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May 15,1990

End Can Deflection Measurements of DS0308

An aluminum end can and collet assembly were used to clamp the ends of magnet DS0308. The initial outside diameter of the aluminum can was 6.250 inches. The can was pressure fit over 4 G-10 quarter round collet pieces and diameter measurements were made at 0, 45, 90 and 135 degrees from the horizontal at 7 longitudinal positions as shown in figure 1. The measurements were made 4 times during this procedure corresponding to: a pre-installation (bench) measurement, a measurement when the can was 3/4" from closing with the face plate, one when it was 7/16" from closing and a final measurement after the can and face plate are together but prior to welding them. The results of these measurements for the return end can are shown in figures 2-6. The data indicate that when the end can is in its final position, it has deformed by +11 mils in the vertical direction and -11 mils in the horizontal direction at the end nearest the coils. It has also deformed by +11 mils at 45 degrees, most of this deformation taking place during the final 7/16" of closing. It apparently was not deformed by more than approximately 1 mil in the 135 degree direction, although it had shown a deformation of 4 mils when it was 7/16" from closed.

To determine the deflection of the return end can during excitation of the magnet, two external deflectometers were fitted to the return end of DS0308 at the mid-plane. These instruments consisted of full bridge constant voltage strain gages mounted on G-10 beams which were in contact with the end can through G-10 rods. The end of the rods rested in cups made of green putty fixed to the can. A sketch of this setup is shown in figure 7. During excitation, the maximum deflection of the end can was approximately 0.5 mil. This is shown in figure 8, for a strain gage run to about 100 amps below the quench current.

To verify that the data obtained from the deflectometers was valid, we attempted to bench test them after the magnet was warmed to room temperature. Prior to removing the gages from the magnet, it was observed that the beams were not relaxed, indicating that the G-10 rods were still in contatct with the end can. One of the deflectometers was damaged when it was removed from the magnet. The other deflectometer, corresponding to the one labelled 13 in figure 8, was bench tested using the same data acquisition system used during the magnet test. Figure 9 shows a comparison of the deflectometer readout versus the readout from a feeler gage which was set up to measure the motion of the G-10 rod. The agreement is very good. Figure 10 shows a similar measurement, however the 4.2 degree calibration coefficients were used to obtain the deflectometer displacement, so some disagreement between the two measurements is to be expected. The conclusion to be drawn from these plots is that the gage works properly at room temperature and that there is no problem with the data acquisition software or readout. Unless there is some unknown physical effect having to do with the installation of the deflectometers and which affected both of them the same, we may also conclude that the end can did not deflect more than approximately half a mil during excitation of the magnet.

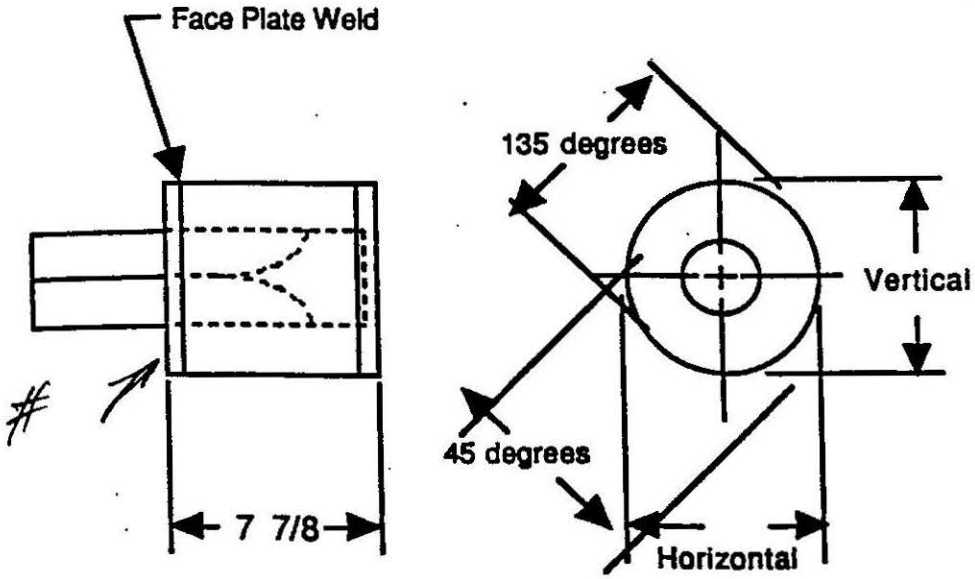
Distribution: Rodger Bossert, John Carson, Mike Lamm, Jim Strait, Bob Wands

SSC Magnet Traveller	Magnet No. DS0308	Page No.
Fermi National Accelerator Laboratory	Name J. Strait/ R. Bossert	Date 2-23-90

DS0308 Return End Clamp Inspection

c.) Pull the clamp outer cylinder tight, preserving its azimuthal orientation.
d.) Measure diameter of end clamp in the vertical, horizontal and 45 degree directions at 1 inch intervals. Enter data on form below.

Final



Distance from face plate weld	Horizontal	Vertical	45 degrees	135 degrees
.5 inches	6.240	6.261	6.261	6.251
1.5 inches	6.241	6.260	6.259	6.250
2.5 inches	6.242	6.258	6.257	6.250
3.5 inches	6.244	6.256	6.255	6.250
4.5 inches	6.245	6.255	6.255	6.250
5.5 inches	6.245	6.255	6.251	6.250
6.5 inches	6.249	6.251	6.250	6.249

Figure 1

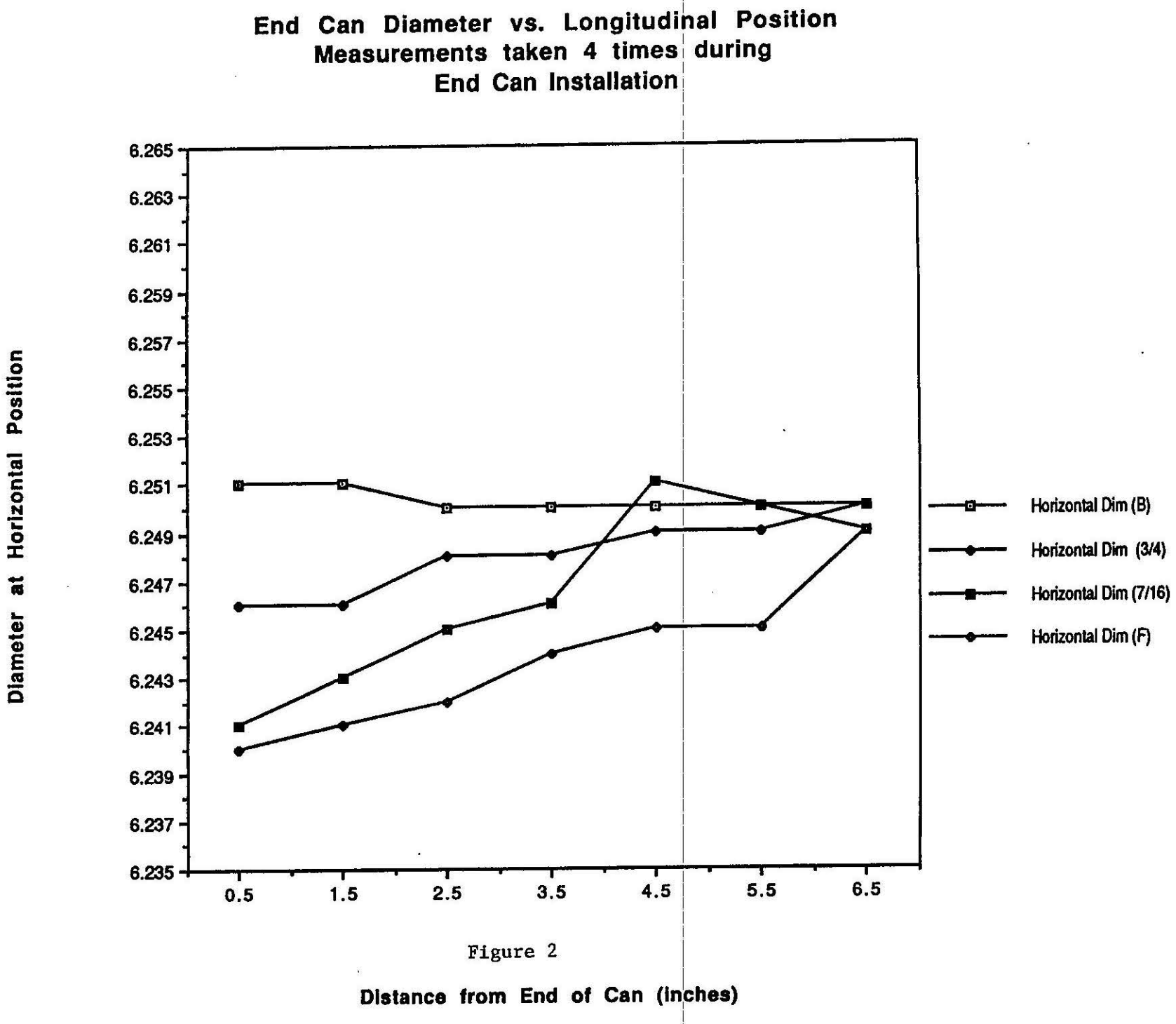

End Can Diameter vs. Longitudinal Position
Measurements taken 4 times during
End Can Installation
Diameter at Horizontal Position
6.265
6.263
6.261
6.259
6.257
6.255
6.253
6.251
6.249
6.247
6.245
6.243
6.241
6.239
6.237
6.235
0.5
1.5
2.5
3.5
4.5
5.5
6.5
Horizontal Dim (B)
Horizontal Dim (3/4)
Horizontal Dim (7/16)
Horizontal Dim (F)
Distance from End of Can (inches)

Figure 2

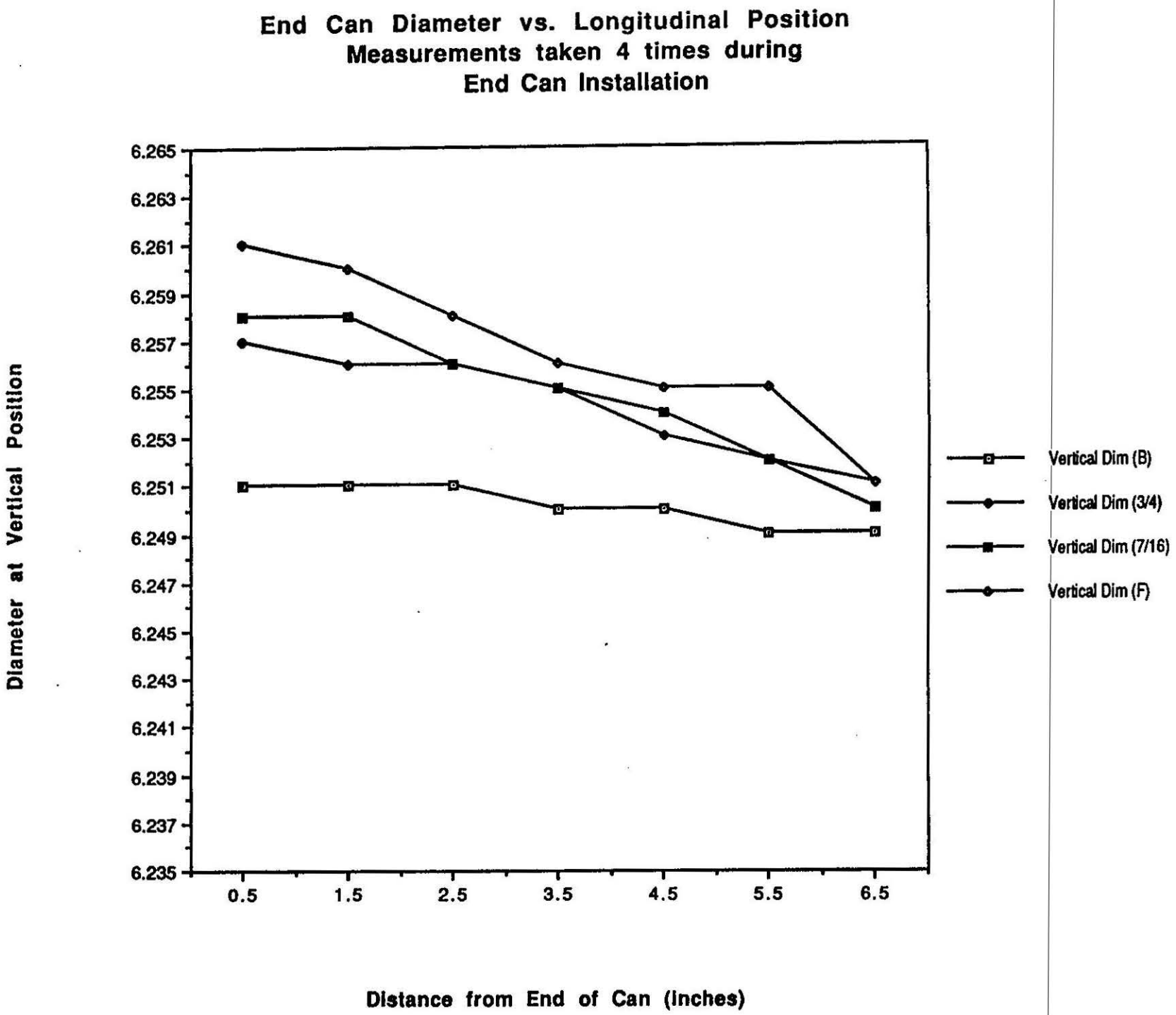

End Can Diameter vs. Longitudinal Position
Measurements taken 4 times during
End Can Installation
Diameter at Vertical Position
6.265
6.263
6.261
6.259
6.257
6.255
6.253
6.251
6.249
6.247
6.245
6.243
6.241
6.239
6.237
6.235
0.5
1.5
2.5
3.5
4.5
5.5
6.5
Distance from End of Can (Inches)
Vertical Dim (B)
Vertical Dim (3/4)
Vertical Dim (7/16)
Vertical Dim (F)

Figure 3

End Can Diameter vs. Longitudinal Position
Measurements taken 4 times during
End Can Installation

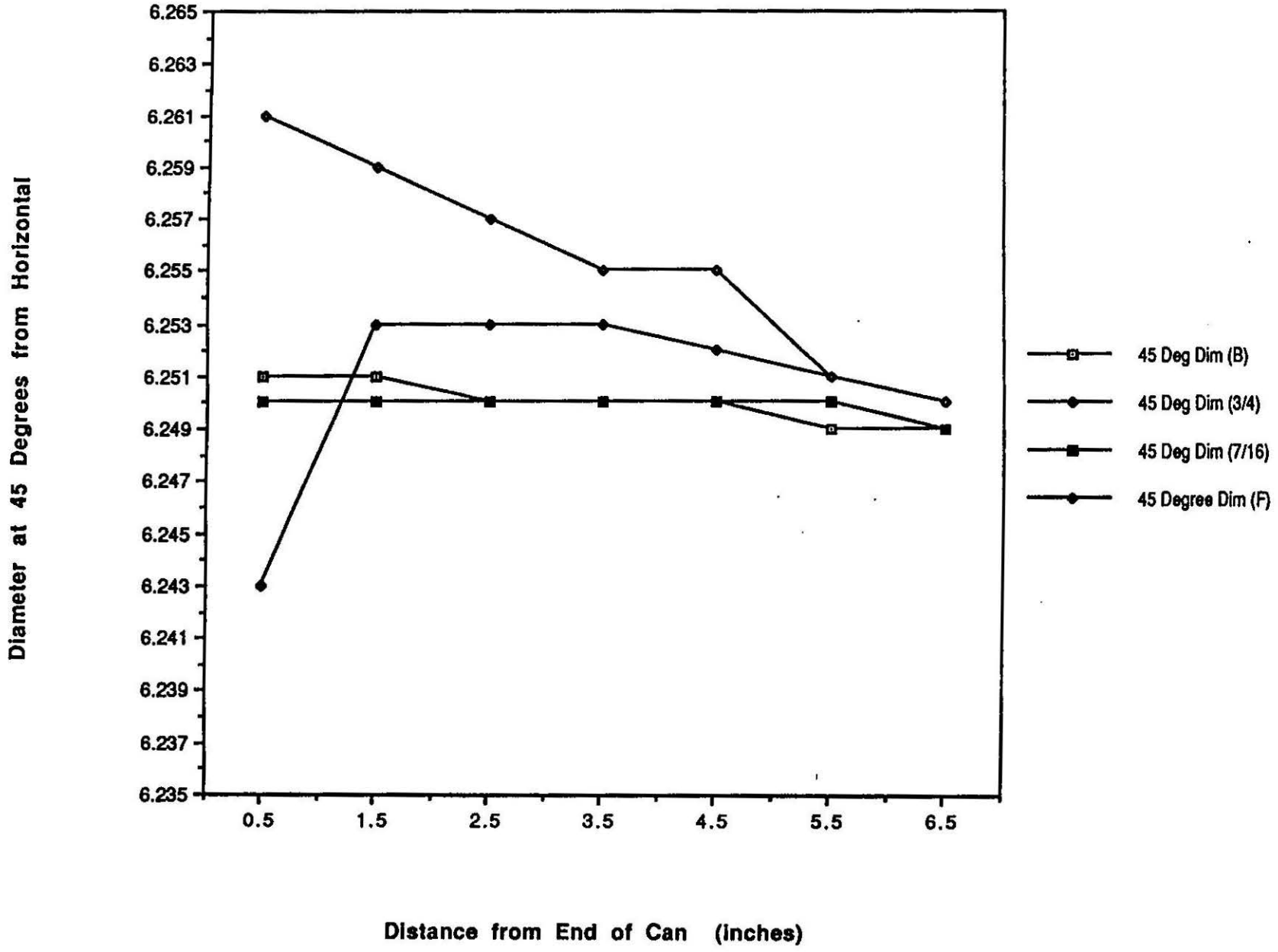


Figure 4

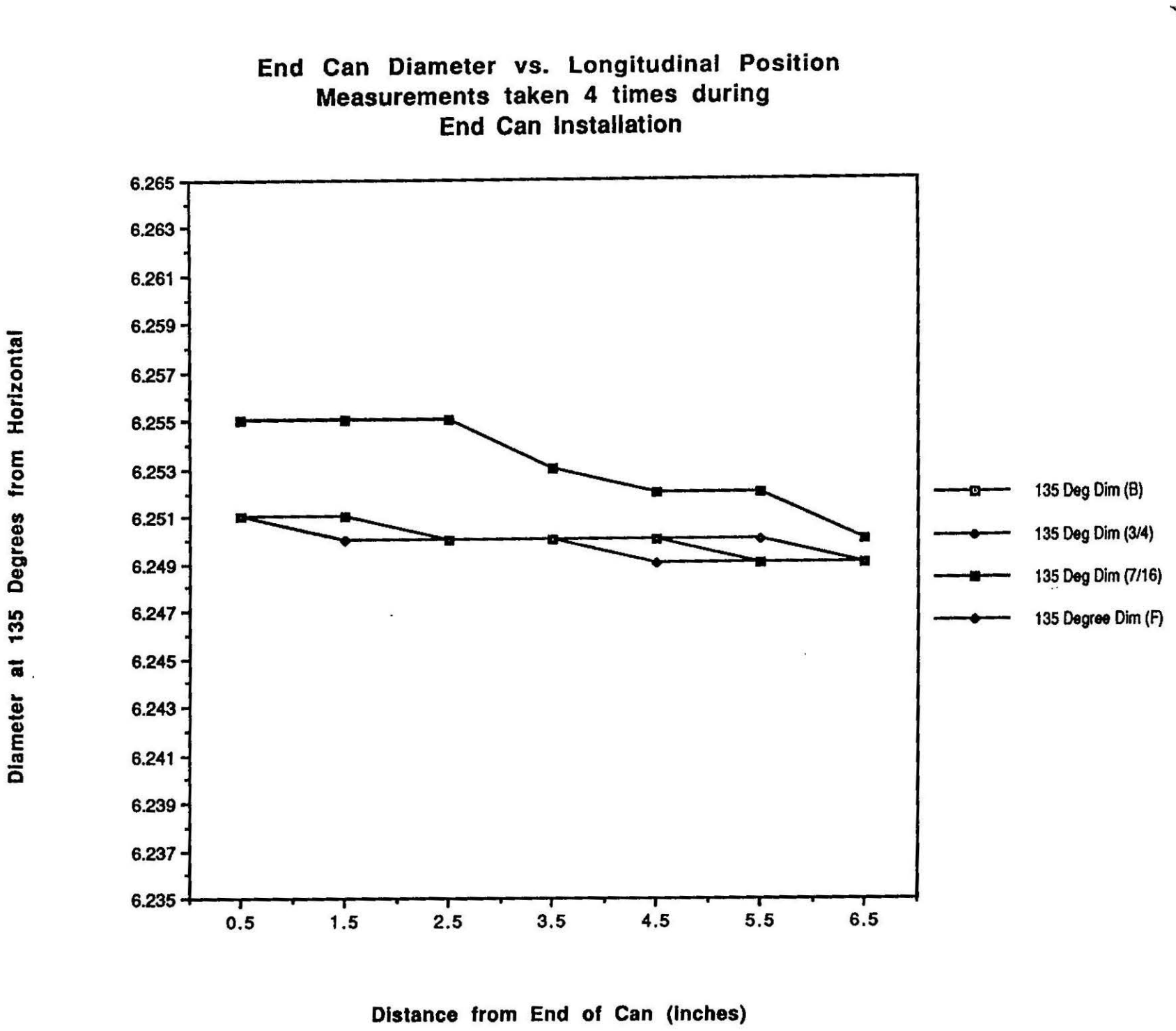

End Can Diameter vs. Longitudinal Position
Measurements taken 4 times during
End Can Installation
Diameter at 135 Degrees from Horizontal
6.265
6.263
6.261
6.259
6.257
6.255
6.253
6.251
6.249
6.247
6.245
6.243
6.241
6.239
6.237
6.235
0.5
1.5
2.5
3.5
4.5
5.5
6.5
Distance from End of Can (Inches)
135 Deg Dim (B)
135 Deg Dim (3/4)
135 Deg Dim (7/16)
135 Degree Dim (F)

Figure 5

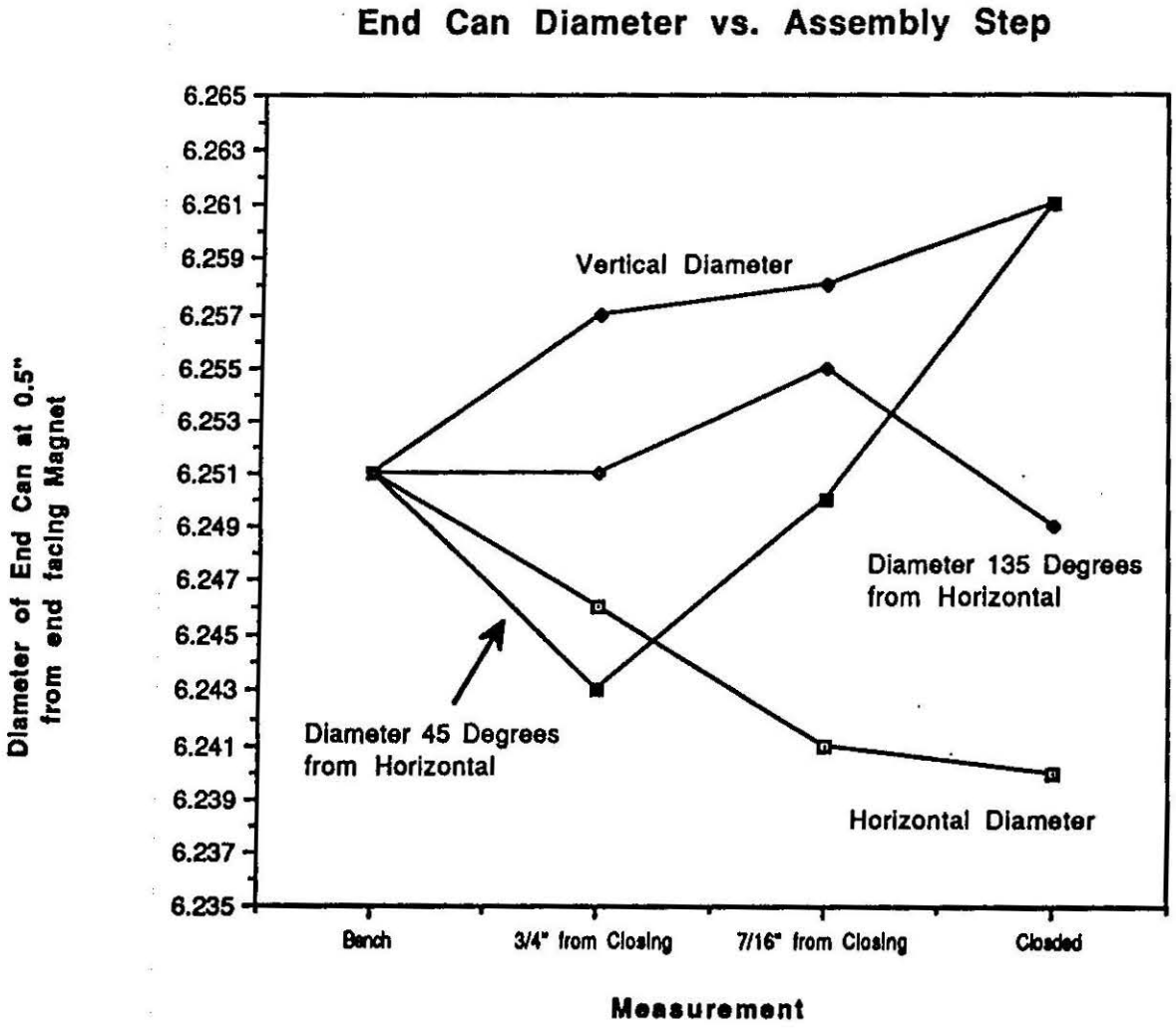

End Can Diameter vs. Assembly Step
Diameter of End Can at 0.5" from end facing Magnet
6.265
6.263
6.261
6.259
6.257
6.255
6.253
6.251
6.249
6.247
6.245
6.243
6.241
6.239
6.237
6.235
Vertical Diameter
Diameter 135 Degrees from Horizontal
Diameter 45 Degrees from Horizontal
Horizontal Diameter
Bench
3/4" from Closing
7/16" from Closing
Closed
Measurement

Figure 6

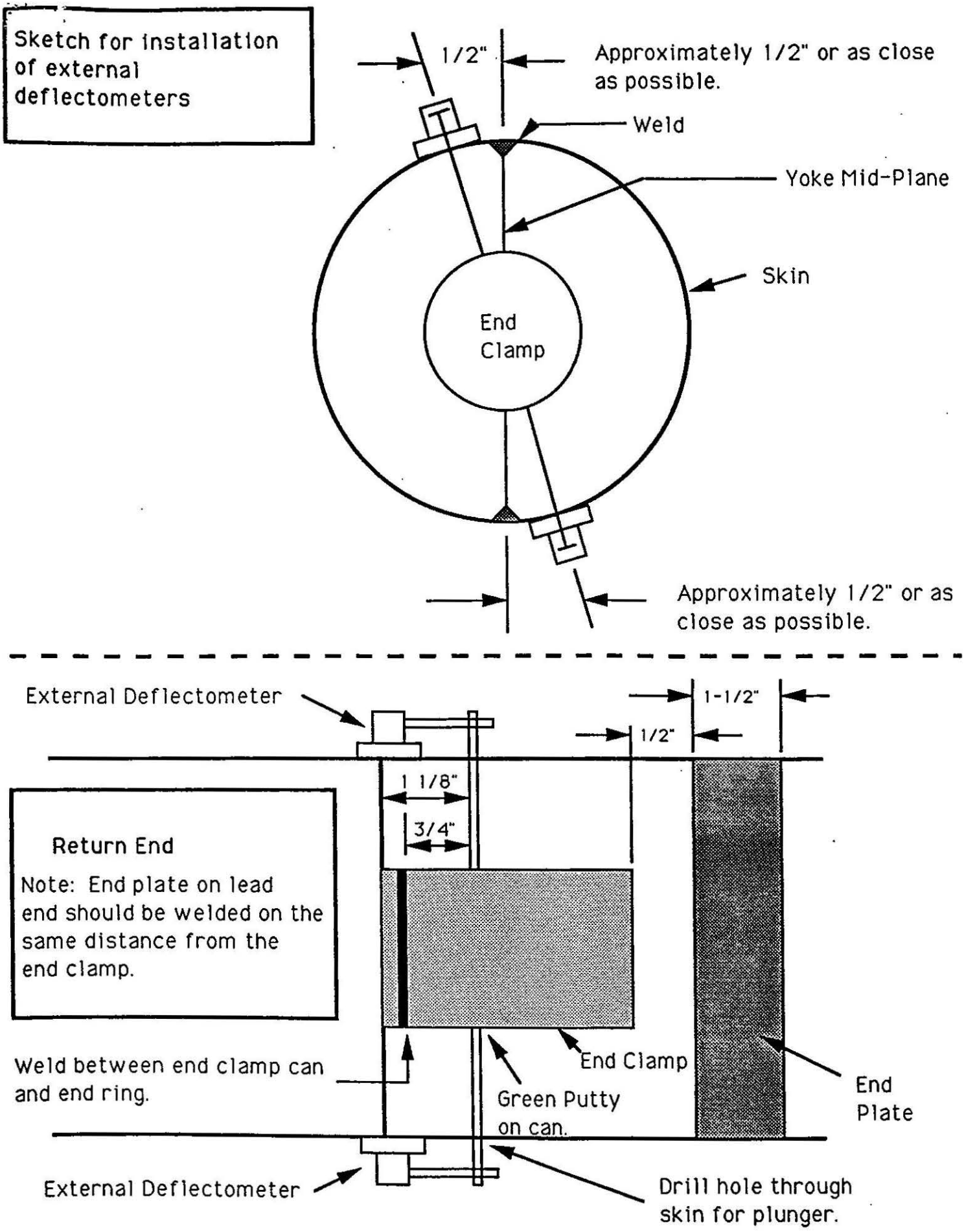
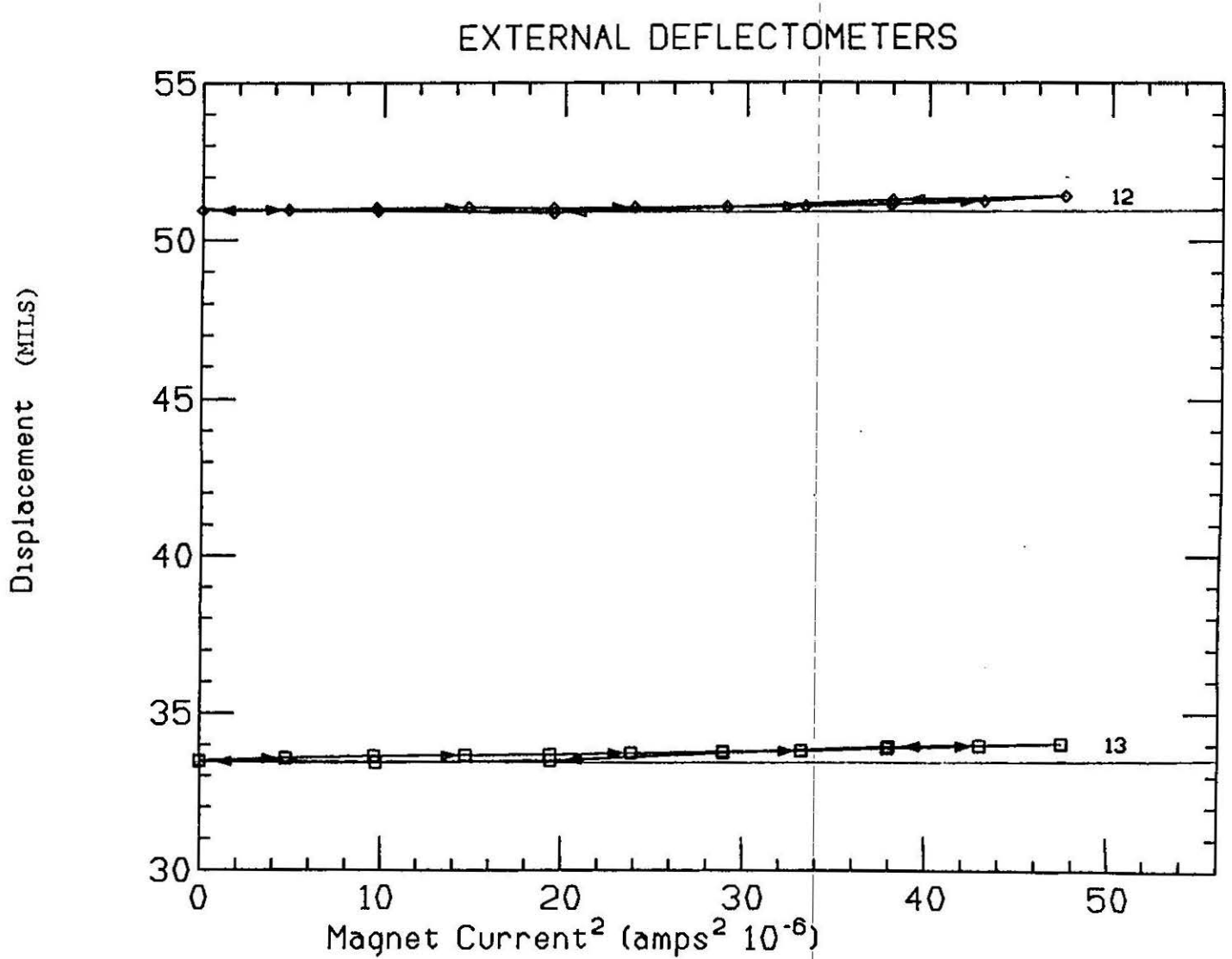

Sketch for installation of external deflectometers
1/2"
Approximately 1/2" or as close as possible.
Weld
Yoke Mid-Plane
Skin
End Clamp
Approximately 1/2" or as close as possible.
External Deflectometer
1-1/2"
1/2"
1 1/8"
3/4"
Return End
Note: End plate on lead end should be welded on the same distance from the end clamp.
Weld between end clamp can and end ring.
End Clamp
Green Putty on can.
End Plate
External Deflectometer
Drill hole through skin for plunger.

Figure 7



DS0308 File: DS0308.CA009 1-MAY-90 16:02:25 2-MAY-90 11:55:51

Figure 8

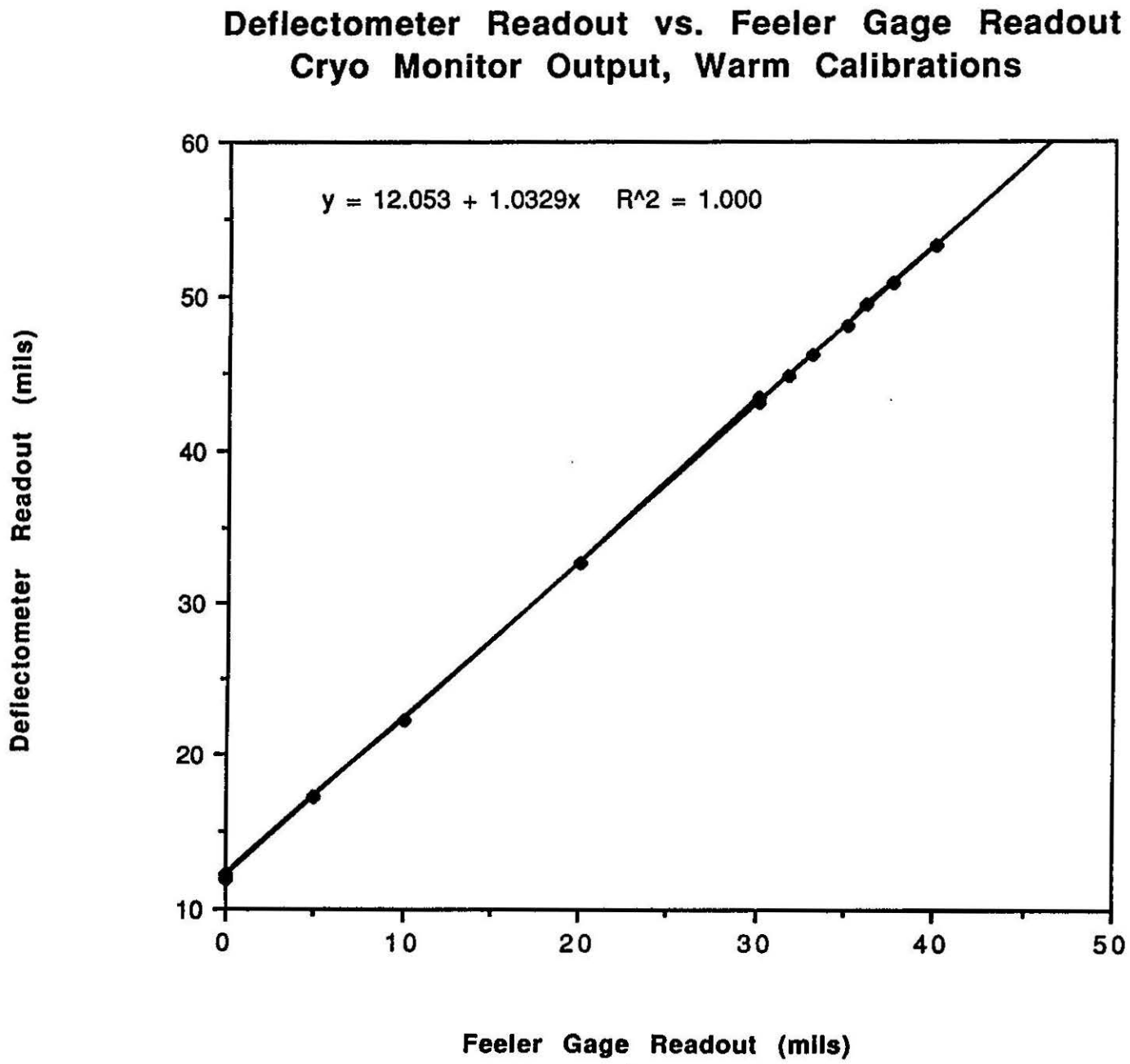

Deflectometer Readout vs. Feeler Gage Readout
Cryo Monitor Output, Warm Calibrations
y = 12.053 + 1.0329x R^2 = 1.000
Deflectometer Readout (mils)
Feeler Gage Readout (mils)
60
50
40
30
20
10
0
10
20
30
40
50

Figure 9

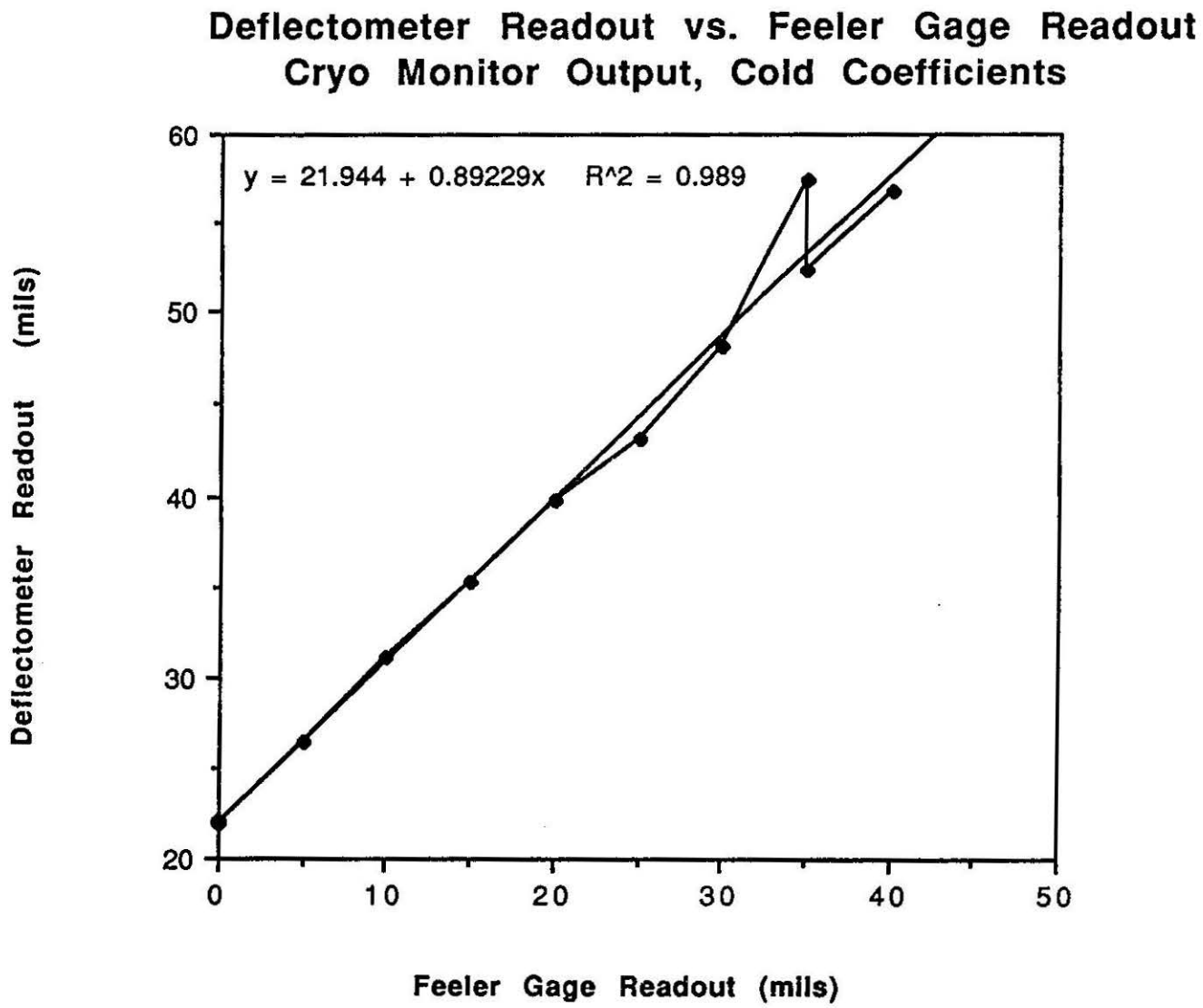

Deflectometer Readout vs. Feeler Gage Readout
Cryo Monitor Output, Cold Coefficients
y = 21.944 + 0.89229x R^2 = 0.989
Deflectometer Readout (mils)
Feeler Gage Readout (mils)
60
50
40
30
20
0
10
20
30
40
50

Figure 10