

Appendix C

Minimum Equipment Efficiency Standards



Port of Stockton
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Appendix C: Minimum Equipment Efficiency Standards

This Appendix is an overview of building and equipment standards in the State of California that have an effect on the baselines used in calculating savings and determining the eligibility of proposed equipment for the Statewide Customized Offering. It contains the minimum equipment efficiency standards that a Customer must use to establish baseline system models and estimate energy savings for projects that involve the replacement of motors. It also describes the minimum standards for T-8 and T-5 linear fluorescent retrofit equipment.

The equipment baselines are based on multiple industry and governmental standards. These include California's Title 24 minimum equipment efficiency standards, NEMA standards, EPACT regulations, DOE's Motor Challenge (Motor Master), and DOE's Air Compressor Challenge (AirMaster+). Some applicable tables have been reproduced or summarized in this section for convenience. Please note that the most current standards take precedence.

Savings from equipment not covered by the standards mentioned above shall be calculated by using the existing equipment as a baseline.

The document "2016 Title 24, Part 6, California's Energy Efficiency Standards for Residential and Non-residential Buildings" can be downloaded from the following Internet address:

<http://www.energy.ca.gov/title24/>

Information concerning the Motor Challenge and Air Compressor Challenge can be found at the following Internet address:

<http://www.doe2.com/>

C.1 Electrical Motors

Starting December 19, 2010, EPC Act 1992 requirements were replaced by the 2007 Energy Independence and Security Act. This new Act updated the minimum efficiency standards for motors to meet NEMA Table 12-11 or 12-12. The motors that are affected by this change have been divided into two groups, Subtype I and Subtype II. Subtype I motors are general purpose motors ranging from 1-200 Hp and either NEMA Design A or B. These motors must meet NEMA Table 12-12 (otherwise known as NEMA Premium Efficiency). Subtype I motors also include motors that are general purpose, ranging from 201-500 Hp and are NEMA Design B. These motors must meet NEMA Table 12-11 (otherwise known as EPC Act Efficiency). Subtype II motors range from 1-200Hp and included Design C motors and 8-pole motors. These motors were not previously covered by EPC Act 1992 but now they must meet NEMA Table 12-11.

The efficiency values given in the following Tables should be used to determine the baseline motor energy consumption. Motors installed under the Port of Stockton Energy Efficiency Offering must be more efficient than the standards shown in order to be eligible for incentives.

Motor Subtype Descriptions:




Baseline	Motor Type	Description	Images
Subtype I	1 - 200 HP general purpose (subtype I): Standard operating characteristics and standard mechanical construction for use under usual and unusual service conditions, such as those specified in NEMA Standards Publication MG1–1993, paragraph 14.02, “Usual Service Conditions,” and paragraph 14.03, “Unusual Service Conditions,” and which can be used in most general purpose applications.		
	Design A & B	Design A motors have a higher breakdown torque than Design B motors and are usually designed for a specific use. Slip is 5%, or less. Design B motors account for most of the induction motors sold. Often referred to as general purpose motors, slip is 5% or less.	See Nameplate ("Design")
Subtype II	1 - 200 HP general purpose (subtype II), and Design C: Any motor incorporating the design elements of a general purpose electric motor (subtype I) that are configured as one of the following:		
	U-frame motor	U -Frame motor are defined by NEMA standards prior to 1965 and is the predecessor to the present T - Frame motor; frame size sets important mounting dimensions	See Nameplate or Specification Sheet ("Frame No." i.e. 445U)
	Design C motor	Design C motors have high starting torque with normal starting current and low slip. Slip is 5% or less.	See Nameplate or Specification Sheet ("Design")
	Close-coupled pump motor	The motor drive and pump impeller are on the same shaft.	
	Footless motor	Not footed; uses a different mounting method such as close-coupled (c-face).	
	Vertical solid shaft normal thrust motor	A motor being mounted vertically with a solid shaft (up or down) as in many pump applications.	
	8-pole motor (900 rpm)	The number of poles determines the motor's speed. 8 magnetic poles in the stator winding; synchronous speed is 900 rpm	See Nameplate or Specification Sheet ("Poles" or "900 rpm")
	Poly-phase motor with voltage of not more than 600 volts (other than 230 or 460 volts)	Used where a polyphase (three-phase) power supply is available and is limited primarily to industrial applications.	

Table 1: [Subtype I] Full-Load Efficiencies of General Purpose Electric Motors

Motor horsepower	Nominal full load efficiency					
	Open motors			Enclosed motors		
	6 poles 1200 rpm	4 poles 1800 rpm	2 poles 3600 rpm	6 poles 1200 rpm	4 poles 1800 rpm	2 poles 3600 rpm
1	82.5	85.5	77	82.5	85.5	77
1.5	86.5	86.5	84	87.5	86.5	84
2	87.5	86.5	85.5	88.5	86.5	85.5
3	88.5	89.5	85.5	89.5	89.5	86.5
5	89.5	89.5	86.5	89.5	89.5	88.5
7.5	90.2	91	88.5	91	91.7	89.5
10	91.7	91.7	89.5	91	91.7	90.2
15	91.7	93	90.2	91.7	92.4	91
20	92.4	93	91	91.7	93	91
25	93	93.6	91.7	93	93.6	91.7
30	93.6	94.1	91.7	93	93.6	91.7
40	94.1	94.1	92.4	94.1	94.1	92.4
50	94.1	94.5	93	94.1	94.5	93
60	94.5	95	93.6	94.5	95	93.6
75	94.5	95	93.6	94.5	95.4	93.6
100	95	95.4	93.6	95	95.4	94.1
125	95	95.4	94.1	95	95.4	95
150	95.4	95.8	94.1	95.8	95.8	95
200	95.4	95.8	95	95.8	96.2	95.4

Table 2: [Subtype I] Full-Load Efficiencies of High HP NEMA Design B General Purpose Electric Motors

Motor horsepower	Nominal full load efficiency							
	Open motors				Enclosed motors			
	8 poles 900 rpm	6 poles 1200 rpm	4 poles 1800 rpm	2 poles 3600 rpm	8 poles 900 rpm	6 poles 1200 rpm	4 poles 1800 rpm	2 poles 3600 rpm
250	94.5	95.4	95.4	94.5	94.5	95	95	95.4
300		95.4	95.4	95		95	95.4	95.4
350		95.4	95.4	95		95	95.4	95.4
400			95.4	95.4			95.4	95.4
450			95.8	95.8			95.4	95.4
500			95.8	95.8			95.8	95.4

Table 3: [Subtype II] Full-Load Efficiencies of General Purpose Electric Motors

Motor horsepower	Nominal full load efficiency							
	Open motors				Enclosed motors			
	8 poles	6 poles	4 poles	2 poles	8 poles	6 poles	4 poles	2 poles
	900 rpm	1200 rpm	1800 rpm	3600 rpm	900 rpm	1200 rpm	1800 rpm	3600 rpm
1	74	80	82.5		74	80	82.5	75.5
1.5	75.5	84	84	82.5	77	85.5	84	82.5
2	85.5	85.5	84	84	82.5	86.5	84	84
3	86.5	86.5	86.5	84	84	87.5	87.5	85.5
5	87.5	87.5	87.5	85.5	85.5	87.5	87.5	87.5
7.5	88.5	88.5	88.5	87.5	85.5	89.5	89.5	88.5
10	89.5	90.2	89.5	88.5	88.5	89.5	89.5	89.5
15	89.5	90.2	91	89.5	88.5	90.2	91	90.2
20	90.2	91	91	90.2	89.5	90.2	91	90.2
25	90.2	91.7	91.7	91	89.5	91.7	92.4	91
30	91	92.4	92.4	91	91	91.7	92.4	91
40	91	93	93	91.7	91	93	93	91.7
50	91.7	93	93	92.4	91.7	93	93	92.4
60	92.4	93.6	93.6	93	91.7	93.6	93.6	93
75	93.6	93.6	94.1	93	93	93.6	94.1	93
100	93.6	94.1	94.1	93	93	94.1	94.5	93.6
125	93.6	94.1	94.5	93.6	93.6	94.1	94.5	94.5
150	93.6	94.5	95	93.6	93.6	95	95	94.5
200	93.6	94.5	95	94.5	94.1	95	95	95