

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

**FERMI MAIN INJECTOR
3Q60 MAGNET QUARTER YOKE ASSEMBLY
TRAVELER**

Reference Drawing(s)

**3Q60 Magnet Quarter Yoke Assembly
5520-MC-331961**

Budget Code: MYI	Project Code: MCS	
Released by:	Date:	
Prepared by: W. L. Isiminger		
Title	Signature	Date
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TD / E&F Assembly	<i>James [unclear]</i>	6-11-98
TD / E&F Tooling	<i>[unclear]</i>	6/11/98
TD / E&F Fabrication Manager	<i>[unclear]</i>	6/11/98
TD / E&F Device Design	<i>[unclear]</i>	6/11/98
TD / E&F Department Head	<i>[unclear]</i>	6/11/98
TD / QA/QC Manager	<i>[unclear]</i>	6/11/98
TD / Main Injector Magnet Project Manager	<i>Henry Glass</i>	6/11/98
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Revision Page

Revision	Revision Description	Date
A	<p>Delete 3Q60 Magnet Main Assembly (5520-ME-331965) from the cover page and all locations within the traveler. This change caused by revised prints released on ECO# 4492.</p> <p>Step 3.3: New step. Clean the quarter core (pre-approved for use as the filler core) used as a filler for stacking using KPC 820N (Fermi stock 1920-0705) and Heavy Disposable Wipers (Fermi Stock 1660-2600 or equivalent) clean all the locations that come in contact with the fixture or the end pack of the next quarter core.</p> <p>Step 3.4: New step. Verify that all the areas of the filler core that will come in contact with the stacking fixture and the end pack of the other quarter core have been cleaned and are ready for stacking.</p> <p>Step 3.5: New step: Using approved lifting equipment and lifting procedures, position the quarter core on the stacking fixture with the fixed end of the core at the fixed end of the stacker.</p> <p>Renumbered as required.</p> <p>Step 3.3: Replaced Left Hand End Pack (MC-196863) with Right Hand End Pack (MC-196864).</p> <p>Step 3.4: Replaced Left Hand End Pack (MC-196863) with Right Hand End Pack (MC-196864). Deleted, fixed end of the Stacking Fixture. Replaced with, floating end of the filler core.</p> <p>Step 3.5: Added after the word pack, and filler core..</p> <p>Step 3.6: Replaced Left Hand End Pack (MC-196863) with Right Hand End Pack (MC-196864).</p> <p>Step 3.7.9: Changed 2" to 2 27/32" due to compression of stacked laminations causing length to be too short.</p> <p>Step 3.8: Replaced Right Hand End Pack (MC-196864) with Left Hand End Pack (MC-196863).</p> <p>Step 3.9: Replaced Right Hand End Pack (MC-196864) with Left Hand End Pack (MC-196863).</p> <p>Step 3.10: New step. Verify the proper orientation of the End Pack.</p> <p>Renumbered as required.</p> <p>Step 3.10: (Old) Deleted; Equally tighten the four (4) locking lugs at the floating end of the stacking fixture.</p> <p>Step 3.11: (Old) Added, Tighten the four (4) locking lugs at the floating end of the stacking fixture to ensure all three (3) lengths as measured are within 1/32".</p> <p>Step 3.12: Added after the word the, Type "C" and the after the word with.</p> <p>Step 3.13: (Old) Changed 3.10 to 3.11 do to renumbering and 3.12 to 3.13 do to renumbering.</p> <p>Step 3.14: (old) Changed 3.13 to 3.14</p> <p>Step 4.1: Added, Position a filler angle between the gaps of the two cores ensuring that it doesn't interfere with the fit of the angle just positioned on the quarter core.</p> <p>Step 4.3: Added a note, Make adjustments to the quarter angle as required to ensure proper position during tensioning of the spider assembly.</p> <p>Step 4.3: Deleted the word equally from the last sentence.</p> <p>Step 4.9: Added, Remove the filler angle between the two cores.</p> <p>Step 5.1: Changed drawing number from MC-351432 to MX-XXXXXX.</p> <p>Step 5.3: Added, Complete the welding of the quarter core.</p> <p>Step 7.1: Changed the word half to quarter.</p> <p>TRR. No. 0839</p>	6/10/98

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. For handling of the laminations during the stacking operation Nitrile Rubber Gloves (MA-274981 or equivalent) may be used.
- 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 quarter yoke assembly with green Herculite (Fermi stock 1740-0100) when not being serviced or assembled. Completed quarter yokes are to be stored in the yoke staging area.

2.0 Parts Kit List

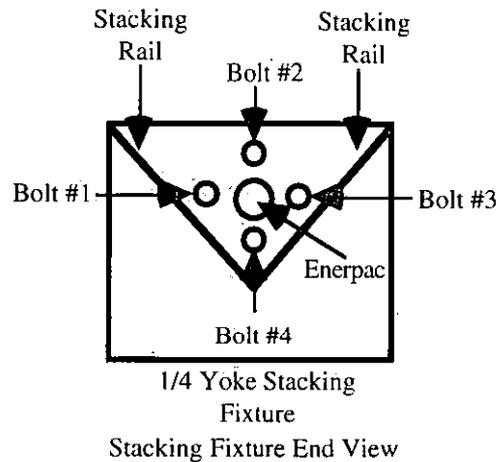
- 2.1 Attach the completed Parts Kit List for the 3Q60 Magnet Quarter Yoke Assembly to this traveler. Ensure that the serial number on the Parts Kit List matches the serial number of this traveler. Verify that the Parts Kit received is complete.

Process Engineering/Designee

Date

3.0 Quarter Yoke Stacking

- 3.1 Remove any weld spatter that is on the Stacking Table Assembly (ME-116296). Clean the Stacking Table Assembly (ME-116296), fixed end plate and the moveable end mars feet and Enerpac of the stacker using KPC 820N (Fermi stock 1920-0705) and Heavy Disposable Wipers (Fermi Stock 1660-2600 or equivalent). Clean all the locations that come in contact with laminations.



Technician(s) _____
Date

- X 3.2 Verify that all the areas that will come in contact with the end plates and the laminations have been cleaned and are ready for stacking.

Lead Person _____
Date

- 3.3 Clean the quarter core (pre-approved for use as the filler core) used as a filler for stacking using KPC 820N (Fermi stock 1920-0705) and Heavy Disposable Wipers (Fermi Stock 1660-2600 or equivalent) clean all the locations that come in contact with the fixture or the end pack of the next quarter core.

Technician(s) _____
Date

- X 3.4 Verify that all the areas of the filler core that will come in contact with the stacking fixture and the end pack of the other quarter core have been cleaned and are ready for stacking.

Filler Core Serial Number	
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Lead Person _____
Date

- 3.5 Using approved lifting equipment and lifting procedures, position the quarter core on the stacking fixture with the fixed end of the core at the fixed end of the stacker.

Technician(s) _____
Date

3.6 Acquire and clean the Right Hand End Pack (MC-196864) using KPC 820N (Fermi stock-1920-0705) and Heavy Disposable Wipers (Fermi Stock 1660-2600 or equivalent) clean all the locations that come in contact with laminations.

Technician

Date

3.7 Place the Right Hand End Pack (MC-196864) on the Stacking Fixture oriented with the machined (chamfered) face of the pack against the floating end of the filler core.

Technician(s)

Date

XX

3.8 Verify the proper orientation of the End Pack and filler core.

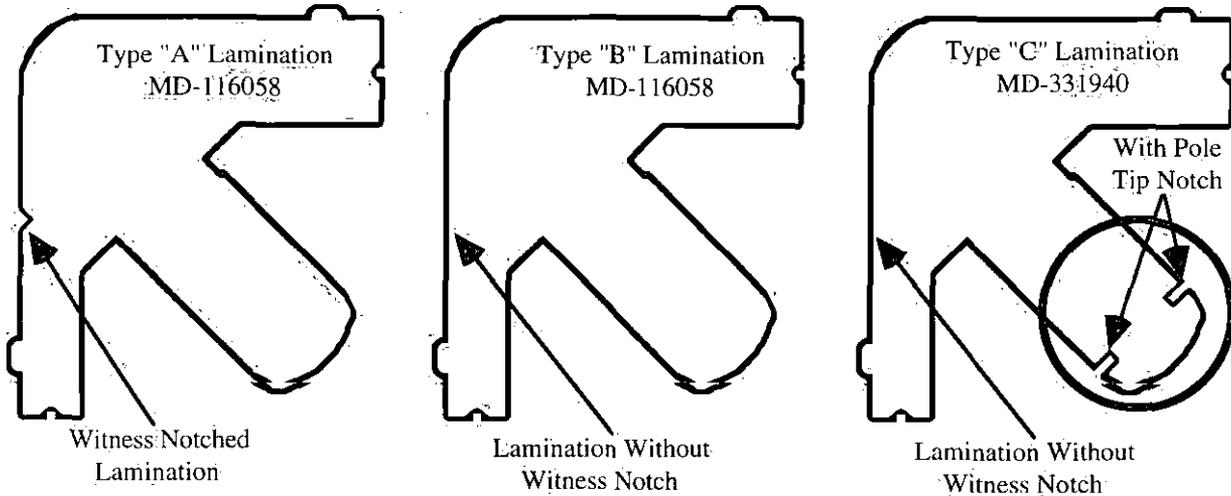
Crew Chief

Date

Lead Inspector

Date

- 3.9 Place a two inch (2") stack of Type 'A' (Notched) Laminations (MD-116058) next to the Right Hand End Pack (MC-196864) on the Stacking Fixture.



Note(s):

At no time is a steel hammer to be used directly against the laminations. Use of a plastic mallet is allowed.

Technician(s)

Date

Note(s):

Stacking will begin and end with 1 3/4" thick laminated end packs

- 3.10 Sequence of events for the stacking operation.
- 3.10.1 Stack nine (9) Type "C" Laminations With (Pole Tip) Notch (MD-331940).
 - 3.10.2 Stack 25 15/32" of Laminations (MD-116058) beginning with the opposite type ("A" or "B") laminations previously stacked (Type "C" laminations do not apply) and alternating the lamination types every 3" ± .120".
 - 3.10.3 Stack nine (9) Type "C" Laminations With (Pole Tip) Notch (MD-331940).
 - 3.10.4 Stack 3" of Laminations (MD-116058) beginning with the opposite type ("A" or "B") laminations previously stacked (Type "C" laminations do not apply) and alternating the lamination types every 3" ± .120".

Note(s):

At no time is a steel hammer to be used directly against the laminations. Use of a plastic mallet is allowed.

- 3.10.5 Install the Backing plate and Arbor for compression. Energize the pump and compress the stacked laminations to 2000 psig. Back the pressure off to no less than 50 psig and gently tap the laminations down to the stacking fixture. Recompress the stacked laminations to 2000 psig.
- 3.10.6 Release the stacking pressure, remove the arbor and backing plate.

- 3.10.7 Stack 22 15/32" of Laminations (MD-116058) beginning with the opposite type ("A" or "B") laminations previously stacked (Type "C" laminations do not apply) and alternating the lamination types every 3" ± .120".
- 3.10.8 Stack nine (9) Type "C" Laminations With (Pole Tip) Notch (MD-331940).
- 3.10.9 Stack 2 27/32" of Laminations (MD-116058) beginning with the opposite type ("A" or "B") laminations previously stacked (Type "C" laminations do not apply) and alternating the lamination types every 3" ± .120".
- 3.11 Acquire and clean the Left Hand End Pack (MC-196863) using KPC 820N (Fermi stock 1920-0705) and Heavy Disposable Wipers (Fermi Stock 1660-2600 or equivalent) clean all the locations that come in contact with laminations.

Technician Date

- X 3.12 Place the Left Hand End Pack (MC-196863) on the Stacking Fixture oriented with the machined (chamfered) face of the pack against the Floating End Plate. Ensure the End Pack is against the Stacking Rails (.002" Max.).

Lead Person Date

- XX 3.13 Verify the proper orientation of the End Pack.

Crew Chief Date

Lead Inspector Date

Note(s):

At no time is a steel hammer to be used directly against the laminations. Use of a plastic mallet is allowed.

- 3.14 Install the Backing plate. Energize the pump and compress the stacked laminations to 2000 psig. Back the pressure off to no less than 50 psig and gently tap the laminations down to the stacking fixture. Recompress the stacked laminations to 2000 psig. Repeat as required to ensure that the laminations are seated against the stacking rails.

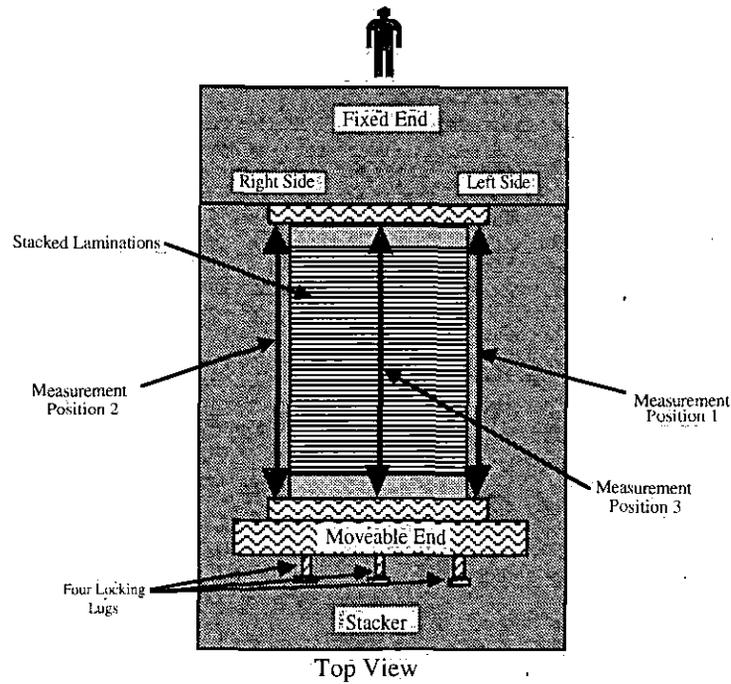
Technician(s) Date

- 3.15 While the stacked laminations are under pressure, measure the overall length of the 1/4 yoke in three (3) locations using a Steel Measuring Tape (Starrett Cat. No. W530F-50 or equivalent) (60" to 60 1/16"), refer to the figure below. All three (3) lengths are to be equal within 1/32". Adjust the quantity of the laminations as required to achieve the proper length of the stacked 1/4 yoke. Tighten the four (4) locking lugs at the floating end of the stacking fixture to ensure all three (3) lengths as measured are within 1/32".

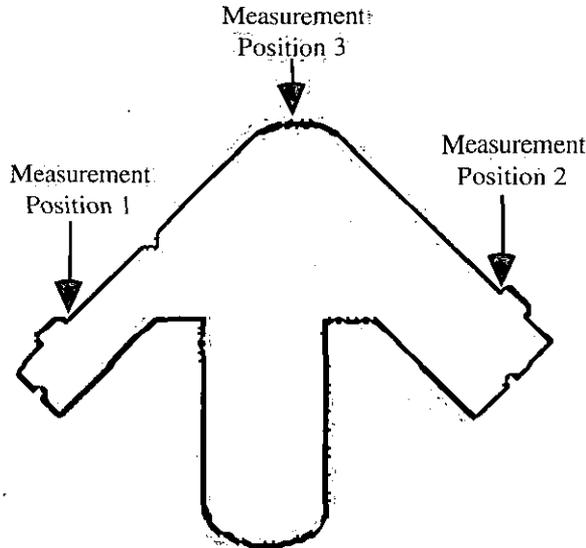
Note(s):

Do not use the Type "C" Laminations With the Notch; (MD-331940) to make the length adjustments.

The left side of the half core is defined as follows; Standing, facing the fixed end of the half core puts the left side on your left.



If any of the measurements do not meet the print tolerances, adjust the quantity of the laminations added in Step 3.10.9 as required to achieve the proper length of the stacked half core.



Viewed from the Fixed End
All 3 length measurements are to be equal within 1/32"

Measurement Position	Length Limit	Actual Dimension	Pass	Fail	Out of Tolerance
1	60" to 60 1/16"				
2	60" to 60 1/16"				
3	60" to 60 1/16"				

Technician(s)

Date

- X 3.16 Verify that the stacked 1/4 yoke under pressure meets the length requirement of 60" to 60 1/16". All three (3) lengths are to be equal within 1/32". Check to ensure that the laminations are in contact with the stacking plate using a .003" feeler gage (Starrett Part No. 667 or equivalent).

Note(s):

If any of the measurements do not meet the print tolerances, adjust the quantity of the laminations added in Step 3.10.9 as required to achieve the proper length of the stacked half core.

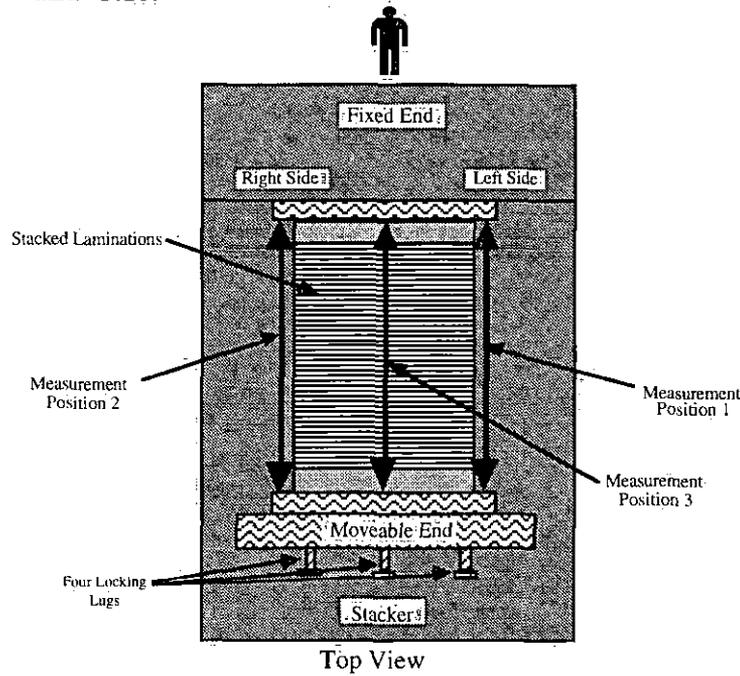
Lead Person

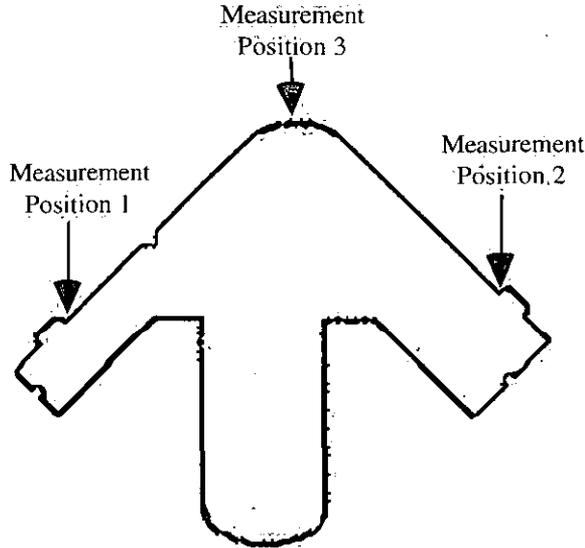
Date

- 3.17 While the stacked laminations are under pressure, measure the overall length of the 1/4 yoke in three (3) locations using a Steel Measuring Tape (Starrett Cat. No. W530F-50 or equivalent) and record the measurements (60" to 60 1/16").

Note(s):

If any of the measurements do not meet the print tolerances, then add or remove laminations (MD-116058) to the last pack and repeat Steps 3.14 and 3.16.





Viewed from the Fixed End

All 3 length measurements are to be equal within 1/32"

Measurement Position	Length Limit	Actual Dimension	Pass	Fail	Out of Tolerance
1	60" to 60 1/16"				
2	60" to 60 1/16"				
3	60" to 60 1/16"				

Inspector

Date

Crew Chief

Date

XX

3.18 The measurements recorded in Steps 3.17 are acceptable to proceed.

Lead Inspector

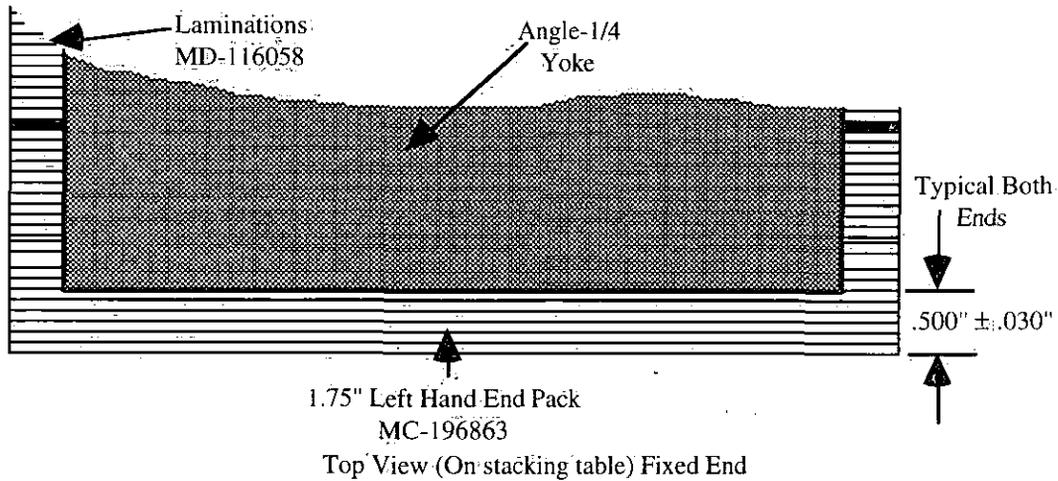
Date

Crew Chief

Date

4.0 Angle-1/4 Yoke Installation

4.1 While maintaining the pressure (100 P.S.I. Minimum.) on the 1/4 yoke. Position the Angle-1/4 Yoke (MC-331928) .50" ± .03" (or equidistant) from the ends as per (MC-331961). Position a filler angle between the gaps of the two cores ensuring that it doesn't interfere with the fit of the angle just positioned on the quarter core.



Technician

Date

4.2 Cover the hydraulics cylinders of the Spider (ME-116296) using Herculite (Fermi stock 1740-0100) and Pressure Sensitive Green Tape (Fermi stock 1365-0980). Using the overhead crane and the appropriate lift device attach the Spider (ME-116296) to the 1/4 yoke stacking table. Disconnect the crane from the spider.

Technician

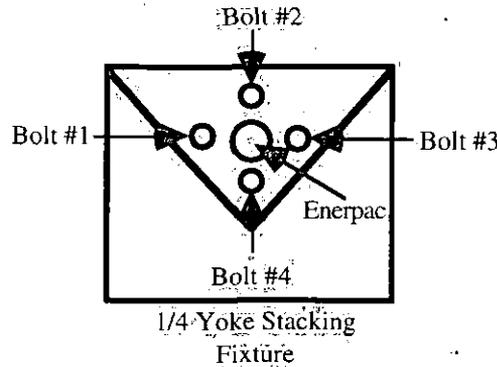
Date

XX

- 4.3 Verify the Position of the Angle-1/4 Yoke (MC-331928) .50" ± .03" (or equidistant) from the ends as per MC-331961. With the spider in place make the required hook ups for the spider's hydraulics. Check the position of the angle 1/4 yoke. Energize the pump and apply (100 psig Min. to 200 psig max.) to the side hydraulics and (4000 psig max.) to the top hydraulics of the 1/4 yoke assembly and valve off the pump. Shut off the pump. Verify that the four (4) bolts at the floating end of the stacker are tightened.

Note(s):

Make adjustments to the quarter angle as required to ensure proper position during tensioning of the spider assembly.



Crew Chief

Date

Lead Inspector

Date

- 4.4 Using white chalk, indicate the locations of the welds and the lengths of the welds as per MC-331961. Using Aluminum Foil (Fermi stock 1750-0350) cover all exposed areas that may come in contact with the weld spatter resulting in damage.

Note(s):

Protect all exposed areas that may come in contact with weld spatter resulting in damage.

Technician

Date

- XX 4.5 Check every inch (1") to ensure that the laminations are in contact with the stacking plate rails using a .003" feeler gage (Starrett Part No. 667 or equivalent). Verify that the weld pattern laid out in step 4.4 complies with MC-331961. Record the pressures below.

Note(s):

The hydraulic clamping pressures must be maintained during the welding process.

Stacking Pressure Minimum 2000 psig	Spider Side Hydraulics 100 psig Min. to 200 psig Max.	Spider Top Hydraulics Maximum 4000 psig

Flatness Check Pass Fail

Crew Chief Date

Lead Inspector Date

- 4.6 Weld the 1/4 Yoke Assembly as per MC-331961.

Welder Date

Technician Date

- XX 4.7 Record the clamping pressures on the quarter yoke assembly. Visually inspect the welds for compliance to MC-331961.

Stacking Pressure Minimum 2000 psig	Spider Side Hydraulics 100 psig Min. to 200 psig Max.	Spider Top Hydraulics Maximum 4000 psig

Lead Person Date

Inspector Date

- X 4.8 Check every inch (1") to ensure that the laminations are in contact with the stacking plate rails using a .003" feeler gage (Starrett Part No. 667 or equivalent).

Flatness Check Pass Fail

Inspector Date

- 4.9 Release the pressure on the spider. Using the overhead crane remove the spider and place it in its storage area. Remove the filler angle between the two cores. Do not release the applied pressure to the core at the floating end. Clean all the welds and remove any weld spatter from the 1/4 yoke assembly.

Technician

Date

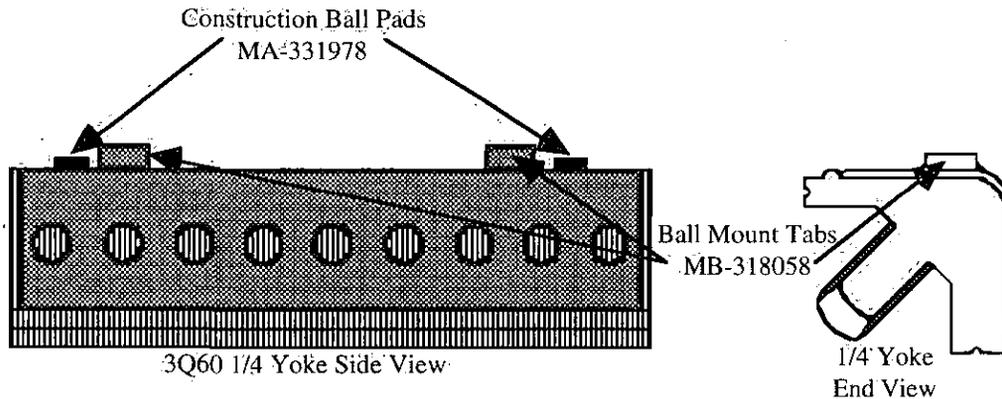
5.0 Ball Mount Tabs

Note(s):

The Ball Mount Tabs are to be located from the fixed end of the yoke on the 8 1/4" leg of all the cores.

Ensure That the stops on the ball mount fixture are placed against the end of the end pack and not the end of the angle iron (skin).

- 5.1 Attach the Ball Mount Aligning Fixture (MX-XXXXXX) to the fixed end of the core. Using the Ball Mount Aligning Fixture (MX-XXXXXX) locate the Ball Mount Tabs (Qty 2) (MB-318058) per the 1/4 Yoke Assembly (MC-331961) as well as the Construction Ball Pads (Qty 2) (MA-331978) to the quarter core per MC-331961.



Technician Date

- XX 5.2 Verify that the location of the two (2) Ball Mount Tabs (MB-318058) complies with MC-331961 and that the two (2) Construction Ball Pads complies with MC-331961.

Crew Chief Date

Lead Inspector Date

- 5.3 Complete the welding of the quarter core and weld the Ball Mount Tabs as per MC-331961 and the two (2) Construction Ball Pads as per MC-331961.

Note(s):

Protect all exposed areas that may come in contact with weld spatter resulting in damage.

Weldor Date

Technician Date

~~XX~~

5.4 Visually inspect the welds on the Ball Mount Tabs as per MC-331961 and the Construction Ball Pads as per MC-331961.

Lead Person

Date

Inspector

Date

5.5 Clean all the welds and remove any weld spatter from the yoke.

Technician

Date

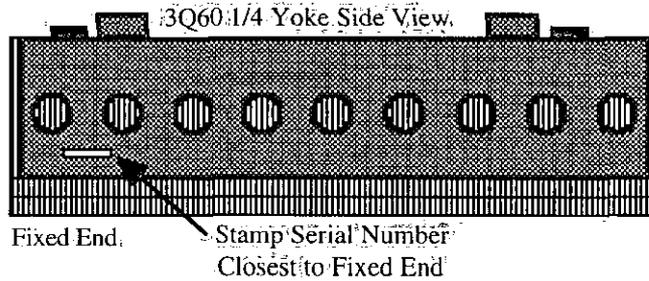
5.6 Stamp the 1/4 yoke with its serial number and part number as per MC-331961 and specification (ES-331729), using 1/4" high letters. The serial number is listed at the base of this Traveler. The stamped serial number and part number is to be located at the fixed end of the yoke, (non-floating end of stacker).

Technician

Date

X

5.7 Verify the stamped serial number on the 1/4 yoke to ensure that it is correct and in the proper location as per MC-331961.



Inspector

Date

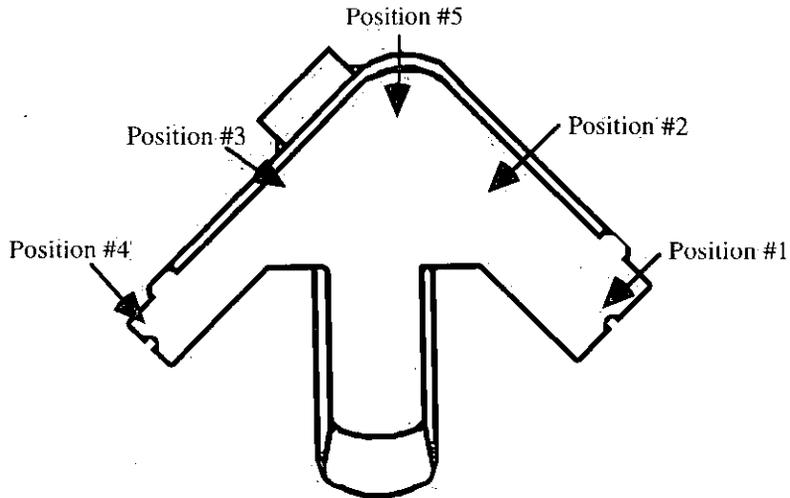
6.0 Final Inspection

6.1 Release the pressure on the Stacked Core.

Technician

Date

X 6.2 Measure the overall length of the 1/4 yoke in five (5) using a Steel Measuring Tape (Starrett Cat. No. W530F-50 or equivalent) and record the measurements (59 15/16" to 60") in the table below.



Viewed from the Fixed End

Measurement Position	Length Limit	Actual Dimension	Pass	Fail	Out of Tolerance
1	59 15/16" to 60"				
2	59 15/16" to 60"				
3	59 15/16" to 60"				
4	59 15/16" to 60"				
5	59 15/16" to 60"				
Average of 1-5	59 15/16" to 60"				

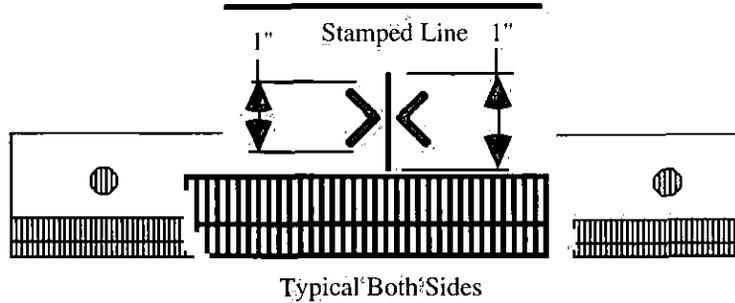
Inspector

Date

- X. 6.3 Using a Steel Measuring Tape (Starrett Cat. No. W530F-50 or equivalent) at measurement positions #1 and #4 respectively, measuring from the fixed end of the assembly, scribe a line at the $30" \pm 1/128"$ location. Now measure from the floating end, the same side/position and scribe a line at the $30" \pm 1/128"$ location, repeat this process for the other side. Centrally stamp the location between the scribed lines within $\pm 1/128"$ on each side of the core skin as indicated in the diagram below, or on the scribed lines if the core is exactly 60" long.

Note(s):

The stamped lines are to be positioned on the skin (angle iron) proper, on both sides of the core assembly. The measurement locations #1 and #4 are independent measurements and stampings, not a combine average.



Inspector

Date

- XX 6.4 Verify the measurements recorded in Steps 6.1 through 6.3 and ensure that they are acceptable.

Crew Chief

Date

Lead Inspector

Date

7.0 Stage Half Core

7.1 Move the quarter core to the staging area using approved lifting equipment and lifting procedures.

Technician

Date

8.0 Production Complete

XXX

8.1 Process Engineering verify that the 3Q60 1/4 Yoke Stacking Traveler (5520-TR-333160) is accurate and complete. This shall include a review of all steps to ensure that all Operations have been completed and signed off. All Discrepancy Reports/Non Conformance Reports, Repair/Rework Forms, Deviation Index and dispositions are reviewed by the Responsible Authority for conformance before being approved.

Comments:

Process Engineering/Designee

Date

XXX

8.2 Assembly verify that the 3Q60 1/4 Yoke Stacking Traveler (5520-TR-333160) is accurate and complete. This shall include a review of all steps to ensure that all Operations have been completed and signed off. All Discrepancy Reports/Non Conformance Reports, Repair/Rework Forms, Deviation Index and dispositions are reviewed by the Responsible Authority for conformance before being approved.

Comments:

Assembly/Designee

Date

9.0 Attach the Process Engineering "OK to Proceed" Tag on the 1/4 Core.

Process Engineering/Designee

Date

10.0 Proceed to the next major assembly operation - 3Q60 Half Magnet Assembly (5520-TR-333292).