An attempt is made in the attached data sheets to draw together the basic descriptions and parameters of standard hardware in use in Fermilab experimental areas. The primary user envisaged is the physicist involved in beam transport calculations, design of experiments and beam tuning. The parameters chosen for display reflect this orientation.

Ideally excitation curves would be long coil measurements, $\frac{\int Bdl}{L}$ for dipoles or $\frac{\int Gdl}{L}$ for quadrupoles. These curves are not available in every case. The nearest approximation to the ideal have been included where the long coil measurements are not available. Wherever possible references are included to the sources of the data displayed.

This initial version of the report covers the most common dipoles and quadrupoles in use in the experimental areas. Subsequent revisions will extend to analysis magnets, more specialized magnets, power supplies, and auxiliary devices as sheets become available.

The "author" is merely a compiler of the work of many people. No credit is claimed other than the credit for mistakes, omissions, etc. Comments, corrections, etc. would be helpful in producing a more useful document.
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B. References
5-1.5-240
MAIN RING B-1 DIPOLE

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
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<tbody>
<tr>
<td>Design Field</td>
<td>1.788 T</td>
</tr>
<tr>
<td>Power (dc)</td>
<td>133 kW</td>
</tr>
<tr>
<td>Current</td>
<td>4.750 kA</td>
</tr>
<tr>
<td>Voltage</td>
<td>28.1 V</td>
</tr>
<tr>
<td>Transfer Constant</td>
<td>2.589 T/kA</td>
</tr>
<tr>
<td>Inductance</td>
<td>6.47 mH</td>
</tr>
<tr>
<td>Gross Weight</td>
<td>11727 kg</td>
</tr>
<tr>
<td>Water Flow</td>
<td>3066 liters/hr</td>
</tr>
<tr>
<td>Pressure Differential</td>
<td>13.71 kg/cm²</td>
</tr>
</tbody>
</table>
5-1.5-240
B-1 DIPOLE

\[ I(\text{kA}) = 2.469 \frac{SB \cdot dl}{L} \left( \frac{T \cdot m}{m} \right) \]

L = physical core length = 6.071 m

Current (kA)
4-2-240
MAIN RING B-2 DIPOLE

Design Field
Power (dc) 1.788 T
Current 162 kW
Voltage 4.750 kA
Transfer Constant 34.0 V
Inductance 2.589 T/kA
Gross Weight 7.95 mH
Water Flow 11455 kg
Pressure Differential 3406 liters/hr

13.71 kg/cm²
$I (kA) = 2.469 \frac{\int B \cdot dl}{L} (T \cdot m)$

$L = \text{physical core length} = 6.071 \text{ m}$
## EPB DIPOLE

### Specifications

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
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<tbody>
<tr>
<td>Design Field</td>
<td>1.5 T</td>
</tr>
<tr>
<td>Power (dc)</td>
<td>50 kW</td>
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<tr>
<td>Current</td>
<td>1.688 kA</td>
</tr>
<tr>
<td>Voltage</td>
<td>29.5 V</td>
</tr>
<tr>
<td>Transfer Constant</td>
<td>1.0 T/kA</td>
</tr>
<tr>
<td>Inductance</td>
<td>30.0 mH</td>
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<tr>
<td>Gross Weight</td>
<td>2558.3 kg</td>
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<tr>
<td>Water Flow</td>
<td>1072 liters/hr</td>
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<tr>
<td>Pressure Differential</td>
<td>7.03 kg/cm²</td>
</tr>
</tbody>
</table>

### Dimensions

- **Core**: 40.6 cm
- **Coil to Coil**: 3.048 m
- **Endpack to Endpack**: 3.17 cm
- **VAC. TUBE (INT. DIM.)**: 12.45 cm

---

**Diagram:**

- A diagram showing the dimensions of the EPB DIPOLE, including core and coil measurements.
### Design Field Parameters

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
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</thead>
<tbody>
<tr>
<td>Power (dc)</td>
<td>47.1 kW</td>
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<tr>
<td>Current</td>
<td>0.975 kA</td>
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<td>Voltage</td>
<td>48.4 V</td>
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<tr>
<td>Transfer Constant</td>
<td>1.5385 T/kA</td>
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<tr>
<td>Inductance</td>
<td>153 mH</td>
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<tr>
<td>Gross Weight</td>
<td>10,236 kg</td>
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<tr>
<td>Water Flow</td>
<td>3200 liters/hr</td>
</tr>
<tr>
<td>Pressure Differential</td>
<td>14.1 kg/cm²</td>
</tr>
</tbody>
</table>

![Beam Line Dipole Diagram](image-url)
$I (\text{kA}) = 0.195 \int B \cdot dl \ (\text{T} \cdot \text{m})$

de:

- $\int B \cdot dl \ (\text{T} \cdot \text{m})$
VERNIER DIPOLE

Design Field
Power (dc)
Current
Voltage
Transfer Constant
Inductance
Gross Weight
Water Flow
Pressure Differential

0.4 T
9 kW
0.18 kA
50 V
0.4 T/kA
mH
462 kg
1454 liters/hr
6.3 kg/cm²

Note: Drawn double the scale of other data sheet magnets.
3Q52
MAIN RING QUADRUPOLE

Design Field Gradient
Power (dc)
Current
Voltage
Transfer Constant
Inductance
Gross Weight
Water Flow
Pressure Differential

25 T/m
56 kW
4.630 kA
12.1 V
3.12 T/m/kA
0.8 mH
2722 kg
1340 liters/hr
14.06 kg/cm²

CORE
L 7.620 cm dia circle
POLE TO POLE
VAC. TUBE I.D.
3Q52
MAIN RING QUADRUPOLE

(T/m)

0 5.0 10.0 15.0 20.0 25.0 30.0 35.0

Current (kA)

0 1.0 2.0 3.0 4.0 5.0 6.0 7.0

11-4-75
### MAIN RING QUADRUPOLE

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
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<tbody>
<tr>
<td><strong>Design Field Gradient</strong></td>
<td>25 T/m</td>
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<tr>
<td><strong>Power (dc)</strong></td>
<td>96.5 kW</td>
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<tr>
<td><strong>Current</strong></td>
<td>4.630 kA</td>
</tr>
<tr>
<td><strong>Voltage</strong></td>
<td>20.8 V</td>
</tr>
<tr>
<td><strong>Transfer Constant</strong></td>
<td>3.12 T/m/kA</td>
</tr>
<tr>
<td><strong>Inductance</strong></td>
<td>1.3 mH</td>
</tr>
<tr>
<td><strong>Gross Weight</strong></td>
<td>4082 kg</td>
</tr>
<tr>
<td><strong>Water Flow</strong></td>
<td>1522 liters/hr</td>
</tr>
<tr>
<td><strong>Pressure Differential</strong></td>
<td>14.06 kg/cm²</td>
</tr>
</tbody>
</table>

### Dimensions
- **Core**: 44.7 cm x 31.9 cm
- **Coil**: 2.133 m x 57.7 cm
- **Coil to Coil**: 2.195 m
- **Pole to Pole**: 7.620 cm dia circle
- **Vac. tube I.D.**: 7.620 cm
3Q84
MAIN RING QUADRUPOLE

(T/m)

Current (kA)
3Q120
EPB QUADRUPOLE

Design Field Gradient
Power (dc)
Current
Voltage
Transfer Constant
Inductance
Gross Weight
Water Flow
Pressure Differential

18.898 T/m
24.1 kW
0.104 kA
234 V
$5.3848 \times 10^3$ T/m/kA
1500 mH
3125.25 kg
681.4 liters/hr
5.78 kg/cm²
$I(kA) = 5.3848 \times 10^{-3} G(T/m)$
4Q120
BEAM LINE QUADRUPOLE

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
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</thead>
<tbody>
<tr>
<td>Design Field Gradient</td>
<td>21.65 T/m</td>
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<tr>
<td>Power (dc)</td>
<td>50.3 kW</td>
</tr>
<tr>
<td>Current</td>
<td>1.175 kA</td>
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<tr>
<td>Voltage</td>
<td>42.8 V</td>
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<tr>
<td>Transfer Constant</td>
<td>1.8431 T/m/kA</td>
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<tr>
<td>Inductance</td>
<td>74.4 mH</td>
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<tr>
<td>Gross Weight</td>
<td>11863.6 kg</td>
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<tr>
<td>Water Flow</td>
<td>1455.87 liters/hr</td>
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<tr>
<td>Pressure Differential</td>
<td>7.031 kg/cm²</td>
</tr>
</tbody>
</table>

[Diagram of 4Q120 Beam Line Quadrupole]
4Q120
BEAM LINE QUADRUPOLE

per John Elias
3Q60
5 FT. EPB QUADRUPOLE

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Design Field Gradient (dc)</td>
<td>18.898 T/m</td>
</tr>
<tr>
<td>Power</td>
<td>12 kW</td>
</tr>
<tr>
<td>Current</td>
<td>0.104 kA</td>
</tr>
<tr>
<td>Voltage</td>
<td>117 V</td>
</tr>
<tr>
<td>Transfer Constant</td>
<td>5.38 x 10^{-3} T/m/kA</td>
</tr>
<tr>
<td>Inductance</td>
<td>1630 mH</td>
</tr>
<tr>
<td>Gross Weight</td>
<td>1630 kg</td>
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<tr>
<td>Water Flow</td>
<td>3.40 liters/hr</td>
</tr>
<tr>
<td>Pressure Differential</td>
<td>5.78 kg/cm²</td>
</tr>
</tbody>
</table>
3Q60
5 FT. EPB QUADRUPOLE

\[ I(\text{kA}) = 5.3848 \times 10^{-3} G(\text{T/m}) \]
Design Field
Power (dc) 1.8 T/m
Current 232 kW
Voltage 2.7 kA
Voltage 86 V
Transfer Constant 1.58 T/kA
Inductance mH
Gross Weight 46266 kg
Water Flow 5724 liters/hr
Pressure Differential 248 kg/cm²

Note: Data for 20.3 cm gap
$I(kA) = 1.581 B(T)$

from: Akerlof
References

5-1.5-240 Main Ring B1 Dipole and 4-2-240 Main Ring B2 Dipole


5-1.5-120 EPB Dipole


6-3-120 Beam Line Dipole

1. TM-607 (2920) "Field Measurements on a 6-3-120 Dipole Magnet", D. Krause and G. Koizumi, August 26, 1975.

3. Assembly Drawing: 2220.100-ME-27730 dated 2-6-74.


4-4-30 Vernier Dipole

1. Data Sheet: F. Mallie.


3Q52 4-foot Main Ring Quadrupole and 3Q84 7-foot Main Ring Quadrupole


3. Data Sheet: 3Q52, EN7027 (2220.0) W. Nestander, Revised November 15, 1972.

4. Data Sheet: 3Q84, EN7027 (2220.0) W. Nestander, Revised November 15, 1972.

5. Assembly Drawing: 3Q52, 0424.12-ME-14928 dated 12-14-70.

6. Assembly Drawing: 3Q84, 0424.11-ME-14927 dated 12-14-70.

3Q120 EPB Quadrupole and 3Q60 5-foot EPB Quadrupole


5. Assembly Drawing: 0624-ME-19414 dated 4-4-70.

References (continued)

4Q120 Beam Line Quadrupole

1. Data Sheet: S. Snowdon, Revised 10-28-74.


BM109 Analysis Magnet


2. Data Sheet: J. O'Meara, Revised August 1, 1975.


4. Engineering Note: "B/I for 24 x 8 x 72 Bending Magnet (El Cheapo)", R. McCracken, August 21, 1972.