

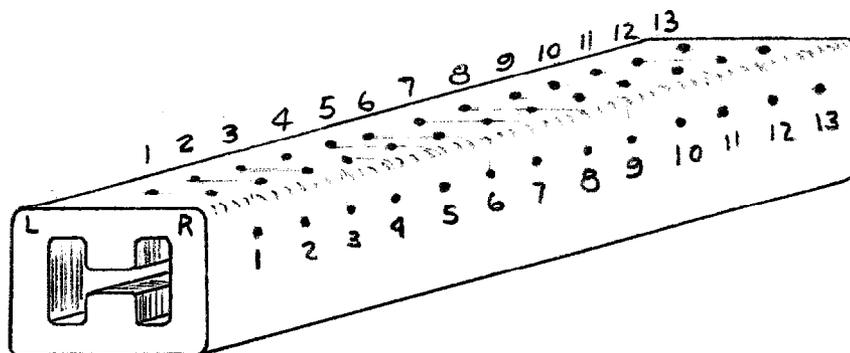


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OPTICAL SURVEY OF EPB MAGNETS

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The magnets are optically surveyed as follows:



Thirteen points are used spaced at 10" intervals. The right and left points are separated by 12 inches. The first and thirteenth points are on the end packs. The magnet is leveled using four points. These are points 3 and 11 on the right and left sides. Obviously not all four points lie on a plane, so what is done is to set the #3 points on the right and left sides right on level and set the other end in between the two #11 points. The readings are then taken for the horizontal survey. The readings for the 26 horizontal points are averaged to form a base point. Then the differences between this base point and all other 26 points are found. No single difference should exceed .015". Next, one subtracts the right hand differences from the left hand differences for corresponding points. The spread between the maximum and minimum of these subtractions should not exceed .015. For the radial straightness only 13 points are used and the points 3 and 11 are then set to be equal. The average of the 13 points is taken as the base point. Again the difference between base point and all thirteen points are found. The differences should be less than .015".

It is of interest to form the average of the sum of absolute values of the horizontal and radial differences to yield two numbers which represent roughly the overall quality of the magnet. The value of these numbers for a magnet of average quality would be approximately .005". This method is illustrated with the actual points taken from an EPB dipole for clarity. A summary of the quality of dipole magnets produced by NAL and two outside vendors (i.e. external proton beam dipoles) is included.



OPTICAL SURVEY OF
EPB DIPOLE

		<u>Left</u>	<u>ΔL</u>	<u>Right</u>	<u>ΔR</u>	<u>ΔL-ΔR</u>	<u>Radial</u>	<u>ΔRD</u>
End Pack	1	6.254	+0.022	6.254	+0.022	0	3.891	+0.011
	10	6.272	+0.004	6.272	+0.004	0	3.901	+0.001
	20	6.280	-0.004	6.280	-0.004	0	3.901	+0.001
	30	6.278	-0.002	6.275	+0.001	-0.003	3.909	-0.007
	40	6.278	-0.002	6.273	+0.003	-0.005	3.914	-0.012
	50	6.280	-0.004	6.276	+0.000	-0.004	3.914	-0.012
	60	6.281	-0.005	6.279	-0.003	-0.002	3.903	-0.001
	70	6.277	-0.001	6.277	-0.001	0	3.901	+0.001
	80	6.277	-0.001	6.275	+0.001	-0.002	3.899	+0.003
	90	6.276	+0.000	6.279	-0.003	+0.003	3.899	+0.003
	100	6.280	-0.004	6.281	-0.005	+0.001	3.899	+0.003
	110	6.279	-0.003	6.279	-0.003	0	3.896	+0.006
End Pack	13	6.285	-0.009	6.285	-0.009	0	3.894	+0.008

Horizontal base point = 6.276
(Average of 26 readings)

Radial base point = 3.902
(Average of 13 readings)

$$\frac{\sum |\Delta L| + \sum |\Delta R|}{26} = .0046 = \Delta H \text{ Average}$$

$$\frac{\sum |\Delta RD|}{13} = .0053 = \Delta RD \text{ Average}$$

(Maximum Range between the ΔL-ΔR to be less than .015") =
-0.005 - (+0.003) = -0.008

* All data are recorded in inches.

SUMMARY OF OVERALL QUALITY OF THOMSON ELECTRIC,
AIRCO TEMESCAL, AND NAL DIPOLES

	<u>Dipole</u>	<u>Average ΔH *</u>	<u>Average ΔRD</u>
Thomson	1	.0072	.0022
	2	.004	.0101
	3	.0048	.0004
	4	.0049	.0081
	5	.0038	.0016
	6	.0039	.0083
	7	.0017	.0010
	8	.0071	.0068
	9	.0029	.0031
	10	.0047	.005
NAL	1	.0030	**
	2	.0052	**
	3	.0016	.0058
	4	**	**
	5	.0046	.0034
	6	.0032	.0056
	7	.0041	.0046
	8	.0037	.0043
	9	.0050	.0043
	10	.0017	.0017
	111	.0047	.0038
	12	.0039	.0064
Airco Temescal	1	.010	.0055
	2	.0035	**
	3	.0142	**
	4	.0052	**
	5	.0041	.0032
	6	.0085	.0017
	7	.0076	.0024
	8	.0047	.0024
	9	.0048	.0024
	10	.0036	.0010
	11	.0057	.0024
	12	.0006	.0016
	13	.0029	.0025
	14	.0025	.0028
	15	.0028	.0013
	16	.0023	.0029
	17	.0025	.0016

* All values quoted are in inches
 **Not Available for this Summary