

only or for speed regulating duty. Fig. 12 illustrates recommended control practice for wound rotor motors.

Typical specifications for wound rotor motor control are shown on page 642.

Synchronous motor controllers should provide pull-out protection, automatic synchronization or automatic stopping of the motor after pull-out, and insurance of complete starting sequence, as well as overload and low voltage protection. The control may be either magnetic or semi-magnetic at full or reduced voltage. Semi-magnetic starters provide automatic field control but require hand operation for closing the line contactors to start and transfer to full voltage.

In applying reduced voltage starters to synchronous motors it should

TABLE 2. TYPICAL APPLICATION REQUIREMENTS OF SYNCHRONOUS MOTOR DRIVES SHOWING STARTING, PULL-IN AND PULL-OUT TORQUES

APPLICATION		METHOD OF CONNECTING MOTOR TO LOAD	STARTING CONDITIONS	TORQUES			REMARKS
				Start-ing	Pull-in	Pull-Out	
Fans	Exhaust and Ventilating	Coupled or Belted	Usually Loaded	50	60-125	150	WR ² of Fan Must be Considered
	Cycloidal Positive	Coupled or Engine Type	Unloaded	40-60	40-60	150	Two-Speed Motors Sometimes Used
Blowers	Blowing Engines Reciprocating	Engine Type	Unloaded	40	40-60	150	
	Turbo High Speed	Direct Connected or Step Up Gear	Unloaded (Intake Closed)	30	50	150	WR ² of Blower Must be Considered
Compressors	Air	Engine Type	Unloaded	40	40	150	Flywheel Effect Important
	Ammonia and Ammonia Booster	High Speed—Belted Low Speed—Engine Type Occasionally Coupled	Unloaded (By By-Pass)	40	40	150	Flywheel Effect Important
	Freon	High Speed—Belted Low Speed—Engine	Unloaded (By By-Pass)	45	60	150	Flywheel Effect Important
	Gas Reciprocating	High Speed—Belted Low Speed—Engine	Unloaded (By By-Pass)	40	40	150	Flywheel Effect Important

be remembered that, since these motors are started on damper windings and during the acceleration period function similarly to squirrel-cage motors, the starting torque varies as the square of the applied voltage. Consideration should be given to insure development of sufficient motor torque to accelerate the load.

Typical specifications for synchronous motor control are shown on page 645.

Multi-Speed control may be either manual or magnetic, and at full or reduced voltage. When using automatic magnetic control with two-, three-, and four-speed separate winding or consequent pole motors, control may be obtained from a remote point by means of a push button master switch. The various speeds of the motor are obtained from the master switch by simply depressing the correct push button. This is known as selective speed control. It is commonly used in the smaller

Typical Specifications for Synchronous Motor Control

Synchronous Motor Control for..... (Application)

Motors Shall Provide for {Full Voltage Reduced Voltage}

Starting And Shall Be {Full Magnetic Semi-Magnetic}. (Reduced

Voltage Starting Shall Be Obtained By Means of

{Autotransformers Resistors Line Reactors Saturable Reactors} And Shall Limit The KVA

Inrush to a Maximum of per cent of Full Load KVA.)

The Control Panel Shall Be For {Isolated Switchboard}

Assembly And Shall Be of {Open Switchboard Enclosed Cubicle} Con-

struction. It Shall Provide Overload, Under

Voltage Protection And After Pulling Out of Step

Will {Automatically Resynchronize Automatically Stop} The Motor.

Typical Specifications for Single Phase Motor Control

Control For Single Phase..... (Fan, Pump, etc.)

Motors Shall Consist of a {Manual Magnetic} Type

{Across The Line Reduced Voltage} Starter Providing Overload

Protection (And Low Voltage); And A Separate Safety Disconnecting Switch.

theater installations where the fan and motor are located backstage and the speed control is located in the lobby.

Multi-speed motor controllers may be provided with compelling relays which make it necessary for the operator to press the first speed button before regulating the motor to the desired speed. This insures that the motor is always started at low speed before adjusting to one of the higher speeds.

Timing relays which provide for automatic acceleration may be used for control. With this feature the motor will always start at low speed and automatically accelerate to the desired speed. Decelerating relays may be used to reduce the shock effect of the braking action to the motor and drive when the speed is reduced from a higher to a lower speed.

Single Phase motor control usually consists only of a linestarter, either