	IB4 Bin	6	QA	78894	167 pcs.
66	Q1/Q3 PIPE ANCHOR	MC	390486	*	EA	1	R8,S1,L4	1	QA	79387	15 pcs.
67	M6 x 45.0mm LG HEX SHCS, 18-8 STN STEEL	MA	393017	*	EA	4	IB4 Bin	4	QA	77846	40 pcs.
68	M6 HEX NUT, 18-8 STN STEEL	MA	393022	A	EA	4	IB4 Bin	4	QA	78236	42 pcs.
69	M6 FLAT WASHER 18-8 STN STEEL	MA	393024	*	EA	4	IB4 Bin	4	QA	78891	652 pcs.
70	M6 LOCK WASHER 18-8 STN STEEL	MA	393026	*	EA	4	IB4 Bin	4	QA	78850	40 pcs.
71	COOLDOWN LINE END FLANGE	MB	390033	B	EA	1	IB4 Bin	1	QA	77844	47 pcs.
72	Q1-Q3 PIPE SUPPORT ASSEMBLY	MD	390092	A	EA	3	P/N	3	QA	76617	45 pcs.
73	Q1 COOLDOWN LINE WELDMENT	MD	390193	A	EA	1	P/N	1	QA	80001	6 pcs.
74	Q1 COLD MASS ASSEMBLY	ME	390526	C		ICB HAS	-		—		
Q1 / Q3 INSTALLATION TIE ROD ASSEMBLY		MC	390638	*	EA	2	-		—		

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
75	Q1 & Q3 INSTALLATION TIE-ROD SHORT THREADED ROD	MA	390639	*	EA	2	R2,2,2	2	[illegible]	81098	18 pcs.
76	JAM NUT (LH)	MA	393046	*	EA	4	IB4 Bin	4	[illegible]	80074	90 pcs.
77	STD ANSI HEX THIN JAM NUT 1/2-13 UNC	MA	393225	*	EA	8	IB4 Bin	8	[illegible]	80073	212 pcs.
78	STD HEX COUPLING NUT 1/2-13 UNC (RH-LH)	MA	393226	*	EA	4	IB4 Bin	4	[illegible]	80075	84 pcs.
79	THREADED ROD 1/2-13 UNC - 24 x 6 FT LONG	MA	393227	*	EA	2	R7,2,4	2	[illegible]	80061	42 pcs.
80	THREADED ROD 1/2-13 UNC - 24 (LH) x 3 FT LONG	MA	393228	*	EA	2	R1,2,3	2	[illegible]	80072	40 pcs.
	Q1 HEAT EXCHANGER ASSEMBLY	ME	390175	*	EA	1	-		—		
	OUTER TUBE WELDMENT	ME	390176	*	EA	1	-		—		
81	END FLANGE	MC	390031	B	EA	1	IB4 Bin	1	[illegible]	77209	56 pcs.
82	OUTER SHELL PIPE	MD	390177	*	EA	1	P/N	1	[illegible]	79998	6 pcs.
83	END PLATE	MB	390178	*	EA	1	R1,2,3	1	[illegible]	79644	15 pcs.
	CORRUGATED TUBE ASSEMBLY	ME	390179	*	EA	1	-		—		
84	CORRUGATED TUBE SUPPORT	MC	390028	*	EA	6	R9,S1,L4	6	[illegible]	77647	75 pcs.
85	CORRUGATED TUBE RESTRICTOR	MC	390029	A	EA	1	R9,S1,L4	1	[illegible]	77724	55 pcs.
86	CORRUGATED TUBE WELDMENT	ME	390393	*	EA	1	P/N	1	[illegible]	79282	6 pcs.
	Q1 PUMPING LINE WELDMENT	ME	390182	*	EA	1	-		—		
87	Q1 PUMPING LINE PIPE	MB	390183	*	EA	1	P/N	1	[illegible]	80000	6 pcs.
88	Q1 PUMPING LINE RETURN FITTING	MC	390184	A	EA	1	R7,3,2	1	[illegible]	81587	7 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
89	Q1 IP END COLLECTION POT WELDMENT	MD	390185	*	EA	1	R7,S2,L2	1	[illegible]	79584	6 pcs.
	Q1 PIPING INSULATION	ME	390541	*	EA	1	-		—		
90	PUMPING LINE END FLANGE	MB	390032	B	EA	1	IB4 Bin	1	[illegible]	72210	63 pcs.
91	Q1 / Q3 MLI END BLANKET	ME	390542	*	EA	1	X Site 38	1	[illegible]	81330	24 pcs.
92	Q1 / Q3 MLI MID BLANKET	ME	390543	*	EA	1	Y Site 38	1	[illegible]	81331	14 pcs.
93	Q1 MLI IP END BLANKET	ME	390544	*	EA	1	Site 38	1	[illegible]	81332	6 pcs.
	Q1 SUSPENSION SYSTEM INSTALLATION COLD MASS ASSEMBLY	*ME*	*390525*	*	*EA*	*1*	-		—		
94	*TIE BAR SHIM, 6.4 mm*	*MB*	*390118*	*	*EA*	*4*	IB4 Bin	4	[illegible]	77204	29 pcs.
95	*TIE BAR SHIM, 2.4 mm*	*MB*	*390119*	*	*EA*	*4*	IB4 Bin	4	[illegible]	77203	28 pcs.
96	*TIE BAR SHIM, 0.8 mm*	*MB*	*390120*	*	*EA*	*4*	IB4 Bin	4	[illegible]	77202	28 pcs.
97	*SUSPENSION MTG BRACKET*	*MD*	*390279*	*	*EA*	*4*	X R9,S1,L1	4	[illegible]	77180	60 pcs.
98	*Q1 / Q3 TIE BAR ASSEMBLY*	*MC*	*390400*	*	*EA*	*2*	P/N	2	[illegible]	77976	30 pcs.
99	*Q1/Q3 COLD MASS END BLANKET*	*ME*	*390521*	*	*EA*	*1*	Site 38	1	[illegible]	79874	24 pcs.
100	*Q1/Q3 COLD MASS MID BLANKET*	*ME*	*390522*	*	*EA*	*1*	Site 38	1	[illegible]	79875	15 pcs.
101	*Q1 INSULATION, COLD MASS IP END BLANKET*	*ME*	*390523*	*	*EA*	*1*	Site 38	1	[illegible]	79876	8 pcs.
102	*Q1 COLD MASS WELDED ASSEMBLY*	*ME*	*390526*	*C*		*ICB HAS*	-		—		
103	*SHIELDING BLOCK*	*MB*	*390534*	*A*	*EA*	*2*	R7,1,3	2	[illegible]	79708	12 pcs.
104	*M8 x 50.0 mm LG SHCS 18-8 STN STEEL*	*MA*	*393020*	*	*EA*	*12*	IB4 Bin	12	[illegible]	77847	56 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		76746	182 pcs.
106	*M8 FLAT WASHER, 18-8 STN STEEL*	*MA*	*393025*	*	*EA*	*12*	IB4 Bin	12		76745	944 pcs.
107	*M8 LOCK WASHER, 18-8 STN STEEL*	*MA*	*393027*	*	*EA*	*12*	IB4 Bin	12		76744	967 pcs.
	COLD MASS INSULATION ASSEMBLY	*ME*	*390524*	*A*	*EA*	*1*	-		—		
108	*MOUNTING LUG BLANKET*	*MC*	*390496*	*	*EA*	*8*	Site 38	8			223 pcs.
109	*Q1 IP END BLANKET*	*ME*	*390523*	*	*EA*	*1*	Site 38	1		79876	8 pcs.
110	*Q1/Q3 MID BLANKET*	*ME*	*390522*	*	*EA*	*1*	Site 38	1		79875	15 pcs.
111	*Q1/Q3 END BLANKET*	*ME*	*390521*	*	*EA*	*1*	Site 38	1		79874	24 pcs.

8-2-04 0900HRS 40X500
8-3-04 0900HRS

Revision Request Control Number: 1705

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

Traveler or Document Title LHC Q1 LQXA Cryostat Final Assembly Traveler

Step #/Description of Revision:

1.6 Added Step. "Protect the bellows during all stages of production." DR No. HGQ-0500.
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) and the 4.5K Intercept Line Tubes (MB-390192) 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.

John Szostak	Jim Rife	1/18/2005
Originator	Responsible Authority	Date
Revision Incorporated into the Traveler:	John Szostak	2/28/2005
	Revision Incorporated By	Date
Process Engineering Final Review:	Jamie Blowers	2/28/2005
	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: 1617

Specification Number: 5520 - TR - 333755 Current Revision: NONE

Traveler or Document Title LHC Q1 LQXA Cryostat Final Assembly Traveler

Step #/Description of Revision:

1.4 Removed Step. "All personnel performing steps in this traveler must have documented training for this traveler and associated operating procedures."
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 ooling 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

John Szostak	Jim Rife	3/10/2004
Originator	Responsible Authority	Date
Revision Incorporated into the Traveler:	John Szostak	7/14/2004
	Revision Incorporated By	Date
Process Engineering Final Review:	Jamie Blowers	7/14/2004
	Process Engineering/Designee	Date

Instructions for the completion of the Revision Request Form

Note(s):

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

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

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Process Engineering Office Instructions:

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

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Traveler Title:	Specification No:	Revision:	DR No:
LHC Q1 LQXA Cryostat Final Assembly Traveler	5520-TR-333755	A	HGQ-0477

Step No:	Drawing No:	Routing Form No:	Serial No:	Rework ID:
4.39	390174		LQXA04	0

Discrepancy Description:

The pumping line end flange was damaged by an arc from the weldor. The sealing surface had a scar from the arc. The flange was polished and it has two pits left in the flange.

JAN 20 2005

Originator: Steve Gould

Date: 7/29/2004

Cause of Nonconformance:

Welding torch touched the flange sealing surface.

Responsible Authority: Thomas Page

Date: 7/29/2004

Disposition:

Polish the flange to repair the surface. The pits do not interfere with the sealing area of the flange.

Responsible Authority: Thomas Page

Date: 7/29/2004

Corrective Action to Prevent Recurrence:

Weldor must be careful not to touch the sealing surface with the torch. No traveler change.

Responsible Authority: Thomas Page

Date: 7/29/2004

Corrective Action/Disposition Verified By: John Szostak

Date: 1/18/2005

Will Configuration be affected?: ☐ YES ☑ NO

Identified problem area:

☐ Material ☐ Manpower ☑ Method ☐ Machine ☐ Measurement

Reviewed By: Bob Jensen

Date: 1/20/2005

Traveler Title:	Specification No:	Revision:	DR No:
LHC Q1 LQXA Cryostat Final Assembly Traveler	5520-TR-333755	A	HGQ-0479

Step No:	Drawing No:	Routing Form No:	Serial No:	Rework ID:
4.53	390174		LQXA04	0

Discrepancy Description:

All three 4.5k intercept lines are dirty on the inside. There is no step in the traveler to have the tubes cleaned. The 4.5k line closest to the open hole on the pipe support has a pitted spot on the IP end.

JAN 20 2005

Originator: Steve Gould

Date: 8/5/2004

Cause of Nonconformance:

Tubes were not cleaned. The pitted spot is a scratch or ding of some type.

Responsible Authority: Thomas Page

Date: 8/5/2004

Disposition:

Clean the tubes. The tube is ok to use.

Responsible Authority: Thomas Page

Date: 8/5/2004

Corrective Action to Prevent Recurrence:

Add a step in the traveler to clean the 4.5K intercept tubes. (TRR No. 1705)

Responsible Authority: Thomas Page

Date: 8/5/2004

Corrective Action/Disposition Verified By: John Szostak

Date: 1/18/2005

Will Configuration be affected?: ☐ YES ☑ NO

Identified problem area:

☐ Material ☐ Manpower ☑ Method ☐ Machine ☐ Measurement

Reviewed By: Bob Jensen

Date: 1/13/2005

ADDITIONAL PARTS REQUEST

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

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

MAGNET OR COIL # *LQXA04*

REQUESTED BY *Steve Gould*

DATE REQUESTED *10/22/04*

DELIVER TO *ICB-Steve Gould*

BUDGET CODE *300/1.1.1.3.4(LCD)*

NEED BY DATE *10/22/04*

JOB TICKET #

MMR #

MACHINE SHOP REQ. #

PO #

PURCHASE RELEASE #

OTHER

PARTS STATUS (CHECK ONE)

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

ACQUISITIONER SIGNATURE Marsha Schmidt **ID#** 4223 **DATE** 10/22/04

PLEASE INDICATE REVISION REQUIRED

IN STOCK 12

LOCATION	PART #	REV	QTY	UOM	DESCRIPTION	RF #	SIR #
R2,2,3	*390746*		*2*	*Each*	*Q1 Therm.Bracket*	81736	

STOCKROOM SIGNATURE [illegible] **ID#** 1698 **DATE** 10/22/04

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

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

PARTS RECEIVED BY S Gould **ID#** 4965 **DATE** 10/22/04

ADDITIONAL PARTS REQUEST

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

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

MAGNET OR COIL # *LQXA04*

REQUESTED BY *Steve Gould*

DATE REQUESTED *10/21/04*

DELIVER TO *ICB-Steve Gould*

BUDGET CODE *300/1.1.1.3.4(LCD)*

NEED BY DATE *10/21/04*

JOB TICKET # _____

MMR # _____

MACHINE SHOP REQ. # _____

PO # _____

PURCHASE RELEASE # _____

OTHER _____

PARTS STATUS (CHECK ONE)

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

ACQUISITIONER SIGNATURE Marsha Schmidt **ID#** 4223 **DATE** 10/21/04

PLEASE INDICATE REVISION REQUIRED

LOCATION	PART #	REV	QTY	UOM	DESCRIPTION	RF #	SIR #
IN STOCK 6							
R2,2,2	390717		1	Each	Q1 Pressure coil assy	81315	

STOCKROOM SIGNATURE _____ **ID#** 12302 **DATE** 10/21/04

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

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

PARTS RECEIVED BY S Gould **ID#** 4965 **DATE** 10/21/04

ADDITIONAL PARTS REQUEST

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

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

MAGNET OR COIL # LHC (LQXA04)

REQUESTED BY Steve Gould

DATE REQUESTED 9/21/04

DELIVER TO ICB

BUDGET CODE 300/1.1.1.3.4(LCD)

NEED BY DATE 9/21/04

JOB TICKET #

MMR #

MACHINE SHOP REQ. #

PO #

PURCHASE RELEASE #

OTHER

PARTS STATUS (CHECK ONE)

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

ACQUISITIONER SIGNATURE Marsha Schmidt **ID#** 4223 **DATE** 9/21/04

PLEASE INDICATE REVISION REQUIRED

LOCATION	PART #	REV	QTY	UOM	DESCRIPTION	RF #	SIR #
SHK 100 IB4 Bin	393369	–	24	Each	M4-.7 Nut	81826	

STOCKROOM SIGNATURE [signature] **ID#** 12698 **DATE** 9/22/04

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

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

PARTS RECEIVED BY [signature] **ID#** 4965 **DATE** 9/22/04

ADDITIONAL PARTS REQUEST

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

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

MAGNET OR COIL # LHC (LQXB04)

REQUESTED BY Steve Gould

DATE REQUESTED 9/21/04

DELIVER TO ICB

BUDGET CODE 300/1.1.1.3.4(LCD)

NEED BY DATE 9/21/04

JOB TICKET #

MMR #

MACHINE SHOP REQ. #

PO #

PURCHASE RELEASE #

OTHER

PARTS STATUS (CHECK ONE)

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

ACQUISITIONER SIGNATURE [signature] **ID#** 9223 **DATE** 9/21/04

PLEASE INDICATE REVISION REQUIRED

Stk	LOCATION	PART #	REV	QTY	UOM	DESCRIPTION	RF #	SIR #
100	~~B4~~ Bin	393307		24	Each	M4-.7X20MM HSHCS	81224	
100	~~B4~~ Bin	393308		48	Each	M4 Lock Washer	81828	
242	~~B4~~ Bin	393181		48	Each	M4 Flat Washer	81226	

STOCKROOM SIGNATURE [signature] **ID#** 12694 **DATE** 9/21/04

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

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

PARTS RECEIVED BY [signature] **ID#** 4965 **DATE** 9/21/04