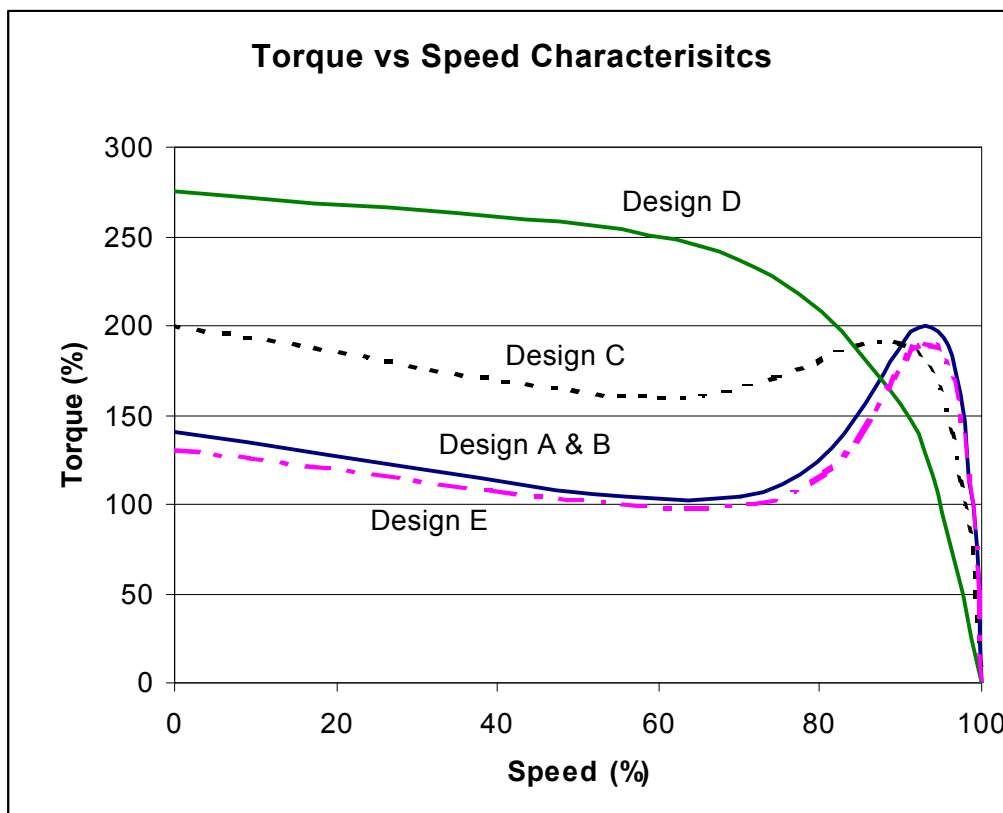


## TORQUE CHARACTERISTICS of NEMA DESIGN A,B,C,D & E MOTORS

Motor designers can change the characteristics of motors by modifying windings, rotor slot geometries, end ring size, rotor bar and end ring resistances, number of slots, number of rotor bars, amount and type of magnetic steel, etc. Most “standard” T-frame, squirrel cage induction motors (SCIMs) are designed to have NEMA design B characteristics. Some applications require torque characteristics that are outside the normal design parameters of a design B motor. Some applications may require higher starting torque (e.g. a loaded conveyor) than a Design B motor’s capability. Either a Design C motor can be chosen or a higher HP Design B motor must be selected. Some manufacturer’s motors, such as Toshiba’s EQPIII series motors, have Design C starting characteristics and in excess of Design B Breakdown torques. Such a motor, though more expensive to manufacture, can provide the advantages of Design C designs and meet all of the criteria of Design B.



Relative torque characteristics of NEMA Design A,B,C,D and E motors.

(Note that manufacturers will have different characteristics than those defined by NEMA as minimum required values.)

Locked Rotor Torque (LRT) is the torque developed by the motor at standstill. This is sometimes also referred to as starting torque.

Pull Up Torque (PUT) is the minimum torque developed by the motor as it accelerates from standstill to the speed at which breakdown torque occurs.

Break Down Torque (BDT) is the maximum torque that the motor is capable of developing. In the case of a Design D motor, this may be the same as LRT.

**TYPICAL CHARACTERISTICS AND APPLICATIONS OF FIXED FREQUENCY SMALL AND MEDIUM AC SQUIRREL-CAGE INDUCTION MOTORS**

Polyphase Characteristics	Locked Rotor Torque (Percent of Rated Load Torque)	Pull-Up Torque (Percent of Rated Load Torque)	Break Down Torque (Percent of Rated Load Torque)	Locked Rotor Current (Percent of Rated Load Current)	Slip	Typical Applications	Relative Efficiency
Design A Normal locked rotor torque and high locked rotor current.	70 - 275	65 - 190	175-300	Not Defined	0.5 - 5%	Fans, blowers, centrifugal pumps and compressors, motor-generator sets, etc. where starting torque requirements are relatively low	Medium or high
Design B Normal locked rotor torque and normal locked rotor current.	70 - 275	65 - 190	175-300	600 - 700	0.5 - 5%	Fans, blowers, centrifugal pumps and compressors, motor-generator sets, etc. where starting torque requirements are relatively low	Medium or high
Design C High locked rotor torque and normal locked rotor current.	200 - 285	140 - 195	190 - 225	600 - 700	1 - 5%	Conveyors, crushers, stirring motors, agitators, reciprocating pumps and compressors, etc., where starting under load is required	Medium
Design D High locked rotor torque and normal locked rotor current.	275	N/A	275	600 - 700	5 - 8%	High peak loads with or without flywheels such as punch presses, shears, elevators, winches, hoists, oil-well pumping and wire drawing motors	Low
Design E Normal locked rotor torque and low slip. High locked rotor current.	75 - 190	60-140	160-200	800 - 1000	0.5 - 3%	Fans, blowers, centrifugal pumps and compressors, motor-generator sets, etc. where starting torque requirements are relatively low	High