

Repulsion-Induction and *Repulsion-Start-Induction Run* motors are suitable for applications such as industrial compressors where high break-away torque is required and where commutator and brush noise are not factors.

Split Phase motors have a high resistance auxiliary winding which is in the circuit during starting but is disconnected through the action of a centrifugal switch as the motor comes up to speed. Under running conditions it operates as a single phase induction motor with one winding in the circuit. These units are available for the small horsepower ratings and when equipped with a high slip rotor may be used for adjustable

TABLE 6. 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 (in-take closed)	30	50	150	WR ² of blower must be considered
Compressors	Air	Engine type	Unloaded	40	30	150	Flywheel effect important
	Ammonia and ammonia booster	High speed—belted Low speed—engine type occasionally coupled	Unloaded (by by-pass)	40	30	150	Flywheel effect important
	Freon	High speed—belted Low speed—engine	Unloaded (by by-pass)	45	50	150	Flywheel effect important
	Gas reciprocating	High speed—belted Low speed—engine	Unloaded (by by-pass)	40	30	150	Flywheel effect important

varying speeds through line voltage control. The motors are ideally suited for fan duty.

Speed-torque characteristics of single phase motors are shown in Fig. 10.

Typical specifications for single phase motors are shown in Table 8.

CONTROL FOR ALTERNATING CURRENT MOTORS

Squirrel-Cage motors are usually linestarted where power company limitations permit. In sizes up to 2 hp the motors are started by means of manual switches with an overload current element for motor protection. In larger ratings a linestarter is usually provided with either an additional safety switch or circuit breaker for disconnecting and short circuit protection. Reduced voltage starting may be either of manual or push button controlled magnetic type. In specifying this type of starter consideration should be given to the fact that starting torque of squirrel-cage motors varies as the square of the applied voltage. For example, a motor developing 100 lb-ft starting torque on full voltage would produce only 25 lb-ft torque on starting on half rated voltage. Fig. 11 illustrates

Motors and Motor Controls

recommended control practice for squirrel-cage motors. Typical specifications for squirrel-cage motor controls are shown in Table 9.

Wound Rotor motors require control of both primary and secondary circuits. The primary* control may be the same as for squirrel-cage motors, manual or magnetic, at full voltage. Secondary* control provides means of varying secondary resistance for starting and speed control. The secondary controller should be specified for starting duty 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 in Table 10.

Synchronous motor starters should provide pull-out protection, auto-

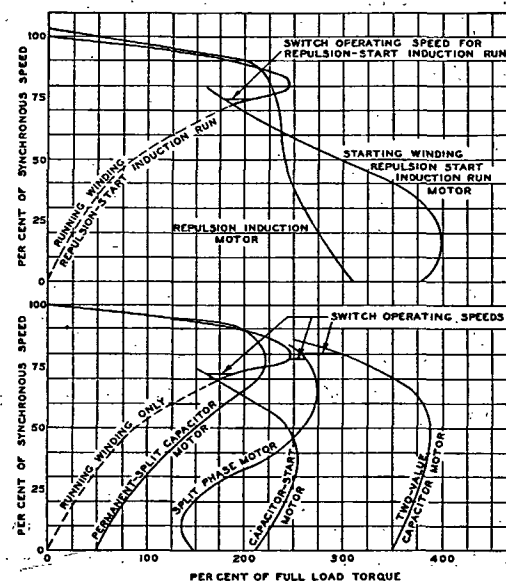


FIG. 10. SPEED-TORQUE CHARACTERISTICS OF SINGLE PHASE MOTORS

matic 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 semimagnetic 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 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 in Table 11.

Refer to Glossary at end of chapter.