

Long 50 mm Dipole Construction Experience

MSIM Executive Summary Wayne Koska

We review the Fermilab construction experience to date as relating to the 50 mm aperture Collider Dipole magnets. Seven magnets are in various stages of assembly, with the most advanced being in the final assembly stage just prior to cryostating. (Since this is DCA310, the practice magnet, it will not be cryostated.) Coil winding and curing is going smoothly and we have good control over average coil size. Collaring and keying is also going well. The press is closing uniformly along the length of the magnet at 6 KPSI pump pressure and the keys are inserted with between 2 and 2.5 KPSI pump pressure on the horizontal cylinders. We are using a combination square/tapered key procedure for inserting the keys. The pole stress appears to be adequate, however we are having some trouble getting reliable strain gauge readings especially on the outer gauges. We are working on solutions, one of which is to pre-test the gauge packs on a short magnet coil assembly prior to installation on a long magnet. We have developed an end clamp assembly procedure and requisite tooling. At least one end clamp on each of DCA310, DCA311 and DCA312 was installed, removed, and reinstalled at least once. The end clamp on DCA311 was removed once to successfully repair a turn to turn short which developed in the most outer turns (i.e. turns 1 and 2 counting from the mid-plane) of its outer coil at the return end. DCA310 has had its shell welded in place. Three weld passes were required. DCA311 and future magnets will have 10 inch monolithic (i.e. epoxy bonded) yoke packs at either end with the remaining packs approximately 12 feet in length. The power busses obtained for the first few magnets have 10 μ a leakage between leads at 5 kV. Future busses may require a better insulation scheme. In conclusion, construction of the long magnets is proceeding fairly smoothly, with no insoluble problems encountered.

Long 50 mm Dipole Construction Experience

**Wayne Koska
Fermilab**

**MSIM Presentation
August 6, 1991**

Status of Program

50 mm Aperture Magnets

DCA310	Practice Magnet Electrical Interconnect Installation
DCA311	Shell Welding
DCA312	Awaiting Shell Welding
DCA313	End Can Installation
DCA314	Coil Assembly
DCA315	Coil Prep
DCA316	Awaiting Inner Cable

Production Stages:

Coil Winding and Curing

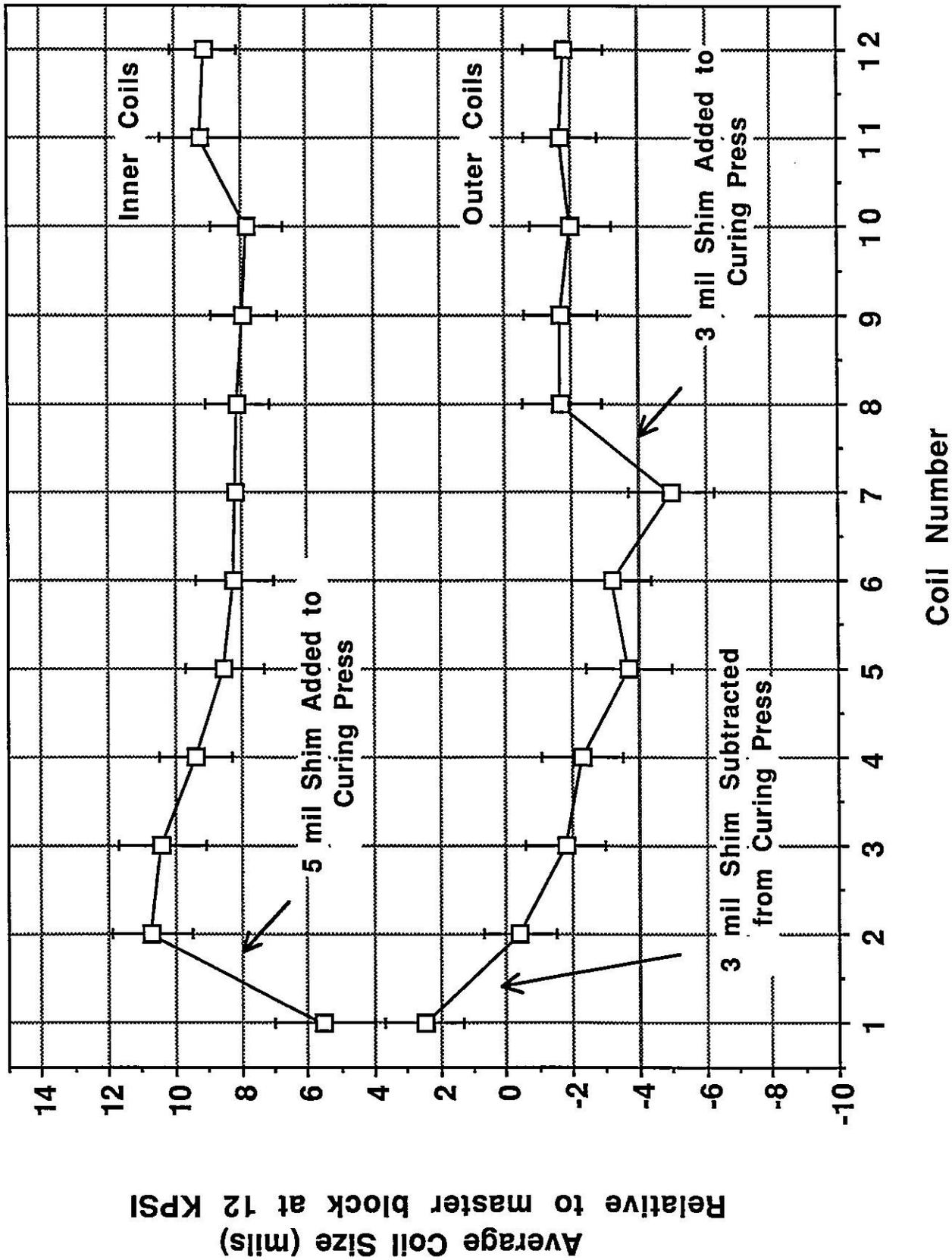
Good control of average coil size

Range of tooling induced coil size variation relative to average coil size is \pm 3-4 mils

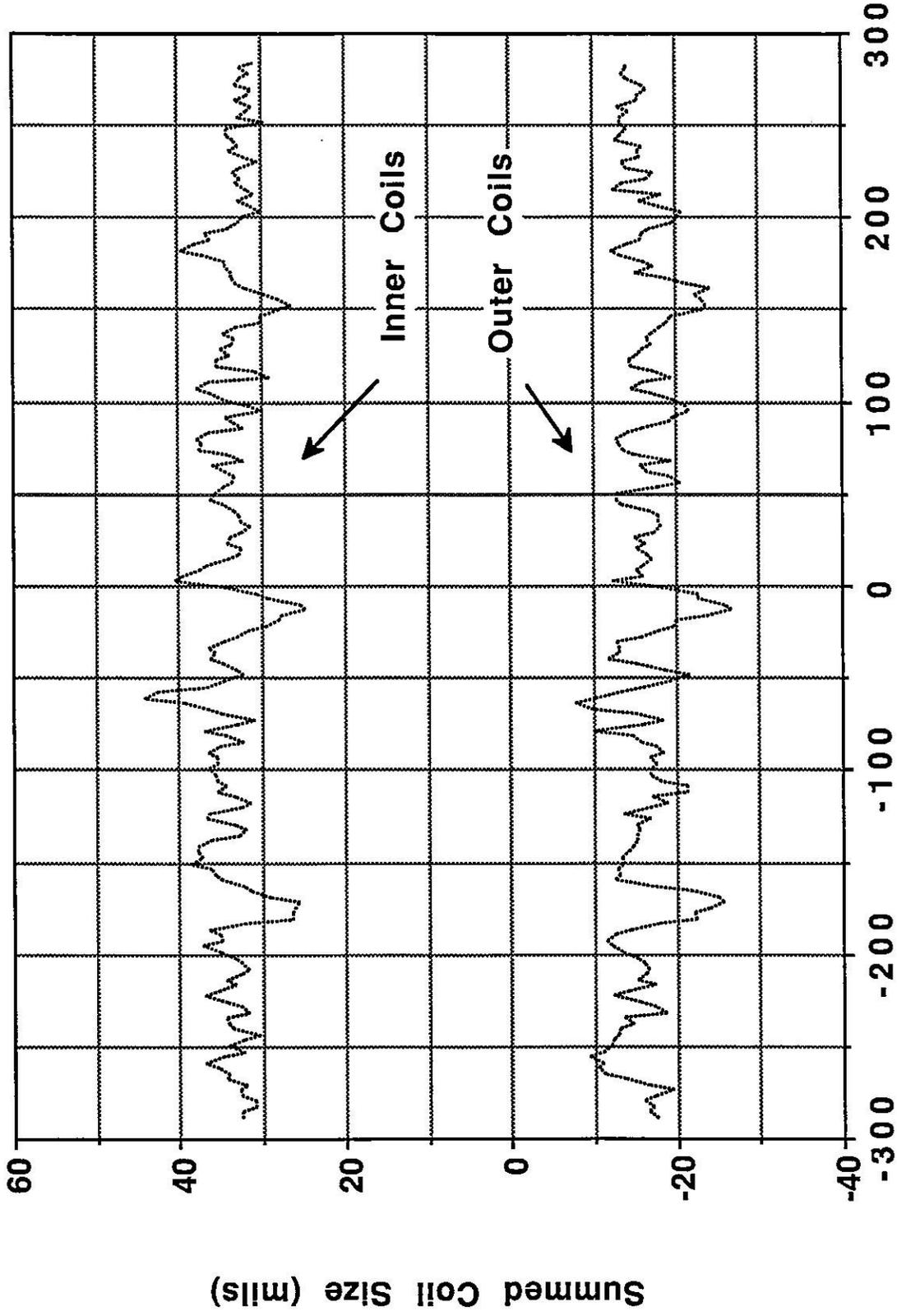
Coil Assembly and Collaring

Longitudinal coil shrinkage of \approx 0.25 inches

Average Inner and Outer Coil Size for Long 50 mm Magnets

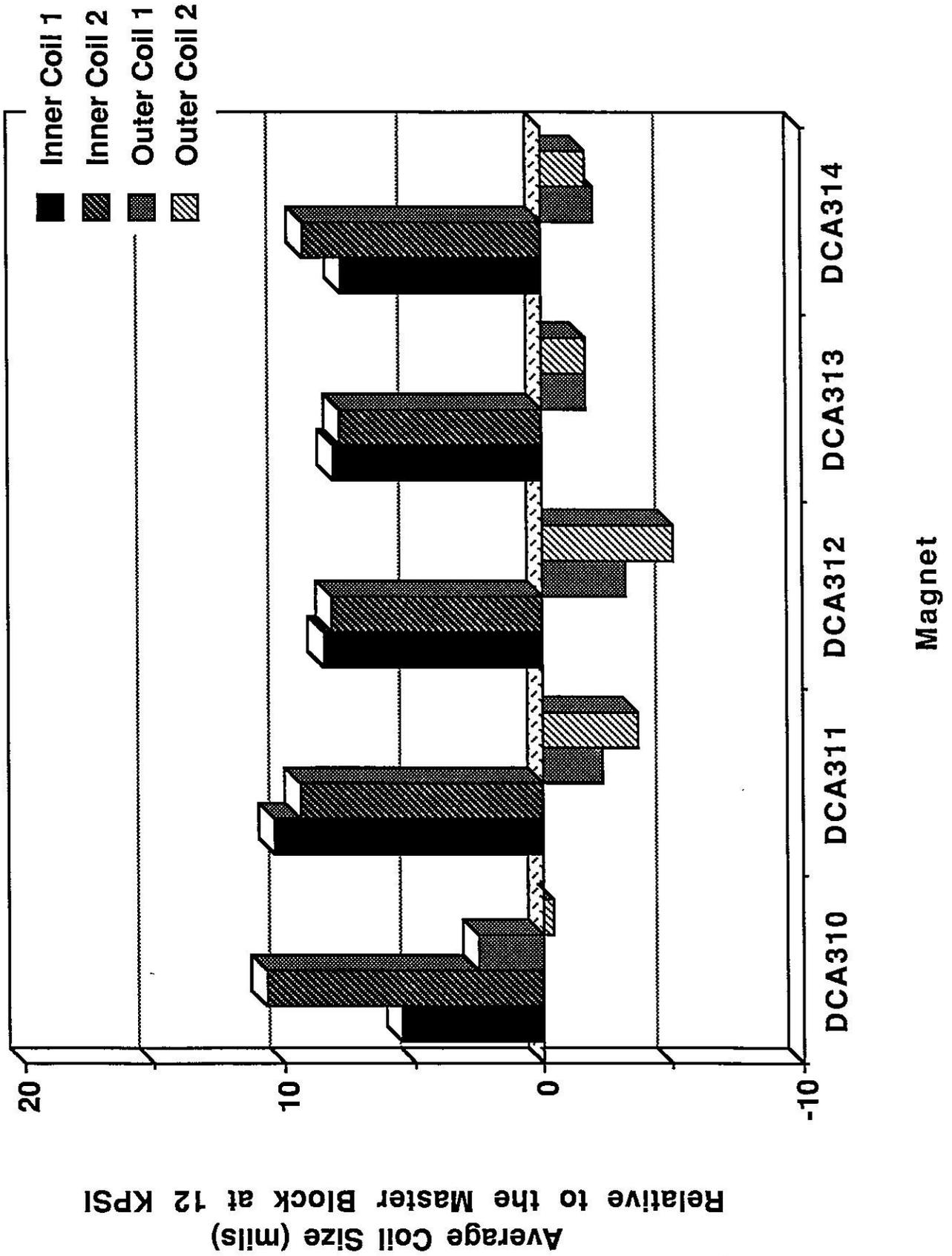


Summed Inner and Outer Coil Sizes for DSA312



Position from Magnet Center Line (Inches)

Average Coil Sizes of the Coils Used in the 50 mm Long Magnets



Keying

Collar coil alignment in press

Press Closure at \approx 6 KPSI pump pressure

Key Insertion at 2 KPSI horizontal pump pressure using mixed square/tapered key insertion technique

Pole Stress

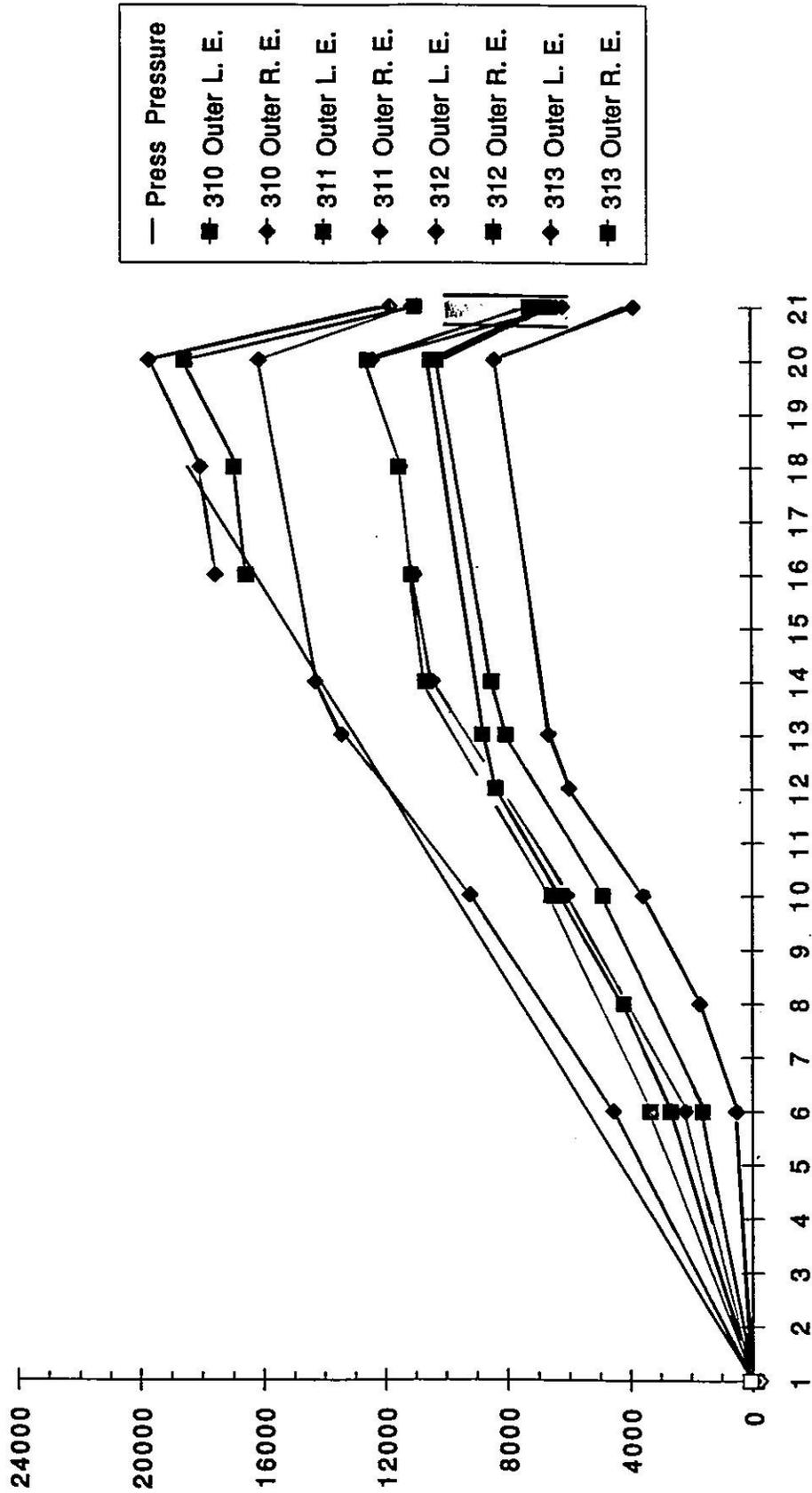
End Clamp Installation

Develop fixture which allows easy installation and removal of end can

Repair of short in DCA311 successful

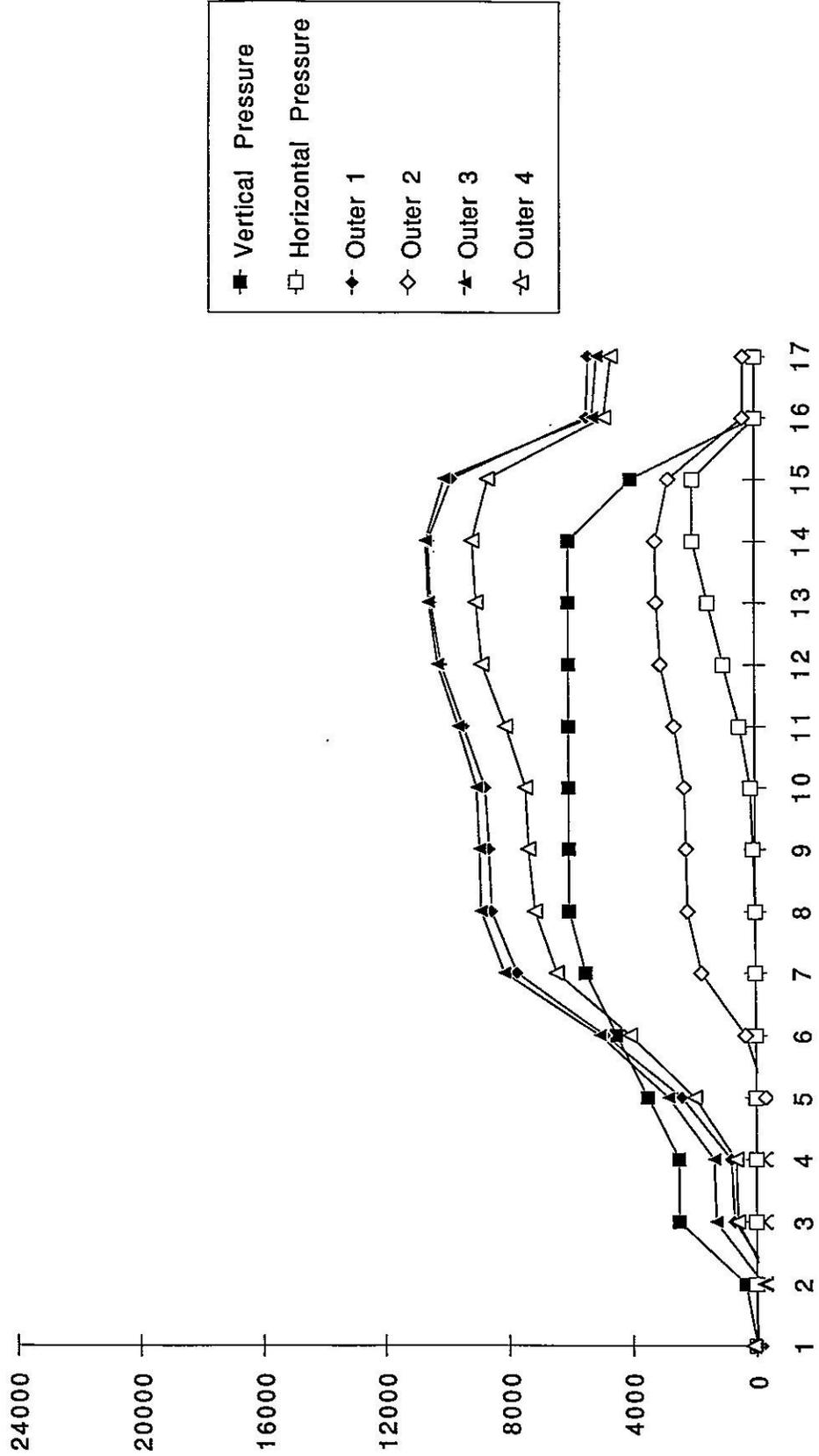
Develop criteria for successful end clamp installation

50 mm CDM Outer Coil Stress History



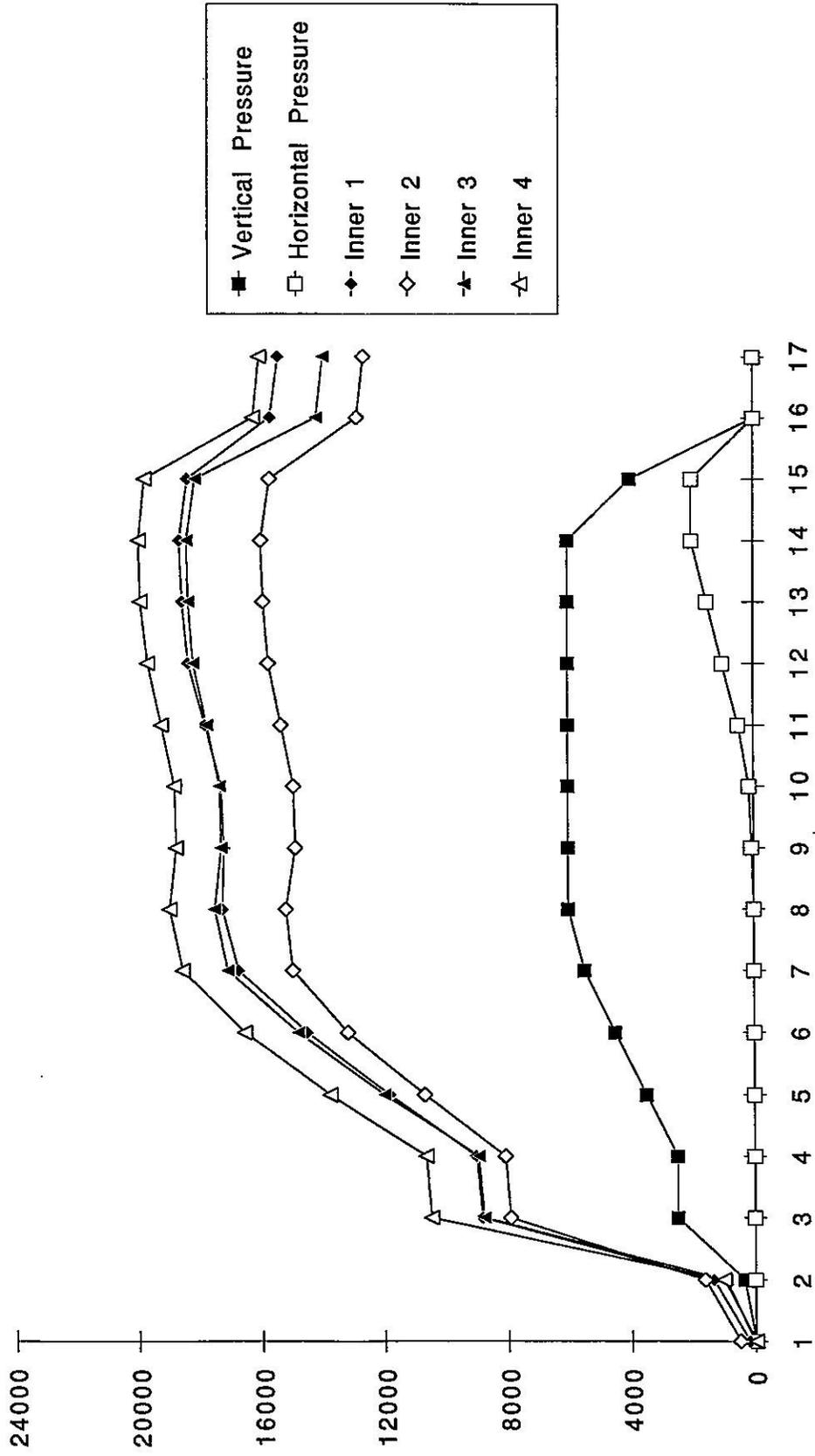
312 L.E. Outer Gauges

Lead End Outer Gauges



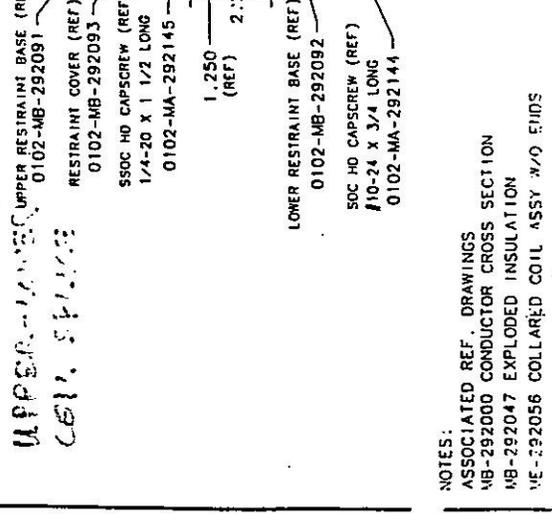
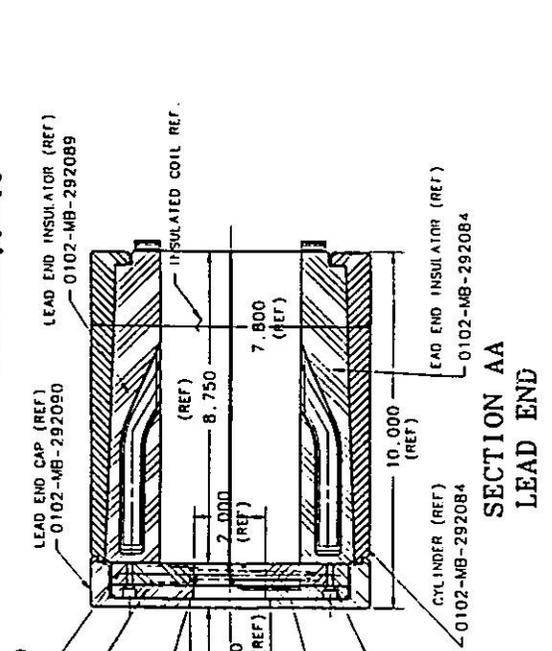
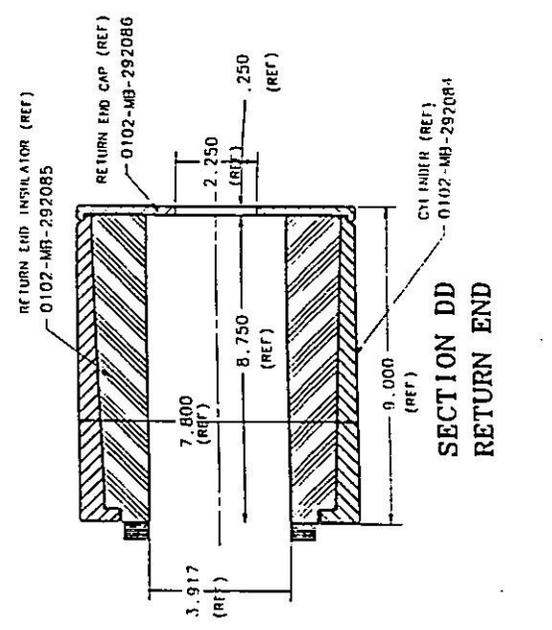
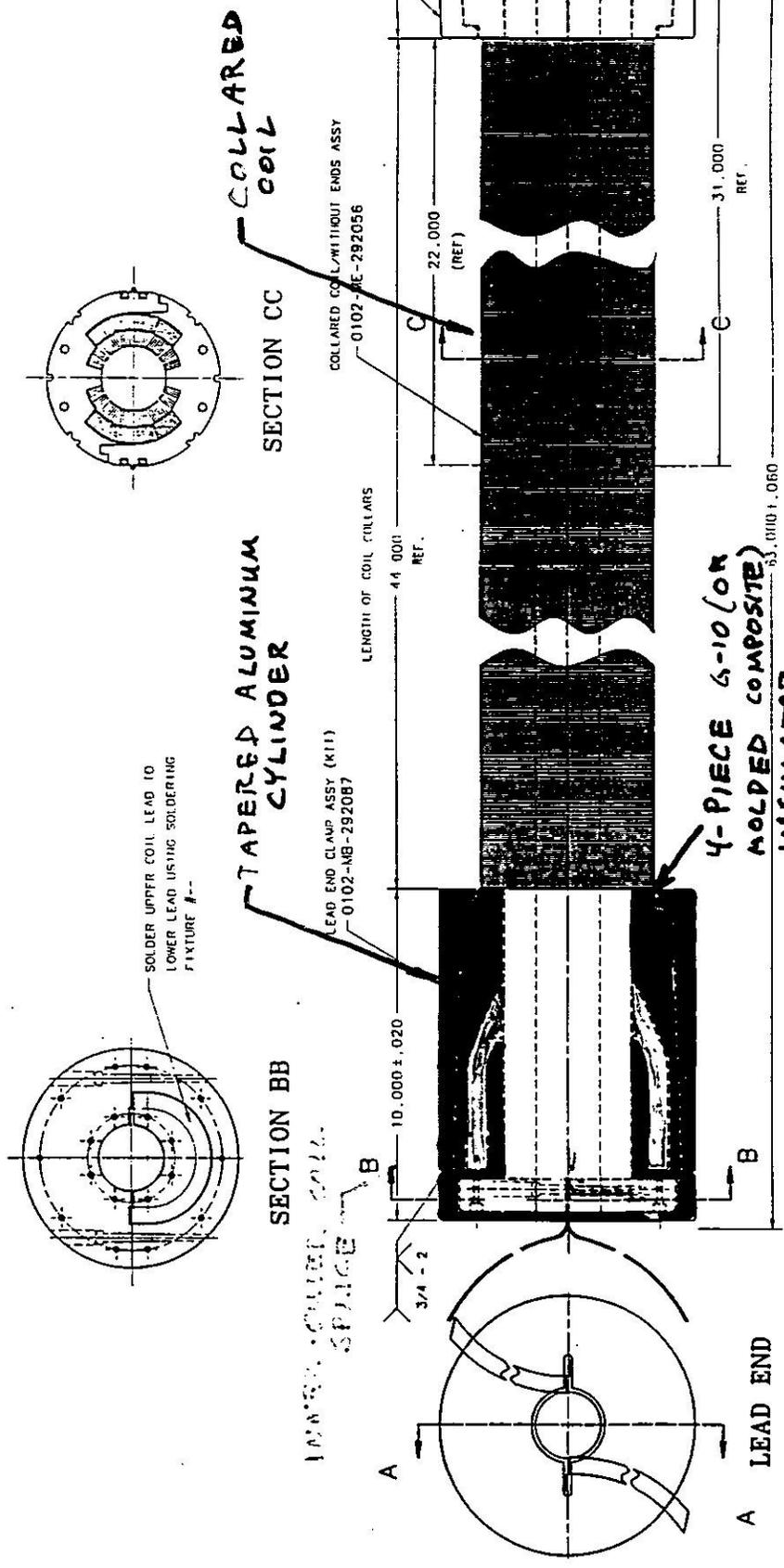
312 L.E. Inner Gauges

Lead End Inner Gauges



COLLARED COIL AND COLLET END-CLAMPS

REV	



- UPPER RESTRAINT BASE (REF) 0102-MB-292091
- RESTRAINT COVER (REF) 0102-MB-292093
- SSOC HD CAPSCREW (REF) 1/4-20 X 1 1/2 LONG
- 0102-MA-292145
- 1.250 (REF)
- 2.250 (REF)
- 2.000 (REF)
- 8.750 (REF)
- 7.800 (REF)
- 10.000 (REF)
- CYLINDER (REF) 0102-MB-292084
- LEAD END INSULATOR (REF) 0102-MB-292084
- LEAD END CAP (REF) 0102-MB-292090
- LEAD END INSULATOR (REF) 0102-MB-292089
- INSULATED COIL REF.
- 7.800 (REF)
- 8.750 (REF)
- 2.250 (REF)
- 3.917 (REF)
- 7.800 (REF)
- 8.750 (REF)
- 2.250 (REF)
- RETURN END INSULATOR (REF) 0102-MB-292085
- RETURN END CAP (REF) 0102-MB-292086
- 9.000 (REF)
- CYLINDER (REF) 0102-MB-292084
- RETURN END CLAMP ASSY (KIT) 0102-MB-292083
- 9.000 ± .010
- 31.000 REF.
- 44.000 REF.
- LENGTH OF COIL COLLARS
- 10.000 ± .020
- 3/4 - 2
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- RESTRAINT COVER (REF) 0102-MB-292093
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- 3/4 - 2

ITEM	PART NO.

UNLESS OTHERWISE SPECIFIED:

- ALL DIMENSIONS IN INCHES
- USE UNLESS OTHERWISE SPECIFIED
- ALL DIMENSIONS ARE TO CENTER UNLESS OTHERWISE SPECIFIED
- USE UNLESS OTHERWISE SPECIFIED
- USE UNLESS OTHERWISE SPECIFIED
- USE UNLESS OTHERWISE SPECIFIED

NOTES:
 ASSOCIATED REF. DRAWINGS
 MB-292000 CONDUCTOR CROSS SECTION
 MB-292047 EXPLODED INSULATION
 VE-292056 COLLARED COIL ASSY W/O ENDS

Yoke installation and shell welding

Yoke Press platten retraction spring problem

3 passes to weld shell

Welding proceeding without major problems

Power Bus and Electrical Interconnect

Hipot failure (10 μ a at 5 kV)

One layer of 1 mil Kapton for insulation

Cryostating

Vacuum flanges with cracked welds.

Field measurements of collared and yoked coils

Summary

Production of 50 mm magnets is proceeding fairly smoothly.

G. D. personnel are well into their first magnet without major problems.