Magnetek
Elevator Products

Application Note DSD 412-115

SUBJECT: Selecting Dynamic Braking Resistors for DC Elevator Drives

Dynamic Braking for an SCR type DC elevator drive is used only when the DC loop contactor is opened during mid flight in order to cause an Emergency Stop. The DB resistor does not need to be rated for continuous use as it only needs to absorb the kinetic energy of the moving elevator during an E-Stop, with long cooling times allowed between uses. Choosing a rugged resistor style will allow a large peak power to be dissipated by the resistor, beyond its normal continuous rating. The following guidelines may be used:

Assumptions:

1. All elevators will have similar payload to overall moving mass ratios. This is fairly true for the design of passenger elevators. Payload refers to the rated payload weight of the elevator. Mass refers to the equivalent rotating inertia of all moving masses, or weight, including that of the car/cab, counterweight, ropes, sheave, etc. Larger, high speed passenger elevators may have a larger payload to cab weight ratio, but will also have longer ropes to add more mass.

2. All elevators will have similar desired acceleration and deceleration characteristics and constraints. So there will be similar moving mass to motor strength ratios in order to get the desired accelerations. This too is fairly true, except that low rise, low speed elevators may have less need for aggressive acceleration and deceleration.

DB Resistor Selection

3. During a dynamic brake E-Stop, current flows through motor armature and DB resistance. The highest current will occur at the highest motor speed where CEMF is the highest. This should be limited to 2.5 to 3 times rated armature current. Higher speed elevator motors tend to have a lower % of internal resistance. The external DB Resistor Ohms should be:

   Rdb = Vdc / (K x Idc), Ohms
   Where Vdc = Rated Motor Armature Volts, Idc = Rated Armature Amps, and K = 4 for elevators of up to 600 fpm, 3.2 for 700-800 fpm, and 3 for 900-1,000 fpm.

4. The energy content of the elevator that must be absorbed by the DB resistor during an Emergency Stop is a function of the total moving mass and the square of the velocity. All of the energy will be transferred to the DB resistor in a matter of seconds. But resistors are rated by their continuous power ratings. For an open edge wound coil type power resistor the ratio of peak power to a continuous power rating can be large, often 10 to 50 times. For typical edge wound, 835 watt resistors in a bank of several resistors connected in series/parallel, use the following:

Pw = 1.5 X (Rated Payload) X (Rated Speed) X (Rated Speed) / 1,000,000
Where Pw = Necessary total of continuous watts rating of all individual DB resistors
Rated Payload = Rated Elevator payload in pounds
Rated Speed = Rated Elevator speed in Feet/Minute

5. Now divide the total Pw by the rated watts per resistor (835 watts for the aforementioned open edge wound type) to determine the minimum total number of resistors required.

6. Now calculate individual resistor ohms values according to the desired series/parallel connection arrangement to achieve the desired overall Rdb Ohms as calculated in step 3.

Part Sources

Open element edge wound power resistors are manufactured by Hubbell Industrial Controls, Inc. Consider using their type SSR series, size 3 (610 watts per resistor) or size 4 (835 watts). Business contacts for Hubbell can be found at www.hubble.com.
Ohmite makes a competitive product, POWR-RIB, types 030 and 080.