MFR – Electronic Components Pvt. Ltd.

DYNAMIC BRAKING RESISTORS

Dynamic braking is the simplest and very widely used method of braking a load driven through a d.c motor as it involves no wear and tear unlike with mechanical brakes. For dynamic braking, the motor armature us closed on a suitably designed Dynamic Braking Resistor (DBR), while the motor field remains energized. The kinetic energy stored in motor and load gets dissipated in the DBR and the system comes to a halt within a few seconds.

Calculation for selection of Dynamic Braking Resistance

When the motor is braked it is desired that it comes to a halt in minimum possible time. Hence the ohmic value of DBR is selected such that it causes maximum braking current at the instant of starting the braking. This maximum braking current depends on the overload capacity of the motor.

Ohmic value of DBR is $R = \frac{V_r}{I_p}$

Where V_r is motor armature rated voltage and I_p is maximum permissible current.

Generally I_p can be considered as twice the value of motor armature rated current. Dynamic braking starts with maximum current and falls exponentially with time, while the field current is maintained constant. The armature voltage and motor speed also decay exponentially. Refer Figure 1. The time constant r of this decay is given by **Fig.1**

The motor comes to a halt in a time period equal to approximately twice this time constant since the friction also aids the braking process. In practice it is found that for most of the applications r is less than 5 seconds and hence dynamic braking period is less than 10 seconds. The DBR must be designed such that it can carry the braking current till the motor comes to a halt.

Design of DBR

The foregoing information helps you in calculating the parameters required for the design of DBR. After the above calculation, the following parameters should be specified.

a) R – ohmic value of the resistance required
b) I_p – Maximum current through DBR

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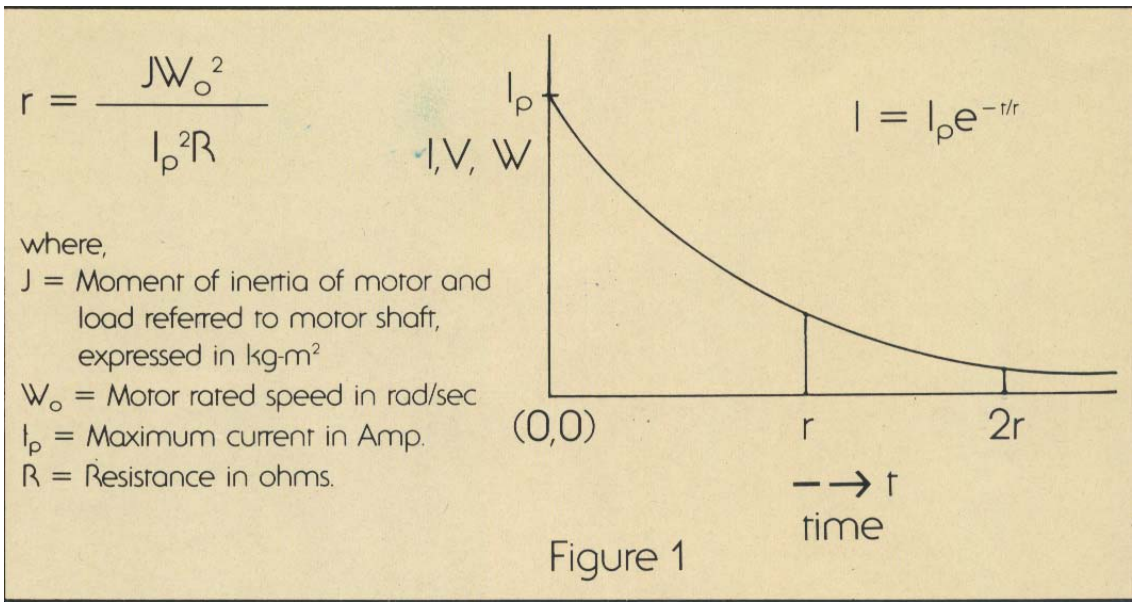

Figure 1

c) Dynamic Braking period – when this is less than 10 seconds (as is normally the case), it need not be specified.
d) V_r – Motor armature rated voltage – this is required for designing the insulation resistance. If V_r is less than 500 volts, it need not be specified.

The DBR is designed for based on the above data. It is built from our standard sub-assemblies to suit individual requirement as detailed below.

Construction of DBR

The DBR is constructed out of stainless steel grid resistors (for medium and high ratings) or wire wound resistors (for low ratings).

Grid Resistors: These are made out of stainless steel wire or suitable diameter bent to form a grid **(Figure 2)** of standard dimension. The required number of grids are put in series to give desired resistance. This assembly is supported through a mica insulated steel rod with mica washers, which separate the grids. Refer figure 3. This assembly, known as stack, has two steel endframes for mounting it on the panel or steel rod is bolted directly to the two sides of a box. The terminals are brought out suitably for external connection. This entire assembly has the advantage of lightness, compactness and high mechanical strength. The high resilience of the material makes it suitable for applications where the equipment is subjected to vibration.

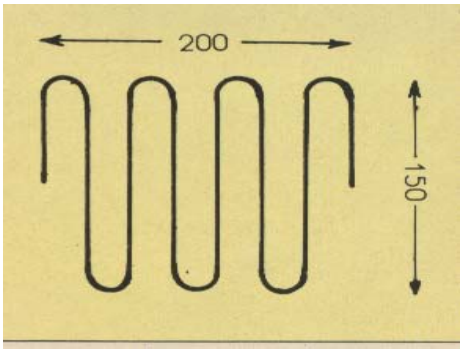

Fig 2 Typical Single grid

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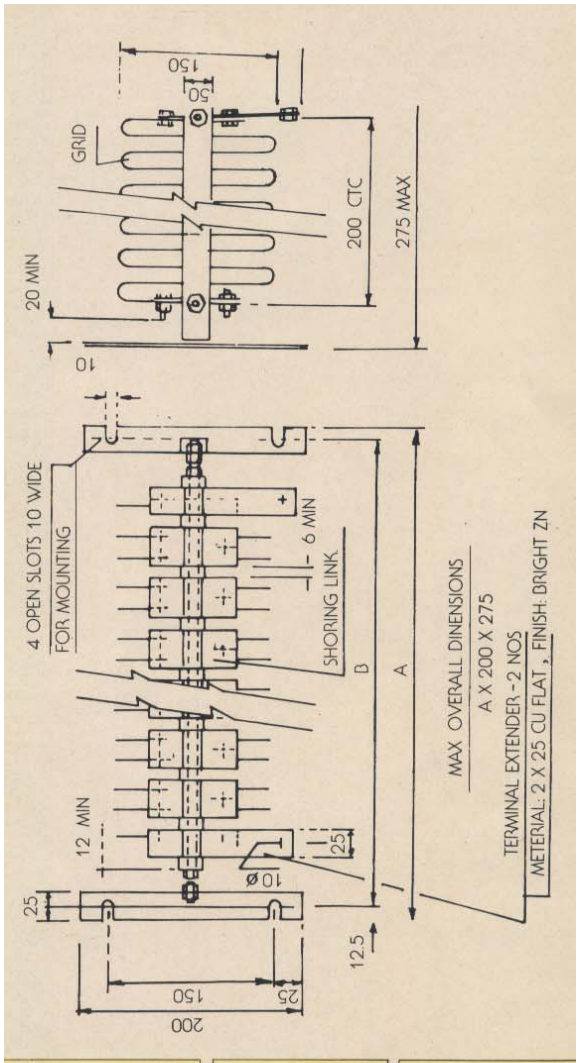
Wire Wound Resistors: These are our standard resistors made out of continuous wire of suitable gauge, wound on a grooved ceramic base. Refer figure 4.

The number of grids to be put in series or the number of wire wound resistors tubes to be put in series to have the desired resistance can be determined from the tables of Figure 5 and 6. The dimensions of the resistance stack depends on the number of grids as shown in figure3. For higher peak currents the stacks can be paralleled.

DBR with Enclosure

DBR can be supplied loose as described above or in a separate enclosure. There are difference sizes of enclosures depending on the number of grids per stack and number of stacks. These are shown in fig.7 along with dimensions. The normal enclosures protection class id IP21. We can also supply protection class IP31 and IP41. A removable bottom plate is provided for making holes for fixing glands for cable entry. The recommended cable rating is 25% of the value of $I_{p.}$ Bigger size enclosures are offered against enquiry. For wire wound resistors, enclosures is supplied as per requirement.



No. of Grids	A (mm)	B (mm)
12	360	385
16	460	485
20	560	585

Fig.3 –Stack of Grid Resistors and Dimensions

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Variations from Standard design:

1. The current ratings given in fig 5 and 6 hold true for dynamic braking time up to 10 seconds. For higher dynamic braking period, I_p permitted for each resistor would be less.
2. It is presumed that dynamic braking is not applied very frequently i.e the time gap between 2 successive dynamic braking operations is sufficient that DBR cools down to ambient temperature. This time gap depends on DBR rating but generally lies within a range of 5 to 20 minutes. In case an application requires dynamic braking at shorter intervals, the interval and no. of successive dynamic braking operations at such intervals should be specified. Sometimes the repeated operations are required at lower speeds (e.g inching) then the speed (in % of full speed) should also be specified. Dynamic braking at lower speeds is less severe than at full speed.

If your application requires the above variations or any other feature, the same can be offered against enquiry.

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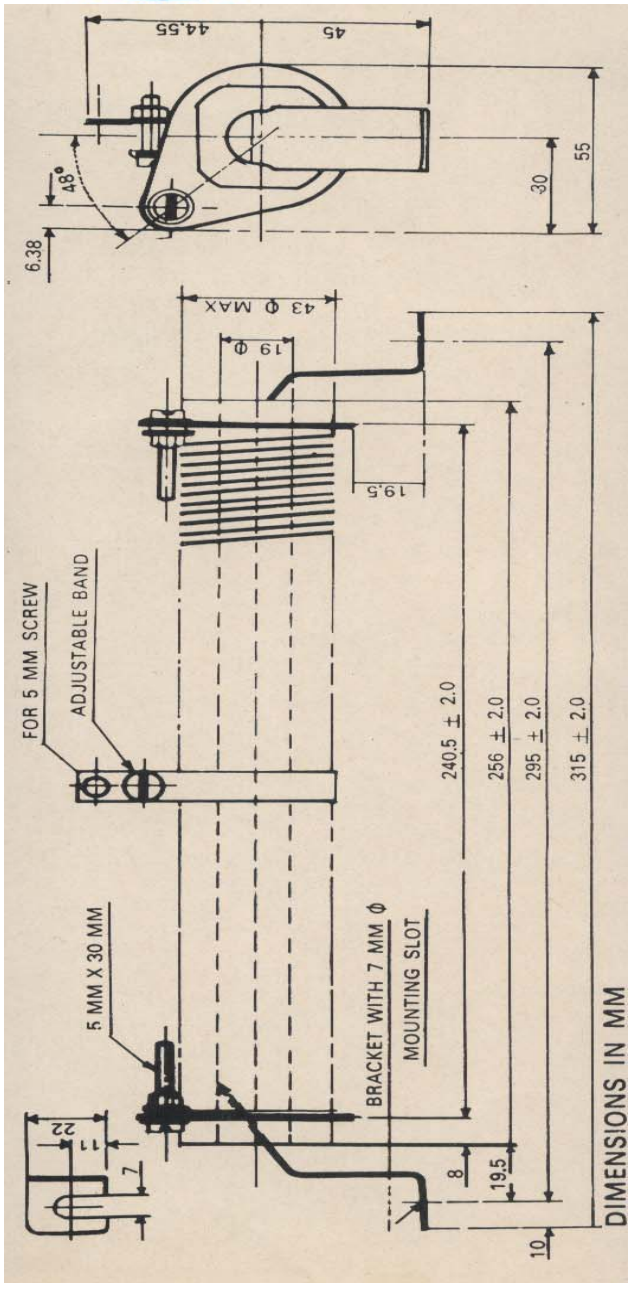

Maximum Current through DBR-I_p (Amps)	Max. Resistance per grid - ohms
717	0.033
618	0.050
528	0.067
442	0.081
365	0.098
296	0.121
234	0.153
179	0.200
132	0.275
95	0.465
60	0.870

Fig 5 – Grid Capacity for dynamic braking period upto 10 seconds

Maximum Current through DBR-I_p (Amps)	Max. Resistance per tube - ohms
72	1.4
56	1.8
43	3.0
35	4.4
28	5.5
21	10.0
15	14.0
11	17.0

Fig. 6 – AA type Wire wound resistor capacity for dynamic braking period upto 10 seconds

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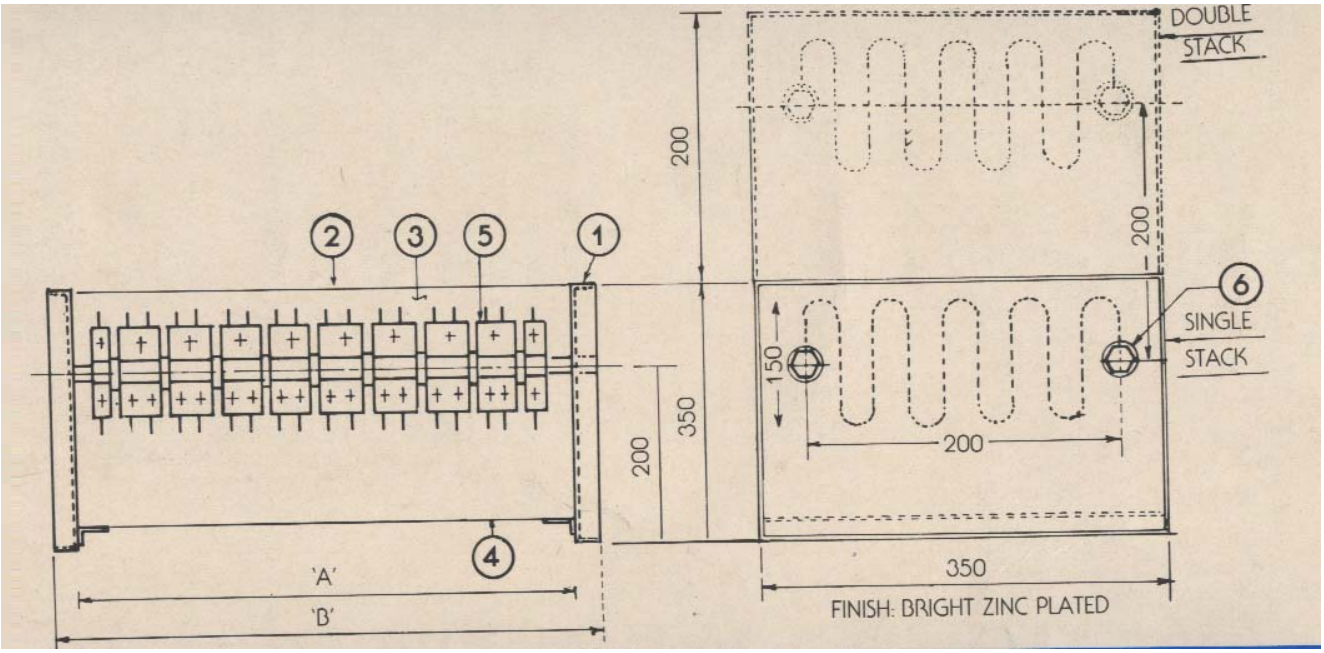

Fig 7 Enclosure for Grid type Resistance

Enclosure Type	No. of Stacks	Maximum No. of Grids per stack	Dimension	
			A	B
PS12X	1	12	360	400
PS16X	1	16	460	500
PS20X	1	20	560	600
PD16X	2	16	460	500
Pd20x	2	20	560	600

Nomenclature

1. Side panel
2. Perforated Top Cover
3. Perforated side cover
4. Perforated bottom cover
5. Resistance wire grids packet
6. Terminals And Tapping

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