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The Impact of the Integral Horsepower Rule (1 – 500 HP Motor)

December 2, 2014

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(as determined by our customers)
marketers, designers and manufacturers
of industrial electric motors, drives and
mechanical power transmission products**

Taking care of our customers safely

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Outline

- History of Efficiency Regulations
- Integral Horsepower Final Rule – June 1, 2016
 - › What is covered
 - › Exemptions
- Small Motor Rule – March 9, 2015
 - › What is covered
 - › Exemptions

Motor Efficiency Regulations

- Energy Policy Act of 1992
 - › Effective October 1997
 - › General Purpose 1 – 200 HP at MG 1, table 12-11 Energy Efficient

- Energy Policy Act of 2001
 - › Raised purchases for government to table 12-12 Premium Efficient

- Energy Independence & Security Act of 2007
 - › Effective December 2010
 - › General Purpose 1-200 HP EPAAct motors to table 12-12 Premium Efficient
 - › Other 1-200 HP motors at table 12-11 Energy Efficient
 - › 201 – 500 HP motors at 12-11 Energy Efficient

Motor Coalition Formed in 2010

- Determine the greatest energy savings potential and improve enforcement
- Agreement on action plan to achieve
 - Legislation?
 - Regulation?
- Product definitions
- Testing issues
- MEPS – efficiency levels
- Timing of implementation

The Motor Coalition Members

- American Council for an Energy-Efficient Economy
- Alliance to Save Energy
- Appliance Standards Awareness Project
- Earthjustice
- Natural Resources Defense Council
- Northeast Energy Efficiency Partnerships
- Northwest Energy Efficiency Alliance
- National Electrical Manufacturers Association
- Pacific Gas and Electric
- Others signed letters of support

2010-11 Motor Coalition Strategy

- Determine and document a plan to improve the efficiency of the greatest number of units providing the **greatest savings impact** while **reducing potential enforcement issues** while maintaining **full product utility** for American industry
- Deliver a plan to DOE as a **platform for a consensus recommendation** that can be acted upon within the **least amount of time** delivering **large net benefits.**
- **Move to a final rule with the least delay to deliver results that save greatest energy as quickly as possible**

EISA 2007 required a Final IHP Rule by December 19th 2012

- Motors must meet 7 standard DOE criteria

Energy Policy & Conservation Act of 1975 Factors	DOE Analysis
1. Economic impact on consumers and manufacturers	Life-cycle cost analysis Manufacturer impact analysis
2. Lifetime operating cost savings compared to increased cost for the product	Life-cycle cost analysis
3. Total projected savings	National impact analysis
4. Impact on utility or performance	Engineering analysis Screening analysis
5. Impact of any lessening of competition	Manufacturer impact analysis
6. Need for national energy conservation	National impact analysis
7. Other factors the Secretary considers relevant	Environmental assessment Utility impact analysis Employment impact analysis

New Integral Horsepower Rule

May 29th 2014 DOE amends motor efficiency regulations

DEPARTMENT OF ENERGY

10 CFR Part 431

[Docket No. EERE-2010-BT-STD-0027]

RIN 1904-AC28

**Energy Conservation Program: Energy
Conservation Standards for
Commercial and Industrial Electric
Motors**

Integral HP Motor Final Rule

- Replaces Energy Independence & Security Act of 2007
- Takes effect 24 months after Final Rule (June 1, 2016)
- Almost all motors will be covered at Premium Efficiency levels NEMA MG 1, Table 12-12 or Part 20, Table A or B (IE3)
- Simplifies enforcement and compliance
- Improved definitions and testing guidelines

Compare Integral Rule to EISA

Motor Type	EISA	New Integral HP Rule
1-200 HP Subtype I	Premium Efficient NEMA MG 1, Table 12-12	Premium Efficient NEMA MG 1, Table 12-12
1-200 HP Subtype II	Energy Efficient NEMA MG 1, Table 12-11	Premium Efficient NEMA MG 1, Table 12-12
201-500 HP	Energy Efficient NEMA MG 1, Table 12-11	Premium Efficient NEMA MG 1, Table 12-12, 20-A & 20-B
56 Frame Enclosed	Exempt	Premium Efficient NEMA MG 1, Table 12-12
Custom Configurations	Exempt	Premium Efficient NEMA MG 1, Table 12-12
1-200 HP Fire Pump Motors	Energy Efficient NEMA MG 1, Table 12-11	Energy Efficient NEMA MG 1, Table 12-11

Motors covered under IHP Final Rule

The motors regulated under expanded scope meet the following nine characteristics:

1. Is a single speed motor
2. Is rated for continuous duty (MG 1) operation or for duty type S1 (IEC)
3. Contains a squirrel-cage (MG 1) or cage (IEC) rotor
4. Operated on polyphase alternating current (AC) 60-hertz sinusoidal line power
5. Has 2-, 4-, 6-, or 8-pole configuration
6. Is rated 600 volts or less
7. Have a three or four digit NEMA frame size (or IEC metric equivalent), including those designs between two consecutive NEMA frame sizes (or IEC metric equivalent) or an enclosed 56 NEMA Frame size (or IEC metric equivalent).
8. Has no more than 500 horsepower, but greater than or equal to 1 horsepower (or kilowatt equivalent)
9. Meets all the performance requirements of a NEMA design A, B or C electric motor or an IEC design N or H electric motor.

Motors added previously not covered by EISA

What additional designs are covered:

- NEMA Design A motors from 201-500 HP
- Electric motors with moisture-resistant windings, sealed or encapsulated windings
- Partial electric motors
- Totally-enclosed non-ventilated (TENV) electric motors
- Immersible electric motors
- Integral or non-integral brake electric motors
- U-frame motors
- Design C motors
- IEC 100 frame, NEMA 66 frame
- Electric motors with non-standard endplates or flanges
- Electric motors with non-standard base or mounting feet
- Footless motors (C-face or D-flange less base)
- Electric motors with special shafts
- Close-coupled pump motors
- 56J Jet pump motors (Enclosed)
- Vertical hollow shaft electric motors
- Vertical medium and high thrust solid shaft electric motors
- Electric motors with sleeve bearings
- Electric motors with thrust bearings
- Pre-NEMA frame motors
- Arbor saw motors

Motors not covered under IHP final rule

Exempt Motors:

- Single phase ODP motors (may be covered by Small Motor Rule)
- Single phase Enclosed motors
- DC motors
- Two digit frames (42 – 48) (may be covered by Small Motor Rule)
- 56 frame ODP (may be covered by Small Motor Rule)
- Multi-speed motors
- Medium voltage motors
- TEAO or Open Air-over motors
- Submersible motors
- Water-cooled motors
- Intermittent duty motors (S2-S8)
- Stator-rotor sets
- Design D motors
- Motors designed for Inverter Power (MG 1, Part 31) with no line start (Baldor V*S Master, RPM AC and similar)
- Synchronous AC motors
- Permanent magnet rotor AC motors
- Servo motors

Partial (3/4 Motor) vs. Stator-Rotor Set

- Partial motors usually have the drive endplate missing and used as part of a gear motor, pump or compressor.
 - › A partial motor may have an endplate installed and tested before shipment.
- A stator and rotor may or may not have a shaft or frame casting.
 - › They are transformed into a motor by someone other than Baldor.
 - › That transforming company becomes the motor manufacturer for DOE compliance. Is the electric motor under the scope of the DOE rules?



Impact to OEMs and End Users

- Form, Fit, Function
 - › Previously unregulated motors may be larger size
 - › Premium motors have less slip – higher speed
 - › Some designs may be Design A – higher inrush current
 - › Some designs in larger NEMA frame
- Buying
 - › More material – higher price for premium efficiency
 - › Can continue to buy and use motors built before June 1, 2016
- Remember the regulation is on the motor manufacturer, not the end user

What the IHP Final Rule Means

- Motors manufacturers must begin building compliant motors June 1, 2016
- Pre-Existing inventory may be sold or used
- Includes motors sold for use in U.S. and those mounted on machinery for use here
- No regulations on rewinding or repairing motors
- Canada and Mexico have not yet matched this regulation

Canada and Mexico

- Canada regulations
 - › Parallel to EISA at this time
 - › US DOE encouraging harmonization
 - › Small motor regulations under review – encouraged to skip until next US rule
 - › Encouraged to adopt rules similar to US
- Mexico regulations
 - › NOM – ANCE regulations are at premium efficiency
 - › Regulations in effect for single phase different to US

Small Motor Rule

- Passed in 2010
- Covers ¼ - 3 HP 2, 4, 6 pole
- Open Drip Proof – General Purpose only
- 42, 48 , 56 Frame
- Both Single and Three Phase
- DOE specified a lower limit on Average Full-load Efficiency (Not NEMA Nominal)
- “Is not restricted to a particular application.” (56J)
- Effective March 9, 2015

Motors covered under Small Motor Rule

These characteristics (as identified by that NEMA document) include the following elements that DOE considered for purposes of defining small electric motors in the 2010 final rule:

1. Built with an open construction;
2. Rated for continuous duty;
3. Incorporates the service factor in MG1-12.47 of MG1-1987;
4. Uses insulation that satisfies *at least* the minimum Class A insulation system temperature rise specifications detailed in MG1-12.42 of MG1-1987;
5. Designed in standard ratings (e.g., horsepower (hp) or kilowatt (kW) ratings);
6. Has standard operating characteristics;
7. Has standard mechanical construction;
8. Designed for use under usual service conditions; and
9. Is not restricted to a particular application.

Small Motor Rule

- Includes motors with longer shafts than NEMA
 - › Interpret as shaft that can be used belted or coupled (up to 2X standard NEMA shaft length)
- Includes C-face or D-flange without base
- Includes resilient mounting base
- Excludes 1ph & 3ph 4-pole resilient base ODP motors with ATO in 1/3, 1/2, 3/4 and 1 HP ratings
- Does not include Air-over or enclosed motors
- Includes motors with thermal protection
 - › Motors without UL Recognized thermal required by March 9, 2015
 - › Motors with UL Recognized thermal gets 2 more years and will be required by March 9, 2017

SMALL ELECTRIC MOTOR RULE COVERAGE DETAILS 10/28/14

Covered Product – Column A	Excluded Product – Column B
<p>For Use in the United States including motor driven product imported into the United States</p> <p>NEMA General Purpose per MG 1-1987</p> <p>Includes:</p> <p>Base mounted with or without C-face per NEMA MG1-11.34(1987) or MG1-4.4.4 (2011) or IEC equivalent.</p> <p>Resilient Mounting Base</p>	<p>Exported from the United States for use in product outside of the United States</p> <p>Definite or Special Purpose Motors</p> <p>Examples: Motors designed for a specific application or purpose, Air Over, Thrust Bearing, Submersible, Immersible, Component Sets, Partial (3/4), Integral and Non-Integral Brake, Liquid Cooled, Inverter-Only, Encapsulated, Double Shafts, NEMA MG1-18 Definite Purpose applications such as Jet Pump, Sump Pump, Oil Burner, Gas Dispensing Pump, Home Laundry, Carbonator Pump, etc.</p> <p>NEMA Part 18 Motors including motors for Belted or Shaft-Mounted Fans and Blowers specifically including 4-pole ratings 1/3, 1/2, 3/4, and 1 horsepower with automatic reset thermal overload protector (ATO)</p>
<p>Open Drip Proof enclosure</p> <p>NEMA Two-Digit Frame Numbers 42, 48, and 56, including equivalent IEC frame numbers 63, 71, & 80</p>	<p>Totally Enclosed or Air-over</p> <p>All other frame numbers</p>
<p>Foot-Mounted with Single Straight-Shaft Extension having standard dimensions as given in MG1-11.31 (1987) - now 4.4.1 (2011) or IEC equivalent;</p> <p>Also motors with a standard diameter shaft 50% to 200% of NEMA “V” dimension with flat or keyway.</p>	<p>Non-standard shaft diameter or extensions which fall outside the guidelines in Column A.</p> <p>Foot-Mounted with Single or double Straight-Shaft Extension having non-standard length or diameter; motors with single tapered or double straight/tapered extensions</p>
<p>Foot or Footless with Type C Face or D-flange -Mounting having standard dimensions as given in MG1-11.34 (1987) - now 4.4.4 (2011) or IEC equivalent.</p>	<p>Foot or Footless with Type C Face-Mounting having non-standard dimensions; Customer defined mounting</p>
<p>Alternating Current</p>	<p>Direct Current</p>

Covered Product – Column A	Excluded Product – Column B
Single Speed (e.g. 60, 60/50Hz)	50 Hz only; Two-Speed, Multispeed and Adjustable Speed
115 and 230 Volt Single Phase voltages and 115, 200, 230, 460 and 575 Volt Polyphase voltages. Dual-and Broad-Voltage Motors (e.g. 115/208-230V) Note: DOE left the determination of the voltage level for determining compliance with the efficiency standard to the discretion of the small electric motor manufacturer	Voltages other than Column A and above 600V
2, 4 and 6 Pole	8 Pole or greater
¼ to 3 HP (0.18 to 2.2 kW) per Tables I.1 and I.2 below Intermediate Horsepower’s within scope shall be rounded up or down to the next closest HP (kW) rating	Outputs outside scope of Tables I.1 and I.2
Polyphase, CSIR (Capacitor Start Induction Run), CSCR (Capacitor Start/Capacitor Run)	PSC (Permanent Split Capacitor), Split Phase, Shaded Pole, ECM (Electronically Controlled Motor), PMAC (Permanent Magnet AC Motor), Switched Reluctance, etc.
Continuous Duty (S1-IEC Equivalent)	Intermittent, Short-Time (S2-S10 IEC Duties)
NEMA Service Factor up to and including MG 1-12.47 (1987) – now 12.51 (2011)	Non-standard Service Factors greater than NEMA MG 1-12.47 (1987) – now 12.51 (2011)
Dual-and Broad-Voltage Motors (e.g. 115/208-230V) Note: DOE left the determination of the voltage level for determining compliance with the efficiency standard to the discretion of the small electric motor manufacturer	No exclusion
Small Electric Motors included as components of non-covered equipment	Small Electric Motors included in equipment that are covered by other energy efficiency regulations
Small electric motors with thermal protection that has not been evaluated by a nationally recognized safety test laboratory shall comply on March 9, 2015. Small electric motors included in nationally recognized safety testing laboratory listings or certifications are granted an additional 2 years effective date – March 9, 2017. (Examples: “Thermally Protected”, “Impedance Protected”)	N exclusion
All insulation Classes A and above	No exclusion

Concerns for OEMs about compliance

- Non-compliant small motors cannot be manufactured after March 9, 2015
- OEMs must review motors to determine if within scope
 - › Remember scope of coverage is narrow for SMR
- Key industries will be HVAC, pumps and compressors
- Develop samples for approval
- Must be ready by March – this is absolute date with no exceptions

Thank you.



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