Motor Assessment Guidelines

General Motor Assessment Tasks

1. Write down motor name plate data (using NREL input forms).
2. Write down operational hours per day, week, and month.

Constant Volume Fans and Pumps

1. Write down motor name plate data (using NREL input forms).
2. Measure voltage (volt) and operating current (amp)
3. Calculate motor load using a hand-held amp/voltage meter with the following equation:
   - For long-term load calculations, a current transformer can be installed to calculate amp load over time (for constant volume fan and pump systems a calculation at one point in time is all that is needed, as the load will not change over time).
   - Record amperage on each phase (A, B, C) and phase to phase voltage (A-B, B-C, A-C) (take an average of the measured amps and voltage).

$$\text{Motor load} = \frac{\text{Amps measured}}{\text{Amps full load nameplate}} x \left(\frac{\text{Volts measured}}{\text{Volts nameplate}} \right)$$

Source: Washington State University Cooperative Extension Energy Program

Figure 1. Voltage compensated amperage ratio technique[1]

4. For fan systems record belt type (cogged or V-belt) and the number of belts per drive.
   - Record pulley dimensions and distance between pulleys.

Variable Frequency Drives

1. Write down variable frequency drive (VFD) name plate data (manufacturer, model number, and specifications).
2. Record frequency and percent flow rate at time of assessment.
3. Make sure the drive isn't in "hand" or "manual" mode.
4. Make sure the VFD display matches the direct digital control (DDC) signal.
   - Command the VFD to ramp up and down through the DDC system and make sure it is controlling properly.

National Electrical Manufacturers Association (NEMA) Premium Open Drip Proof (ODP) Motors[2]

HP	Speed	Full Load RPM	Encl	*Eff*	PF
1	1,800	1740	ODP	***86.0%***	78.0%
3	1,800	1770	ODP	***90.2%***	78.9%
5	1,800	1750	ODP	***90.0%***	80.0%
7.5	1,800	1760	ODP	***92.0%***	79.0%
10	1,800	1773	ODP	***93.0%***	83.4%
20	1,800	1775	ODP	***93.6%***	82.7%
40	1,800	1775	ODP	***95.0%***	86.0%
60	1,800	1785	ODP	***95.4%***	85.3%
75	1,800	1785	ODP	***95.0%***	86.3%
200	1,800	1780	ODP	***96.0%***	87.0%

Source: NREL

[1] *MotorMaster 4.0 User Guide*. WSUCEEP03_13. Developed by Washington State University Cooperative Extension Energy Program for U.S. Dept. of Energy. http://www1.eere.energy.gov/industry/bestpractices/pdfs/motormaster_user_manual.pdf. 2003.
[2] Generated using data from MotorMaster+, a free online NEMA motor selection and management tool, available at www.eere.energy.gov/industry/bestpractices/software_motormaster.html.

NEMA Premium ODP Motors[3]

HP	Speed	Full Load RPM	Encl	Eff	PF
1	3,600	3492	ODP	84.0%	84.0%
3	3,600	3450	ODP	88.0%	89.0%
5	3,600	3515	ODP	91.0%	89.0%
7.5	3,600	3500	ODP	91.0%	95.0%
10	3,600	3500	ODP	92.0%	90.0%
20	3,600	3540	ODP	93.0%	85.0%
40	3,600	3550	ODP	94.5%	83.0%
60	3,600	3540	ODP	95.0%	92.0%
75	3,600	3560	ODP	95.4%	89.0%
200	3,600	3570	ODP	96.2%	91.0%

Source: NREL

NEMA Premium Totally Enclosed Fan Cooled (TEFC) Motors[4]

HP	Speed	Full Load RPM	Encl	Eff	PF
1	1,800	1775	TEFC	88.5%	76.3%
3	1,800	1775	TEFC	91.7%	81.3%
5	1,800	1760	TEFC	90.2%	84.1%
7.5	1,800	1770	TEFC	92.4%	80.5%
10	1,800	1770	TEFC	92.4%	80.5%
20	1,800	1780	TEFC	93.6%	81.0%
40	1,800	1775	TEFC	95.0%	84.0%
60	1,800	1780	TEFC	95.0%	87.0%
75	1,800	1775	TEFC	95.4%	88.0%
200	1,800	1790	TEFC	96.5%	86.5%

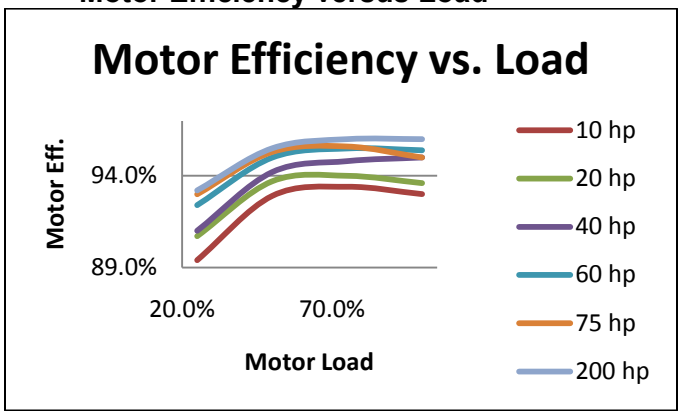
Source: NREL

NEMA Premium TEFC Motors[5]

HP	Speed	Full Load RPM	Encl	Eff	PF
1	3,600	3550	TEFC	88.5%	85.0%
3	3,600	3500	TEFC	90.0%	92.0%
5	3,600	3550	TEFC	90.2%	84.0%
7.5	3,600	3535	TEFC	91.7%	86.0%
10	3,600	3500	TEFC	92.0%	92.0%
20	3,600	3530	TEFC	92.4%	89.0%
40	3,600	3540	TEFC	94.1%	91.5%
60	3,600	3565	TEFC	95.0%	89.5%
75	3,600	3575	TEFC	95.4%	82.5%
200	3,600	3575	TEFC	96.2%	87.7%

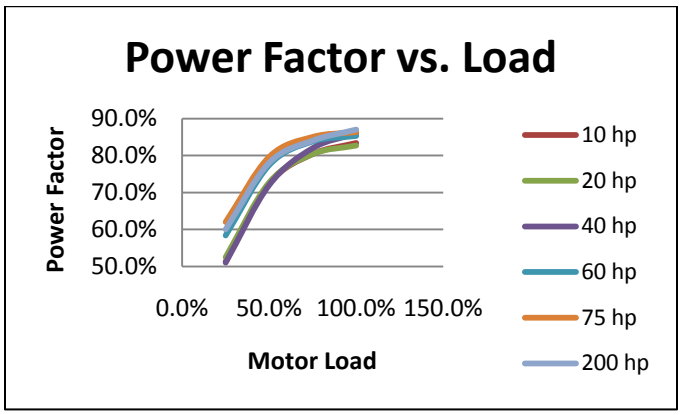
Source: NREL

Motor Efficiency versus Load[6]



Source: NREL

Motor Power Factor versus Load[7]



Source: NREL

[3, 4, 5, 6, 7] Generated using data from MotorMaster+, a free online NEMA motor selection and management tool, available at www.eere.energy.gov/industry/bestpractices/software_motormaster.html.

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