almost entirely by inrush current limitations. The starting torque of all motors varies with the starting current and it is therefore necessary to insure that the motor is supplied with sufficient current to develop enough torque to accelerate the load.

In present practice overload protection of motors is obtained by use of thermal overload inverse time limit type protection. The usual setting of such protection devices is not to exceed 125 per cent of rated full load current for open 40 C rise motors, and not to exceed 115 per cent of rated full load current for all other motors, the element tripping after a definite interval of time. The National Electrical Code requires the addition of fuses or circuit breakers to protect the overload elements from severe short circuit currents.

Two types of protection are available against low voltage at the motor terminals. One type, called low voltage release, permits the motor line contactor to drop out on low voltage and to close again when the voltage returns to normal, thereby restarting the motor when the abnormal condition is ended. The second type, called low voltage protection, causes the motor line contactor to drop out on low voltage, but prevents restarting when the voltage returns to normal except by the action of an operator. This latter type of protection is desirable where it is necessary for the operator to make initial starting adjustments on the machine.

Manual control for an alternating or a direct current motor is usually located near the motor. When so located an operator must be present to start and stop or change the speed of the motor by operating the control mechanism. Manual control is sometimes employed only as a device to give overload protection and another device is employed to start and stop the motor. Manual control is used particularly on small motors which operate unit heaters, small blowers, and room coolers in an air conditioning system. In other cases manual control in the form of drums, when used with multi-speed motors, is only used as a speed setting device, while the starting and stopping functions operate automatically through thermostats and pressure switches.

Because of the increasing complexity of air conditioning systems, the equipment is operated preferably by automatic control, and less dependence is placed on manual operation and regulation.

Automatic control of motor starters may be accomplished by the use of remote push button stations, by a thermostat, float switch, pressure regulator, or other similar pilot devices. An added advantage of automatic control is that the main wiring for the starter may be installed near the motor, while the starter may be operated by a control device located elsewhere.

TYPICAL MOTOR AND CONTROL SPECIFICATIONS

Specification A. Typical Specifications for d-c Motors

......Hp, ...RPM, $\left\{\begin{matrix}\text{Constant}\\\text{Adjustable}\\\text{Varying}\end{matrix}\right\}$ Speed, $\left\{\begin{matrix}\text{Shunt}\\\text{Compound}\\\text{Series}\end{matrix}\right\}$ Wound, $\left\{\begin{matrix}115\\230\\600\end{matrix}\right\}$ Volts d-c Motors for Driving .... (Application) Motor Shall Be Arranged for $\left\{\begin{matrix}\text{Horizontal}\\\text{Vertical}\end{matrix}\right\}$ Mounting and Shall Be Provided with a .... (Open, Splashproof, etc.) Type of Enclosure, *NEMA* $\left\{\begin{matrix}\text{Class } A\\\text{Class } B\end{matrix}\right\}$ Insulation, and $\left\{\begin{matrix}\text{Ball}\\\text{Sleeve}\end{matrix}\right\}$ Bearings.

Specification B. Typical Specifications for d-c Motor Control

Control for $\left\{\begin{matrix}\text{Constant}\\\text{Adjustable}\\\text{Adjustable Varying}\end{matrix}\right\}$ Speed d-c Motors Shall Be $\left\{\begin{matrix}\text{Manual}\\\text{Magnetic}\end{matrix}\right\}$ and Shall Consist of a $\left\{\begin{matrix}\text{Safety Switch}\\\text{Circuit Breaker}\end{matrix}\right\}$ and an Enclosed Controller Providing Overload Protection [and Low Voltage $\left\{\begin{matrix}\text{Protection}\\\text{Release}\end{matrix}\right\}$].

Specification C. Typical Specifications for Squirrel-Cage Motors

..................Hp, ...RPM, $\left\{\begin{matrix}25\\60\end{matrix}\right\}$ Cycles, $\left\{\begin{matrix}208\\220\\440\\550\end{matrix}\right\}$ Volts, $\left\{\begin{matrix}2\\3\end{matrix}\right\}$ Phase, Squirrel-Cage Induction Motors of the *NEMA* $\left\{\begin{matrix}\text{Design A—Normal Starting Torque, Starting Current Above } NEMA \text{ Value}\\\text{Design B—Normal Starting Torque, } NEMA \text{ Starting Current}\\\text{Design C—High Starting Torque, } NEMA \text{ Starting Current}\\\text{Design D—High Slip High Starting Torque}\end{matrix}\right\}$ Type** Driving.................. (Application) Motor Shall Be Arranged for $\left\{\begin{matrix}\text{Horizontal}\\\text{Vertical}\end{matrix}\right\}$ Mounting and Shall Be Provided with a..................... (Open, Splashproof, etc.) Type of Enclosure, *NEMA* $\left\{\begin{matrix}\text{Class A}\\\text{Class B}\end{matrix}\right\}$ Insulation, and $\left\{\begin{matrix}\text{Sleeve}\\\text{Ball}\end{matrix}\right\}$ Bearings.

** Refer to section on Alternating Current Motors for explanation of types.

Specification D. Typical Specifications for Wound Rotor Motors

..........Hp, ...RPM, $\left\{\begin{matrix}25\\60\end{matrix}\right\}$ Cycles, $\left\{\begin{matrix}208\\220\\440\\550\end{matrix}\right\}$ Volts, $\left\{\begin{matrix}2\\3\end{matrix}\right\}$ Phase, Wound Rotor Induction Motors for Driving .... (Application) Motor Shall Be Arranged for $\left\{\begin{matrix}\text{Horizontal}\\\text{Vertical}\end{matrix}\right\}$ Mounting and Shall Be Provided with a........................ (Open, Splashproof, etc.) Type of Enclosure; *NEMA* $\left\{\begin{matrix}\text{Class A}\\\text{Class B}\end{matrix}\right\}$ Insulation and $\left\{\begin{matrix}\text{Ball}\\\text{Sleeve}\end{matrix}\right\}$ Bearings.

Specification E. Typical Specifications for Synchronous Motors

..........Hp, ...RPM, ...Per Cent P.F., ...Volts, $\left\{\begin{matrix}2\\3\end{matrix}\right\}$ Phase, $\left\{\begin{matrix}25\\60\end{matrix}\right\}$ Cycles, Synchronous Motors of the $\left\{\begin{matrix}\text{Belted}\\\text{Coupled}\\\text{Engine}\end{matrix}\right\}$ Type for Driving...................... (Application) Motor Shall Be Arranged for $\left\{\begin{matrix}\text{Horizontal}\\\text{Vertical}\end{matrix}\right\}$ Operation and Shall Be Provided with a .... (Open, Splashproof, etc.) Type of Enclosure. Motor Shall Be Capable