Post Glover Resistors

Wound Rotor Motor Resistors

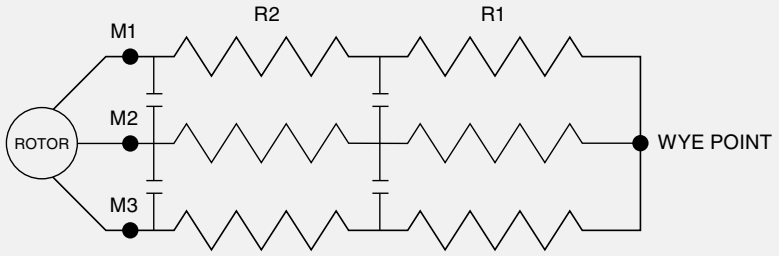
Wound rotor motors, as opposed to AC induction motors, generate the same torque in both forward and reverse. They are commonly used on fans, pumps, conveyors and crane systems.

The motors are rated according to their primary and secondary windings. The primary ratings are given in volts and power (kilowatts), while the secondary ratings are specified in terms of voltage and current (the secondary current is defined by the locked rotor output, verified during testing of the motor.

Resistance Calculation

To calculate the total resistance per phase, the following information is required:

1. Secondary voltage
2. Secondary current
3. The number of speeds/steps required for the application. The number of steps is the actual number of resistor stages to be switched through, whereas the number of speeds is the number of steps plus one (the "extra" speed being no resistors at all in the circuit.)
4. Duty class, according to NEMA
5. Starting torque, (which can also be specified as the last digit of the classification number.)



2 STEP / 3 SPEED

Formula for Total Resistance

Rtot = Secondary Voltage / (Secondary Current x 1.713 x Percentage Starting Torque)

The total resistance is then divided into the requisite number of steps. The size is not uniform to allow for smooth transitions of motor speed as the load's inertia changes. The most common breakdowns are given below, with the first step being that closest to the secondary AC power source and then moving progressively toward the motor.

The amperage associated with each step is determined by the amount of current seen by the individual steps, as dictated by how long they are left in the circuit and by the duty class of the motor. These values listed below are percentages of the rated secondary current. As a general rule, pumps, fans and conveyor systems are Class 130, while crane systems can be Class 160, 170 or 190.

One note concerning the secondary current: if the starting torque is greater than 100%, remember to also use this factor in sizing the individual resistor steps. For example, if the starting torque is 150% of nominal, the amperage used for designing the resistor sizes will be 1.5 times the rated secondary current of the motor.

NEMA Classification of Resistors

The following table is for selecting the NEMA Class for an application in relation to starting torque and duty cycle.

Approximate Percent of Full-Load Current on First Point Starting @ Rest	Class Numbers Applying to Duty Cycles							
	30 sec. on Out of each 15 min.	5 sec. on Out of each 80 sec.	10 sec. on Out of each 80 sec.	15 sec. on Out of each 90 sec.	15 sec. on Out of each 60 sec.	15 sec. on Out of each 45 sec.	15 sec. on Out of each 30 sec.	Continuous Duty
25	101	111	131	141	151	161	171	91
50	102	112	132	142	152	162	172	92
70	103	113	133	143	153	163	173	93
100	104	114	134	144	154	164	174	94
150	105	115	135	145	155	165	175	95
200 or over	106	116	136	146	156	166	176	96

NEMA Resistor Application Standards

APPLICATION	NEMA CLASS
Blowers	
Centrifugal	133-93
Constant Pressure	135-95
Brick Plants	
Augers, Conveyors,	135
Dry Plans, Pug Mills	
By-product Coke Plants	
Door Machine, Leveler Ram,	153
Pusher Bar, Valve Reversing Machines	
Cement Mills	
Conveyors	135
Crushers	145
Elevators	135
Rotary Dryers	145-95
Grinders and Pulverizers	135
Kilns	135-95
Coal and Ore Bridges	
Bridge	153
Closing, Holding	162
Trolley	162 or 163
Coal Mines	
Car Hauls	162
Conveyors	135 or 155
Cutters	135
Crushers	145
Fans	134 or 95
Hoists	
Slope	172
Vertical	162
Jigs, PickingTables	135
Rotary Car Dumpers	153
Shaker Screens	135
Compressors	
Constant Speed	135
Varying Speed	
Centrifugal	93
Plunger Type	95
Concrete Mixers	135
Cranes-General Purpose	
Hoist	153-163
Bridge or Trolley with	
Sleeve Bearings	153-163
Roller Bearings	152-162
Flour Mills	
Line Shafting	135

APPLICATION	NEMA CLASS
Food Plants	
Butter Churns, Dough Mixer	135
Hoists	
Winch	153
Mine Slope	172
Mine Vertical	162
Contractor's Hoists	152
Larry Cars	153
Lift Bridges	152
Machine Tools	
Bending Rolls	163 or 164
Boring Mills	135
Bulldozers	135
Drills, Gear Cutters	115
Grinders	135
Hobbing Machines, Lathes	115
Milling Machines	
Presses, Punches	135
Saws, Shapers	115
Metal Mining	
Ball, Rod and Tube Mills	135
Car Dumpers-Rotary	153
Converters-Copper	154
Crushers	145
Conveyors	135
Tilting Furnace	153
Paper Mills	
Beaters	135
Calenders	154-92
Chippers	145
Pipeworking	
Cutting and Threading	135
Expanding and Flanging	135-95
Power Plants	
Clinker Grinders	135
Coal Crushers	135
Conveyors	
Belt,Screw	135
Pulverized Fuel Feeders	135
Pulverizers	
Ball Type	135
Centrifugal	134
Stokers	135-93
Pumps	
Centrifugal	134-93
Plunger	135-95

APPLICATION	NEMA CLASS
Rubber Mills	
Banbury, Crackers	135
Calenders	155
Mixing Mills, Washers	135
Steel Mills	
Accummulators	153
Casting Machines-Pig,	153
Charging Machines	
Bridge	153 or 163
Peel	153 or 163
Trolley	153 or 163
Coiling Machines	135
Converters-Metal	154
Conveyors	135-155
Crushers	145
Furnace Door, Gas Valves,	155
Gas Washers	
Hot Metal Mixers	163
Ingot Buggy, Kickoff,	153
Levelers	
Manipulator Fingers	153 or 163
Pickling Machine,	153
Pilars-Slab, Racks	
Reelers	135
Saws-Hot or Cold	155
Screw Downs	153 or 163
Shears, Shuffle Bars	155
Side Guards	153 or 163
Sizing Rolls, Slab Buggy,	155
Soaking Pit Covers	
Straighteners	153
Tables	
Approach	153
Lift	153 or 163
Main Roll	153 or 163
Roll	153
Shear Approach	153 or 163
Transfer	153
Tilting Furnace	153
Wire Stranding Machine	153
Woodworking Plants	
Boring Machines, Lathe,	115
Mortiser, Moulder, Planers, Power Trimmer and Mitre, Sanders, Saws, Shapers, Shingle Machine	

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