

**Fermi National Accelerator Laboratory  
Batavia, IL 60510**

**FERMI MAIN INJECTOR 3Q60 MAGNET  
IMPREGNATION AND FINAL ASSEMBLY TRAVELER**

**Reference Drawing(s)**

**3Q60/3Q120 Magnet Lead End Cover Assembly  
8020-MD-351005**

**3Q60/3Q120 Magnet Return End Cover Assembly  
8020-MD-351006**

**3Q60 Magnet Assembly With Beam Tube  
5520-ME-331965**

**3Q120/3Q60 Quadrupole Magnet Insulation And  
Impregnation  
5520-ES-331790**

**Budget Code: MYI**

**Project Code: MAF**

**Released by:**

**Date:**

**Prepared by: W. L. Isiminger**

Title	Signature	Date
TD / E&F Process Engineering	<i>Bob J...</i>	7/23/98
TD / E&F Assembly	<i>James R...</i>	7-24-98
TD / E&F Tooling	<i>[Signature]</i>	7/23/98
TD / E&F Fabrication Manager	<i>[Signature]</i>	7/23/98
TD / E&F Device Design	<i>[Signature]</i>	7/23/98
TD / E&F Department Head	<i>V. Garcia</i>	7/23/98
TD / QA/QC Manager	<i>M. N. Sp...</i>	7/24/98
TD / Main Injector Magnet Project Manager	<i>[Signature]</i>	7/23/98
BD / Main Injector Magnet Liaison Project Physicist	<i>[Signature]</i>	7/23/98

Revision Page

Revision	Revision Description	Date
A	Step 11.10: Added Ls/Q per new release of ES-331810 Rev. "D". Step 11.11: Changed flow data, 60 psi changed from 4.8 gpm to 5.4 gpm, 100 psi changed from 6.8 gpm to 7.0 gpm per new release of ES-331810 Rev. "D". Step 12.5: Deleted MX-XXXXXX and replaced with MA-351609 per ER# 6334. TRR. No. 0864.	07/20/98

**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 White (Lint-Free) Gloves (Fermi stock 2250-1800) or Surgical Latex Gloves (Fermi stock 2250-2494) shall be worn by all personnel when handling all product parts after the parts have been prepared/cleaned.
- 1.2 All steps that require a sign-off shall include the Technician/Inspectors first initial and full last name.
- 1.3 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.
- 1.4 All Discrepancy Reports issued shall be recorded in the left margin next to the applicable step.
- 1.5 All personnel performing steps in this traveler must have documented training for this traveler and associated operating procedures.
- 1.6 Personnel shall perform all tasks in accordance with current applicable ES&H guidelines and those specified within the step.
- 1.7 Cover the magnet 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 List for the 3Q60 Magnet Impregnation and Assembly to this traveler. Ensure that the serial number on the Parts Kit List matches the serial number of this traveler. Verify that the Parts Kit received is complete.

\_\_\_\_\_  
Process Engineering/Designee

\_\_\_\_\_  
Date

3.0 Magnet Transportation and Serial Number Verification

- X 3.1 Transport the magnet to the impregnation preparation area using the overhead crane, 3Q60/3Q120 Lifting fixture and approved lifting procedures. The serial number stamped on the magnet should match the serial number at the bottom of this traveler. Visually inspect magnet for damage.

Record the Magnet Serial Number \_\_\_\_\_

\_\_\_\_\_  
Lead Person

\_\_\_\_\_  
Date

- 3.2 Attach the "OK to Proceed" tag to this traveler

\_\_\_\_\_  
Assembly/Designee

\_\_\_\_\_  
Date

4.0 Potting Cover Dry Fit

4.1 Verify that the Potting Cover parts kit was received in Step 2.1.

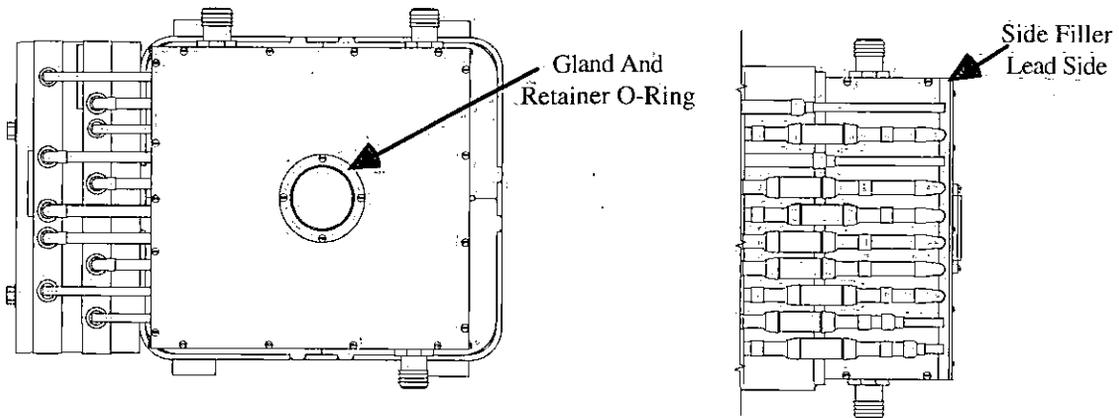
OK

\_\_\_\_\_  
Technician(s)

\_\_\_\_\_  
Date

4.2 Dry Fit the Lead End Cover Assembly per MD-351005 using the following parts:

Description	Part Number	Qty.	Installed
Top Plate	MC-351075	1	
Bottom Plate	MC-351076	1	
Side Plate Blank Side	MC-351073	1	
Side Plate Lead Side	MC-351071	1	
Side Filler Lead Side	MB-351072	1	
Cover Plate	MC-351077	1	
Male Nipple	MA-331884	3	
Gland	MB-351079	1	
O-Ring	Fermi Stock 1045-6476	1	
S.S. Binder Head Screw	MA-351571	5	
S.S. Binder Head Screw	MA-351569	24	



Lead End Cover Assembly

Dry fit Side Plate Lead Side (MC-351071) over the coil leads.

Completed

Use S.S. Binder Head Screws (MA-351569) to fasten the top plate, side plate blank side and bottom plates (MC-351075/MC-351073/MC-351076) to each other.

Completed

Use S.S. Binder Head Screws (MA-351569/MA-351571) to fasten the Cover Plate (MC-351077) and Side Filler Lead Side (MB-351072) to the assembly.

Completed

Dry fit the Retainer O-Ring (Fermi stock 1045-6476) and the Gland (MB-351079) to the cover plate per MD-351005.

Completed

\_\_\_\_\_  
Technician(s)

\_\_\_\_\_  
Date

X 4.3 Verify that Step 4.2 has been properly completed.

OK to Proceed

\_\_\_\_\_  
Lead Person

\_\_\_\_\_  
Date

4.4 Remove the lead end cover assembly.

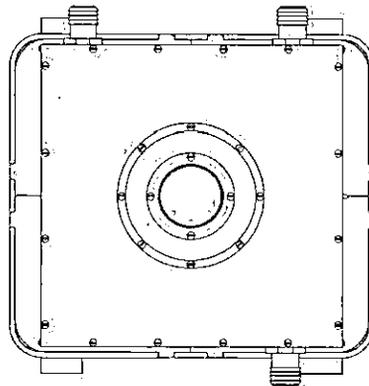
Completed

\_\_\_\_\_  
Technician(s)

\_\_\_\_\_  
Date

4.5 Dry Fit the Return End Cover Assembly per MD-351006 using the following parts:

Description	Part Number	Qty.	Installed
Top Plate	MC-351085	1	
Bottom Plate	MC-351085	1	
Side Plate	MC-351084	1	
Side Plate	MC-351084	1	
Outer Cover Plate	MC-351088	1	
Inner Cover Plate	MB-351086	1	
Cover Spacer Plate	MB-351087	1	
Male Nipple	MA-331884	3	
Gland	MB-351079	1	
O-Ring	Fermi Stock 1045-6476	1	
S.S. Binder Head Screw	MA-351569	28	



Return-End Potting Cover View

Dry fit the partially assembled potting cover over the coils.

Completed

Insert the Retainer O-Ring (Fermi Stock 1045-6476) and Gland (MB-351079) into position

Completed

Use S.S. Binder Head Screws (MA-351569) to secure the gland into position, install and tighten any remaining screws at this time.

Completed

\_\_\_\_\_  
Technician(s)

\_\_\_\_\_  
Date

X 4.6 Verify that Step 4.5 has been properly completed.

OK to Proceed

\_\_\_\_\_  
Lead Person

\_\_\_\_\_  
Date

4.7 Remove all of the return end cover components.

Completed

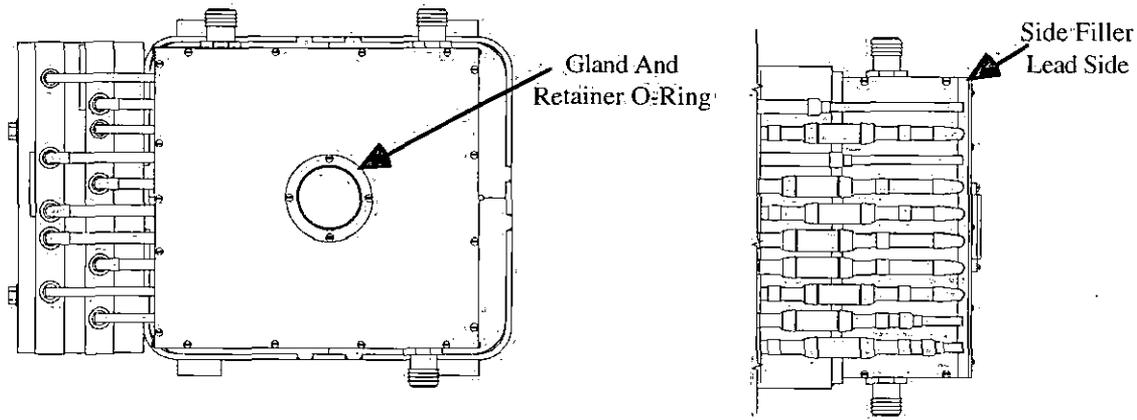
\_\_\_\_\_  
Technician(s)

\_\_\_\_\_  
Date

5.0 Potting Cover Final Assembly

5.1 Install the Lead End Cover Assembly per MD-351005 using the following parts:

Description	Part Number	Qty.	Installed
Top Plate	MC-351075	1	
Bottom Plate	MC-351076	1	
Side Plate Blank Side	MC-351073	1	
Side Plate Lead Side	MC-351071	1	
Side Filler Lead Side	MB-351072	1	
Cover Plate	MC-351077	1	
Male Nipple	MA-331884	3	
Gland	MB-351079	1	
O-Ring	Fermi Stock 1045-6476	1	
S.S. Binder Head Screw	MA-351571	5	
S.S. Binder Head Screw	MA-351569	24	



Lead End Cover Assembly

**Note(s):**

Coat the threads of each screw with Red Mold Release (MA-292449) or equivalent and Gray RTV (MA-318765) or equivalent prior to insertion. Ensure that there are four (4) holes drilled 90° apart through the retaining nut and fitting.

Position the Side Plate Lead Side (MC-351071) over the coil leads. Use Gray RTV (MA-318765) or equivalent as needed to seal the plate to the magnet core and around the leads.

Completed

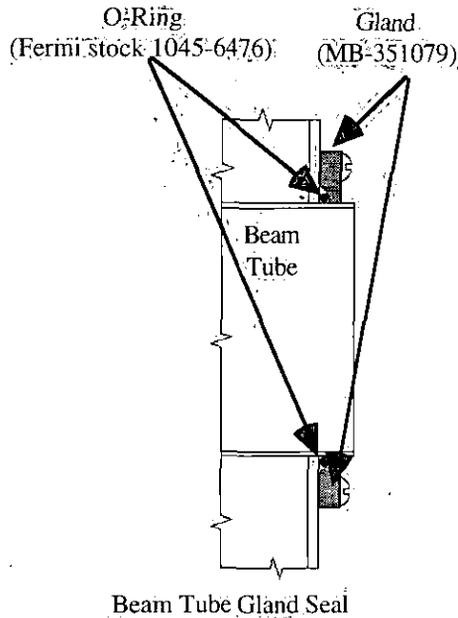
Use S.S. Binder Head Screws (MA-351569) to fasten the top plate, side plate blank side and bottom plates (MC-351075/MC-351073/MC-351076) to each other. Use Gray RTV (MA-318765) as needed to seal the plates to each other and the magnet core.

Completed

Use S.S. Binder Head Screws (MA-351569/MA-351571) to fasten the Cover Plate (MC-351077) and Side Filler-Lead Side (MB-351072) to the assembly. Use Gray RTV (MA-318765) as needed to seal the plates to each other, the magnets core and around the leads.

Completed

Install O-Ring (Fermi Stock 1045-6476) onto beam tube. Install Gland (MB-351079) onto beam tube. Fasten gland in place using S.S. Binder Head Screws (MA-351569).



Completed

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Technician(s)

\_\_\_\_\_  
Date

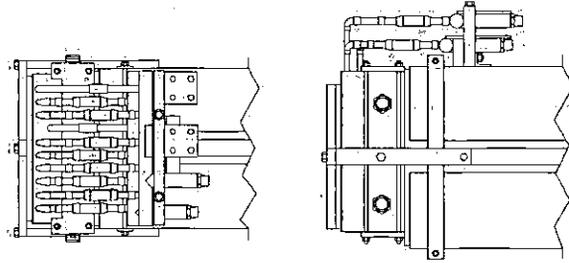
X 5.2 Verify that Step 5.1 has been properly completed.

OK to Proceed

\_\_\_\_\_  
Lead Person

\_\_\_\_\_  
Date

5.3 Install the lead end potting cover Tooling Assembly MD-351103.

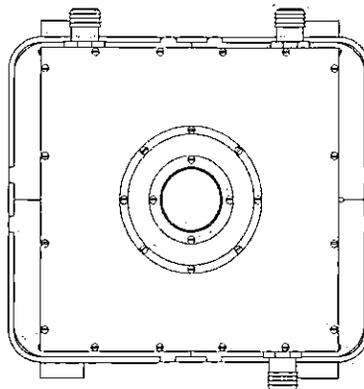


\_\_\_\_\_  
Technician(s)

\_\_\_\_\_  
Date

5.4 Install the Return End Cover Assembly per MD-351006 using the following parts:

Description	Part Number	Qty.	Installed
Top Plate	MC-351085	1	
Bottom Plate	MC-351085	1	
Side Plate	MC-351084	1	
Side Plate	MC-351084	1	
Outer Cover Plate	MC-351088	1	
Inner Cover Plate	MB-351086	1	
Cover Spacer Plate	MB-351087	1	
Male Nipple	MA-331884	3	
Gland	MB-351079	1	
O-Ring	Fermi Stock 1045-6476	1	
S.S. Binder Head Screw	MA-351569	28	



Return End Potting Cover View

**Note(s):**

**Coat the threads of each screw with Red Mold Release (MA-292449) or equivalent and Gray RTV (MA-318765) or equivalent prior to insertion. Ensure that there are four (4) holes drilled 90° apart through the retaining nut and fitting.**

Partially assembled potting cover, Top Plate (MC-351085), Bottom Plate (MC-351085), both Side Plates (MC-351084), Outer Cover Plate (MC-351088), Cover Spacer Plate (MB-351087), Inner Cover Plate (MB-351086) with S.S. Binder Head Screws (MA-351569) and Gray RTV (MA-318765) as needed to seal the plates/covers together.

Completed

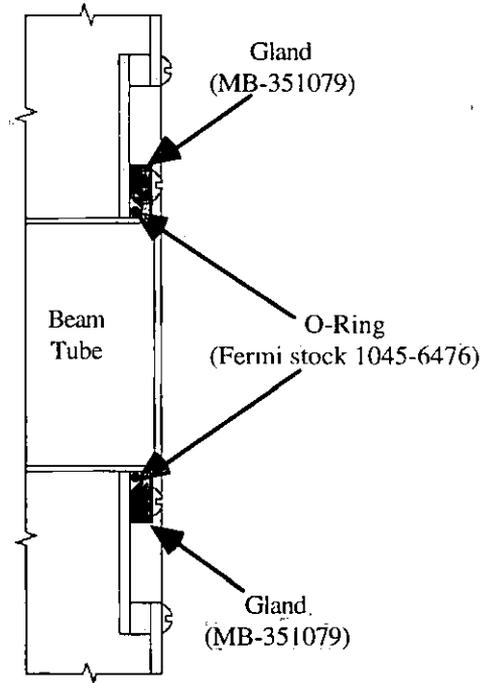
Trim off any excess length of the screws used to hold the inner cover plate, cover spacer plate and outer cover plate together.

Completed

Position the partially assembled potting cover over the coils. Use Gray RTV (MA-318765) as needed to seal the partially assembled potting cover to the magnets core.

Completed

Insert the Retainer O-Ring (Fermi Stock 1045-6476) and Gland (MB-351079) into position



Completed

Use S.S. Binder Head Screws (MA-351569) to secure the gland into position, install and tighten any remaining screws at this time.

Completed

Use Gray RTV (MA-318765) as needed to seal the return end potting cover to the magnets core.

Completed

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Technician(s)

\_\_\_\_\_  
Date

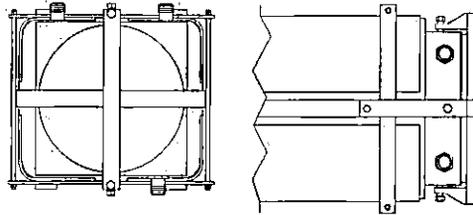
X 5.5 Verify that Step 5.4 has been properly completed.

OK to Proceed

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Lead Person

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Date

5.6 Install the lead end potting cover Tooling Assembly MD-351103.



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Technician(s)

\_\_\_\_\_  
Date

6:0 Sealing of the Magnet

- 6.1 Seal all of the tie plate/angle iron openings with G.E. RTV-157 (MA-318765) and Size 11 Neoprene Stoppers (Fermi stock 2580-1300) or equivalent.

\_\_\_\_\_  
Technician(s)

\_\_\_\_\_  
Date

- 6.2 Band the Neoprene Stoppers in place using Steel Strapping (C-103946).

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Technician(s)

\_\_\_\_\_  
Date

- 6.3 Seal all exposed lamination areas including the top center of the magnet, the ends of the tie plates and the welds with G.E. RTV-21 (Fermi stock 1940-0550 or equivalent) with Curing Agent (Fermi stock 1940-0400 or equivalent).

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Technician(s)

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Date

- 6.4 Install two (2) Caplugs (MB-124728) or equivalent at each end of the beam tube. Ensure that each Caplug has a 1/4" hole punched clear through the center of the plug.

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Technician(s)

\_\_\_\_\_  
Date

- X 6.5 Verify that all areas that may leak during the impregnation process are sealed and that the Caplugs with through holes are installed at each end of the beam tube.

\_\_\_\_\_  
Lead Person

\_\_\_\_\_  
Date

7.0 Oven Loading and Pump Down

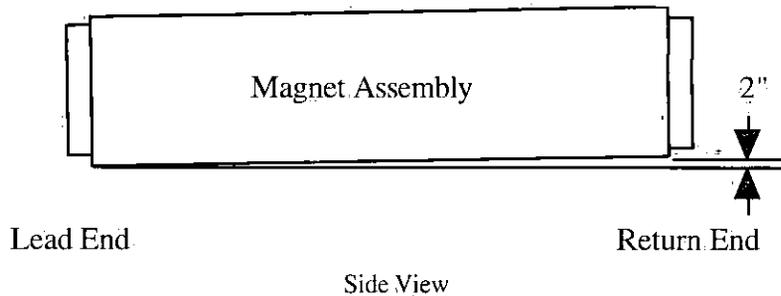
7.1 Pull the oven cart out of the Vacuum Oven as per the Vacuum Oven Cart Operation Procedure (OP-318940).

\_\_\_\_\_  
Technician(s) Date

7.2 Lift the magnet using the overhead crane and the appropriate slings and place the magnet on the cart. Load the Vacuum Oven Cart into the oven as per the Vacuum Oven Cart Operation Procedure (OP-318940).

**Note(s):**

**Place the core on the cart with the lead end towards the door.  
The return end of the magnet should be 2" higher than the lead end.**



- Return End Of Magnet Raised Higher Than Lead End. (Preferred)
- Return End Of Magnet Not Raised Higher Than The Lead End.

\_\_\_\_\_  
Technician(s) Date

X 7.3 Install the Parker Quick Couplings (BH6-60 (Body) Fermi stock 1018-0125 and BH6-61 (Nipple) Fermi stock 1018-0200) on the magnet manifold.

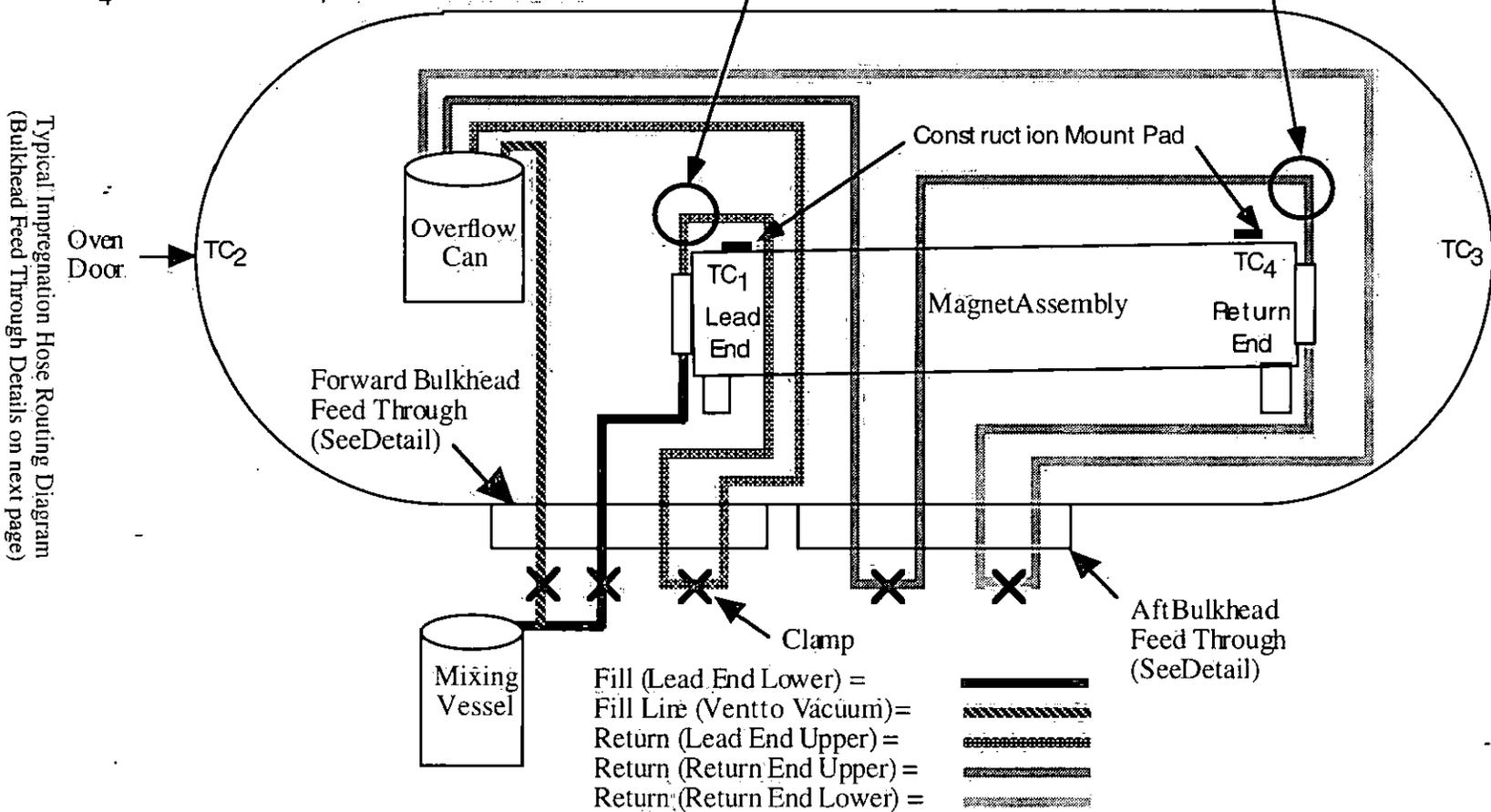
\_\_\_\_\_  
Lead Person Date

7.4 Route the Clear PVC Tubing (MA-225543) as per the diagrams on the following pages.

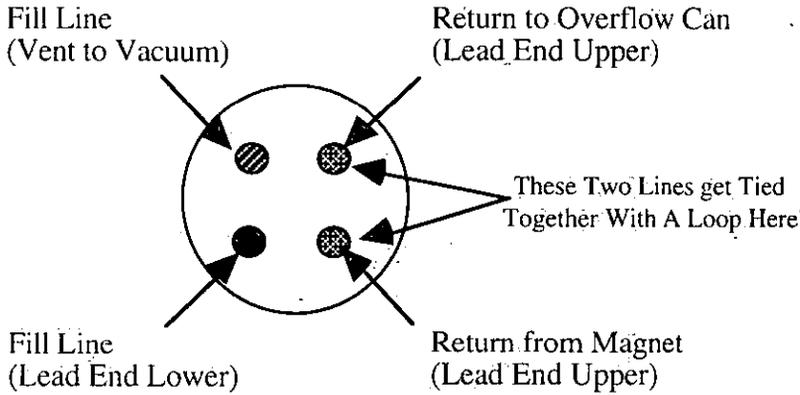
\_\_\_\_\_  
Technician(s) Date

- TC<sub>1</sub>: Lead End Clamped To Construction Mount Pad
- TC<sub>2</sub>: In Air Located At Oven Door End
- TC<sub>3</sub>: In Air Located At Back Of Oven
- TC<sub>4</sub>: Return End Clamped To Construction Mount Pad

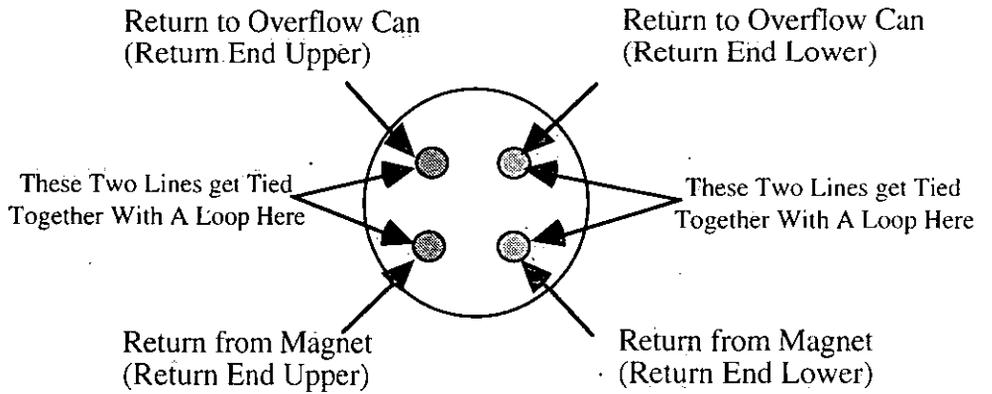
May Require A Tee Installed At This Location If More Than One Filler Tube Is Attached To the Potting Covers



Typical Impregnation Hose Routing Diagram  
(Bulkhead Feed Through Details on next page)



Forward Bulkhead Feed Through



Aft Bulkhead Feed Through

Bulkhead Feed Though Detail

7.5 Install a thermocouple to the side of the magnet. Connect the thermocouple lead to a chart recorder. Reference diagram on page 17.

**Note(s):**

**The chart recorder has to cover a temperature range of 100° F to 175° F. Ensure that the chart recorder is operating properly before continuing.**

\_\_\_\_\_  
Technician(s)

\_\_\_\_\_  
Date

XX

7.6 Verify that the magnet is setup and ready for impregnation.

\_\_\_\_\_  
Crew Chief

\_\_\_\_\_  
Date

\_\_\_\_\_  
Lead Inspector

\_\_\_\_\_  
Date

8.0 Epoxy Mixing

- 8.1 Mix the epoxy (MA-331507) for Batch 1, ensure that enough epoxy is mixed to complete the Batch 1 impregnation process.

Batch 1

42.0 Kg Epoxy Resin, Epon 826 (MA-116501)\*

38.0 Kg Epoxy Hardener, NMA (MA-116503)

Close the mixing vessel. Mix and pump down to 500 microns or better for 2 hours.

Note(s):

**Do not add the accelerator until 1 hour prior to impregnation (Batch 1) of the magnet.**

**Do not run the mixer during the adding of the accelerator.**

Stop the mixing, open the mixing vessel and add the accelerator.

540 grams Accelerator, DMP-30 (MA-116500)\*\*

Close the Mixing vessel. Mix for 5 minutes without vacuum. Mix and pump down to 500 microns or better for 1 hour.

Alternates

\* DER-828 (MA-331443)

\*\* BDMA (MA-225565)

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Technician(s)

\_\_\_\_\_  
Date

- 8.2 Mix the epoxy (MA-331721) for Batch 2, ensure that enough epoxy is mixed to complete the Batch 2 impregnation process.

Batch 2

27.0 Kg Epoxy Resin, Epon 826 (MA-116501)

24.5.0 Kg Epoxy Hardener, NMA (MA-116503)

30.2 Kg Glass Filler (MA-116595)

24.3 Kg Tabular Alumina (MA-116597)

Close the Mixing vessel. Mix and pump down to 500 microns or better for 2 hours.

Note(s):

**Do not add the accelerator until 1 hour prior to impregnation (Batch 2) of the magnet.**

**Do not run the mixer during the adding of the accelerator.**

Stop the mixing, open the mixing vessel and add the accelerator.

360 grams Accelerator, DMP-30 (MA-116500)

Close the Mixing vessel. Mix for 5 minutes without vacuum. Mix and pump down to 500 microns or better for 1 hour.

\_\_\_\_\_  
Technician(s)

\_\_\_\_\_  
Date

- 7.7 Coat the oven door seal with Dow Corning Molykote 44 Grease or equivalent (MA-116544). Close and secure the oven door. Pump down the oven to 100 microns or less. Operate the Vacuum Oven as per the Large Vacuum Oven - Vacuum System Operation Procedure (OP-318862).

**Note(s):**

**All impregnation hoses are to be open to the oven except for the fill hose to the mixing tank.**

Technician(s)	Date
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- 7.8 Set the oven temp to 145° F ± 10° F. Refer to the Hydro-Therm System Operation Procedure (OP-318958).

Technician(s)	Date
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- X 7.9 Record the stabilized readings for the temperature and vacuum. Hold the magnet at the stabilized temperature and vacuum for a period of not less than 1 hour.

**Notes:**

**When using 826 Magnet temperature shall be 120° F ± 10° F.**

**When using 828 Magnet temperature shall be 100° F ± 10° F**

Magnet Temperature (See Above Notes)	
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Vacuum(100 microns or less)	
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Start Time	
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Completion Time (Not to be less than 1 Hour)	
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Lead Person	Date
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9:0 Magnet Impregnation

**Note(s):**

**The magnet shall be held under a vacuum of 100 microns or less and a magnet temperature of 100° F ± 10° F if 828 was used or 120° F ± 10° F if 826 was used for no less than 1 hour.**

- 9.1 Connect the Batch 1 mixing vessel to the oven. Bleed the air out of the mixing vessel into the oven by un-clamping the Fill Line (Vent to Vacuum) as shown in the diagram on pages 17 and 18. Clamp off the Fill Line (Vent to Vacuum).

\_\_\_\_\_  
Technician(s)

\_\_\_\_\_  
Date

- 9.2 Start impregnation of Batch 1 when the magnet pressure and temperature have stabilized for no less than 1 hour (Refer to Step 7.9). Time Flow to be determined.

All return lines should be open at the start of the Batch 1 impregnation. Clamp off the return lines as soon as that specific return line starts to dump into the overflow can. Once all the return lines have dumped in the overflow can and have been clamped off, un-clamp all the return lines and allow them to flow into the overflow can for 1 minute. Re-clamp the return lines and the fill lines.

**Note(s):**

**Do not use a head pressure greater than 3 psig. during impregnation. Ensure that during the impregnation process that no air is introduced into the magnet.**

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Technician(s)

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Date

- 9.3 Disconnect the Batch 1 mixing vessel to the oven. Connect the Batch 2 mixing vessel to the oven. Bleed the air out of the mixing vessel into the oven by un-clamping the Fill Line (Vent to Vacuum) as shown in the diagram on pages 17 and 18. Clamp off the Fill Line (Vent to Vacuum).

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Technician(s)

\_\_\_\_\_  
Date

- 9.4 Start impregnation of Batch 2. Time Flow to be determined.

All return lines should be open at the start of the Batch 2 impregnation. Clamp off the return lines as soon as that specific return line starts to dump into the overflow can. Once all the return lines have dumped in the overflow can and have been clamped off, un-clamp all the return lines and allow them to flow into the overflow can for 1 minute. Re-clamp the return lines and the fill lines.

**Note(s):**

**Do not use a head pressure greater than 3 psig. during impregnation. Ensure that during the impregnation process that no air is introduced into the magnet.**

\_\_\_\_\_  
Technician(s)

\_\_\_\_\_  
Date

10.0 Magnet Curing

- 10.1 Bring the oven up to atmosphere as per the Vacuum Oven as per the Vacuum System Operation Procedure (OP-318862). Open the oven door. Attach the temperature chart to this traveler. Ensure that the magnet serial number (stamped on the core and at the base of this traveler) and date cured is written on the temperature chart.

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 Technician(s) \_\_\_\_\_  
 Date

- 10.2 Clamp off the impregnation lines. Cut the Clear PVC Tubing at the oven bulkhead using a hacksaw or equivalent.

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 Technician(s) \_\_\_\_\_  
 Date

- 10.3 Pull the oven cart out of the Vacuum Oven as per the Vacuum Oven Cart Operation Procedure (OP-318940).

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 Technician(s) \_\_\_\_\_  
 Date

- 10.4 Lift the magnet using the overhead crane and the appropriate slings and place the magnet in the magnet impregnation area.

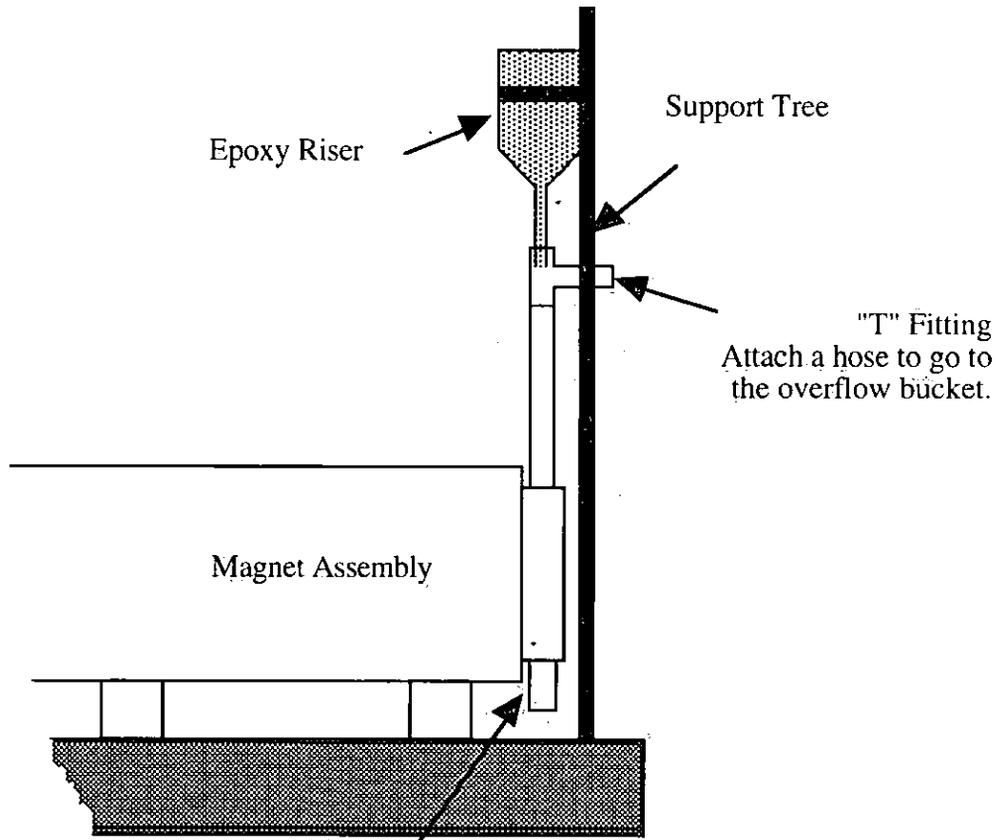
**Note(s):**  
**To prevent leakage of epoxy on the production floor while transporting the magnet to the curing table, place a sheet of Polyethylene Plastic (Fermi stock 1670-2100) under the magnet.**

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 Technician(s) \_\_\_\_\_  
 Date

- 10.5 Install the Epoxy Risers (MC-331166) at each end of the magnet refer to the diagram below. Fill the risers with Batch 2.

**Note(s):**

At no time are the epoxy risers to be allowed to run dry.  
 Ensure that the epoxy riser tube doesn't enter the potting cover opening as this may cause damage to the coil insulation.  
 Multiple tee's may be used to accommodate more than one fill tube on the end cans/epoxy risers.



Route and restrain the lower hoses up along the support tree.

Typical setup for the Epoxy Riser and Support Tree  
 Side View

\_\_\_\_\_  
 Technician(s)

\_\_\_\_\_  
 Date

- 10.6 Install a thermocouple to the magnet at the lead end and the return end of the magnets construction pads as indicated on page 17. Connect the thermocouple lead to a chart recorder.

**Note(s):**

The chart recorder has to cover a temperature range of 100° F to 275° F.  
 Ensure that the chart recorder is operating properly before continuing.

\_\_\_\_\_  
 Technician(s)

\_\_\_\_\_  
 Date

- 10.7 Clamp the impregnated magnet on the 3Q-Magnet Curing Table (ME-331050). Operate the table as per the Curing Table Operation Procedure (OP-318861).

\_\_\_\_\_  
Technician(s)

\_\_\_\_\_  
Date

- 10.8 Install the Insulated Thermal Box per the 3Q-Magnet Curing Table (ME-331050) drawing.

\_\_\_\_\_  
Technician(s)

\_\_\_\_\_  
Date

- 10.9 Connect the magnet to the magnet curing station as per the Dow Frost (Magnet Curing Station) Operation Procedure (OP-318962). Stabilize the magnet temperature at 250° F - 0° F + 20° F before starting the 16 hour cure cycle.

**Note(s):**

**Refer to the Dow Frost (Magnet Curing Station) Operation Procedure (OP-318962) and the Hydro-Therm System Operation Procedure (OP-318958).**

**Ensure that while operating the Dow Frost (Magnet Curing Station) that the proper Personal Protection Equipment is worn (Face Shield, Safety Goggles and Gloves).**

**Ensure that the first amount of Dow Frost is purged into a bucket, refer to Page 2 of the Dow Frost (Magnet Curing Station) Operation Procedure.**

**At no time are the epoxy risers to be allowed to run dry.**

Start Time \_\_\_\_\_

Completion Time \_\_\_\_\_

(Not to be less than 16 Hours) \_\_\_\_\_

\_\_\_\_\_  
Technician(s)

\_\_\_\_\_  
Date

- 10.10 Turn the Hydro-Therm System Heaters Off (**Do Not Turn Off the Fluid Flow**). Turn the Hydro-Therm System Heat Control to cool.

**Note(s):**

**Refer to the Hydro-Therm System Operation Procedure (OP-318958).**

\_\_\_\_\_  
Technician(s)

\_\_\_\_\_  
Date

- 10.11 Remove the Insulated Thermal Box per the 3Q-Magnet Curing Table (ME-331050) drawing.

\_\_\_\_\_  
Technician(s)

\_\_\_\_\_  
Date

10.12 When the magnet temperature drops below 100°F purge the magnet coils with house air as per the Dow Frost (Magnet Curing Station) Operation Procedure (OP-318962) and the Hydro-Therm System Operation Procedure (OP-318958). While the magnet is still warm, purge the remaining Dow Frost out of the magnet coils with Distilled Water (Fermi stock 1725-0550). Dispense the waste water into a storage drum for disposal.

\_\_\_\_\_  
Technician(s)

\_\_\_\_\_  
Date

10.13 Disconnect the magnet from the magnet curing station as per the Dow Frost (Magnet Curing Station) Operation Procedure (OP-318962). Remove the Parker Quick Couplings (BH6-60 (Body) Fermi stock 1018-0125 and BH6-61 (Nipple) Fermi stock 1018-0200) from the magnet manifold.

\_\_\_\_\_  
Technician(s)

\_\_\_\_\_  
Date

10.14 Remove the Epoxy Risers (MC-331166) at each end of the magnet.

\_\_\_\_\_  
Technician(s)

\_\_\_\_\_  
Date

10.15 Un-clamp the magnet on the curing table. Operate the table as per the Curing Table Operation Procedure (OP-318861).

\_\_\_\_\_  
Technician(s)

\_\_\_\_\_  
Date

10.16 Remove the thermocouples on the magnet. Attach the temperature chart to this traveler. Ensure that the magnet serial number (stamped on the core and at the base of this traveler) and date cured is written on the temperature chart.

\_\_\_\_\_  
Technician(s)

\_\_\_\_\_  
Date

10.17 Remove the potting cover supports, both glands, the o-rings and Caplugs from each end of the magnet. Clean these areas using KPC 820N (Fermi stock 1920-0705) and Heavy Disposable Wipers (Fermi stock 1660-2600 or equivalent).

\_\_\_\_\_  
Technician(s)

\_\_\_\_\_  
Date

10.18 Cut the Steel Strapping (C-103946) holding the Neoprene Stoppers in place and remove the stoppers. Clean these areas of the magnet using KPC 820N (Fermi stock 1920-0705) and Heavy Disposable Wipers (Fermi stock 1660-2600 or equivalent).

\_\_\_\_\_  
Technician(s)

\_\_\_\_\_  
Date

11.0 Magnet Clean Up and Final Preparation

11.1 Remove the RTV from the magnet using a wire brush (Fermi stock 1246-0860). Clean the magnet with KPC 820N (Fermi stock 1920-0705 or equivalent) and Heavy Disposable Wipers (Fermi stock 1660-2600 or equivalent).

\_\_\_\_\_  
Technician(s) \_\_\_\_\_  
Date

11.2 Cut the Potting Cover impregnation tubes flush with the potting cover using a hacksaw.

\_\_\_\_\_  
Technician(s) \_\_\_\_\_  
Date

11.3 Using Green Pressure Sensitive Tape (Fermi Stock 1365-0980) or equivalent, cover all the sensitive areas of the magnet prior to Grit blasting, *i.e.* survey pads, flow fittings, beam tube cap plugs...

\_\_\_\_\_  
Technician(s) \_\_\_\_\_  
Date

11.4 Position the magnet in the Grit Blast Booth on the cart. Grit Blast the magnet in accordance with the Grit Blasting Procedure (ES-318953). After Grit blasting clean the magnet of any excess grit and dust before removing tape/protective covers.

\_\_\_\_\_  
Technician(s) \_\_\_\_\_  
Date

11.5: Remove the screws used to hold the potting covers together at each end of the magnet. Fill the voids in the potting covers where the screws were with Loaded Room Cure (MA-274695) or equivalent. Attach the 3Q60/3Q120 Magnet Locating Fixture (Pad Welding) (MD-351447) to the magnet assembly. Using the fixture locate the Construction Ball Pads (Qty. 4) (MA-331978) to the magnet assembly per ME-331965.

\_\_\_\_\_  
Technician(s) \_\_\_\_\_  
Date

XX 11.6 Verify that the location of the four (4) Construction Ball Pads as they are attached prior to welding comply with ME-331965.

\_\_\_\_\_  
Crew Chief \_\_\_\_\_  
Date

\_\_\_\_\_  
Lead Inspector \_\_\_\_\_  
Date

11.7 Weld the four (4) Construction Ball Pads once attached by the fixture per ME-331965.

**Note(s):**  
**Protect all exposed areas that may come in contact with weld spatter resulting in damage.**

\_\_\_\_\_  
Welder \_\_\_\_\_  
Date

11.8 Clean the inside of the beam tube using Wipers, Disposable (Low-Lint) (Fermi stock 1660-2500) with Isopropyl Alcohol (Fermi stock 1920-0300) until no residue is visible on wipers.

\_\_\_\_\_  
Technician(s) Date

X 11.9 Verify that the beam tube is clean inside and the magnet has been cleaned.

\_\_\_\_\_  
Lead Person Date

X 11.10 Perform an electrical check of the magnet and record results below.

Magnet Serial No. _____						
Electrical Test	Equipment Serial Number	Limit	Actual Measurement	Pass	Fail	Out of Tolerance
Resistance		76 mΩ to 84 mΩ				
LS @ 1 KHz		Reference Test Only Not Subject to Limit Values				
Q @ 1 KHz		Reference Test Only Not Subject to Limit Values				
LS @ 100 Hz		40.5 mH to 41.5 mH				
Q @ 100 Hz		14.0 to 15.2				
100 Volt Ring		Reference Test Only Not Subject to Limit Values				
Hipot Coils to Core @ 1 Kvdc		< 5μA				
Hipot Beam Tube to Core @ 1 Kvdc		< 5μA				

\_\_\_\_\_  
Inspector

\_\_\_\_\_  
Date

- X 11.11 Perform a Flow Check at a ΔP of 60 PSI and 100 PSI. A hydrostatic check at 500 PSI and record the results below. Refer to the Mechanical (Flow) Inspection (ES-318968).

**Note(s):**

**Flush each coil with at least 2.5 gallons of water from the flow cart reservoir into a bucket before doing a flow test.**

Flow Cart Serial Number			
Desired ΔP	Actual ΔP Attained	Minimum Desired Flow in GPM	Attained Flow in GPM
60 PSI		5.4 GPM	
100 PSI		7.0 GPM	

Perform a hydrostatic check of the joints at 500 PSI for 30 minutes. Pass

Once the tests are complete and the water passages blown dry, remove the Herculite from the assembly.

\_\_\_\_\_  
Inspector

\_\_\_\_\_  
Date

- 11.12 Assemble Beam Tube Vacuum Flange (Bellows MB-331988) (Qty. 1) to the beam tube at the return end and the Beam Tube Vacuum Flange (MB-331990) (Qty. 1) to the beam tube at the lead end. Insure that the flange shoulders are a flush fit to the face of the beam tube and that the flanges are perpendicular to the magnet centerline as per ME-331965.

\_\_\_\_\_  
Technician(s)

\_\_\_\_\_  
Date

- 11.13 Weld beam tube vacuum flanges to the beam tube in accordance with ME-331965.

\_\_\_\_\_  
Welder

\_\_\_\_\_  
Date

- X 11.14 Perform Helium Leak Check of Beam Tube flanges.

Part No.	Date Time	Operators Last Name	Scale Units BEFORE Helium Probe	Scale Units WHILE Enclosure Flooding	Determination of Minimum Detectable Leak				
					MDS+ ((Response - Background) + Leak Value) = MDL				

\_\_\_\_\_  
Inspector

\_\_\_\_\_  
Date

**XX** 11.15 Verify that readings taken in Steps 11.10, 11.11 and 11.14 are acceptable before continuing with this traveler.

\_\_\_\_\_  
Lead Inspector

\_\_\_\_\_  
Date

12.0 Painting of the Magnet

12.1 Paint the body of the magnet as per (ME-331965) using Orange Paint (MA-351017).

**Note(s):**

**Paint all iron surfaces EXCEPT within the survey holes in the Tie Bars & Plate or on the mounting surfaces of the magnet feet and supports.**

\_\_\_\_\_  
Technician(s) Date

12.2 Paint the potting covers as per (ME-331965) using Epoxy Paint (Resin MA-274444 and Catalyst MA-274445).

Completed

\_\_\_\_\_  
Technician(s) Date

12.3 Weigh the magnet using a under a hook scale or equivalent. Record the magnet weight below.

Scale Model/Type	Scale Serial Number	Magnet Weight (Lbs.)

\_\_\_\_\_  
Technician(s) Date

12.4 Stencil the serial number and weight (Lbs.) in 1" characters at the center on both sides of the magnet as per (ME-331965) using Gloss Black Enamel Paint (Fermi stock 1825-1305 or equivalent). Attach the Manifold Cover MC-351558 at the lead end of the magnet.

**Note(s):**

**The magnet serial number is stamped on the magnet and is indicated at the base of this traveler.**

EXAMPLE

3Q60  
SERIAL # QQC XXX  
MAGNET WEIGHT 4000 LBS

\_\_\_\_\_  
Technician(s) Date

- X 12.5 Check the Beam Tube Size using the Beam Tube Bore Gage (MA-351609).

Note(s):

Minimum Allowable Plug Size: 2.800"

Using the plug, pass it through the beam tube from the lead end to the return end.

Plug 

Record the largest plug that passes through the beam tube from the lead end to the center of the magnet. If the plug doesn't make it to the center of the magnet record the location from the lead end where it stops.

Maximum Plug Size \_\_\_\_\_

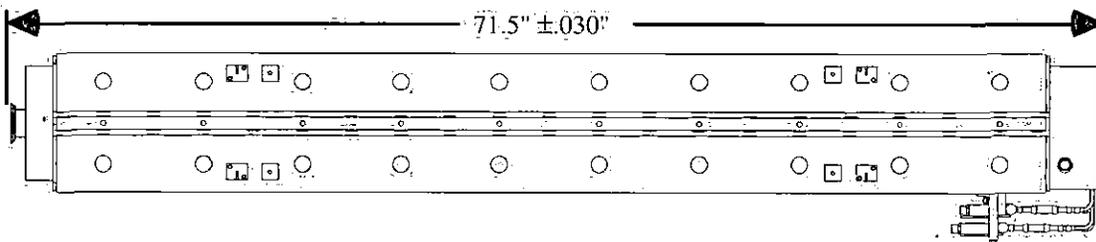
Location from the lead end \_\_\_\_\_

Inspector \_\_\_\_\_

Date \_\_\_\_\_

- X 12.6 Measure the Length of the Beam Tube from Flange to Flange.

Length (71.50" ± .030") \_\_\_\_\_



Inspector \_\_\_\_\_

Date \_\_\_\_\_

- X 12.7 Install Caplugs (MA-125284) on the manifold fittings. Install the Beam Tube Flange Covers (MA-125282) on the ends of the beam tube.

Inspector \_\_\_\_\_

Date \_\_\_\_\_

- 12.8. Using the overhead crane and 3Q60/3Q120 Lifting Fixture (ME-351438), move the magnet to the staging area for final inspection and shipment.

\_\_\_\_\_  
Technician(s)

\_\_\_\_\_  
Date

14.0 Production Complete

~~XXX~~

14.1 Process Engineering verify that the FMI 3Q60 Magnet Impregnation Traveler (5520-TR-333294) 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

~~XXX~~

14.2 Assembly verify that the FMI 3Q60 Magnet Impregnation Traveler (5520-TR-333294) 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:

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

\_\_\_\_\_  
Assembly/Designee

\_\_\_\_\_  
Date

15.0 Attach the Process Engineering "OK to Proceed" Tag on the magnet.

\_\_\_\_\_  
Process Engineering/Designee

\_\_\_\_\_  
Date

16.0 Proceed to the next major assembly operation, 3Q60 Magnet Final Inspection & Shipment (5520-TR-333295).