

Adjustable Speed Motors are normally shunt wound and are operated at various speeds by varying a resistance connected in series with the motor field. A maximum range of speed of about 5 to 1 can be obtained by this means. Rated speed regulation is 22 per cent for motors of this type from 2 to 5 hp; 15 per cent is standard in larger sizes. The *NEMA* practice on rating adjustable speed d-c motors is defined in the Glossary at the end of the chapter.

The control for the adjustable speed motor consists of the addition of a field rheostat for speed control to the equipment specified for the constant speed motor.

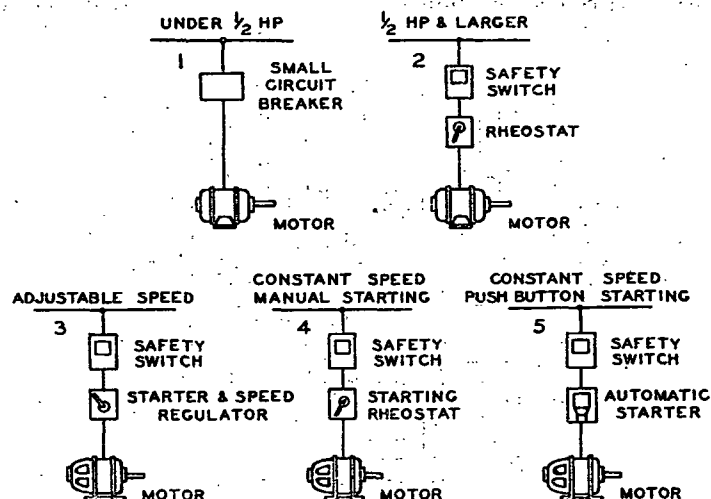


FIG. 2. RECOMMENDED CONTROLS FOR d-c MOTORS.

Adjustable Varying Speed * Motors are d-c motors in which the speed is varied by the addition of resistance in series with the armature. The speed of the motor by this means is always less than the rated full field speed and varies widely with a change in load, especially with high series resistance. Fig. 3 illustrates typical speed characteristics of this type of motor for different values of armature resistance.

The addition of series resistance in the armature circuit reduces the motor speed by lowering the voltage on the armature. At one-half speed the voltage is approximately one-half of line voltage. Consequently, with rated full load current the power delivered by the motor will be only one-half of the maximum, e.g., it will be 5 hp from a 10 hp motor, because the other 5 hp will be lost in the resistance. It is, therefore, evident that the efficiency of the motor is reduced at reduced speeds due to the loss in the resistor.

Control for the adjustable varying speed motor is similar to that for the constant speed motor with the exception that the starting resistor

*Refer to Glossary at end of chapter

Typical Specifications for d-c Motors

Hp, _____ RPM, {Constant Adjustable Varying} Speed, {Shunt Compound Series} Wound, {115 230 600} Volts
 d-c Motors For Driving _____ Motor Shall Be Arranged For _____ (Application)
 {Horizontal Vertical} Mounting And Shall Be Provided With A _____ (Open, Splashproof, etc.)
 Type Of Enclosure, *NEMA* {Class A Class B} Insulation, And {Ball Sleeve} Bearings.

Typical Specifications for d-c Motor Control

Control For {Constant Adjustable Varying} Speed d-c Motors Shall Be {Manual Magnetic} And Shall
 Consist of a {Safety Switch Circuit Breaker} And an Enclosed Controller Providing Overload Protection [And Low Voltage {Protection Release}].

Typical Specifications for Squirrel-Cage Motors

Hp, _____ RPM, {25 60} Cycles, {208 220 440 550} Volts, {2 3} Phase,

Squirrel-Cage Induction Motors of the *NEMA*

{Class A—Normal Starting Torque, Normal Starting Current
 Class B—Normal Starting Torque, Low Starting Current
 Class C—High Starting Torque, Low Starting Current
 Class D—High Slip} Type

Driving _____ Motor Shall Be Arranged For {Horizontal Vertical} Mounting
 (Application)
 And Shall Be Provided With A _____ Type of Enclosure, *NEMA*
 (Open, Splashproof, etc.)
 {Class A Class B} Insulation, And {Sleeve Ball} Bearings.

must be designed for speed regulating duty which means that it must be capable of carrying the motor current continuously. Speed controllers are available both for constant torque applications and varying torque drives, such as required by fans, in which the torque is reduced considerably at reduced speed.

The **Adjustable Voltage** type of speed control is also often known as the variable voltage or Ward-Leonard system. For machines requiring a wide range in speed control and a large number of steps of control this type of system is used most extensively. The drive consists of one or more d-c motors, the armatures of which are supplied with power from a d-c generator and the fields of all machines are excited from a constant voltage exciter. A schematic diagram of connections for an adjustable voltage drive is shown in Fig. 4. In most cases the d-c generator is a part of a three-unit set including a constant speed a-c driving motor, and a constant voltage exciter. As the voltage on the generator and consequently on the d-c motor or motors is adjusted by a rheostat in the