national accelerator laboratory

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MAGNET REPLACEMENT AT THE MAIN RING

Three full years have passed since the initial installation of all the Main Ring magnets was completed in April, 1971. This is a summary report of magnet replacement in the Main Ring during these years.

Methods and procedures of magnet fabrication have been changed or modified during and after the installation period of early 1971 in order to improve the quality of magnets and to prevent failures. Five major generations of bending magnets have been made. From their typical characteristics, they are called (1) plaster-stick, (2) epoxy-stick, (3) vacuum-impregnation, (4) integral-impregnation ("super" magnets), and (5) sleeve-joint ("super-duper" magnets). Some of the plaster-stick and epoxy-stick bending magnets were vacuum-impregnated without being disassembled. They are called "salvage-impregnation" magnets. This procedure was applied before magnets were installed in the Main Ring (BC magnets; before commission) and after magnets had been installed and failed (AC magnets; after commission).

Table I gives the numbers of replaced magnets, including shorted magnets, and magnets replaced for reasons other than shorts. The shorted magnets include magnets that failed by hi-potting and magnets with turn-to-turn shorts.

Table I

Replaced Magnets

	Total Number of Replaced Magnets	Number of Shorted Magnets	Miscellaneous Replaced Magnets
Bending	466	399	67
Quadrupole	87	50	37*
Total	553	449	104

*This includes 12 quadrupole magnets that were replaced because other quadrupole magnets in the same doublet structures had to be replaced.

The miscellaneous replaced magnets consist of magnets that were replaced for convenience, because of vacuum leaks inside magnets, and because of bad doublet mates.

The main reasons for magnet replacement for convenience are:

1. Wrong-Series Magnets. Because of shortages of proper-series magnets, B2 bending magnets were installed in place of B1 magnets, and inner coil-up bending magnets (1500 and 2500 series) in place of inner coil-down magnets (1000 and 2000 series) and vice versa; "old" style quadrupole magnets were installed in place of "new" style quadrupole magnets and vice versa.

2. Proto-Main Bending Magnets. These magnets have magnetic-field properties almost identical to those of the regular bending magnets in the magnetic-field range below 300 GeV, but have different field-saturation characteristics at higher fields, for example at 400-GeV excitation.

3. Substandard Magnets.

4. Magnets in which the vacuum chamber was built using different stainless steel from the regular chamber.

5. Plaster-stick B2 bending magnets with low resistance to ground. Those magnets are being used at secondary beam lines at the Meson Experimental Area, where magnets are generally operated at very low voltage.

6. Bending magnets with collapsed vacuum chambers or with suspected collapsed vacuum chambers.

7. Quadrupole magnets for magnetic field studies. No useful information has been obtained from this practice.

8. Magnets on which special devices such as extraction targets were installed.

9. Quadrupole doublets for splitting.

Details of magnet replacement data as of 2400 hours, April 30, 1974, are given in Table II(a) through Table II(k). Reference numbers, removed magnets, replacement magnets, locations, dates and reasons for replacement are listed. Table III is a list of failed magnets because of turn-to-turn shorts. Table IV is a list of magnets that were replaced because of leaks in vacuum chambers. Fourteen quadrupole magnets and only four bending magnets are in this category.

Figures 1(a) and 1(b) show the number of magnets per month replaced for convenience or because of vacuum leaks and the number of failed magnets because of shorts to ground or hi-pot failure, respectively. The absissa is the month and year. A total of 20 magnets that failed because of turn-to-turn shorts are indicated as black histograms in Figure 1(b).

Figure 2 gives semi-log plots of the number of the failed magnets per month as a function of the calendar year. The upper data correspond to the sum of both bending and quadrupole magnets and the lower data to the shorted quadrupole magnets only. Two curves are drawn to guide the eye.

Table V gives a summary statistics for the bending magnets in seven categories; i.e., (1) plaster-stick (pure), (2) plaster-stick with salvage impregnation after failure (AC), (3) plaster-stick with salvage impregnation before failure (BC), (4) epoxy-stick (pure or salvage impregnation), (5) vacuum impregnation, (6) integral impregnation (super), and (7) sleeve joint (super-duper). The lifetime of a replaced magnet is measured from the date of installation to the date of replacement. For those magnets that were installed during the initial installation period, the date of installation was assumed to be April 15, 1971. Similarly, the lifetime of a magnet that is currently installed is measured from the date of installation to April 30, 1974.

An average mean - life for shorted magnets, λ_{ave}, is defined by

$$\lambda_{ave} = \frac{\lambda_1 \cdot N_1 + \lambda_2 \cdot N_2}{N_1 + N_2} \Big/ \log_e \frac{N_1 + N_2}{N_2} \quad ,$$

where λ_1 and λ_2 are average lifetimes for shorted magnets and magnets that are currently in use, respectively, and N_1 and N_2 are respectively the numbers of shorted magnets and magnets in use. Magnets that have been replaced for other reasons than shorts are not included in this analysis.

Failure rates for those bending magnets in the first four categories reveal a very strong dependence on their lifetimes. The longer they survive, the lower are the failure rates. Figures 3, 4, and 5 show percentage failure rates per month as a function of the magnet lifetime for the plaster-stick (pure or salvage impregnation), epoxy-stick (pure or salvage impregnation), and vacuum-impregnation bending magnets, respectively. The last shows essentially no lifetime

dependence. The failure rates for the plaster-stick and epoxy-stick bending magnets were very high during the first 12 months, but they are now 0.5% or less per month. The three kinds of plaster-stick magnets (pure, AC and BC) are combined together in order to improve statistics.

Table VI(a) through VI(c) are lifetime distributions for shorted bending magnets, bending magnets that are currently in use, and bending magnets that have been replaced for other reasons than shorts, respectively, in the seven categories. The first column corresponds to the lifetime in units of months. In Table VI(b), one can see that essentially all the bending magnets that are in the first five categories and that are currently in use, have a lifetime of 36 months, i.e., 3 years. Sixteen pure plaster-stick magnets that were replaced for convenience at the 17th month (Table VI(c) were sent to the Meson Area. The failure rate of the integral-impregnation magnets (super) does not seem to have an apparent correlation with the magnet lifetime. (See Table VI(a) and (b).)

Table VII gives an extrapolated failure rate for the bending magnets in the near future. The individual extrapolated failure rates are determined from Figures 3, 4, and5 for the first three kinds, and from the

Table VII.

Extrapolated Failure Rate

Magnets	Number of Bending Magnets In Use	Extrapolated Failure Rate per Month (%)	Number of Extrapolated Failed Magnets per Month
Plaster-Stick	145	0.35	0.5
Epoxy-Stick	333	0.3	1.0
Vacuum Impreg.	127	0.5	0.6
Integral Impreg.	138	0.74	1.0
Sleeve Joints	31	0.73	0.2
Total	774	0.44	3.3

average mean-lives given in Table V for the integral-impregnation and sleeve-joint magnets. This failure rate of 3.3 bending magnets per month is consistent with those shown in Figure 2.

Table VIII(a) through Table VIII(f) and Table IX(a) through Table IX(f) give magnet arrangements of the Main Ring magnets (total of 1014) on April 18, 1971, when the intial installation was completed, and on April 30, 1974, respectively. A magnet serial number of 0 at Stations 17-2 and 17-3 etc. indicates that those stations do not have any magnet.

Table XI(a) through Table XI(l) show a history of magnet replacement at each station. Four-digit numbers correspond to the current magnet arrangement given in Table IX(a) through Table IX(f). Twelve-digit numbers correspond to replaced magnets and should be read as follows (starting from the left):

4 digits = magnet serial number of a removed magnet

1 digit = replacement mode

- 1 = short or hi-pot failure
- 2 = vacuum leaks
- 3 = convenience
- 4 = turn-to-turn short
- 5 = doublet mate

3 digits = reference number of replacement

4 digits = date.

For example, a magnet replacement history at Station A11-3 (Table XI(a)) is as follows:

> The original magnet (2022) failed due to shorts in March, 1972, Reference #332, and the second magnet (2260) was replaced for convenience (a suspected collapsed vacuum chamber) in June, 1972, Reference #370. The magnet in the ring now is 2275.

No magnet has been replaced at Station A12-3.

Throughout the present analysis only two inconsistent data regarding magnet serial numbers were found. They will be straightened out in the near future.

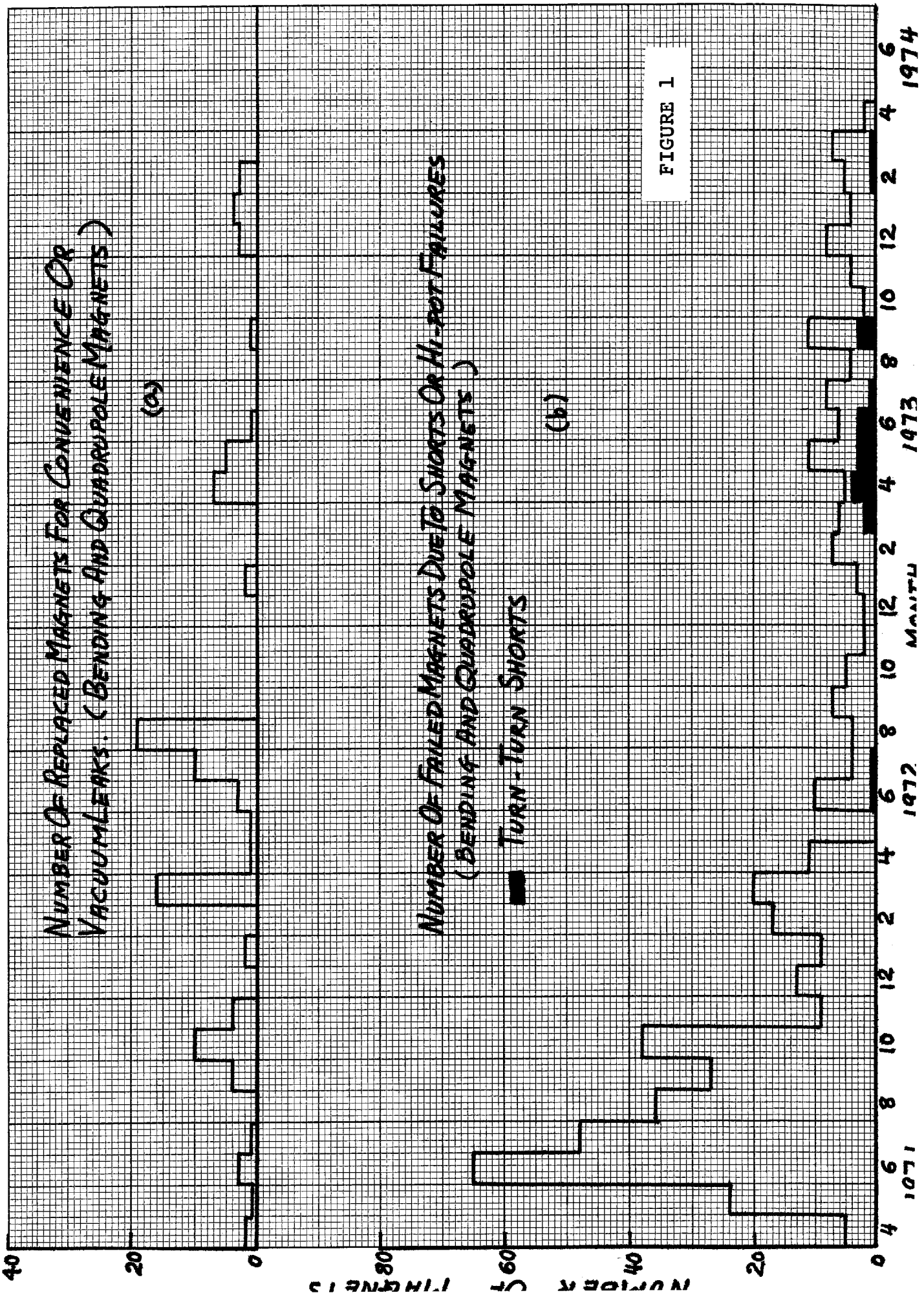
NUMBER OF REPLACED MAGNETS FOR CONVENIENCE OR VACUUM LEAKS. (BENDING AND QUADRUPOLE MAGNETS)
(a)
NUMBER OF FAILED MAGNETS DUE TO SHORTS OR HI-POT FAILURES (BENDING AND QUADRUPOLE MAGNETS)
(b)
TURN-TURN SHORTS
NUMBER OF MAGNETS
MONTH
1971
1972
1973
1974
40
20
0
80
60
40
20
0
4
6
8
10
12
2
4
6
8
10
12
2
4
6

FIGURE 1

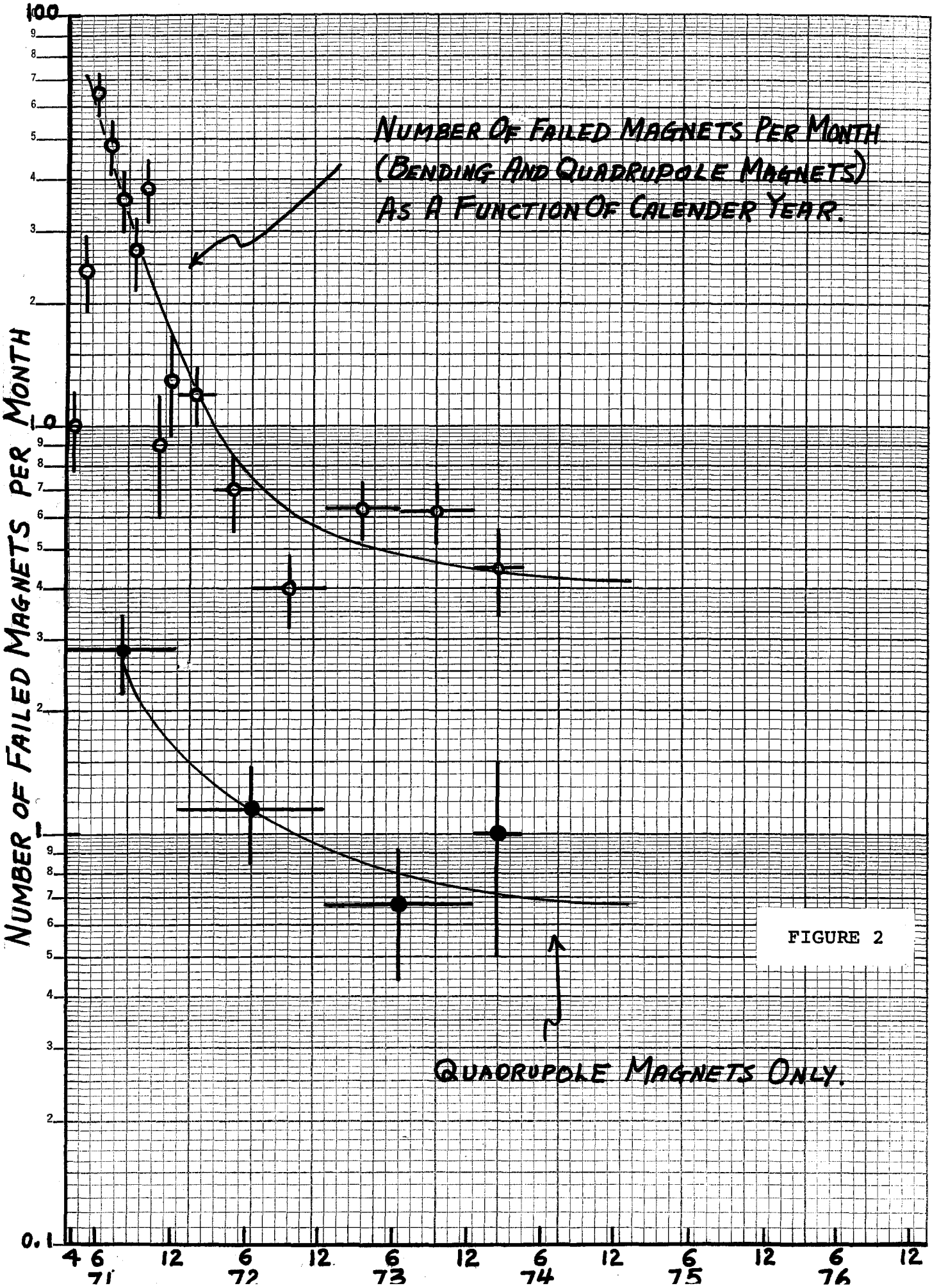
NUMBER OF FAILED MAGNETS PER MONTH
(BENDING AND QUADRUPOLE MAGNETS)
AS A FUNCTION OF CALENDER YEAR.
QUADRUPOLE MAGNETS ONLY.
NUMBER OF FAILED MAGNETS PER MONTH
100
10
1
0.1
4 6 12 6 12 6 12 6 12 6 12 6 12
71 72 73 74 75 76

FIGURE 2

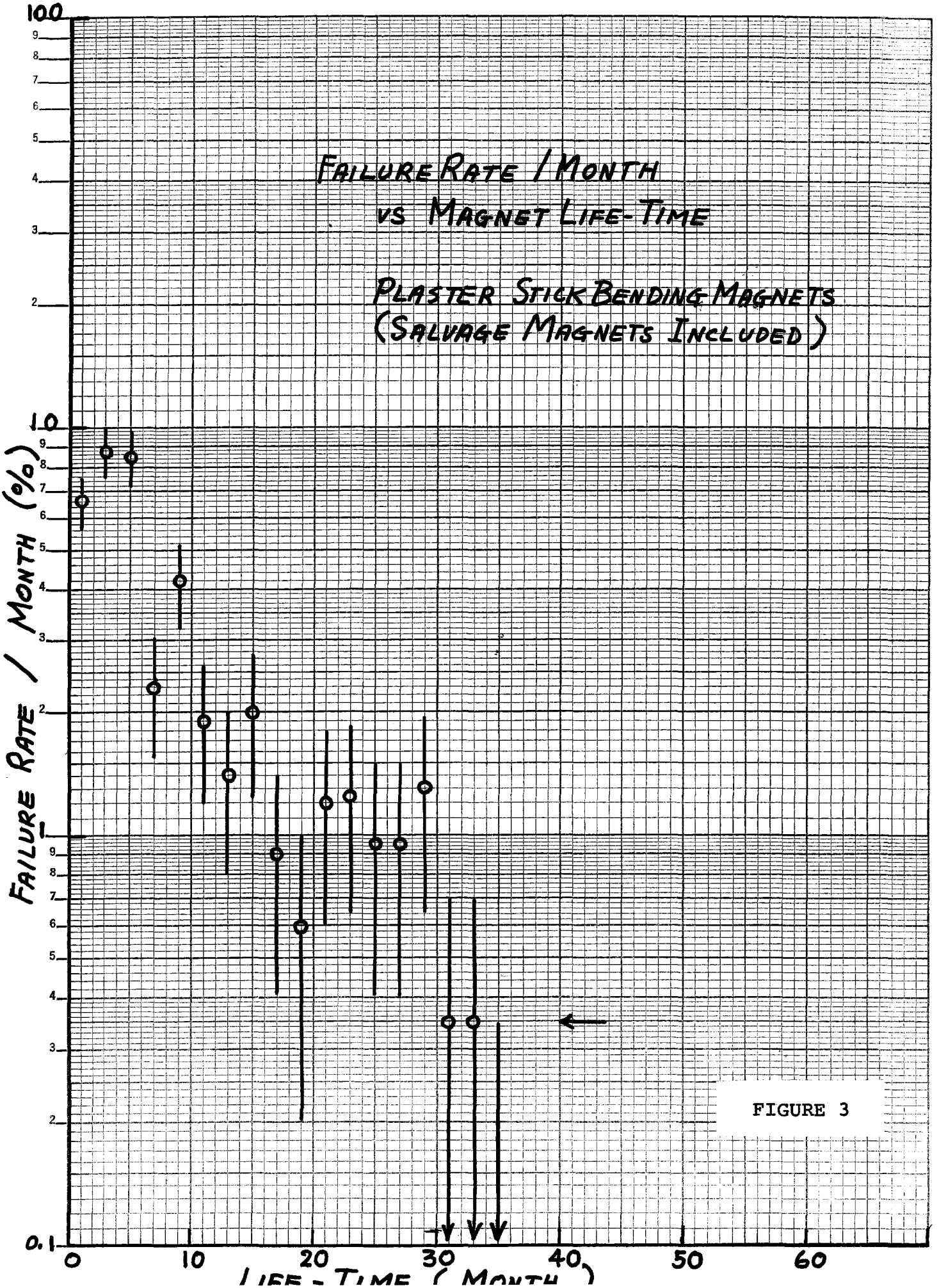
FAILURE RATE / MONTH
VS MAGNET LIFE-TIME
PLASTER STICK BENDING MAGNETS
(SALVAGE MAGNETS INCLUDED)
FAILURE RATE / MONTH (%)
LIFE-TIME (MONTH)
100
10
1
0.1
0
10
20
30
40
50
60

FIGURE 3

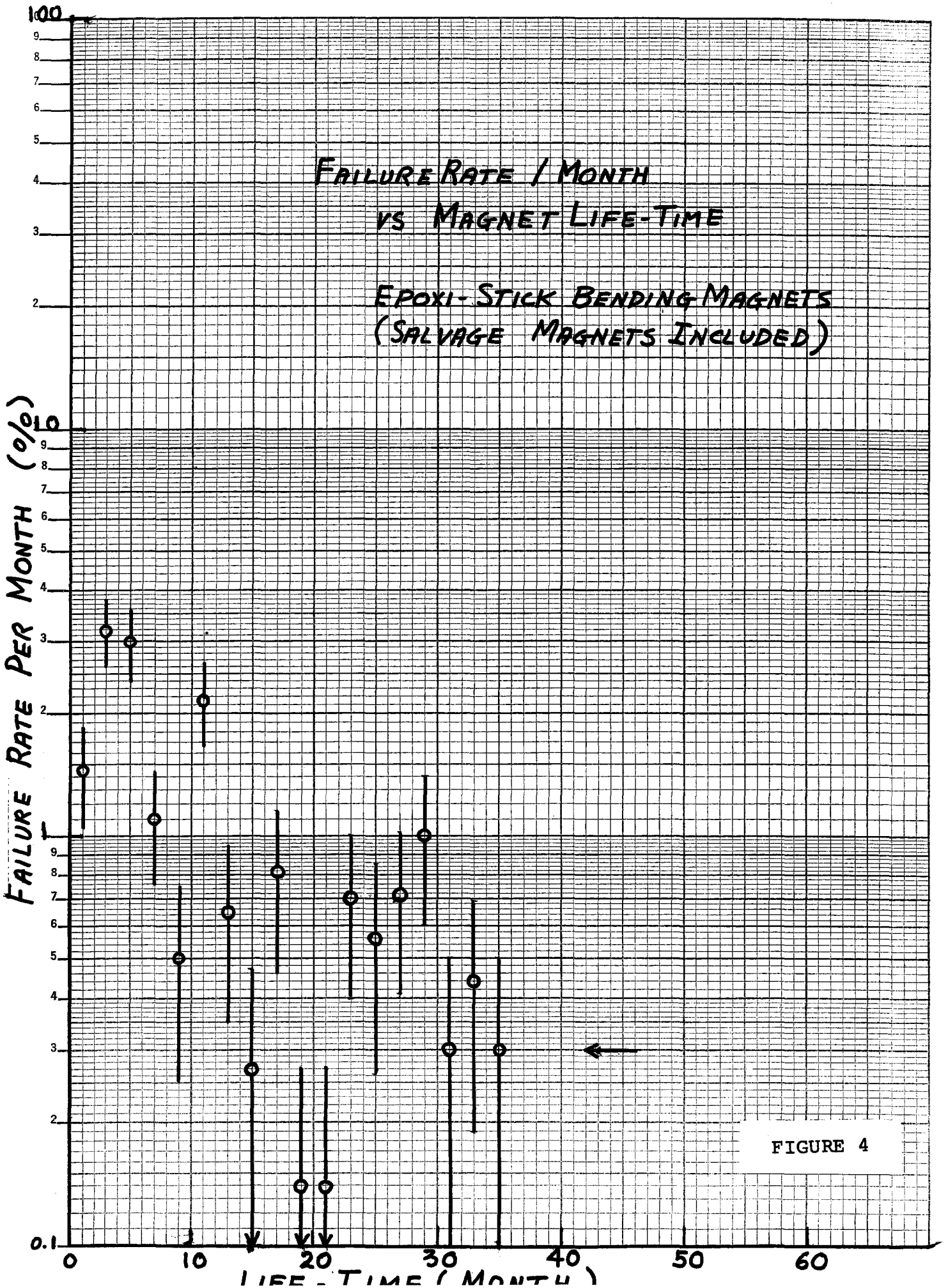
FAILURE RATE / MONTH
VS MAGNET LIFE-TIME
EPOXI-STICK BENDING MAGNETS
(SALVAGE MAGNETS INCLUDED)
FAILURE RATE PER MONTH (%)
100
10
1
0.1
0
10
20
30
40
50
60
LIFE-TIME (MONTH)

FIGURE 4

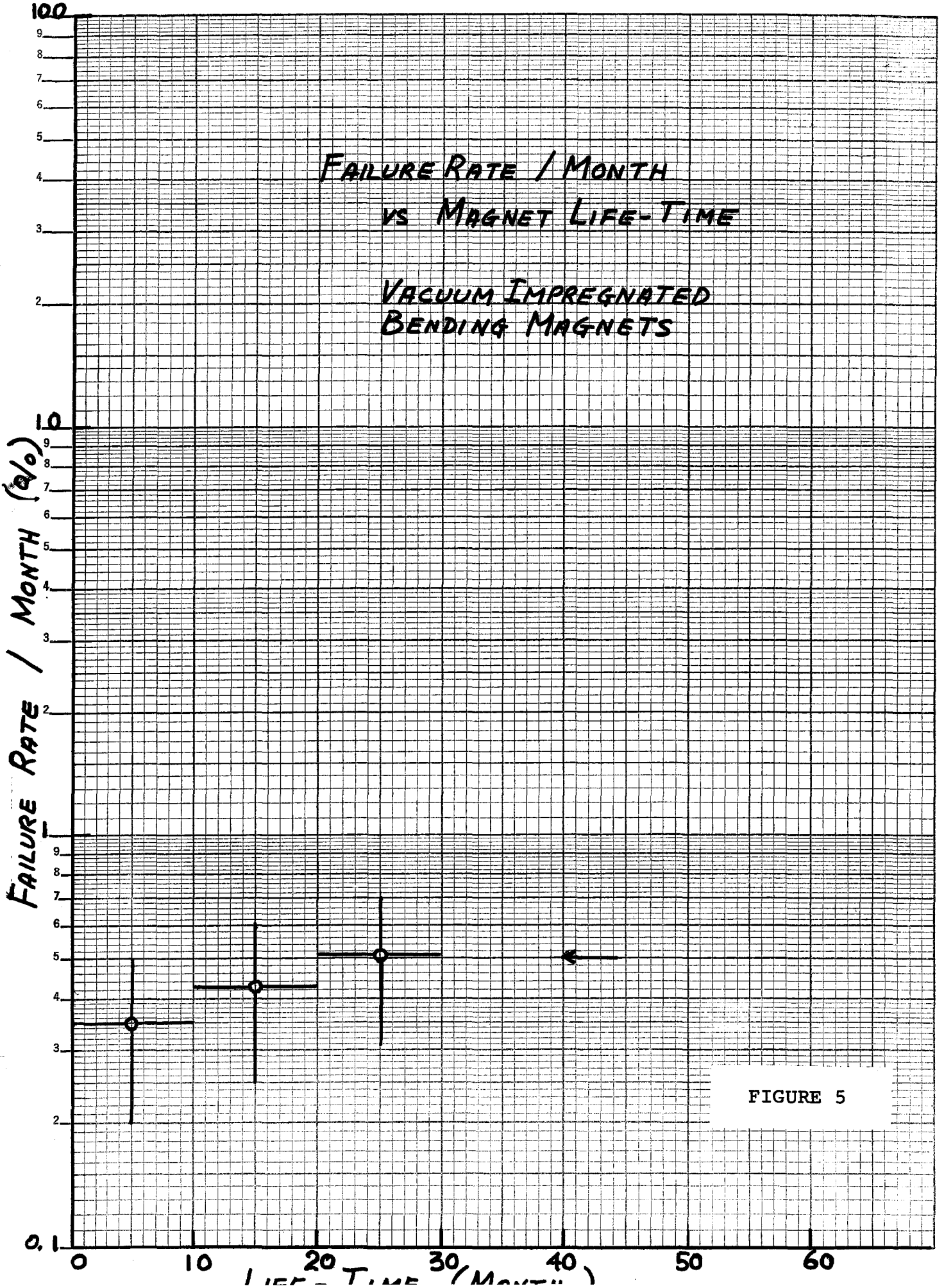
FAILURE RATE / MONTH
VS MAGNET LIFE-TIME
VACUUM IMPREGNATED
BENDING MAGNETS
FAILURE RATE / MONTH (%)
100
10
1
0.1
0
10
20
30
40
50
60

FIGURE 5

MAGNET REPLACEMENT FOR THE MAIN ACCELERATOR AT NAL

REFERENCE NUMBER	MAGNET REMOVED	REPLAC. MAGNET	LOCATION	DATE	COMMENTS
1	2501	2665	A-16-2	4-23-1971	SHORT OR HI-POT
2	2070	2712	B-11-3	4-23-1971	SHORT OR HI-POT
3	1521	1704	A-35-4	4-26-1971	SHORT OR HI-POT
4	1023	1190	A-28-3	4-27-1971	SHORT OR HI-POT
5	2175	2563	E-17-5	4-28-1971	VACUUM LEAK
6	1508	1705	A-27-4	4-29-1971	SHORT OR HI-POT
7	7038	7196	B-15-1	4-30-1971	VACUUM LEAK
8	1184	1192	F-25-5	5- 4-1971	SHORT OR HI-POT
9	2575	2715	F-29-2	5- 4-1971	SHORT OR HI-POT
10	1593	1707	F-42-2	5- 4-1971	SHORT OR HI-POT
11	2071	2077	F-17-5	5- 4-1971	SHORT OR HI-POT
12	1592	1710	F-35-4	5- 4-1971	SHORT OR HI-POT
13	1529	1709	F-48-4	5- 4-1971	SHORT OR HI-POT
14	1635	1521	D-13-2	5- 7-1971	SHORT OR HI-POT
15	7157	7197	F-36-1	5-10-1971	SHORT OR HI-POT
16	7122	7202	F-18-1	5-10-1971	SHORT OR HI-POT
17	7108	7198	E-15-1	5-10-1971	SHORT OR HI-POT
18	7036	7195	C-39-1	5-10-1971	SHORT OR HI-POT
19	7119	7203	D-44-1	5-14-1971	SHORT OR HI-POT
20	4028	4055	E-10-7	5-14-1971	SHORT OR HI-POT
	7163	7163	E-10-6		DOUBLET MATE
21	2123	2063	E-29-3	5-20-1971	SHORT OR HI-POT
22	1177	1193	E-44-3	5-20-1971	SHORT OR HI-POT
23	2213	1195	F-28-3	5-20-1971	SHORT OR HI-POT
24	1698	1708	F-37-5	5-21-1971	SHORT OR HI-POT
25	2139	2062	E-27-3	5-21-1971	SHORT OR HI-POT
26	2023	2214	A-23-3	5-24-1971	SHORT OR HI-POT
27	2072	2716	E-34-5	5-24-1971	SHORT OR HI-POT
28	1514	1706	A-12-4	5-26-1971	SHORT OR HI-POT
29	1057	1194	A-12-5	5-27-1971	SHORT OR HI-POT
30	1515	1714	A-18-4	5-27-1971	SHORT OR HI-POT
31	1511	1543	A-19-2	5-27-1971	SHORT OR HI-POT
32	1506	1514	A-13-2	6- 1-1971	SHORT OR HI-POT
33	2506	2714	A-19-4	6- 1-1971	SHORT OR HI-POT
34	1513	1718	A-23-4	6- 1-1971	SHORT OR HI-POT
35	1038	1196	A-24-3	6- 2-1971	SHORT OR HI-POT
36	1544	1201	F-29-5	6- 2-1971	CONVENIENCE
37	1708	1199	F-37-5	6- 2-1971	CONVENIENCE
38	1700	1198	F-43-5	6- 2-1971	CONVENIENCE
39	2042	2215	A-28-5	6- 2-1971	SHORT OR HI-POT
40	1518	1700	A-29-4	6- 2-1971	SHORT OR HI-POT
41	2545	2722	B-35-2	6- 3-1971	SHORT OR HI-POT
42	2134	2217	B-32-5	6- 3-1971	SHORT OR HI-POT
43	2578	2717	B-22-4	6- 3-1971	SHORT OR HI-POT
44	1703	1511	F-13-3	6- 4-1971	SHORT OR HI-POT
45	2033	2219	A-24-5	6- 4-1971	SHORT OR HI-POT
46	2038	2221	A-19-5	6- 4-1971	SHORT OR HI-POT
47	2504	2724	A-12-2	6- 4-1971	SHORT OR HI-POT
48	2516	2718	A-43-2	6- 5-1971	SHORT OR HI-POT
49	2531	2720	A-46-4	6- 5-1971	SHORT OR HI-POT
50	1522	1698	A-38-2	6- 5-1971	SHORT OR HI-POT

TABLE II(a)

MAGNET REPLACEMENT FOR THE MAIN ACCELERATOR AT NAL

REFERENCE NUMBER	MAGNET REMOVED	REPLAC. MAGNET	LOCATION	DATE	COMMENTS
51	2532	2726	A-39-2	6- 7-1971	SHORT OR HI-POT
52	1509	1544	A-24-2	6- 3-1971	SHORT OR HI-POT
53	1512	1708	A-26-2	6- 3-1971	SHORT OR HI-POT
54	2036	2223	A-35-3	6- 7-1971	SHORT OR HI-POT
55	1516	1713	A-37-4	6- 7-1971	SHORT OR HI-POT
56	2565	1057	F-32-3	6- 8-1971	SHORT OR HI-POT
57	2201	2076	F-21-3	6- 9-1971	SHORT OR HI-POT
58	2552	2719	B-26-4	6- 9-1971	SHORT OR HI-POT
59	1016	1200	A-37-5	6-10-1971	SHORT OR HI-POT
60	1046	1202	A-48-5	6-10-1971	SHORT OR HI-POT
61	1033	1204	A-44-3	6- 9-1971	SHORT OR HI-POT
62	1526	1518	A-48-4	6- 9-1971	SHORT OR HI-POT
63	1049	1205	A-45-5	6-10-1971	SHORT OR HI-POT
64	1007	1203	A-34-3	6-10-1971	SHORT OR HI-POT
65	1531	1513	A-44-2	6-10-1971	SHORT OR HI-POT
66	2529	2721	A-34-4	6-11-1971	SHORT OR HI-POT
67	2511	2545	A-21-2	6-11-1971	SHORT OR HI-POT
68	1524	1506	A-43-4	6-10-1971	SHORT OR HI-POT
69	1133	1206	C-32-3	6-14-1971	SHORT OR HI-POT
70	2135	2042	D-33-3	6-14-1971	SHORT OR HI-POT
71	7099	7199	A-32-1	6-15-1971	SHORT OR HI-POT
72	7190	7200	F-26-1	6-15-1971	SHORT OR HI-POT
73	1029	1016	A-43-5	6-15-1971	SHORT OR HI-POT
74	2503	2506	A-17-4	6-15-1971	SHORT OR HI-POT
75	1557	1531	C-14-4	6-16-1971	SHORT OR HI-POT
76	2055	2216	B-42-5	6-17-1971	SHORT OR HI-POT
77	1189	1208	F-22-3	6-17-1971	SHORT OR HI-POT
78	2081	2134	B-47-3	6-16-1971	SHORT OR HI-POT
79	1689	1524	F-24-2	6-17-1971	SHORT OR HI-POT
80	1534	1515	B-23-4	6-18-1971	SHORT OR HI-POT
81	1552	1207	C-22-2	6-18-1971	SHORT OR HI-POT
82	2077	2087	F-17-5	6-21-1971	SHORT OR HI-POT
83	2698	2531	F-28-4	6-21-1971	SHORT OR HI-POT
84	2692	2511	F-15-4	6-21-1971	SHORT OR HI-POT
85	1181	1046	F-26-3	6-21-1971	SHORT OR HI-POT
86	2027	2030	A-42-5	6-21-1971	SHORT OR HI-POT
87	1031	1029	B-26-3	6-22-1971	SHORT OR HI-POT
88	1025	1033	A-36-3	6-22-1971	SHORT OR HI-POT
89	1578	1694	F-14-4	6-22-1971	SHORT OR HI-POT
90	2024	2529	A-37-3	6-22-1971	SHORT OR HI-POT
91	1694	1007	F-35-5	6-23-1971	CONVENIENCE
92	2509	2532	F-36-3	6-23-1971	SHORT OR HI-POT
93	2064	2552	F-37-3	6-23-1971	SHORT OR HI-POT
94	1178	1189	F-14-5	6-25-1971	SHORT OR HI-POT
95	2196	2218	F-15-5	6-25-1971	SHORT OR HI-POT
96	2187	2692	F-14-3	6-26-1971	SHORT OR HI-POT
97	1545	1209	C-36-2	6-27-1971	SHORT OR HI-POT
98	1042	1181	E-33-5	6-27-1971	SHORT OR HI-POT
99	1181	1049	E-33-5	6-27-1971	SHORT OR HI-POT
100	1166	1509	F-45-5	6-27-1971	SHORT OR HI-POT

TABLE II(b)

MAGNET REPLACEMENT FOR THE MAIN ACCELERATOR AT NAL

REFERENCE NUMBER	MAGNET REMOVED	REPLAC. MAGNET	LOCATION	DATE	COMMENTS
101	7147	7208	F-15-1	7- 2-1971	SHORT OR HI-POT
102	2195	2729	F-12-3	7- 6-1971	SHORT OR HI-POT
103	2188	2727	F-19-5	7- 6-1971	SHORT OR HI-POT
104	2052	2509	F-43-3	7- 6-1971	SHORT OR HI-POT
105	2544	2725	B-47-2	7- 6-1971	SHORT OR HI-POT
106	2043	2730	B-38-5	7- 6-1971	SHORT OR HI-POT
107	1036	1516	B-37-5	7- 7-1971	SHORT OR HI-POT
108	2066	2027	B-28-5	7- 7-1971	SHORT OR HI-POT
109	1021	1031	B-15-3	7- 7-1971	SHORT OR HI-POT
110	2053	2024	B-14-3	7- 7-1971	SHORT OR HI-POT
111	1560	1578	F-47-4	7- 7-1971	SHORT OR HI-POT
112	1078	1025	F-47-5	7- 7-1971	SHORT OR HI-POT
113	2535	2731	B-39-2	7- 7-1971	SHORT OR HI-POT
114	2119	2222	C-12-3	7- 8-1971	SHORT OR HI-POT
115	2046	2224	C-27-3	7- 8-1971	SHORT OR HI-POT
116	2596	2713	C-33-2	7- 8-1971	SHORT OR HI-POT
117	1024	1032	A-39-5	7- 8-1971	SHORT OR HI-POT
118	1523	1575	A-39-4	7- 8-1971	SHORT OR HI-POT
119	2035	2228	A-27-3	7- 8-1971	SHORT OR HI-POT
120	1047	1211	A-48-3	7- 8-1971	SHORT OR HI-POT
121	2505	2548	A-13-4	7- 8-1971	SHORT OR HI-POT
122	1032	1024	A-23-5	7- 8-1971	SHORT OR HI-POT
123	1039	1180	B-47-5	7- 9-1971	SHORT OR HI-POT
124	1575	1533	B-15-2	7- 9-1971	SHORT OR HI-POT
125	1533	1580	B-16-4	7- 9-1971	SHORT OR HI-POT
126	1090	1078	B-25-5	7- 9-1971	SHORT OR HI-POT
127	1045	1210	B-35-5	7- 9-1971	SHORT OR HI-POT
128	1541	1541	B-38-2	7- 9-1971	SHORT OR HI-POT
129	1581	1535	B-42-2	7- 9-1971	SHORT OR HI-POT
130	1584	1715	B-47-4	7- 9-1971	SHORT OR HI-POT
131	1580	1584	B-39-4	7- 9-1971	SHORT OR HI-POT
132	2038	2123	B-33-3	7-12-1971	SHORT OR HI-POT
133	2069	2220	B-36-5	7-12-1971	SHORT OR HI-POT
134	2708	2732	F-38-4	7-12-1971	SHORT OR HI-POT
135	2684	2598	F-11-2	7-12-1971	SHORT OR HI-POT
136	2050	2227	F-11-3	7-12-1971	SHORT OR HI-POT
137	1054	1090	C-27-5	7-13-1971	SHORT OR HI-POT
138	2164	2188	F-36-5	7-19-1971	SHORT OR HI-POT
139	7152	7212	F-17-1	7-19-1971	SHORT OR HI-POT
140	2525	2596	A-27-2	7-20-1971	SHORT OR HI-POT
141	2090	2195	C-19-5	7-20-1971	SHORT OR HI-POT
142	2632	2733	D-38-4	7-20-1971	SHORT OR HI-POT
143	2150	2229	D-38-5	7-20-1971	SHORT OR HI-POT
144	2126	2089	D-13-5	7-21-1971	SHORT OR HI-POT
145	1619	1045	C-34-2	7-21-1971	SHORT OR HI-POT
146	2089	2069	D-13-5	7-27-1971	CONVENIENCE
147	1134	1213	D-14-5	7-30-1971	SHORT OR HI-POT
148	2101	2225	C-34-5	7-30-1971	SHORT OR HI-POT
149	2048	2226	D-19-5	7-30-1971	SHORT OR HI-POT
150	2028	2119	A-18-3	8- 2-1971	SHORT OR HI-POT

TABLE II(c)

MAGNET REPLACEMENT FOR THE MAIN ACCELERATOR AT NAL

REFERENCE NUMBER	MAGNET REMOVED	REPLAC. MAGNET	LOCATION	DATE	COMMENTS
151	1612	1716	D-16-4	8- 5-1971	SHORT OR HI-POT
152	1553	1717	C-39-4	8- 5-1971	SHORT OR HI-POT
153	1148	1217	D-16-5	8- 5-1971	SHORT OR HI-POT
154	2537	2505	C-15-4	8- 7-1971	SHORT OR HI-POT
155	2110	2232	C-29-3	8- 7-1971	SHORT OR HI-POT
156	1136	1214	C-34-3	8- 7-1971	SHORT OR HI-POT
157	1653	1721	D-48-4	8-12-1971	SHORT OR HI-POT
158	1521	1720	D-13-2	8-12-1971	SHORT OR HI-POT
159	2638	2540	C-32-4	8-12-1971	SHORT OR HI-POT
160	1658	1722	E-33-4	8-16-1971	SHORT OR HI-POT
161	2659	2735	E-14-2	8-16-1971	SHORT OR HI-POT
162	1621	1723	C-32-2	8-16-1971	SHORT OR HI-POT
163	7104	7201	C-37-1	8-16-1971	SHORT OR HI-POT
164	1594	1512	C-12-4	8-23-1971	SHORT OR HI-POT
165	2073	2053	C-13-5	8-23-1971	SHORT OR HI-POT
166	1590	1724	C-16-4	8-23-1971	SHORT OR HI-POT
167	2572	2737	C-18-2	8-23-1971	SHORT OR HI-POT
168	2556	2738	C-19-4	8-23-1971	SHORT OR HI-POT
169	1116	1136	C-33-5	8-23-1971	SHORT OR HI-POT
170	1610	1726	C-35-4	8-23-1971	SHORT OR HI-POT
171	1043	1220	C-37-5	8-23-1971	SHORT OR HI-POT
172	1620	1727	C-47-4	8-23-1971	SHORT OR HI-POT
173	1622	1612	D-14-4	8-23-1971	SHORT OR HI-POT
174	1618	1725	D-12-4	8-23-1971	SHORT OR HI-POT
175	1167	1047	E-24-3	8-24-1971	SHORT OR HI-POT
176	2674	2736	E-11-4	8-24-1971	SHORT OR HI-POT
177	2668	2734	E-36-4	8-24-1971	SHORT OR HI-POT
178	2044	2065	E-36-5	8-24-1971	SHORT OR HI-POT
179	2667	2535	E-37-2	8-24-1971	SHORT OR HI-POT
180	7050	7214	B-34-1	8-31-1971	SHORT OR HI-POT
181	7048	7210	B-14-1	8-31-1971	SHORT OR HI-POT
182	7168	7215	E-24-1	8-31-1971	SHORT OR HI-POT
183	4010	4008	B-12-1	8-31-1971	SHORT OR HI-POT
184	7143	7213	A-38-1	8-31-1971	SHORT OR HI-POT
185	1040	1148	C-14-5	8-31-1971	SHORT OR HI-POT
186	2060	2233	B-45-3	9- 1-1971	SHORT OR HI-POT
187	2074	2238	B-19-5	9- 5-1971	SHORT OR HI-POT
188	2699	2544	F-21-2	9- 7-1971	SHORT OR HI-POT
189	7051	7206	B-32-1	9-14-1971	VACUUM LEAK
190	2079	2239	B-43-3	9-14-1971	SHORT OR HI-POT
191	1131	1219	C-19-3	9-14-1971	SHORT OR HI-POT
192	2148	2237	D-42-5	9-14-1971	SHORT OR HI-POT
193	2219	2234	A-24-5	9-14-1971	SHORT OR HI-POT
194	1050	1222	E-43-5	9-15-1971	SHORT OR HI-POT
195	2016	2073	A-38-5	9-15-1971	SHORT OR HI-POT
196	1211	1215	A-48-3	9-15-1971	CONVENIENCE
197	1180	1218	B-47-5	9-17-1971	SHORT OR HI-POT
198	2085	2242	B-25-3	9-17-1971	SHORT OR HI-POT
199	1585	1719	C-13-2	9-20-1971	SHORT OR HI-POT
200	1600	1553	C-18-4	9-20-1971	SHORT OR HI-POT

TABLE II(d)

MAGNET REPLACEMENT FOR THE MAIN ACCELERATOR AT NAL

REFERENCE NUMBER	MAGNET REMOVED	REPLAC. MAGNET	LOCATION	DATE	COMMENTS
251	1542	1728	F-43-4	10-18-1971	SHORT OR HI-POT
252	2589	2747	D-12-2	10-20-1971	SHORT OR HI-POT
253	4041	4061	C-48-6	10-21-1971	VACUUM LEAK
	4045	4057	C-48-7		DOUBLET MATE
254	7138	7048	A-19-1	10-22-1971	VACUUM LEAK
255	7095	7207	A-44-1	10-25-1971	VACUUM LEAK
256	7037	7191	B-27-1	10-22-1971	VACUUM LEAK
257	1050	1232	A-36-3	10-25-1971	VACUUM LEAK
258	7159	7051	F-19-1	10-26-1971	SHORT OR HI-POT
259	7043	7230	B-47-1	10-27-1971	VACUUM LEAK
260	2623	2748	C-39-2	10-28-1971	SHORT OR HI-POT
261	2687	2750	E-45-2	10-29-1971	SHORT OR HI-POT
262	1510	1743	A-22-2	11- 1-1971	SHORT OR HI-POT
263	1082	1045	C-29-5	11- 2-1971	SHORT OR HI-POT
264	1045	1742	C-34-2	11- 2-1971	CONVENIENCE
265	1022	1223	A-25-5	11- 2-1971	CONVENIENCE
266	1118	1225	D-12-5	11- 5-1971	SHORT OR HI-POT
267	2083	2249	B-39-3	11-10-1971	SHORT OR HI-POT
268	1004	1226	F-44-3	11-12-1971	CONVENIENCE
269	1003	1233	F-46-3	11-12-1971	CONVENIENCE
270	1589	1745	B-46-2	11-16-1971	SHORT OR HI-POT
271	2112	2158	C-33-3	11-19-1971	SHORT OR HI-POT
272	7161	7227	E-37-1	11-24-1971	SHORT OR HI-POT
273	2704	2579	F-19-4	11-24-1971	SHORT OR HI-POT
274	7181	7229	E-42-1	11-24-1971	SHORT OR HI-POT
275	1688	1510	F-18-4	12- 1-1971	SHORT OR HI-POT
276	2080	2245	B-15-5	12-16-1971	SHORT OR HI-POT
277	7166	7216	E-45-1	12-16-1971	SHORT OR HI-POT
278	2087	2241	F-17-5	12-19-1971	SHORT OR HI-POT
279	7131	7231	F-45-1	12-19-1971	SHORT OR HI-POT
280	2031	2252	A-43-3	12-20-1971	SHORT OR HI-POT
281	2025	2240	A-22-5	12-28-1971	SHORT OR HI-POT
282	1570	1734	B-29-4	12-28-1971	SHORT OR HI-POT
283	2041	2246	C-24-5	12-28-1971	SHORT OR HI-POT
284	1582	1740	C-45-4	12-29-1971	SHORT OR HI-POT
285	7115	7233	D-25-1	12-29-1971	SHORT OR HI-POT
286	1053	1235	E-47-5	12-29-1971	SHORT OR HI-POT
287	2559	2753	B-23-2	12-30-1971	SHORT OR HI-POT
288	1186	1234	F-27-5	1- 3-1972	SHORT OR HI-POT
289	1501	1746	A-16-4	1- 3-1972	SHORT OR HI-POT
290	7047	7225	A-26-1	1- 3-1972	VACUUM LEAK
291	2051	2253	B-29-3	1- 3-1972	SHORT OR HI-POT
292	1051	1236	B-45-5	1- 4-1972	SHORT OR HI-POT
293	1588	1735	C-33-4	1- 4-1972	SHORT OR HI-POT
294	2593	2749	D-17-4	1- 4-1972	SHORT OR HI-POT
295	1029	1238	B-26-3	1- 6-1972	SHORT OR HI-POT
296	7094	7232	C-21-1	1- 9-1972	VACUUM LEAK
297	1037	1239	A-47-5	1- 9-1972	SHORT OR HI-POT
298	2088	2257	B-11-5	1-12-1972	SHORT OR HI-POT
299	2028	1748	B-24-2	2- 1-1972	SHORT OR HI-POT
300	2546	1244	F-34-3	2- 4-1972	SHORT OR HI-POT

TABLE II(f)

MAGNET REPLACEMENT FOR THE MAIN ACCELERATOR AT NAL

REFERENCE NUMBER	MAGNET REMOVED	REPLAC. MAGNET	LOCATION	DATE	COMMENTS
201	2152	2244	D-44-5	9-21-1971	SHORT OR HI-POT
202	2551	2659	C-17-4	9-21-1971	SHORT OR HI-POT
203	1052	1221	B-21-5	9-22-1971	SHORT OR HI-POT
204	2029	2064	B-22-5	9-22-1971	SHORT OR HI-POT
205	1567	2028	B-24-2	9-22-1971	SHORT OR HI-POT
206	2604	2740	C-44-4	9-22-1971	SHORT OR HI-POT
207	2039	2050	A-47-3	9-22-1971	SHORT OR HI-POT
208	1544	1043	A-24-2	9-24-1971	SHORT OR HI-POT
209	4022	4059	A-49-0	9-27-1971	VACUUM LEAK
	7117	7117	A-49-1		DOUBLET MATE
210	2513	2668	A-11-4	9-30-1971	SHORT OR HI-POT
211	1517	1736	A-21-4	9-30-1971	SHORT OR HI-POT
212	1026	1116	A-21-5	9-30-1971	SHORT OR HI-POT
213	1028	1228	A-22-3	9-30-1971	SHORT OR HI-POT
214	2519	2743	A-28-4	9-30-1971	SHORT OR HI-POT
215	1520	1738	A-32-2	9-30-1971	SHORT OR HI-POT
216	2011	2247	A-34-5	10- 1-1971	SHORT OR HI-POT
217	1519	1731	A-42-2	10- 1-1971	SHORT OR HI-POT
218	1030	1040	A-38-3	10- 6-1971	SHORT OR HI-POT
219	2568	2742	B-13-4	10- 6-1971	SHORT OR HI-POT
220	2579	2741	B-16-2	10- 6-1971	SHORT OR HI-POT
221	2068	2248	B-17-5	10- 6-1971	SHORT OR HI-POT
222	1556	1737	B-25-4	10- 7-1971	SHORT OR HI-POT
223	2040	2231	B-16-3	10- 7-1971	SHORT OR HI-POT
224	2605	2744	B-18-2	10- 7-1971	SHORT OR HI-POT
225	1573	1732	B-26-2	10- 7-1971	SHORT OR HI-POT
226	1067	1229	B-38-3	10- 9-1971	SHORT OR HI-POT
227	1058	1227	B-39-5	10- 9-1971	SHORT OR HI-POT
228	2131	2230	C-17-5	10- 9-1971	SHORT OR HI-POT
229	2158	2236	C-22-5	10- 9-1971	SHORT OR HI-POT
230	1064	1052	B-43-5	10-11-1971	SHORT OR HI-POT
231	2047	2243	B-35-3	10-11-1971	SHORT OR HI-POT
232	1548	1567	B-35-4	10-11-1971	SHORT OR HI-POT
233	1583	1730	C-19-2	10-11-1971	SHORT OR HI-POT
234	4009	4066	D-12-1	10-12-1971	SHORT OR HI-POT
235	7123	7050	D-13-1	10-12-1971	SHORT OR HI-POT
236	2136	2235	D-14-3	10-12-1971	SHORT OR HI-POT
237	2124	2250	D-26-5	10-12-1971	SHORT OR HI-POT
238	2149	2016	D-39-3	10-12-1971	SHORT OR HI-POT
239	2539	2745	B-46-4	10-13-1971	SHORT OR HI-POT
240	1047	1230	E-24-3	10-13-1971	SHORT OR HI-POT
241	7078	7204	B-10-6	10-14-1971	CONVENIENCE
	4024	4056	B-10-7		DOUBLET MATE
242	1041	1224	A-46-3	10-15-1971	SHORT OR HI-POT
243	2658	2716	E-34-4	10-15-1971	SHORT OR HI-POT
244	2716	2251	E-34-5	10-15-1971	CONVENIENCE
245	2665	2739	E-47-2	10-15-1971	SHORT OR HI-POT
246	1566	1739	B-33-4	10- 8-1971	SHORT OR HI-POT
247	1563	1733	B-34-2	10- 8-1971	SHORT OR HI-POT
248	2566	2674	B-34-4	10- 8-1971	SHORT OR HI-POT
249	2555	2746	F-47-2	10-16-1971	SHORT OR HI-POT
250	1033	1050	A-36-3	10-16-1971	SHORT OR HI-POT

TABLE II(e)

MAGNET REPLACEMENT FOR THE MAIN ACCELERATOR AT NAL

REFERENCE NUMBER	MAGNET REMOVED	REPLAC. MAGNET	LOCATION	DATE	COMMENTS
301	2127	2261	D-12-3	2- 6-1972	SHORT OR HI-POT
302	7025	7228	E-35-1	2- 6-1972	SHORT OR HI-POT
303	7121	7223	F-44-1	2-11-1972	SHORT OR HI-POT
304	2580	2764	B-19-4	2-18-1972	SHORT OR HI-POT
305	2662	2755	E-13-4	2-19-1972	SHORT OR HI-POT
306	1136	1246	C-33-5	2-20-1972	SHORT OR HI-POT
307	2642	2762	D-32-4	2-22-1972	SHORT OR HI-POT
308	1096	1243	B-18-5	2-23-1972	SHORT OR HI-POT
309	1538	1751	A-36-2	2-23-1972	SHORT OR HI-POT
310	2680	2752	F-22-4	2-24-1972	SHORT OR HI-POT
311	2654	2767	E-26-4	2-25-1972	SHORT OR HI-POT
312	2605	2756	E-35-2	2-26-1972	SHORT OR HI-POT
313	2104	2258	C-32-5	2-28-1972	SHORT OR HI-POT
314	2540	2265	D-34-4	2-29-1972	SHORT OR HI-POT
315	2114	2264	C-36-5	2-29-1972	SHORT OR HI-POT
316	1176	1237	E-25-5	3- 1-1972	SHORT OR HI-POT
317	2177	2267	E-23-3	3- 1-1972	SHORT OR HI-POT
318	2193	2263	E-16-3	3- 2-1972	SHORT OR HI-POT
319	2121	2266	C-47-3	3- 2-1972	SHORT OR HI-POT
320	1640	1747	E-14-4	3- 2-1972	SHORT OR HI-POT
321	1209	1759	C-36-2	3-13-1972	CONVENIENCE
322	1550	1762	C-37-4	3-13-1972	SHORT OR HI-POT
323	1207	1752	C-22-2	3-14-1972	CONVENIENCE
324	4031	4052	B-48-1	3-14-1972	SHORT OR HI-POT
325	1516	1207	B-37-5	3-15-1972	CONVENIENCE
326	2730	2269	B-38-5	3-15-1972	CONVENIENCE
327	7003	7235	D-39-1	3-15-1972	SHORT OR HI-POT
328	7178	7236	E-22-1	3-15-1972	SHORT OR HI-POT
329	2693	2765	F-12-2	3-15-1972	SHORT OR HI-POT
330	7164	7047	F-42-1	3-15-1972	SHORT OR HI-POT
331	2729	2271	F-12-3	3-15-1972	CONVENIENCE
332	2022	2260	A-11-3	3-16-1972	SHORT OR HI-POT
333	2030	2272	A-42-5	3-16-1972	SHORT OR HI-POT
334	7204	7239	B-10-6	3-16-1972	SHORT OR HI-POT
	4056	4058	B-10-7		DOUBLET MATE
335	2532	1247	F-36-3	3-16-1972	CONVENIENCE
336	2510	1252	F-38-3	3-16-1972	CONVENIENCE
337	2212	2763	F-46-4	3-17-1972	CONVENIENCE
338	7034	7094	F-34-1	3-17-1972	CONVENIENCE
339	7016	7034	A-47-1	3-17-1972	CONVENIENCE
340	2670	2772	E-38-4	3-20-1972	SHORT OR HI-POT
341	2563	2265	E-17-5	3-20-1972	CONVENIENCE
342	2265	2563	D-34-4	3-20-1972	CONVENIENCE
343	2691	2692	F-14-3	3-20-1972	SHORT OR HI-POT
344	2692	2262	F-14-3	3-20-1972	CONVENIENCE
345	1546	1754	F-39-5	3-20-1972	SHORT OR HI-POT
346	1714	1756	A-18-4	3-20-1972	SHORT OR HI-POT
347	1754	1257	F-39-5	3-21-1972	CONVENIENCE
348	1561	1755	B-32-2	3-28-1972	SHORT OR HI-POT
349	4020	4060	A-48-6	3-29-1972	SHORT OR HI-POT
	4019	4062	A-48-7		DOUBLET MATE
350	4023	4056	A-11-0	4- 1-1972	SHORT OR HI-POT
	4021	4053	A-11-1		DOUBLET MATE

TABLE II(g)

MAGNET REPLACEMENT FOR THE MAIN ACCELERATOR AT NAL

REFERENCE NUMBER	MAGNET REMOVED	REPLAC. MAGNET	LOCATION	DATE	COMMENTS
351	2506	2761	A-17-4	4- 5-1972	SHORT OR HI-POT
352	1706	1761	A-12-4	4- 5-1972	SHORT OR HI-POT
353	1201	1251	F-29-5	4- 8-1972	SHORT OR HI-POT
354	2743	2510	A-28-4	4-18-1972	SHORT OR HI-POT
355	2673	2532	E-16-2	4-18-1972	SHORT OR HI-POT
356	1083	1248	F-15-3	4-18-1972	SHORT OR HI-POT
357	1196	1249	A-24-3	4-25-1972	SHORT OR HI-POT
358	1513	1753	A-44-2	4-27-1972	SHORT OR HI-POT
359	1728	1754	F-43-4	4-27-1972	SHORT OR HI-POT
360	2611	2771	D-37-2	4-27-1972	SHORT OR HI-POT
361	1702	1258	F-45-4	5-31-1972	CONVENIENCE
362	2122	2273	D-17-5	6- 3-1972	SHORT OR HI-POT
363	2558	2730	B-24-4	6- 4-1972	SHORT OR HI-POT
364	1537	1758	A-46-2	6- 6-1972	SHORT OR HI-POT
365	1735	1770	C-33-4	6- 6-1972	SHORT OR HI-POT
366	2686	2769	E-44-4	6- 6-1972	SHORT OR HI-POT
367	2086	2270	B-44-5	6-20-1972	SHORT OR HI-POT
368	1535	1765	B-42-2	6-23-1972	SHORT OR HI-POT
369	2045	2278	A-11-5	6-24-1972	SHORT OR HI-POT
370	2270	2275	A-11-3	6-24-1972	CONVENIENCE
371	2012	2282	A-13-5	6-27-1972	CONVENIENCE
372	4011	4019	A-10-7	6-27-1972	TURN-TURN SHORT
	7060	7060	A-10-6		DOUBLET MATE
373	1060	1242	C-39-5	6-30-1972	SHORT OR HI-POT
374	1511	1043	F-13-3	7- 6-1972	CONVENIENCE
375	1043	1511	A-24-2	7- 6-1972	CONVENIENCE
376	1694	1763	F-14-4	7- 6-1972	TURN-TURN SHORT
377	2727	2260	F-19-5	7-11-1972	CONVENIENCE
378	2552	2287	F-37-3	7-11-1972	CONVENIENCE
379	2509	2293	F-43-3	7-11-1972	CONVENIENCE
380	2712	2285	B-11-3	7-11-1972	CONVENIENCE
381	2529	2281	A-37-3	7-13-1972	CONVENIENCE
382	1509	1254	F-45-5	7-13-1972	CONVENIENCE
383	1258	1768	F-45-4	7-13-1972	CONVENIENCE
384	2091	2277	B-23-3	7-16-1972	SHORT OR HI-POT
385	2533	2529	A-45-2	7-19-1972	CONVENIENCE
386	1540	1769	F-21-4	7-24-1972	SHORT OR HI-POT
387	2661	2727	E-29-2	7-26-1972	SHORT OR HI-POT
388	2619	2775	D-16-2	8- 1-1972	SHORT OR HI-POT
389	2567	2766	B-14-2	8- 7-1972	CONVENIENCE
390	2538	2768	B-25-2	8- 7-1972	CONVENIENCE
391	2543	2776	B-28-4	8- 8-1972	CONVENIENCE
392	2569	2779	B-29-2	8- 8-1972	CONVENIENCE
393	2550	2774	B-38-4	8- 8-1972	CONVENIENCE
394	2536	2712	A-47-2	8- 9-1972	CONVENIENCE
395	2520	2552	A-37-2	8- 9-1972	CONVENIENCE
396	2518	2729	A-35-2	8- 9-1972	CONVENIENCE
397	2018	2268	A-32-5	8- 9-1972	CONVENIENCE
398	2530	2770	A-32-4	8- 9-1972	CONVENIENCE
399	2010	2284	A-29-3	8- 9-1972	CONVENIENCE
400	2032	2280	A-25-3	8-10-1972	CONVENIENCE

TABLE II(h)

MAGNET REPLACEMENT FOR THE MAIN ACCELERATOR AT NAL

REFERENCE NUMBER	MAGNET REMOVED	REPLAC. MAGNET	LOCATION	DATE	COMMENTS
401	2515	2782	A-25-2	8-10-1972	CONVENIENCE
402	2522	2780	A-24-4	8-10-1972	CONVENIENCE
403	2006	2290	A-14-3	8-10-1972	CONVENIENCE
404	2514	2783	A-11-2	8-10-1972	CONVENIENCE
405	1188	1258	F-33-5	8-10-1972	CONVENIENCE
406	4060	4071	A-48-6	8-15-1972	CONVENIENCE
	4062	4069	A-48-7		DOUBLET MATE
407	7137	7240	D-37-1	8-17-[illegible]2	SHORT OR HI-POT
408	7047	7243	F-42-1	8-26-1972	SHORT OR HI-POT
409	1599	1766	B-13-2	8-25-1972	SHORT OR HI-POT
410	1079	1253	F-24-3	9- 4-1972	SHORT OR HI-POT
411	2165	2288	E-47-3	9-13-1972	SHORT OR HI-POT
412	1628	1764	D-25-4	9-14-1972	SHORT OR HI-POT
413	2622	2778	D-22-4	9-14-1972	SHORT OR HI-POT
414	1132	1256	C-45-5	9-14-1972	SHORT OR HI-POT
415	2564	2781	C-24-4	9-22-1972	SHORT OR HI-POT
416	2206	2289	F-44-5	9-29-1972	SHORT OR HI-POT
417	2561	2777	F-27-2	10- 3-1972	SHORT OR HI-POT
418	2560	2773	B-36-4	10-18-1972	SHORT OR HI-POT
419	2024	2292	B-14-3	10-18-1972	SHORT OR HI-POT
420	1616	1509	B-18-4	10-25-1972	SHORT OR HI-POT
421	7061	7238	B-24-1	10-25-1972	SHORT OR HI-POT
422	1553	1767	C-18-4	11- 9-1972	SHORT OR HI-POT
423	2050	2254	A-47-3	11-30-1972	SHORT OR HI-POT
424	1193	1261	E-44-3	12- 9-1972	SHORT OR HI-POT
425	7193	7251	F-37-1	12-16-1972	SHORT OR HI-POT
426	7148	7252	F-46-1	1- 5-1973	SHORT OR HI-POT
427	1258	1264	F-33-5	1- 8-1973	CONVENIENCE
428	2542	2791	B-32-4	1-22-1973	SHORT OR HI-POT
429	7163	7241	E-10-6	1-25-1973	SHORT OR HI-POT
	4055	4075	E-10-7		DOUBLET MATE
430	1087	1241	E-34-3	2- 2-1973	SHORT OR HI-POT
431	2075	2285	C-44-5	2- 8-1973	SHORT OR HI-POT
432	7102	7247	C-45-1	2- 8-1973	SHORT OR HI-POT
433	1025	1245	F-47-5	2-14-1973	SHORT OR HI-POT
434	2267	2298	E-23-3	2-14-1973	SHORT OR HI-POT
435	7004	7250	A-39-1	2-27-1973	SHORT OR HI-POT
436	2078	2259	F-38-5	2-27-1973	SHORT OR HI-POT
437	2732	2793	F-38-4	3- 3-1973	SHORT OR HI-POT
438	1192	1265	F-25-5	3- 9-1973	SHORT OR HI-POT
439	2756	2788	E-35-2	3-12-1973	SHORT OR HI-POT
440	2553	2789	B-45-2	3-16-1973	TURN-TURN SHORT
441	2629	2279	D-21-2	3-18-1973	SHORT OR HI-POT
442	1528	1776	A-47-4	3-22-1973	TURN-TURN SHORT
443	1554	1773	E-23-4	4- 9-1973	SHORT OR HI-POT
444	2100	2295	E-38-5	4- 9-1973	TURN-TURN SHORT
445	7197	7263	F-36-1	4- 9-1973	CONVENIENCE
446	7077	7262	A-15-1	4-10-1973	VACUUM LEAK
447	1090	1240	C-27-5	4-10-1973	TURN-TURN SHORT
448	2587	2794	C-29-2	4-10-1973	TURN-TURN SHORT
449	1626	1775	D-21-4	4-10-1973	TURN-TURN SHORT
450	7113	7242	D-19-1	4-10-1973	CONVENIENCE

TABLE II(i)

MAGNET REPLACEMENT FOR THE MAIN ACCELERATOR AT NAL

REFERENCE NUMBER	MAGNET REMOVED	REPLAC. MAGNET	LOCATION	DATE	COMMENTS
451	1002	1269	F-48-3	4-30-1973	CONVENIENCE
452	2009	2301	A-45-3	4-30-1973	CONVENIENCE
453	2008	2300	A-17-5	4-30-1973	CONVENIENCE
454	2007	2296	A-16-3	4-30-1973	CONVENIENCE
455	1612	1749	D-14-4	5- 2-1973	SHORT OR HI-POT
456	1730	1781	C-19-2	5- 3-1973	SHORT OR HI-POT
457	2577	2798	C-21-2	5- 9-1973	VACUUM LEAK
458	2115	2279	C-43-3	5- 9-1973	VACUUM LEAK
459	2279	2797	D-21-2	5- 9-1973	CONVENIENCE
460	2762	2799	D-32-4	5- 9-1973	SHORT OR HI-POT
461	7050	7264	D-13-1	5- 9-1973	VACUUM LEAK
462	7039	7267	D-23-1	5-10-1973	VACUUM LEAK
463	1100	1250	B-13-3	5-10-1973	TURN-TURN SHORT
464	1094	1263	B-12-5	5-10-1973	TURN-TURN SHORT
465	1010	1272	A-14-5	5-10-1973	TURN-TURN SHORT
466	2254	2299	A-47-3	5-12-1973	SHORT OR HI-POT
467	2557	2786	B-43-2	5-20-1973	SHORT OR HI-POT
468	2199	2302	E-45-3	5-28-1973	SHORT OR HI-POT
469	2095	2274	C-28-5	5-28-1973	SHORT OR HI-POT
470	2123	2795	B-33-3	5-28-1973	SHORT OR HI-POT
471	2526	2801	A-38-4	6-11-1973	SHORT OR HI-POT
472	1092	1276	B-14-5	6-26-1973	TURN-TURN SHORT
473	2570	2802	B-11-4	6-26-1973	TURN-TURN SHORT
474	7118	7244	A-37-1	6-27-1973	SHORT OR HI-POT
475	1269	1277	F-48-3	6-27-1973	CONVENIENCE
476	2218	2305	F-15-5	6-27-1973	TURN-TURN SHORT
477	2292	2304	B-14-3	6-29-1973	SHORT OR HI-POT
478	2185	2303	F-16-3	7- 4-1973	SHORT OR HI-POT
479	2132	2306	B-24-5	7-11-1973	SHORT OR HI-POT
480	2021	2758	A-39-3	7-12-1973	SHORT OR HI-POT
481	1652	1783	E-18-4	7-12-1973	SHORT OR HI-POT
482	2657	2803	D-47-2	7-15-1973	SHORT OR HI-POT
483	1244	1269	F-34-3	7-15-1973	TURN-TURN SHORT
484	2019	2308	A-36-5	7-27-1973	SHORT OR HI-POT
485	1251	1274	F-29-5	7-31-1973	SHORT OR HI-POT
486	1264	1275	F-33-5	8-11-1973	SHORT OR HI-POT
487	2284	2309	A-29-3	8-18-1973	SHORT OR HI-POT
488	1634	1782	C-44-2	8-28-1973	SHORT OR HI-POT
489	1762	1786	C-37-4	8-31-1973	SHORT OR HI-POT
490	1707	1777	F-42-2	9-12-1973	TURN-TURN SHORT
491	1227	1278	B-39-5	9-12-1973	TURN-TURN SHORT
492	2758	2311	A-39-3	9-12-1973	CONVENIENCE
493	2552	2758	A-37-2	9-12-1973	TURN-TURN SHORT
494	1756	1785	A-18-4	9-14-1973	SHORT OR HI-POT
495	2707	2805	F-39-2	9-14-1973	SHORT OR HI-POT
496	2167	2312	E-37-3	9-14-1973	SHORT OR HI-POT
497	2779	2800	B-29-2	9-21-1973	SHORT OR HI-POT
498	1572	1784	B-43-4	9-26-1973	SHORT OR HI-POT
499	1699	1787	F-38-2	9-29-1973	SHORT OR HI-POT
500	1200	1255	A-37-5	9-30-1973	SHORT OR HI-POT

TABLE II(j)

MAGNET REPLACEMENT FOR THE MAIN ACCELERATOR AT NAL

REFERENCE NUMBER	MAGNET REMOVED	REPLAC. MAGNET	LOCATION	DATE	COMMENTS
501	2014	2313	A-33-3	9-30-1973	SHORT OR HI-POT
502	2677	2804	E-21-2	10-14-1973	SHORT OR HI-POT
503	2681	2796	E-27-2	10-14-1973	SHORT OR HI-POT
504	2273	2315	D-17-5	11- 6-1973	SHORT OR HI-POT
505	2026	2316	A-46-5	11-13-1973	SHORT OR HI-POT
506	2214	2310	A-23-3	11-13-1973	SHORT OR HI-POT
507	7128	7269	D-18-1	11-20-1973	SHORT OR HI-POT
508	2701	2807	F-23-2	12- 2-1973	SHORT OR HI-POT
509	1226	1279	F-44-3	12- 8-1973	SHORT OR HI-POT
510	4029	4068	C-48-1	12-10-1973	CONVENIENCE
511	1175	1267	E-36-3	12-10-1973	CONVENIENCE
512	1617	1788	C-46-2	12-11-1973	CONVENIENCE
513	1697	1774	F-44-2	12-12-1973	SHORT OR HI-POT
514	1578	1790	F-47-4	12-14-1973	SHORT OR HI-POT
515	2709	2811	F-43-2	12-14-1973	SHORT OR HI-POT
516	7140	7274	D-45-1	12-18-1973	SHORT OR HI-POT
517	2302	2319	E-45-3	12-29-1973	SHORT OR HI-POT
518	7144	7260	A-42-1	12-31-1973	SHORT OR HI-POT
519	1031	1283	B-15-3	1- 2-1974	SHORT OR HI-POT
520	7260	7273	A-42-1	1- 3-1974	SHORT OR HI-POT
521	7075	7199	A-34-1	1- 7-1974	CONVENIENCE
522	7199	7075	A-32-1	1- 7-1974	CONVENIENCE
523	7194	7200	F-24-1	1- 7-1974	CONVENIENCE
524	7200	7194	F-26-1	1- 7-1974	CONVENIENCE
525	2649	2808	D-43-2	1-23-1974	SHORT OR HI-POT
526	1767	1792	C-18-4	1-29-1974	SHORT OR HI-POT
527	1659	1789	E-19-2	2-14-1974	SHORT OR HI-POT
528	4037	4079	C-11-0	2-17-1974	TURN-TURN SHORT
	4042	4073	C-11-1		DOUBLET MATE
529	1272	1281	A-14-5	2-18-1974	SHORT OR HI-POT
530	7151	7271	E-49-1	2-22-1974	SHORT OR HI-POT
	4047	4076	E-49-0		DOUBLET MATE
531	1122	1285	B-16-5	2-22-1974	SHORT OR HI-POT
532	7142	7278	A-24-1	2-28-1974	VACUUM LEAK
533	1781	1793	C-19-2	3- 9-1974	SHORT OR HI-POT
534	1667	1794	E-32-2	3-11-1974	SHORT OR HI-POT
535	2801	2809	A-38-4	3-15-1974	SHORT OR HI-POT
536	2252	2314	A-43-3	3-16-1974	SHORT OR HI-POT
537	1743	1795	A-22-2	3-23-1974	TURN-TURN SHORT
538	2312	2318	E-37-3	3-27-1974	SHORT OR HI-POT
539	7010	7276	A-29-1	3-28-1974	SHORT OR HI-POT
540	2305	2322	F-15-5	4-11-1974	SHORT OR HI-POT
541	1575	1796	A-39-4	4-30-1974	SHORT OR HI-POT

TABLE II(k)

TURN-TURN SHORT MAGNETS AS OF APRIL 1974

ACCUM. NUMBER	REFERENCE NUMBER	MAGNET	LOCATION	DATE
1	372	4011	A-10-7	6-27-1972
2	376	1694	F-14-4	7- 6-1972
3	440	2553	B-45-2	3-16-1973
4	442	1528	A-47-4	3-22-1973
5	444	2100	E-38-5	4- 9-1973
6	447	1090	C-27-5	4-10-1973
7	448	2587	C-29-2	4-10-1973
8	449	1626	D-21-4	4-10-1973
9	463	1100	B-13-3	5-10-1973
10	464	1094	B-12-5	5-10-1973
11	465	1010	A-14-5	5-10-1973
12	472	1092	B-14-5	6-26-1973
13	473	2570	B-11-4	6-26-1973
14	476	2218	F-15-5	6-27-1973
15	483	1244	F-34-3	7-15-1973
16	490	1707	F-42-2	9-12-1973
17	491	1227	B-39-5	9-12-1973
18	493	2552	A-37-2	9-12-1973
19	528	4037	C-11-0	2-17-1974
20	537	1743	A-22-2	3-23-1974

TABLE III

MAGNETS REPLACED DUE TO VACUUM CHAMBER LEAKS AS OF APRIL 1974

ACCUM. NUMBER	REFERENCE NUMBER	MAGNET	LOCATION	DATE
1	5	2175	E-17-5	4-28-1971
2	7	7038	B-15-1	4-30-1971
3	189	7051	B-32-1	9-14-1971
4	209	4022	A-49-0	9-27-1971
5	253	4041	C-48-6	10-21-1971
6	254	7138	A-19-1	10-22-1971
7	255	7095	A-44-1	10-25-1971
8	256	7037	B-27-1	10-22-1971
9	257	1050	A-36-3	10-25-1971
10	259	7043	B-47-1	10-27-1971
11	290	7047	A-26-1	1- 3-1972
12	296	7094	C-21-1	1- 9-1972
13	446	7077	A-15-1	4-10-1973
14	457	2577	C-21-2	5- 9-1973
15	458	2115	C-43-3	5- 9-1973
16	461	7050	D-13-1	5- 9-1973
17	462	7039	D-23-1	5-10-1973
18	532	7142	A-24-1	2-28-1974

TABLE IV

THE FOLLOWING COLUMNS CORRESPOND TO:
PLASTER STICK (PURE)
PLASTER STICK, SALVAGE IMPREGNATION AFTER FAILURE
PLASTER STICK, SALVAGE IMPREGNATION BEFORE FAILURE
EPOXI STICK, PURE OR SALVAGE IMPREGNATION
ORIGINAL VACUUM IMPREGNATION
INTEGRAL IMPREGNATION (SUPER)
SLEEVE JOINTS (SUPER-DUPER)
IN THIS ORDER
AS OF APRIL 30, 1974

SHORTED BENDING MAGNETS	99	85	34	142	18	20	1
BENDING MAGNETS REPLACED FOR CONVENIENCE	25	9	5	12	8	8	0
TOTAL NUMBERS OF BENDING MAGNETS REPLACED	124	94	39	154	26	28	1
BENDING MAGNETS IN SERVICE AS OF 4-30-1974	62	42	41	333	127	138	31
AVERAGE LIFE-TIME (MONTH) FOR SHORTED BENDING MAGNETS	8.75	4.68	8.19	10.95	16.78	13.05	6.40
AVERAGE LIFE-TIME (MONTH) FOR BENDING MAGNETS REPLACED FOR CONVENIENCE	15.34	10.46	9.74	14.63	6.76	2.03	0.00
AVERAGE LIFE-TIME (MONTH) FOR BENDING MAGNETS IN SERVICE	36.81	32.28	36.12	36.75	32.24	18.96	4.26
AVERAGE MEAN-LIFE (MONTH) FOR SHORTED BENDING MAGNETS AND MAGNETS IN SERVICE	20.49	12.48	38.84	81.75	228.77	134.55	136.39

	PLASTER STICK (PURE)	PLASTER STICK SALVAGE IMPREG. AFTER COMM.	PLASTER STICK SALVAGE IMPREG. BEFORE COMM.	EPOXI STICK PURE OR SALVAGE IMPREG.	VACUUM IMPREG. (ORIG.)	INTEGR. IMPREG. (SUPER)	SLEEVE JOINTS (SUPER-DUPER)

TABLE V

LIFE-TIME DISTRIBUTIONS FOR SEVEN KINDS OF SHORTED BENDING MAGNETS IN THE UNIT OF A MONTH, 4-30-1974

MONTHS	PLASTER STICK (PURE)	PLASTER STICK SALVAGE IMPREG. AFTER COMM.	PLASTER STICK SALVAGE IMPREG. BEFORE COMM.	EPOXI STICK PURE OR SALVAGE IMPREG.	VACUUM IMPREG. (ORIG.)	INTEGR. IMPREG. (SUPER)	SLEEVE JOINTS (SUPER-DUPER)
1.	5	1	4	3	0	0	0
2.	6	28	4	9	0	0	0
3.	7	30	8	18	0	0	0
4.	6	3	1	11	1	0	0
5.	8	3	0	15	0	0	0
6.	21	7	1	10	1	1	0
7.	8	2	2	9	2	0	1
8.	2	0	0	3	0	2	0
9.	12	1	2	3	0	1	0
10.	0	1	1	1	1	3	0
11.	1	1	0	15	3	1	0
12.	3	0	2	2	0	1	0
13.	0	0	1	3	0	2	0
14.	2	2	0	2	0	1	0
15.	2	1	1	0	0	2	0
16.	1	1	1	2	0	0	0
17.	0	0	1	1	0	1	0
18.	1	0	1	5	0	3	0
19.	1	0	0	1	1	1	0
20.	0	1	0	0	2	0	0
21.	0	0	0	1	0	0	0
22.	1	1	1	0	0	0	0
23.	1	0	1	1	1	0	0
24.	2	0	0	1	1	0	0
25.	0	0	1	3	1	0	0
26.	2	0	0	4	1	0	0
27.	2	0	0	1	0	0	0
28.	2	0	0	4	0	1	0
29.	0	0	0	1	3	0	0
30.	2	0	1	3	0	0	0
31.	0	1	0	3	0	0	0
32.	1	0	0	0	0	0	0
33.	0	0	0	3	0	0	0
34.	0	0	0	1	0	0	0
35.	0	1	0	2	0	0	0
36.	0	0	0	1	0	0	0
37.	0	0	0	0	0	0	0
38.	0	0	0	0	0	0	0
39.	0	0	0	0	0	0	0
40.	0	0	0	0	0	0	0
41.	0	0	0	0	0	0	0
42.	0	0	0	0	0	0	0
43.	0	0	0	0	0	0	0
44.	0	0	0	0	0	0	0
45.	0	0	0	0	0	0	0
46.	0	0	0	0	0	0	0
47.	0	0	0	0	0	0	0
48.	0	0	0	0	0	0	0
49.	0	0	0	0	0	0	0
50.	0	0	0	0	0	0	0

TABLE VI(a)

LIFE-TIME DISTRIBUTIONS FOR SEVEN KINDS OF BENDING MAGNETS IN SERVICE IN THE UNIT OF A MONTH, 4-30-1974

MONTHS	PLASTER STICK (PURE)	PLASTER STICK SALVAGE IMPREG. AFTER COMM.	PLASTER STICK SALVAGE IMPREG. BEFORE COMM.	EPOXI STICK PURE OR SALVAGE IMPREG.	VACUUM IMPREG. (ORIG.)	INTEGR. IMPREG. (SUPER)	SLEEVE JOINTS (SUPER-DUPER)
1.	0	0	0	0	0	0	2
2.	0	0	0	0	0	0	6
3.	0	0	0	0	0	0	3
4.	0	0	0	0	0	0	3
5.	0	0	0	0	0	2	6
6.	0	0	0	0	0	0	3
7.	0	0	0	0	0	2	2
8.	0	0	0	0	0	6	4
9.	0	0	0	0	0	2	1
10.	0	0	0	0	0	6	1
11.	0	0	0	0	0	4	0
12.	0	0	0	0	0	10	0
13.	0	0	0	0	0	9	0
14.	0	0	0	0	0	4	0
15.	0	0	0	0	0	5	0
16.	0	0	0	0	0	2	0
17.	0	0	0	0	0	1	0
18.	0	0	0	0	0	0	0
19.	0	1	0	0	0	1	0
20.	0	0	0	0	0	7	0
21.	0	0	0	1	1	13	0
22.	0	1	0	0	1	10	0
23.	0	2	0	0	0	7	0
24.	0	0	0	0	1	3	0
25.	0	1	1	0	0	5	0
26.	0	0	1	0	1	16	0
27.	0	0	0	0	1	12	0
28.	0	0	0	0	0	2	0
29.	0	0	0	0	7	9	0
30.	0	1	0	2	3	0	0
31.	1	3	0	0	20	0	0
32.	1	2	0	4	26	0	0
33.	0	5	1	1	16	0	0
34.	0	2	0	5	12	0	0
35.	0	18	1	2	11	0	0
36.	0	5	4	2	24	0	0
37.	60	1	33	316	3	0	0
38.	0	0	0	0	0	0	0
39.	0	0	0	0	0	0	0
40.	0	0	0	0	0	0	0
41.	0	0	0	0	0	0	0
42.	0	0	0	0	0	0	0
43.	0	0	0	0	0	0	0
44.	0	0	0	0	0	0	0
45.	0	0	0	0	0	0	0
46.	0	0	0	0	0	0	0
47.	0	0	0	0	0	0	0
48.	0	0	0	0	0	0	0
49.	0	0	0	0	0	0	0
50.	0	0	0	0	0	0	0

TABLE VI(b)

LIFE-TIME DISTRIBUTIONS FOR SEVEN KINDS OF BENDING MAGNETS REPLACED FOR CONVENIENCE IN THE UNIT OF A MONTH. 4-30-1974

MONTHS	PLASTER STICK (PURE)	PLASTER STICK SALVAGE IMPREG. AFTER COMM.	PLASTER STICK SALVAGE IMPREG. BEFORE COMM.	EPOXI STICK PURE OR SALVAGE IMPREG.	VACUUM IMPREG. (ORIG.)	INTEGR. IMPREG. (SUPER)	SLEEVE JOINTS (SUPER-DUPER)
1.	1	0	1	2	1	2	0
2.	0	0	1	1	0	3	0
3.	0	0	0	1	1	1	0
4.	0	1	0	0	0	1	0
5.	0	0	0	0	1	1	0
6.	0	0	0	0	0	0	0
7.	1	0	0	0	0	0	0
8.	2	0	0	0	0	0	0
9.	0	2	0	0	4	0	0
10.	0	1	0	0	0	0	0
11.	0	0	1	0	0	0	0
12.	0	0	1	1	0	0	0
13.	0	4	0	0	1	0	0
14.	0	1	0	1	0	0	0
15.	1	0	0	1	0	0	0
16.	1	0	0	0	0	0	0
17.	16	0	0	1	0	0	0
18.	0	0	0	0	0	0	0
19.	0	0	0	0	0	0	0
20.	0	0	0	0	0	0	0
21.	0	0	0	0	0	0	0
22.	0	0	0	0	0	0	0
23.	0	0	0	0	0	0	0
24.	0	0	0	0	0	0	0
25.	3	0	1	0	0	0	0
26.	0	0	0	2	0	0	0
27.	0	0	0	0	0	0	0
28.	0	0	0	0	0	0	0
29.	0	0	0	0	0	0	0
30.	0	0	0	0	0	0	0
31.	0	0	0	0	0	0	0
32.	0	0	0	0	0	0	0
33.	0	0	0	2	0	0	0
34.	0	0	0	0	0	0	0
35.	0	0	0	0	0	0	0
36.	0	0	0	0	0	0	0
37.	0	0	0	0	0	0	0
38.	0	0	0	0	0	0	0
39.	0	0	0	0	0	0	0
40.	0	0	0	0	0	0	0
41.	0	0	0	0	0	0	0
42.	0	0	0	0	0	0	0
43.	0	0	0	0	0	0	0
44.	0	0	0	0	0	0	0
45.	0	0	0	0	0	0	0
46.	0	0	0	0	0	0	0
47.	0	0	0	0	0	0	0
48.	0	0	0	0	0	0	0
49.	0	0	0	0	0	0	0
50.	0	0	0	0	0	0	0

TABLE VI(c)

MAGNET ARRANGEMENT AT THE MAIN ACCELERATOR ON APRIL 18, 1971
DOUBLETS AT THE LONG STRAIGHT SECTIONS ARE ADDRESSED AS FOLLOW:
A10-2(7-FT), A10-3(4-FT), A10-4(4-FT), A10-5(4-FT),
A49-2(4-FT), A49-3(4-FT), A49-4(4-FT), A49-5(7-FT), ETC.

	1	2	3	4	5
A-10	0	7060	4011	4023	4021
A-11	0	2514	2022	2513	2045
A-12	4002	2504	2037	1514	1057
A-13	7068	1506	1006	2505	2012
A-14	7065	2508	2006	1502	1010
A-15	7077	1505	1015	2507	2017
A-16	7012	2501	2007	1501	1012
A-17	7072	0	0	2503	2008
A-18	7112	2502	2028	1515	1020
A-19	7138	1511	1018	2506	2030
A-21	7139	2511	2013	1517	1026
A-22	7067	1510	1028	2534	2025
A-23	7027	2512	2023	1513	1032
A-24	7142	1509	1038	2522	2033
A-25	7120	2515	2032	1525	1022
A-26	7047	1512	1035	2523	2034
A-27	7013	2525	2035	1508	1013
A-28	7134	1536	1023	2519	2042
A-29	7010	2524	2010	1518	1014
A-32	7099	1520	1008	2530	2018
A-33	7085	2521	2014	1574	1011
A-34	7075	1527	1007	2529	2011
A-35	7031	2518	2036	1521	1019
A-36	7079	1538	1025	2528	2019
A-37	7118	2520	2024	1516	1016
A-38	7143	1522	1030	2526	2016
A-39	7004	2532	2021	1523	1024
A-42	7144	1519	1034	2541	2027
A-43	7136	2516	2031	1524	1029
A-44	7095	1531	1033	2527	2015
A-45	7109	2533	2009	1504	1049
A-46	7135	1537	1041	2531	2026
A-47	7016	2536	2039	1528	1037
A-48	4027	0	1047	1526	1046
A-49	0	4020	4019	4022	7117

TABLE VIII(a)

MAGNET ARRANGEMENT AT THE MAIN ACCELERATOR ON APRIL 18, 1971
DOUBLETS AT THE LONG STRAIGHT SECTIONS ARE ADDRESSED AS FOLLOW:
A10-2(7-FT), A10-3(4-FT), A10-4(4-FT), A10-5(4-FT),
A49-2(4-FT), A49-3(4-FT), A49-4(4-FT), A49-5(7-FT), ETC.

	1	2	3	4	5
B-10	0	7078	4024	4013	4016
B-11	0	2609	2070	2570	2088
B-12	4010	2585	2118	1604	1094
B-13	7054	1599	1100	2568	2058
B-14	7048	2567	2053	1598	1092
B-15	7038	1575	1021	2582	2080
B-16	7019	2579	2040	1533	1122
B-17	7082	0	0	2603	2068
B-18	7083	2605	2094	1616	1096
B-19	7069	1597	1095	2580	2074
B-21	7045	2517	2111	1555	1052
B-22	7053	1577	1091	2578	2029
B-23	7017	2559	2091	1534	1068
B-24	7061	1567	1101	2558	2132
B-25	7046	2538	2085	1556	1090
B-26	7064	1573	1031	2552	2059
B-27	7037	2581	2105	1601	1102
B-28	7052	1539	1109	2543	2066
B-29	7002	2569	2051	1570	1106
B-32	7051	1561	1107	2542	2134
B-33	7070	2635	2038	1566	1104
B-34	7050	1563	1093	2566	2082
B-35	7040	2545	2047	1548	1045
B-36	7049	1569	1113	2560	2069
B-37	7058	2573	2106	1576	1036
B-38	7063	1541	1067	2550	2043
B-39	7041	2535	2083	1580	1058
B-42	7057	1581	1017	2554	2055
B-43	7059	2557	2079	1572	1064
B-44	7066	1571	1069	2549	2086
B-45	7076	2553	2060	1562	1051
B-46	7081	1589	1059	2539	2057
B-47	7043	2544	2081	1584	1039
B-48	4031	0	1111	1625	1099
B-49	0	4044	4034	4046	7162

TABLE VIII(b)

MAGNET ARRANGEMENT AT THE MAIN ACCELERATOR ON APRIL 18, 1971
DOUBLETS AT THE LONG STRAIGHT SECTIONS ARE ADDRESSED AS FOLLOW:
A10-2(7-FT), A10-3(4-FT), A10-4(4-FT), A10-5(4-FT),
A49-2(4-FT), A49-3(4-FT), A49-4(4-FT), A49-5(7-FT), ETC.

	1	2	3	4	5
C-10	0	7154	4051	4037	4042
C-11	0	2616	2102	2612	2092
C-12	4006	2615	2119	1594	1120
C-13	7056	1585	1097	2592	2073
C-14	7073	2613	2117	1557	1040
C-15	7074	1603	1065	2537	2084
C-16	7021	2651	2107	1590	1110
C-17	7090	0	0	2551	2131
C-18	7091	2572	2109	1600	1112
C-19	7055	1583	1131	2556	2090
C-21	7094	2577	2097	1606	1126
C-22	7093	1552	1105	2588	2158
C-23	7015	2591	2108	1602	1124
C-24	7101	1609	1103	2564	2041
C-25	7097	2586	2049	1596	1114
C-26	7100	1611	1115	2600	2098
C-27	7023	2595	2046	1568	1054
C-28	7080	1615	1117	2634	2095
C-29	7020	2587	2110	1591	1082
C-32	7096	1621	1133	2638	2104
C-33	7098	2596	2112	1588	1116
C-34	7084	1619	1136	2590	2101
C-35	7022	2597	2113	1610	1128
C-36	7116	1545	1138	2614	2114
C-37	7104	2599	2020	1550	1043
C-38	7105	1607	1123	2608	2093
C-39	7036	2623	2099	1553	1060
C-42	7107	1630	1129	2636	2056
C-43	7114	2625	2115	1608	1130
C-44	7110	1634	1121	2604	2075
C-45	7102	2627	2103	1582	1132
C-46	7111	1617	1125	2602	2096
C-47	7042	2607	2121	1620	1076
C-48	4029	0	1141	1507	1073
C-49	0	4041	4045	4018	7089

TABLE VIII(c)

MAGNET ARRANGEMENT AT THE MAIN ACCELERATOR ON APRIL 18, 1971
DOUBLETS AT THE LONG STRAIGHT SECTIONS ARE ADDRESSED AS FOLLOW:
A10-2(7-FT), A10-3(4-FT), A10-4(4-FT), A10-5(4-FT),
A49-2(4-FT), A49-3(4-FT), A49-4(4-FT), A49-5(7-FT), ETC.

	1	2	3	4	5
D-10	0	7088	4048	4026	4032
D-11	0	2656	2156	2648	2120
D-12	4009	2589	2127	1618	1118
D-13	7123	1635	1119	2606	2126
D-14	7125	2633	2136	1622	1134
D-15	7124	1629	1135	2610	2128
D-16	7033	2619	2125	1612	1148
D-17	7127	0	0	2593	2122
D-18	7128	2631	2129	1624	1140
D-19	7113	1633	1086	2628	2048
D-21	7129	2629	2137	1626	1074
D-22	7132	1623	1143	2622	2130
D-23	7039	2637	2141	1503	1144
D-24	7130	1631	1077	2624	2116
D-25	7115	2645	2143	1628	1142
D-26	7086	1613	1055	2644	2124
D-27	7035	2643	2133	1632	1150
D-28	7087	1605	1149	2646	2140
D-29	7044	2641	2145	1138	1156
D-32	7113	1639	1027	2642	2142
D-33	7146	2639	2135	1636	1152
D-34	7126	1645	1147	2640	2138
D-35	7018	2647	2153	1660	1160
D-36	7141	1655	1139	2630	2155
D-37	7137	2611	2147	1664	1056
D-38	7150	1643	1151	2632	2150
D-39	7003	2653	2149	1614	1088
D-42	7145	1649	1075	2626	2148
D-43	7062	2649	2151	1642	1146
D-44	7119	1532	1145	2652	2152
D-45	7140	2655	2159	1586	1158
D-46	7103	1641	1153	2650	2144
D-47	7024	2657	2157	1646	1062
D-48	4038	0	1155	1653	1159
D-49	0	4039	4043	4050	7153

TABLE VIII(d)

MAGNET ARRANGEMENT AT THE MAIN ACCELERATOR ON APRIL 18, 1971
DOUBLETS AT THE LONG STRAIGHT SECTIONS ARE ADDRESSED AS FOLLOW:
A10-2(7-FT), A10-3(4-FT), A10-4(4-FT), A10-5(4-FT),
A49-2(4-FT), A49-3(4-FT), A49-4(4-FT), A49-5(7-FT), ETC.

	1	2	3	4	5
E-10	0	7163	4028	4025	4036
E-11	0	2678	2182	2674	2054
E-12	4005	2663	2173	1648	1162
E-13	7092	1651	1157	2662	2170
E-14	7158	2659	2179	1640	1164
E-15	7108	1647	1163	2672	2172
E-16	7009	2673	2193	1654	1170
E-17	7172	0	0	2669	2175
E-18	7175	2584	2183	1652	1154
E-19	7173	1659	1089	2676	2178
E-21	7169	2677	2171	1650	1168
E-22	7178	1559	1169	2664	2166
E-23	7005	2675	2177	1554	1174
E-24	7168	1657	1167	2660	2176
E-25	7106	2679	2191	1662	1176
E-26	7188	1661	1165	2654	2154
E-27	7029	2681	2139	1558	1172
E-28	7170	1663	1171	2618	2168
E-29	7030	2661	2123	1670	1084
E-32	7177	1667	1071	2620	2184
E-33	7160	2601	2169	1658	1042
E-34	7184	1669	1087	2658	2072
E-35	7025	2685	2161	1656	1072
E-36	7171	1665	1175	2668	2044
E-37	7161	2667	2167	1674	1066
E-38	7179	1675	1173	2670	2100
E-39	7014	2583	2181	1644	1070
E-42	7181	1673	1085	2594	2146
E-43	7183	2671	2189	1666	1050
E-44	7182	1671	1177	2686	2180
E-45	7166	2687	2199	1530	1080
E-46	7186	1679	1137	2688	2192
E-47	7001	2665	2165	1668	1053
E-48	4001	0	1044	1677	1063
E-49	0	4040	4035	4047	7151

TABLE VIII(e)

MAGNET ARRANGEMENT AT THE MAIN ACCELERATOR ON APRIL 18, 1971
DOUBLETS AT THE LONG STRAIGHT SECTIONS ARE ADDRESSED AS FOLLOW:
A10-2(7-FT), A10-3(4-FT), A10-4(4-FT), A10-5(4-FT),
A49-2(4-FT), A49-3(4-FT), A49-4(4-FT), A49-5(7-FT), ETC.

	1	2	3	4	5
F-10	0	7156	4049	4033	4030
F-11	0	2684	2050	2682	2186
F-12	4004	2693	2195	1672	1182
F-13	7153	1695	1703	2690	2174
F-14	7149	2691	2187	1678	1178
F-15	7147	1685	1083	2692	2196
F-16	7026	2695	2185	1676	1179
F-17	7152	0	0	2683	2071
F-18	7122	2689	2203	1688	1127
F-19	7159	1587	1161	2704	2188
F-21	7165	2699	2201	1540	1187
F-22	7187	1687	1189	2680	2190
F-23	7008	2701	2207	1680	1185
F-24	7194	1689	1079	2694	2162
F-25	7174	2697	2197	1684	1184
F-26	7190	1683	1181	2696	2160
F-27	7028	2561	2163	1686	1186
F-28	7176	1691	2213	2698	2194
F-29	7011	2575	2205	1690	1544
F-32	7180	1693	2565	2700	2198
F-33	7167	2705	2211	1696	1188
F-34	7034	1681	2546	2702	2200
F-35	7006	2547	2202	1592	1694
F-36	7157	1551	2509	2576	2164
F-37	7193	2703	2064	1692	1698
F-38	7192	1699	2510	2708	2078
F-39	7007	2707	2210	1678	1546
F-42	7164	1593	1183	2706	2204
F-43	7189	2709	2052	1542	1700
F-44	7121	1697	1004	2710	2206
F-45	7131	2711	2209	1702	1166
F-46	7148	1701	1003	2212	2208
F-47	7032	2555	2067	1560	1078
F-48	4003	0	1002	1529	1191
F-49	0	4014	4012	4017	7071

TABLE VIII(f)

CURRENT MAGNET ARRANGEMENT AT THE MAIN ACCELERATOR AS OF APRIL 30, 1974

DOUBLETS AT THE LONG STRAIGHT SECTIONS ARE ADDRESSED AS FOLLOW:
A10-2(7-FT), A10-3(4-FT), A10-4(4-FT), A10-5(4-FT),
A49-2(4-FT), A49-3(4-FT), A49-4(4-FT), A49-5(7-FT), ETC.

	1	2	3	4	5
A-10	0	7060	4019	4056	4053
A-11	0	2783	2275	2668	2278
A-12	4002	2724	2037	1761	1194
A-13	7068	1514	1006	2548	2282
A-14	7065	2508	2290	1502	1281
A-15	7262	1505	1015	2507	2017
A-16	7012	2666	2296	1746	1012
A-17	7072	0	0	2761	2300
A-18	7112	2502	2119	1785	1020
A-19	7048	1543	1018	2714	2221
A-21	7139	2545	2013	1736	1116
A-22	7067	1795	1228	2534	2240
A-23	7027	2512	2310	1718	1024
A-24	7278	1511	1249	2780	2234
A-25	7120	2782	2280	1525	1223
A-26	7225	1708	1035	2523	2034
A-27	7013	2596	2228	1705	1013
A-28	7134	1536	1190	2510	2215
A-29	7276	2524	2309	1700	1014
A-32	7075	1738	1008	2770	2268
A-33	7085	2521	2313	1574	1011
A-34	7199	1527	1203	2721	2247
A-35	7031	2729	2223	1704	1019
A-36	7079	1751	1232	2528	2308
A-37	7244	2758	2281	1713	1255
A-38	7213	1698	1040	2809	2073
A-39	7250	2726	2311	1796	1032
A-42	7273	1731	1034	2541	2272
A-43	7136	2718	2314	1506	1016
A-44	7207	1753	1204	2527	2015
A-45	7109	2529	2301	1504	1205
A-46	7135	1758	1224	2720	2316
A-47	7034	2712	2299	1776	1239
A-48	4027	0	1215	1518	1202
A-49	0	4071	4069	4059	7117

TABLE IX(a)

CURRENT MAGNET ARRANGEMENT AT THE MAIN ACCELERATOR AS OF APRIL 30, 1974
DOUBLETS AT THE LONG STRAIGHT SECTIONS ARE ADDRESSED AS FOLLOW:
A10-2(7-FT), A10-3(4-FT), A10-4(4-FT), A10-5(4-FT),
A49-2(4-FT), A49-3(4-FT), A49-4(4-FT), A49-5(7-FT), ETC.

	1	2	3	4	5
B-10	0	7239	4058	4013	4016
B-11	0	2609	2286	2802	2257
B-12	4008	2585	2118	1604	1263
B-13	7054	1766	1250	2742	2058
B-14	7210	2766	2304	1598	1276
B-15	7196	1533	1283	2582	2245
B-16	7019	2741	2231	1580	1285
B-17	7082	0	0	2603	2248
B-18	7083	2744	2094	1509	1243
B-19	7069	1597	1095	2764	2238
B-21	7045	2517	2111	1555	1221
B-22	7053	1577	1091	2717	2064
B-23	7017	2753	2277	1515	1068
B-24	7238	1748	1101	2730	2306
B-25	7046	2768	2242	1737	1078
B-26	7064	1732	1238	2719	2059
B-27	7191	2581	2105	1601	1102
B-28	7052	1539	1109	2776	2027
B-29	7002	2800	2253	1734	1106
B-32	7206	1755	1107	2791	2217
B-33	7070	2635	2795	1739	1104
B-34	7214	1733	1093	2674	2082
B-35	7040	2722	2243	1567	1210
B-36	7049	1569	1113	2773	2220
B-37	7058	2573	2106	1576	1207
B-38	7063	1541	1229	2774	2269
B-39	7041	2731	2249	1584	1278
B-42	7057	1765	1017	2554	2216
B-43	7059	2786	2239	1784	1052
B-44	7066	1571	1069	2549	2270
B-45	7076	2789	2233	1562	1236
B-46	7081	1745	1059	2745	2057
B-47	7230	2725	2134	1715	1218
B-48	4052	0	1111	1625	1099
B-49	0	4044	4034	4046	7162

TABLE IX(b)

CURRENT MAGNET ARRANGEMENT AT THE MAIN ACCELERATOR AS OF APRIL 30, 1974

DOUBLETS AT THE LONG STRAIGHT SECTIONS ARE ADDRESSED AS FOLLOW:
A10-2(7-FT), A10-3(4-FT), A10-4(4-FT), A10-5(4-FT),
A49-2(4-FT), A49-3(4-FT), A49-4(4-FT), A49-5(7-FT), ETC.

	1	2	3	4	5
C-10	0	7154	4051	4079	4073
C-11	0	2616	2102	2612	2092
C-12	4006	2615	2222	1512	1120
C-13	7056	1719	1097	2592	2053
C-14	7073	2613	2117	1531	1148
C-15	7074	1603	1065	2505	2084
C-16	7021	2651	2107	1724	1110
C-17	7090	0	0	2659	2230
C-18	7091	2737	2109	1792	1112
C-19	7055	1793	1219	2738	2195
C-21	7232	2798	2097	1606	1126
C-22	7093	1752	1105	2588	2236
C-23	7015	2591	2108	1602	1124
C-24	7101	1609	1103	2781	2246
C-25	7097	2586	2049	1596	1114
C-26	7100	1611	1115	2600	2098
C-27	7023	2595	2224	1568	1240
C-28	7080	1615	1117	2634	2274
C-29	7020	2794	2232	1591	1045
C-32	7096	1723	1206	2540	2258
C-33	7098	2713	2158	1770	1246
C-34	7084	1742	1214	2590	2225
C-35	7022	2597	2113	1726	1128
C-36	7116	1759	1138	2614	2264
C-37	7201	2599	2020	1786	1220
C-38	7105	1607	1123	2608	2093
C-39	7195	2748	2099	1717	1242
C-42	7107	1630	1129	2636	2056
C-43	7114	2625	2279	1608	1130
C-44	7110	1782	1121	2740	2285
C-45	7247	2627	2103	1740	1256
C-46	7111	1788	1125	2602	2096
C-47	7042	2607	2266	1727	1076
C-48	4068	0	1141	1507	1073
C-49	0	4061	4057	4018	7089

TABLE IX(c)

CURRENT MAGNET ARRANGEMENT AT THE MAIN ACCELERATOR AS OF APRIL 30, 1974
DOUBLETS AT THE LONG STRAIGHT SECTIONS ARE ADDRESSED AS FOLLOW:
A10-2(7-FT), A10-3(4-FT), A10-4(4-FT), A10-5(4-FT),
A49-2(4-FT), A49-3(4-FT), A49-4(4-FT), A49-5(7-FT), ETC.

	1	2	3	4	5
D-10	0	7088	4048	4026	4032
D-11	0	2656	2156	2648	2120
D-12	4066	2747	2261	1725	1225
D-13	7264	1720	1119	2606	2069
D-14	7125	2633	2235	1749	1213
D-15	7124	1629	1135	2610	2128
D-16	7033	2775	2125	1716	1217
D-17	7127	0	0	2749	2315
D-18	7269	2631	2129	1624	1140
D-19	7242	1633	1086	2628	2226
D-21	7129	2797	2137	1775	1074
D-22	7132	1623	1143	2778	2130
D-23	7267	2637	2141	1503	1144
D-24	7130	1631	1077	2624	2116
D-25	7233	2645	2143	1764	1142
D-26	7086	1613	1055	2644	2250
D-27	7035	2643	2133	1632	1150
D-28	7087	1605	1149	2646	2140
D-29	7044	2641	2145	1138	1156
D-32	7113	1639	1027	2799	2142
D-33	7146	2639	2042	1636	1152
D-34	7126	1645	1147	2563	2138
D-35	7018	2647	2153	1660	1160
D-36	7141	1655	1139	2630	2155
D-37	7240	2771	2147	1664	1056
D-38	7150	1643	1151	2733	2229
D-39	7235	2653	2016	1614	1088
D-42	7145	1649	1075	2626	2237
D-43	7062	2808	2151	1642	1146
D-44	7203	1532	1145	2652	2244
D-45	7274	2655	2159	1586	1158
D-46	7103	1641	1153	2650	2144
D-47	7024	2803	2157	1646	1062
D-48	4038	0	1155	1721	1159
D-49	0	4039	4043	4050	7153

TABLE IX(d)

CURRENT MAGNET ARRANGEMENT AT THE MAIN ACCELERATOR AS OF APRIL 30, 1974

DOUBLETS AT THE LONG STRAIGHT SECTIONS ARE ADDRESSED AS FOLLOW:
A10-2(7-FT), A10-3(4-FT), A10-4(4-FT), A10-5(4-FT),
A49-2(4-FT), A49-3(4-FT), A49-4(4-FT), A49-5(7-FT), ETC.

	1	2	3	4	5
E-10	0	7241	4075	4025	4036
E-11	0	2678	2182	2736	2054
E-12	4005	2663	2173	1648	1162
E-13	7092	1651	1157	2755	2170
E-14	7158	2735	2179	1747	1164
E-15	7198	1647	1163	2672	2172
E-16	7009	2532	2263	1654	1170
E-17	7172	0	0	2669	2265
E-18	7175	2584	2183	1783	1154
E-19	7173	1789	1089	2676	2178
E-21	7169	2804	2171	1650	1168
E-22	7236	1559	1169	2664	2166
E-23	7005	2675	2298	1773	1174
E-24	7215	1657	1230	2660	2176
E-25	7106	2679	2191	1662	1237
E-26	7188	1661	1165	2767	2154
E-27	7029	2796	2062	1558	1172
E-28	7170	1663	1171	2618	2168
E-29	7030	2727	2063	1670	1084
E-32	7177	1794	1071	2620	2184
E-33	7160	2601	2169	1722	1049
E-34	7184	1669	1241	2716	2251
E-35	7228	2788	2161	1656	1072
E-36	7171	1665	1267	2734	2066
E-37	7227	2535	2318	1674	1066
E-38	7179	1675	1173	2772	2295
E-39	7014	2583	2181	1644	1070
E-42	7229	1673	1085	2594	2146
E-43	7183	2671	2189	1666	1222
E-44	7182	1671	1261	2769	2180
E-45	7216	2750	2319	1530	1080
E-46	7186	1679	1137	2688	2192
E-47	7001	2739	2288	1668	1235
E-48	4001	0	1044	1677	1063
E-49	0	4040	4035	4076	7271

TABLE IX(e)

CURRENT MAGNET ARRANGEMENT AT THE MAIN ACCELERATOR AS OF APRIL 30, 1974
DOUBLETS AT THE LONG STRAIGHT SECTIONS ARE ADDRESSED AS FOLLOW:
A10-2(7-FT), A10-3(4-FT), A10-4(4-FT), A10-5(4-FT),
A49-2(4-FT), A49-3(4-FT), A49-4(4-FT), A49-5(7-FT), ETC.

	1	2	3	4	5
F-10	0	7156	4049	4033	4030
F-11	0	2598	2227	2682	2186
F-12	4004	2765	2271	1672	1182
F-13	7153	1695	1043	2690	2174
F-14	7149	2691	2262	1763	1189
F-15	7208	1685	1248	2511	2322
F-16	7026	2695	2303	1676	1179
F-17	7212	0	0	2683	2241
F-18	7202	2689	2203	1510	1127
F-19	7051	1587	1161	2579	2260
F-21	7165	2544	2076	1769	1187
F-22	7187	1687	1208	2752	2190
F-23	7008	2807	2207	1680	1185
F-24	7200	1524	1253	2694	2162
F-25	7174	2697	2197	1684	1266
F-26	7194	1683	1046	2696	2160
F-27	7028	2777	2163	1686	1234
F-28	7176	1691	1195	2531	2194
F-29	7011	2715	2205	1690	1274
F-32	7180	1693	1057	2700	2198
F-33	7167	2705	2211	1696	1275
F-34	7094	1681	1269	2702	2200
F-35	7006	2547	2202	1710	1007
F-36	7263	1551	1247	2576	2188
F-37	7251	2703	2287	1692	1199
F-38	7192	1787	1252	2793	2259
F-39	7007	2806	2210	1678	1257
F-42	7243	1777	1183	2706	2204
F-43	7189	2811	2293	1754	1198
F-44	7223	1774	1279	2710	2289
F-45	7231	2711	2209	1768	1254
F-46	7252	1701	1233	2763	2208
F-47	7032	2746	2067	1790	1245
F-48	4003	0	1277	1709	1191
F-49	0	4014	4012	4017	7071

TABLE IX(f)

CURRENT MAGNET ARRANGEMENT AT THE MAIN ACCELERATOR AS OF APRIL 30, 1974

DOUBLETS AT THE LONG STRAIGHT SECTIONS ARE ADDRESSED AS FOLLOW:
A10-2(7-FT), A10-3(4-FT), A10-4(4-FT), A10-5(4-FT),
A49-2(4-FT), A49-3(4-FT), A49-4(4-FT), A49-5(7-FT), ETC.

CODES FOR REMOVED MAGNETS, STARTING FROM LEFT :
MAGNET NUMBER(4), FAILURE MODE(1), REFERENCE NUMBER(3), DATE(4)

FAILURE MODES : 1 = SHORT OR HI-POT, 2 = VACUUM LEAK, 3 = CONVENIENCE,
4 = TURN-TURN SHORT, 5 = DOUBLET MATE (CONVENIENCE)

	1	2	3	4	5
A-10	0	7060 706063720672	4019 401143720672	4056 402313500472	4053 402163500472
A-11	0	2783 251434040872	2275 202213320372 226033700672	2668 251312100971	2278 204513690672
A-12	4002	2724 250410470671	2037	1761 151410280571 170613520472	1194 105710290571
A-13	7068	1514 150610320671	1006	2548 250511210771	2282 201233710672
A-14	7065	2508	2290 200634030872	1502	1281 101044650573 127215290274
A-15	7262 707724460473	1505	1015	2507	2017
A-16	7012	2666 250110010471	2296 200734540473	1746 150112890172	1012
A-17	7072	0	0	2761 250310740671 250613510472	2300 200834530473
A-18	7112	2502	2119 202811500871	1785 151510300571 171413460372 175614940973	1020
A-19	7048 713822541071	1543 151110310571	1018	2714 250610330671	2221 203010460671
A-21	7139	2545 251110670671	2013	1736 151712110971	1116 102612120971
A-22	7067	1795 151012621171 174345370374	1228 102812130971	2534	2240 202512811271
A-23	7027	2512	2310 202310260571 221415061173	1718 151310340671	1024 103211220771
A-24	7278 714225320274	1511 150910520671 154412080971 104333750772	1249 103810350671 119613570472	2780 252234020872	2234 203310450671 221911930971
A-25	7120	2782 251534010872	2280 203234000872	1525	1223 102232651171
A-26	7225 704722900172	1708 151210530671	1035	2523	2034
A-27	7013	2596 252511400771	2228 203511190771	1705 150810060471	1013
A-28	7134	1536	1190 102310040471	2510 251912140971 274313540472	2215 204210390671

TABLE X(a)

CURRENT MAGNET ARRANGEMENT AT THE MAIN ACCELERATOR AS OF APRIL 30, 1974

	1	2	3	4	5
A-29	7276	2524	2309	1700	1014
	701015390374		201033990872	151810400671	
			228414870873		
A-32	7075	1738	1008	2770	2268
	709910710671	152012150971		253033980872	201833970872
	719935220174				
A-33	7085	2521	2313	1574	1011
			201415010973		
A-34	7199	1527	1203	2721	2247
	707535210174		100710640671	252910660671	201112161071
A-35	7031	2729	2223	1704	1019
		251833960872	203510540671	152110030471	
A-36	7079	1751	1232	2528	2308
		153813090272	102510880671		201914840773
			103312501071		
			105022571071		
A-37	7244	2758	2281	1713	1255
	711814740673	252033950872	202410900671	151610550671	101610590671
		255244930973	252933810772		120015000973
A-38	7213	1698	1040	2809	2073
	714311840871	152210500671	103012181071	252614710673	201611950971
				280115350374	
A-39	7250	2726	2311	1796	1032
	700414350273	253210510671	202114800773	152311180771	102411170771
			275834920973	157515410474	
A-42	7273	1731	1034	2541	2272
	714415181273	151912171071			202710860671
	726015200174				203013330372
A-43	7136	2718	2314	1506	1016
		251610480671	203112801271	152410680671	102910730671
			225215360374		
A-44	7207	1753	1204	2527	2015
	709522551071	153110650671	103310610671		
		151313580472			
A-45	7109	2529	2301	1504	1205
		253333850772	200934520473		104910630671
A-46	7135	1758	1224	2720	2316
		153713640672	104112421071	253110490671	202615051173
A-47	7034	2712	2299	1776	1239
	701633390372	253633940872	203912070971	152844420373	103712970172
			205014231172		
			225414660573		
A-48	4027	0	1215	1518	1202
			104711200771	152610620671	104610600671
			121131960971		
A-49	0	4071	4069	4059	7117
		402013490372	401963490372	402222090971	711762090971
		406034060872	406264060872		

TABLE X(b)

CURRENT MAGNET ARRANGEMENT AT THE MAIN ACCELERATOR AS OF APRIL 30, 1974

DOUBLETS AT THE LONG STRAIGHT SECTIONS ARE ADDRESSED AS FOLLOW:
A10-2(7-FT), A10-3(4-FT), A10-4(4-FT), A10-5(4-FT),
A49-2(4-FT), A49-3(4-FT), A49-4(4-FT), A49-5(7-FT), ETC.

CODES FOR REMOVED MAGNETS, STARTING FROM LEFT :
MAGNET NUMBER(4), FAILURE MODE(1), REFERENCE NUMBER(3), DATE(4)

FAILURE MODES : 1 = SHORT OR HI-POT, 2 = VACUUM LEAK, 3 = CONVENIENCE,
4 = TURN-TURN SHORT, 5 = DOUBLET MATE (CONVENIENCE)

	1	2	3	4	5
B-10	0	7239 707832411071 720413340372	4058 402462411071 405663340372	4013	4016
B-11	0	2609	2286 207010020471 271233800772	2802 257044730673	2257 208812980172
B-12	4008 401011830871	2585	2118	1604	1263 109444640573
B-13	7054	1766 159914090872	1250 110044630573	2742 256812191071	2058
B-14	7210 704811810871	2766 256733890872	2304 205311100771 202414191072 229214770673	1598	1276 109244720673
B-15	7196 703820070471	1533 157511240771	1283 102111090771 103115190174	2582	2245 208012761271
B-16	7019	2741 257912201071	2231 204012231071	1580 153311250771	1285 112215310274
B-17	7082	0	0	2603	2248 206812211071
B-18	7083	2744 260512241071	2094	1509 161614201072	1243 109613080272
B-19	7069	1597	1095	2764 258013040272	2238 207411870971
B-21	7045	2517	2111	1555	1221 105212030971
B-22	7053	1577	1091	2717 257810430671	2064 202912040971
B-23	7017	2753 255912871271	2277 209113840772	1515 153410800671	1068
B-24	7238 706114211072	1748 156712050971 202812990272	1101	2730 255813630672	2306 213214790773
B-25	7046	2768 253833900872	2242 208511980971	1737 155612221071	1078 109011260771
B-26	7064	1732 157312251071	1238 103110870671 102912950172	2719 255210580671	2059
B-27	7191 703722561071	2581	2105	1601	1102
B-28	7052	1539	1109	2776 254333910872	2027 206611080771
B-29	7002	2800 256933920872 277914970973	2253 205112910172	1734 157012821271	1106

TABLE X(c)

CURRENT MAGNET ARRANGEMENT AT THE MAIN ACCELERATOR AS OF APRIL 30, 1974

	1	2	3	4	5
B-32	7206	1755	1107	2791	2217
	705121890971	156113480372		254214280173	213410420571
B-33	7070	2635	2795	1739	1104
			203811320771	156612461071	
			212314700573		
B-34	7214	1733	1093	2674	2082
	705011800871	156312471071		256612481071	
B-35	7040	2722	2243	1567	1210
		254510410671	204712311071	154812321071	104511270771
B-36	7049	1569	1113	2773	2220
				256014181072	206911330771
B-37	7058	2573	2106	1576	1207
					103611070771
					151633250372
B-38	7063	1541	1229	2774	2269
		154111280771	106712261071	255033930872	204311060771
					273033260372
B-39	7041	2731	2249	1584	1278
		253511130771	208312671171	158011310771	105812271071
					122744910973
B-42	7057	1765	1017	2554	2216
		158111290771			205510760671
		153513680672			
B-43	7059	2786	2239	1784	1052
		255714670573	207911900971	157214980973	106412301071
B-44	7066	1571	1069	2549	2270
					208613670672
B-45	7076	2789	2233	1562	1236
		255344400373	206011860971		105112920172
B-46	7081	1745	1059	2745	2057
		158912701171		253912391071	
B-47	7230	2725	2134	1715	1218
	704322591071	254411050771	208110780671	158411300771	103911230771
					118011970971
B-48	4052	0	1111	1625	1099
	403113240372				
B-49	0	4044	4034	4046	7162

TABLE X(d)

CURRENT MAGNET ARRANGEMENT AT THE MAIN ACCELERATOR AS OF APRIL 30, 1974

DOUBLETS AT THE LONG STRAIGHT SECTIONS ARE ADDRESSED AS FOLLOW:
A10-2(7-FT), A10-3(4-FT), A10-4(4-FT), A10-5(4-FT),
A49-2(4-FT), A49-3(4-FT), A49-4(4-FT), A49-5(7-FT), ETC.

CODES FOR REMOVED MAGNETS, STARTING FROM LEFT :
MAGNET NUMBER(4), FAILURE MODE(1), REFERENCE NUMBER(3), DATE(4)

FAILURE MODES : 1 = SHORT OR HI-POT, 2 = VACUUM LEAK, 3 = CONVENIENCE,
4 = TURN-TURN SHORT, 5 = DOUBLET MATE (CONVENIENCE)

	1	2	3	4	5
C-10	0	7154	4051	4079 403745280274	4073 404265280274
C-11	0	2616	2102	2612	2092
C-12	4006	2615	2222 211911140771	1512 159411640871	1120
C-13	7056	1719 158511990971	1097	2592	2053 207311650871
C-14	7073	2613	2117	1531 155710750671	1148 104011850871
C-15	7074	1603	1065	2505 253711540871	2084
C-16	7021	2651	2107	1724 159011660871	1110
C-17	7090	0	0	2659 255112020971	2230 213112281071
C-18	7091	2737 257211670871	2109	1792 160012000971 155314221172 176715260174	1112
C-19	7055	1793 158312331071 173014560573 178115330374	1219 113111910971	2738 255611680871	2195 209011410771
C-21	7232 709422960172	2798 257724570573	2097	1606	1126
C-22	7093	1752 155210810671 120733230372	1105	2588	2236 215812291071
C-23	7015	2591	2108	1602	1124
C-24	7101	1609	1103	2781 256414150972	2246 204112831271
C-25	7097	2586	2049	1596	1114
C-26	7100	1611	1115	2600	2098
C-27	7023	2595	2224 204611150771	1568	1240 105411370771 109044470473
C-28	7080	1615	1117	2634	2274 209514690573
C-29	7020	2794 258744480473	2232 211011550871	1591	1045 108212631171
C-32	7096	1723 162111620871	1206 113310690671	2540 263811590871	2258 210413130272
C-33	7098	2713 259611160771	2158 211212711171	1770 158812930172 173513650672	1246 111611690871 113613060272
C-34	7084	1742 161911450771 104532641171	1214 113611560871	2590	2225 210111480771

TABLE X(e)

CURRENT MAGNET ARRANGEMENT AT THE MAIN ACCELERATOR AS OF APRIL 30, 1974

	1	2	3	4	5
C-35	7022	2597	2113	1726	1128
				161011700871	
C-36	7116	1759	1138	2614	2264
		154510970671			211413150272
		120933210372			
C-37	7201	2599	2020	1786	1220
	710411630871			155013220372	104311710871
				176214890873	
C-38	7105	1607	1123	2608	2093
C-39	7195	2748	2099	1717	1242
	703610180571	262312601071		155311520871	106013730672
C-42	7107	1630	1129	2636	2056
C-43	7114	2625	2279	1608	1130
			211524580573		
C-44	7110	1782	1121	2740	2285
		163414880873		260412060971	207514310273
C-45	7247	2627	2103	1740	1256
	710214320273			158212841271	113214140972
C-46	7111	1788	1125	2602	2096
		161735121273			
C-47	7042	2607	2266	1727	1076
			212113190372	162011720871	
C-48	4068	0	1141	1507	1073
	402935101273				
C-49	0	4061	4057	4018	7089
		404122531071	404562531071		

TABLE X(f)

CURRENT MAGNET ARRANGEMENT AT THE MAIN ACCELERATOR AS OF APRIL 30, 1974

DOUBLETS AT THE LONG STRAIGHT SECTIONS ARE ADDRESSED AS FOLLOW:
A10-2(7-FT), A10-3(4-FT), A10-4(4-FT), A10-5(4-FT),
A49-2(4-FT), A49-3(4-FT), A49-4(4-FT), A49-5(7-FT), ETC.

CODES FOR REMOVED MAGNETS, STARTING FROM LEFT :
MAGNET NUMBER(4), FAILURE MODE(1), REFERENCE NUMBER(3), DATE(4)

FAILURE MODES : 1 = SHORT OR HI-POT, 2 = VACUUM LEAK, 3 = CONVENIENCE,
4 = TURN-TURN SHORT, 5 = DOUBLET MATE (CONVENIENCE)

	1	2	3	4	5
D-10	0	7088	4048	4026	4032
D-11	0	2656	2156	2648	2120
D-12	4066	2747	2261	1725	1225
	400912341071	258912521071	212713010272	161811740871	111812661171
D-13	7264	1720	1119	2606	2069
	712312351071	163510140571			212611440771
	705024610573	152111580871			208931460771
D-14	7125	2633	2235	1749	1213
			213612361071	162211730871	113411470771
				161214550573	
D-15	7124	1629	1135	2610	2128
D-16	7033	2775	2125	1716	1217
		261913880872		161211510871	114811530871
D-17	7127	0	0	2749	2315
				259312940172	212213620672
					227315041173
D-18	7269	2631	2129	1624	1140
	712815071173				
D-19	7242	1633	1086	2628	2226
	711334500473				204811490771
D-21	7129	2797	2137	1775	1074
		262914410373		162644490473	
		227934590573			
D-22	7132	1623	1143	2778	2130
				262214130972	
D-23	7267	2637	2141	1503	1144
	703924620573				
D-24	7130	1631	1077	2624	2116
D-25	7233	2645	2143	1764	1142
	711512851271			162814120972	
D-26	7086	1613	1055	2644	2250
					212412371071
D-27	7035	2643	2133	1632	1150
D-28	7087	1605	1149	2646	2140
D-29	7044	2641	2145	1138	1156
D-32	7113	1639	1027	2799	2142
				264213070272	
				276214600573	
D-33	7146	2639	2042	1636	1152
			213510700671		
D-34	7126	1645	1147	2563	2138
				264013140272	
				226533420372	
D-35	7018	2647	2153	1660	1160
D-36	7141	1655	1139	2630	2155
D-37	7240	2771	2147	1664	1056
	713714070872	261113600472			

TABLE X(g)

CURRENT MAGNET ARRANGEMENT AT THE MAIN ACCELERATOR AS OF APRIL 30, 1974

	1	2	3	4	5
D-38	7150	1643	1151	2733	2229
				263211420771	215011430771
D-39	7235	2653	2016	1614	1088
	700313270372		214912381071		
D-42	7145	1649	1075	2626	2237
					214811920971
D-43	7062	2808	2151	1642	1146
		264915250174			
D-44	7203	1532	1145	2652	2244
	711910190571				215212010971
D-45	7274	2655	2159	1586	1158
	714015161273				
D-46	7103	1641	1153	2650	2144
D-47	7024	2803	2157	1646	1062
		265714820773			
D-48	4038	0	1155	1721	1159
				165311570871	
D-49	0	4039	4043	4050	7153

TABLE X(h)

CURRENT MAGNET ARRANGEMENT AT THE MAIN ACCELERATOR AS OF APRIL 30, 1974

DOUBLETS AT THE LONG STRAIGHT SECTIONS ARE ADDRESSED AS FOLLOW:
A10-2(7-FT), A10-3(4-FT), A10-4(4-FT), A10-5(4-FT),
A49-2(4-FT), A49-3(4-FT), A49-4(4-FT), A49-5(7-FT), ETC.

CODES FOR REMOVED MAGNETS, STARTING FROM LEFT :
MAGNET NUMBER(4), FAILURE MODE(1), REFERENCE NUMBER(3), DATE(4)

FAILURE MODES : 1 = SHORT OR HI-POT, 2 = VACUUM LEAK, 3 = CONVENIENCE,
4 = TURN-TURN SHORT, 5 = DOUBLET MATE (CONVENIENCE)

	1	2	3	4	5
E-10	0	7241 716360200571	4075 402810200571 405564290173	4025	4036
		716314290173			
E-11	0	2678	2182	2736 267411760871	2054
E-12	4005	2663	2173	1648	1162
E-13	7092	1651	1157	2755 266213050272	2170
E-14	7158	2735 265911610871	2179	1747 164013200372	1164
E-15	7198 710810170571	1647	1163	2672	2172
E-16	7009	2532 267313550472	2263 219313180372	1654	1170
E-17	7172	0	0	2669	2265 217520050471 256333410372
E-18	7175	2584	2183	1783 165214810773	1154
E-19	7173	1789 165915270274	1089	2676	2178
E-21	7169	2804 267715021073	2171	1650	1168
E-22	7236 717813280372	1559	1169	2664	2166
E-23	7005	2675	2298 217713170372 226714340273	1773 155414430473	1174
E-24	7215 716811820871	1657	1230 116711750871 104712401071	2660	2176
E-25	7106	2679	2191	1662	1237 117613160372
E-26	7188	1661	1165	2767 265413110272	2154
E-27	7029	2796 268115031073	2062 213910250571	1558	1172
E-28	7170	1663	1171	2618	2168
E-29	7030	2727 266113870772	2063 212310210571	1670	1084
E-32	7177	1794 166715340374	1071	2620	2184
E-33	7160	2601	2169	1722 165811600871	1049 104210980671 118110990671
E-34	7184	1669	1241 108714300273	2716 265812431071	2251 207210270571 271632441071

TABLE X(i)

CURRENT MAGNET ARRANGEMENT AT THE MAIN ACCELERATOR AS OF APRIL 30, 1974

	1	2	3	4	5
E-35	7228	2788	2161	1656	1072
	702513020272	268513120272			
		275614390373			
E-36	7171	1665	1267	2734	2066
			117535111273	266811770871	204411780871
E-37	7227	2535	2318	1674	1066
	716112721171	266711790871	216714960973		
			231215380374		
E-38	7179	1675	1173	2772	2295
				267013400372	210044440473
E-39	7014	2583	2181	1644	1070
E-42	7229	1673	1085	2594	2146
	718112741171				
E-43	7183	2671	2189	1666	1222
					105011940971
E-44	7182	1671	1261	2769	2180
			117710220571	268613660672	
			119314241272		
E-45	7216	2750	2319	1530	1080
	716612771271	268712611071	219914680573		
			230215171273		
E-46	7186	1679	1137	2688	2192
E-47	7001	2739	2288	1668	1235
		266512451071	216514110972		105312861271
E-48	4001	0	1044	1677	1063
E-49	0	4040	4035	4076	7271
				404765300274	715115300274

TABLE X(j)

CURRENT MAGNET ARRANGEMENT AT THE MAIN ACCELERATOR AS OF APRIL 30, 1974

DOUBLETS AT THE LONG STRAIGHT SECTIONS ARE ADDRESSED AS FOLLOW:
A10-2(7-FT), A10-3(4-FT), A10-4(4-FT), A10-5(4-FT),
A49-2(4-FT), A49-3(4-FT), A49-4(4-FT), A49-5(7-FT), ETC.

CODES FOR REMOVED MAGNETS, STARTING FROM LEFT :
MAGNET NUMBER(4), FAILURE MODE(1), REFERENCE NUMBER(3), DATE(4)

FAILURE MODES : 1 = SHORT OR HI-POT, 2 = VACUUM LEAK, 3 = CONVENIENCE,
4 = TURN-TURN SHORT, 5 = DOUBLET MATE (CONVENIENCE)

	1	2	3	4	5
F-10	0	7156	4049	4033	4030
F-11	0	2598 268411350771	2227 205011360771	2682	2186
F-12	4004	2765 269313290372	2271 219511020771 272933310372	1672	1182
F-13	7153	1695	1043 170310440671 151133740772	2690	2174
F-14	7149	2691	2262 218710960671 269213430372 269233440372	1763 157810890671 169443760772	1189 117810940671
F-15	7208 714711010771	1685	1248 108313560472	2511 269210840671	2322 219610950671 221844760673 230515400474
F-16	7026	2695	2303 218514780773	1676	1179
F-17	7212 715211390771	0	0	2683	2241 207110110571 207710820671 208712781271
F-18	7202 712210160571	2689	2203	1510 168812751271	1127
F-19	7051 715912581071	1587	1161	2579 270412731171	2260 218811030771 272733770772
F-21	7165	2544 269911880971	2076 220110570671	1769 154013860772	1187
F-22	7187	1687	1208 118910770671	2752 268013100272	2190
F-23	7008	2807 270115081273	2207	1680	1185
F-24	7200 719435230174	1524 168910790671	1253 107914100972	2694	2162
F-25	7174	2697	2197	1684	1266 118410080571 119214380373
F-26	7194 719010720671 720035240174	1683	1046 118110850671	2696	2160
F-27	7028	2777 256114171072	2163	1686	1234 118612880172
F-28	7176	1691	1195 221310230571	2531 269810830671	2194

TABLE X(k)

CURRENT MAGNET ARRANGEMENT AT THE MAIN ACCELERATOR AS OF APRIL 30, 1974

	1	2	3	4	5
F-29	7011	2715	2205	1690	1274
		257510090571			154430360671
					120113530472
					125114850773
F-32	7180	1693	1057	2700	2198
			256510560671		
F-33	7167	2705	2211	1696	1275
					118834050872
					125834270173
					126414860873
F-34	7094	1681	1269	2702	2200
	703433380372		254513000272		
			124444830773		
F-35	7006	2547	2202	1710	1007
				159210120571	169430910671
F-36	7263	1551	1247	2576	2188
	715710150571		250910920671		216411380771
	719734450473		253233350372		
F-37	7251	2703	2287	1692	1199
	719314251272		206410930671		169810240571
			255233780772		170830370671
F-38	7192	1787	1252	2793	2259
		169914990973	251033360372	270811340771	207814360273
				273214370373	
F-39	7007	2806	2210	1678	1257
		270714950973			154613450372
					175433470372
F-42	7243	1777	1183	2706	2204
	716413300372	159310100571			
	704714080872	170744900973			
F-43	7189	2811	2293	1754	1198
		270915151273	205211040771	154212511071	170030380671
			250933790772	172813590472	
F-44	7223	1774	1279	2710	2289
	712113030272	169715131273	100432681171		220614160372
			122515091273		
F-45	7231	2711	2209	1768	1254
	713112791271			170233610572	116611000671
				125833830772	150933820772
F-46	7252	1701	1233	2763	2208
	714814260173		100332691171	221233370372	
F-47	7032	2746	2067	1790	1245
		255512491071		156011110771	107811120771
				157815141273	102514330273
F-48	4003	0	1277	1709	1191
			100234510473	152910130571	
			126934750673		
F-49	0	4014	4012	4017	7071

TABLE X(1)