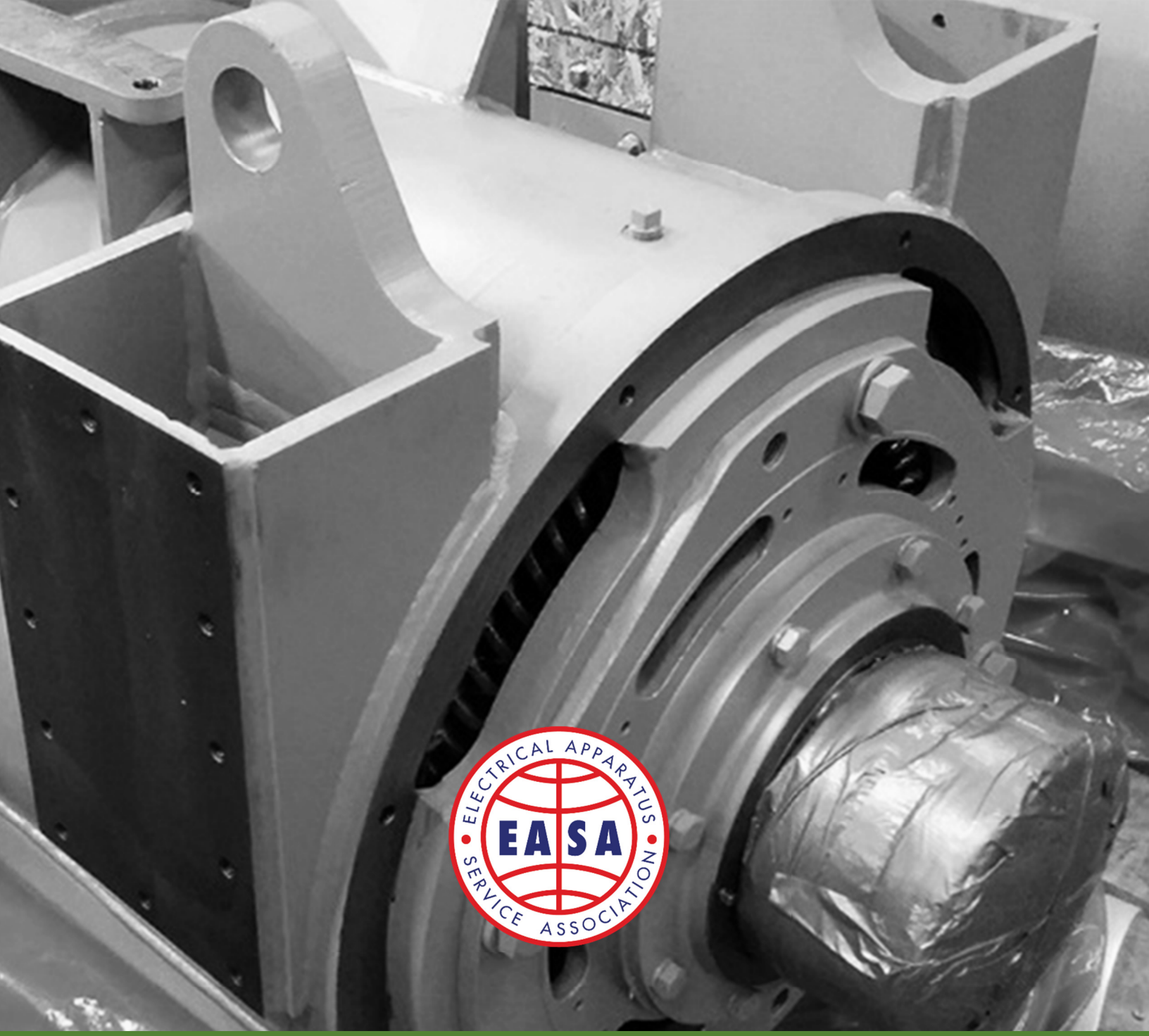

FULL LOAD EFFICIENCIES **GUIDE**

TECHNICAL INFORMATION EDUCATION SERIES

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MAXIMUM LOCKED-ROTOR CURRENTS

THREE-PHASE SQUIRREL CAGE MOTORS
NEMA DESIGNS B, C AND D

LOCKED-ROTOR CURRENT IN AMPERES

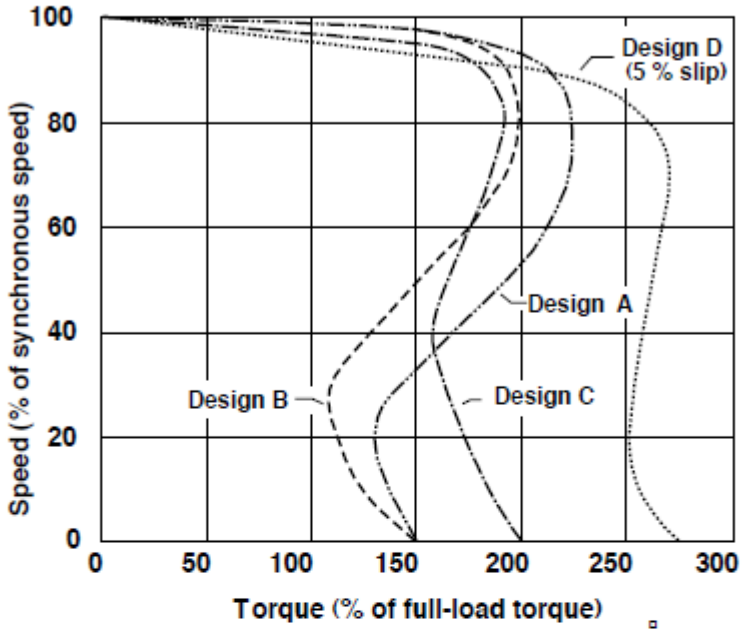
HP	RATED VOLTAGE, 60 Hz					
	200V	230V	460V	575V	2300V	4000V
.5	23	20	10	8		
.75	29	25	12	10		
1	34	30	15	12		
1.5	46	40	20	16		
2	57	50	25	20		
3	74	64	32	26		
5	106	92	46	37		
7.5	146	127	63	51		
10	186	162	81	65		
15	267	232	116	93		
20	333	290	145	116		
25	420	365	182	146		
30	500	435	217	174		
40	667	580	290	232		
50	834	725	362	290		
60	1000	870	435	348	87	50
75	1250	1085	542	434	108	62
100	1665	1450	725	580	145	83
125	2085	1815	907	726	181	104
150	2500	2170	1085	868	217	125
200	3335	2900	1450	1160	290	167
250	4200	3650	1825	1460	365	210
300	5060	4400	2200	1760	440	253
350	5860	5100	2550	2040	510	293
400	6670	5800	2900	2320	580	333
450	7470	6500	3250	2600	650	374
500	8340	7250	3625	2900	725	417

The locked-rotor current of Design B, C and D constant-speed induction motors, when measured with rated voltage and frequency impressed and with rotor locked, shall not exceed the above values.

Reference: NEMA MG 1-1998 (Rev. 3), 12.35.1. See NEMA MG 1-1998 (Rev. 3), 12.35.3 for 50 Hz, 380 volts.

GENERAL SPEED-TORQUE CHARACTERISTICS

THREE-PHASE INDUCTION MOTORS



NEMA DESIGN	LOCKED ROTOR TORQUE	BREAKDOWN TORQUE	LOCKED ROTOR CURRENT	SLIP	RELATIVE EFFICIENCY
B	70 - 275%*	175 - 300%*	600 - 800%	0.5-5%	Medium or High
	Applications: Fans, blowers, centrifugal pumps and compressors, motor-generator sets, etc., where starting torque requirements are relatively low.				
C	200 - 250%*	190 - 225%*	600 - 800%	1-5%	Medium
	Applications: Conveyors, crushers, stirring machines, agitators, reciprocating pumps and compressors, etc., where starting under load is required.				
D	275%	275%	600 - 800%	≥5%	Medium
	Applications: High peak loads with or without flywheels, such as punch presses, shears,elevators, extractors, winches, hoists, oil-well pumping, and wire-drawing machines.				

Based on NEMA MG 10-2001, Table 1. NEMA Design A is a variation of Design B having higher locked-rotor current.

*Higher values are for motors having lower horsepower ratings.

FULL-LOAD EFFICIENCIES

THREE-PHASE, SQUIRREL CAGE, ENERGY EFFICIENT OPEN MOTORS (NEMA DESIGNS A AND B)

HP	2 POLE		4 POLE		6 POLE	
	NOMINAL EFFICIENCY	MINIMUM EFFICIENCY	NOMINAL EFFICIENCY	MINIMUM EFFICIENCY	NOMINAL EFFICIENCY	MINIMUM EFFICIENCY
1.0			82.5	80.0	80.0	77.0
1.5	82.5	80.0	84.0	81.5	84.0	81.5
2.0	84.0	81.5	84.0	81.5	85.5	82.5
3.0	84.0	81.5	86.5	84.0	86.5	84.0
5.0	85.5	82.5	87.5	85.5	87.5	85.5
7.5	87.5	85.5	88.5	86.5	88.5	86.5
10.0	88.5	86.5	89.5	87.5	90.2	88.5
15.0	89.5	87.5	91.0	89.5	90.2	88.5
20.0	90.2	88.5	91.0	89.5	91.0	89.5
25.0	91.0	89.5	91.7	90.2	91.7	90.2
30.0	91.0	89.5	92.4	91.0	92.4	91.0
40.0	91.7	90.2	93.0	91.7	93.0	91.7
50.0	92.4	91.0	93.0	91.7	93.0	91.7
60.0	93.0	91.7	93.6	92.4	93.6	92.4
75.0	93.0	91.7	94.1	93.0	93.6	92.4
100.0	93.0	91.7	94.1	93.0	94.1	93.0
125.0	93.6	92.4	94.5	93.6	94.1	93.0
150.0	93.6	92.4	95.0	94.1	94.5	93.6
200.0	94.5	93.6	95.0	94.1	94.5	93.6
250.0	94.5	93.6	95.4	94.5	95.4	94.5
300.0	95.0	94.1	95.4	94.5	95.4	94.5
350.0	95.0	94.1	95.4	94.5	95.4	94.5
400.0	95.4	94.5	95.4	94.5		
450.0	95.8	95.0	95.8	95.0		
500.0	95.8	95.0	95.8	95.0		

The full load efficiency of Design A and B motors rated 600 volts or less, when operating at rated voltage and frequency, shall not be less than the minimum efficiency listed in the table above for the motor to be classified as "energy efficient." Nominal efficiency represents a value which should be used to compute the energy consumption of a motor or group of motors.

Reference: NEMA MG 1-1998 (Rev. 3), 12.60, Table 12-11.

The Energy Policy Act of 1992 (USA): The nominal full-load efficiency of electric motors as specified in the Energy Policy Act of 1992 is the same as that listed in the table for 1.0 to 200.0 hp motors.

FULL-LOAD EFFICIENCIES

THREE-PHASE, SQUIRREL CAGE, ENERGY EFFICIENT ENCLOSED MOTORS (NEMA DESIGNS A AND B)

HP	2 POLE		4 POLE		6 POLE	
	NOMINAL EFFICIENCY	MINIMUM EFFICIENCY	NOMINAL EFFICIENCY	MINIMUM EFFICIENCY	NOMINAL EFFICIENCY	MINIMUM EFFICIENCY
1.0	75.5	72.0	82.5	80.0	80.0	77.0
1.5	82.5	80.0	84.0	81.5	85.5	82.5
2.0	84.0	81.5	84.0	81.5	86.5	84.0
3.0	85.5	82.5	87.5	85.5	87.5	85.5
5.0	87.5	85.5	87.5	85.5	87.5	85.5
7.5	88.5	86.5	89.5	87.5	89.5	87.5
10.0	89.5	87.5	89.5	87.5	89.5	87.5
15.0	90.2	88.5	91.0	89.5	90.2	88.5
20.0	90.2	88.5	91.0	89.5	90.2	88.5
25.0	91.0	89.5	92.4	91.0	91.7	90.2
30.0	91.0	89.5	92.4	91.0	91.7	90.2
40.0	91.7	90.2	93.0	91.7	93.0	91.7
50.0	92.4	91.0	93.0	91.7	93.0	91.7
60.0	93.0	91.7	93.6	92.4	93.6	92.4
75.0	93.0	91.7	94.1	93.0	93.6	92.4
100.0	93.6	92.4	94.5	93.6	94.1	93.0
125.0	94.5	93.6	94.5	93.6	94.1	93.0
150.0	94.5	93.6	95.0	94.1	95.0	94.1
200.0	95.0	94.1	95.0	94.1	95.0	94.1
250.0	95.4	94.5	95.0	94.1	95.0	94.1
300.0	95.4	94.5	95.4	94.5	95.0	94.1
350.0	95.4	94.5	95.4	94.5	95.0	94.1
400.0	95.4	94.5	95.4	94.5		
450.0	95.4	94.5	95.4	94.5		
500.0	95.4	94.5	95.8	95.0		

The full load efficiency of Design A and B motors rated 600 volts or less, when operating at rated voltage and frequency, shall not be less than the minimum efficiency listed in the table above for the motor to be classified as "energy efficient." Nominal efficiency represents a value which should be used to compute the energy consumption of a motor or group of motors.

Reference: NEMA MG 1-1998 (Rev. 3), 12.60, Table 12-11.

The Energy Policy Act of 1992 (USA): The nominal full-load efficiency of electric motors as specified in the Energy Policy Act of 1992 is the same as that listed in the table for 1.0 to 200.0 hp motors.

Source The Electrical Engineering Pocket Handbook
Electrical Apparatus Service Association

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