



75 years of excellence

Motor Efficiency EISA Regulations Update Type II Motors



Rob Boteler

**Emerson Motor Company
Chairman NEMA Marketing**



R.Boteler CEE Sept 2009

Electric Motors Energy Solutions

- 💡 **Phase One = Epact regulations 1992/1997**
 - General Purpose Products move to NEMA 12-11
- 💡 **Phase Two = EISA 2007**
 - General Purpose Products move to NEMA 12-12
 - Type II categories added
- 💡 **Phase Three = Energy and Climate Bill 2010**
 - Early retirement
 - Tax incentives
- 💡 **Phase Four -Save Energy Now**
 - Trade Associations and NGO's working together to support custom system programs

So how important are electric motors?

Source Dr Paul Waide IEA

- >40% of global power demand
- >6000 TWh of electricity
- >4.4 Gt of indirect CO₂ emissions
- >16% of all energy-related CO₂ emissions
- CO₂ emissions of similar magnitude to motor cars!

Estimated global figures

Source Dr Paul Waide IEA

Stock:

- 0.6 million > 375kW [500HP]
- 230 million electric motor systems > 0.75kW [10HP]
- 2 billion electric motor systems < 0.75kW [1HP]

Energy:

- 9% < 0.75kW;
- 68%, 0.75kW-375kW
- 23% > 375kW
- Electric peak load in excess of 2000 GWe
- Energy savings potential 20% to 30%



Motors Are Everywhere!

- U.S. Installed Base is 90 Million Electric Motors
- Industrial & Commercial Electric Motors is 40 Million
- Applications Such As:
 - Pumps
 - Fans
 - Blowers
 - Compressors
 - Conveyors
 - And More



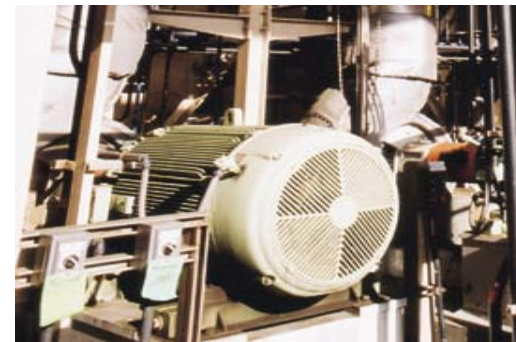
- 💡 **Energy Independence & Security Act Passed into law 12/19/07**
 - **Implementing 12/19/10**
- 💡 **1 – 200 HP General Purpose motors already covered by EPA Act will change from NEMA MG-1, Table 12-11 *Energy Efficient* to Table 12-12 *NEMA Premium*[®] efficiencies.**
- 💡 **What is currently covered by EPA Act 92 will move to premium efficient - 230/460v**

What is the energy saving opportunity?

- 💡 **1 – 200 HP motors not previously covered by EAct will comply with NEMA MG-1, Table 12-11 *Energy Efficient* efficiencies.**
- 💡 **Type II Motors:**
 - U-frame motors
 - Design C
 - Close-coupled pump motors
 - C-face or D-flange without base
 - Vertical solid shaft normal thrust motors (P-base)
 - 8-pole motors
 - 3-ph motors of not more than 600 volts (other than 230 or 460 volts). This includes IEC Metric frame motors from 90 frame – up.

Type II Motors - U-frame motors

- 💡 Older style motors with oversize frames compared to T-frame designs
- 💡 1950's technology
- 💡 Used in automotive assembly plants with special efficiency standards
- 💡 Not much development as NEMA Premium designs



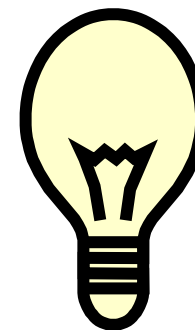
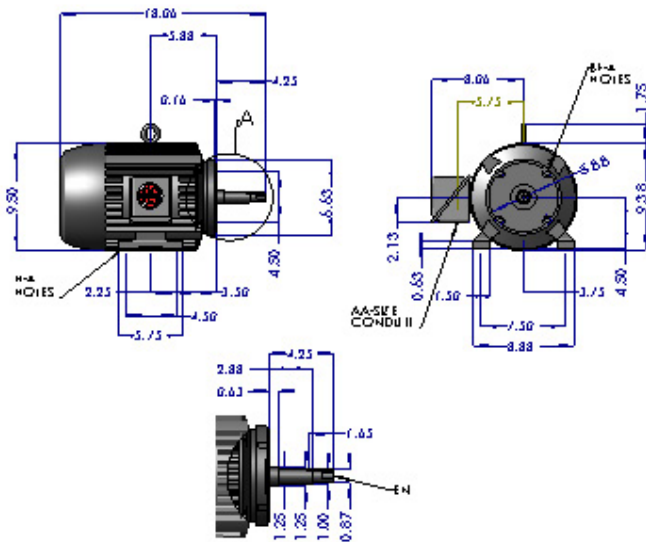
Type II Motors - Design C

- 💡 **Design C is high breakdown torque (compared to Design B)**
- 💡 **Applications include crushers and conveyors**
 - **More prevalent above 50HP**
- 💡 **Could be made with NEMA Premium[®] efficiency but rarely are**

What is the energy saving opportunity?

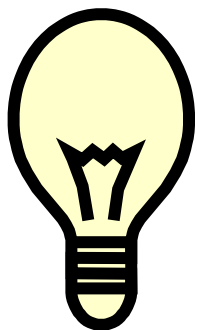
Type II Motors - Close-coupled pump motors

- 💡 C-face motor with or without base with special shaft and mounts to the pump
- 💡 Available from stock as NEMA Premium[®]
- 💡 Often used with adjustable speed drives



Type II Motors - C-face or D-flange without base

- 💡 Mounts to gearbox, pump or compressor
- 💡 Available from stock as NEMA Premium[®]
- 💡 Often used with adjustable speed drives



What is the energy saving opportunity?

Type II Motors - Vertical solid shaft normal thrust motors (P-base)

- 💡 **Mounts to pump**
- 💡 **Used in water/waste water plants and process industries**
- 💡 **Available from stock as NEMA Premium[®]**
- 💡 **Often used with adjustable speed drives**

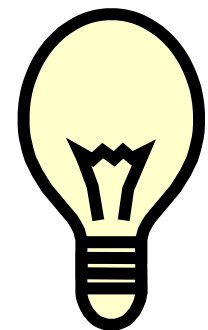


Type II Motors - 8-pole motors

- 💡 **Motors with synchronous speed of 900 RPM**
- 💡 **Used in process industries**
- 💡 **NEMA Premium[®] efficiency not defined for 8-pole but available with premium efficiency above Energy Efficient**

Type II Motors - 3-ph motors of not more than 600 volts (other than 230 or 460 volts). This includes IEC Metric frame motors from 90 frame – up.

- 💡 **Any configuration of motor other than 230/460 volts**
 - Typical voltages 200 and 575
- 💡 **Mounting not defined for this classification**
 - Could be base, C-face, D-flange, pump, etc.



What is the energy saving opportunity?



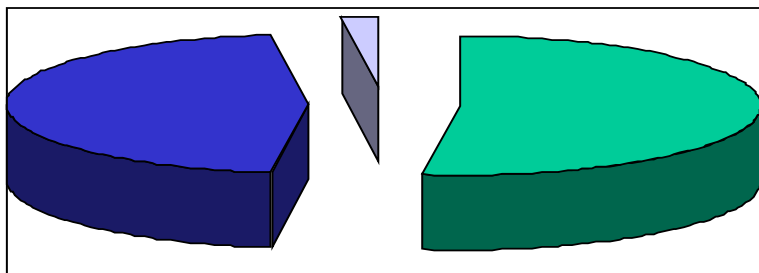
75 years of excellence

Technology	Is this a replacement for an existing technology (e.g. general purpose motors)?	Application: General Purpose, Special purpose, etc.	How big is the market? Units	Market Scope: Industrial, Commercial	Which industries? E.g. pulp/paper, food processing	Is there an Industry Test Procedure for efficiency? What is it?	Energy savings potential:	What inputs are used to calculate cost-effectiveness? Specific market conditions?	Is there an opportunity for efficiency programs?	How do these technologies address cross-cutting issues such as right-sizing and system considerations?
U-frame motor	Pre T frame product	Sold mostly to Automotive users and OEM	Less than 1 % of US	Industrial	Automotive	IEEE112B	Same as Epact	LCC	Yes	Dimensions are fixed rapidly declining market
Design C motor	High Torque	High Torque	2 to 46 % of US	Industrial	Aggregate and Mining	IEEE112B	Same as Epact	LCC	Yes	Definite Purpose Higher HP motors
Close-coupled pump motors	Existing mechanical design uses direct coupled impeller	Definite Purpose	5 to 7 % of US	Industrial & Commercial	Process industries and commercial buildings	IEEE112B	Available as Epact and NEMA Premium	LCC	Yes	There should be no issue replacing with NEMA Premium
Footless motors	Used extensively for material handling conveyor applications	Definite Purpose	10 to 15% of US	Industrial & Commercial	Food & beverage, package conveyors, unit conveyors, pumps	IEEE112B	Available as Epact and NEMA Premium	LCC	Yes	There should be no issue replacing with NEMA Premium, 1/2 to 10 HP
Vertical solid shaft normal thrust motors (tested in a horizontal configuration)	Existing mechanical design uses direct coupled impeller	Definite Purpose	2 to 3 % of US	Industrial & Commercial	Used for a wide variety of industrial , commercial and municipal pumps	IEEE112B	Yes	LCC	Yes	Both Epact and NEMA Premium available. Definite purpose engineered to order
8-pole (900 rpm) motor	Existing	used in driven equipment	Less than 1% of US			IEEE112B	Minimal	LCC	Yes	Existing technologies very small market
Poly-phase motors of not more than 600 volts (other than 230 or 460 volts)	Existing mechanical design for a direct replacement	Commercial buildings	Less than 3%	Commercial	Commercial buildings pumps and air handling applications	IEEE112B	Yes	LCC	Yes	Both Epact and NEMA Premium available.

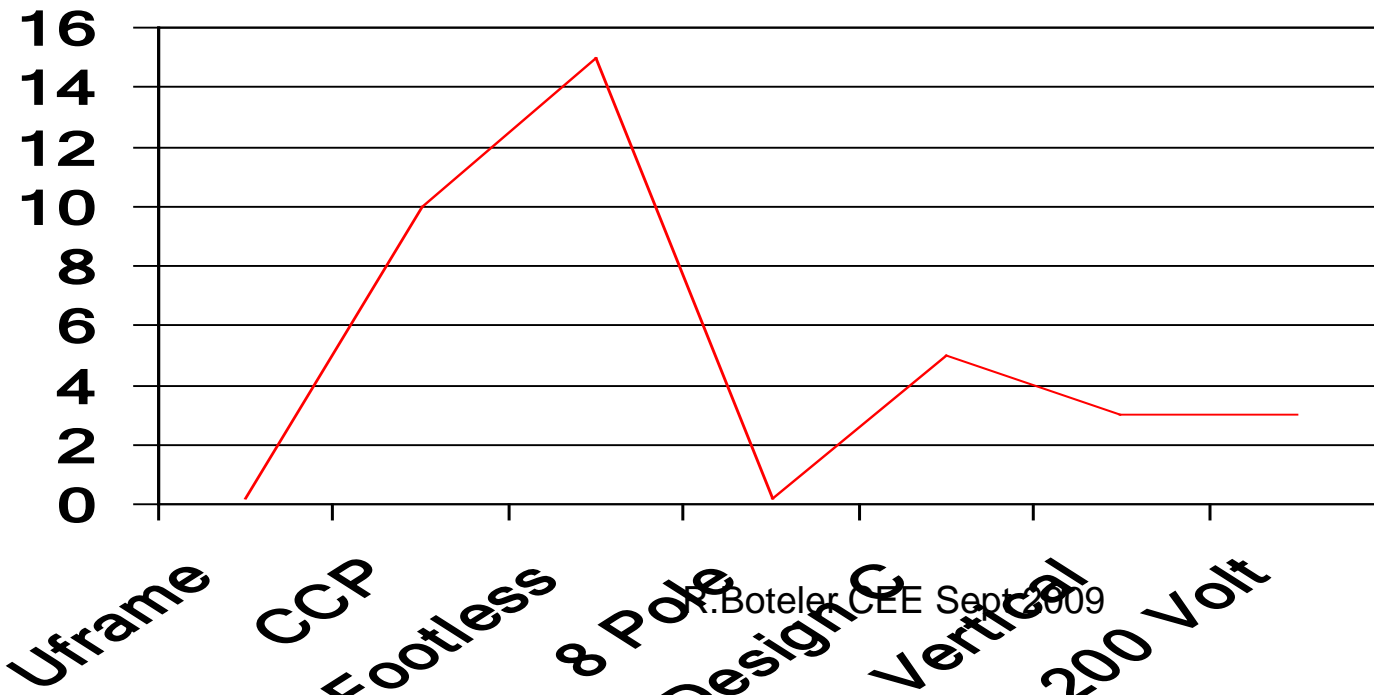
R. Boteler CEE Sept 2009



Utility Programs are most effective with end users

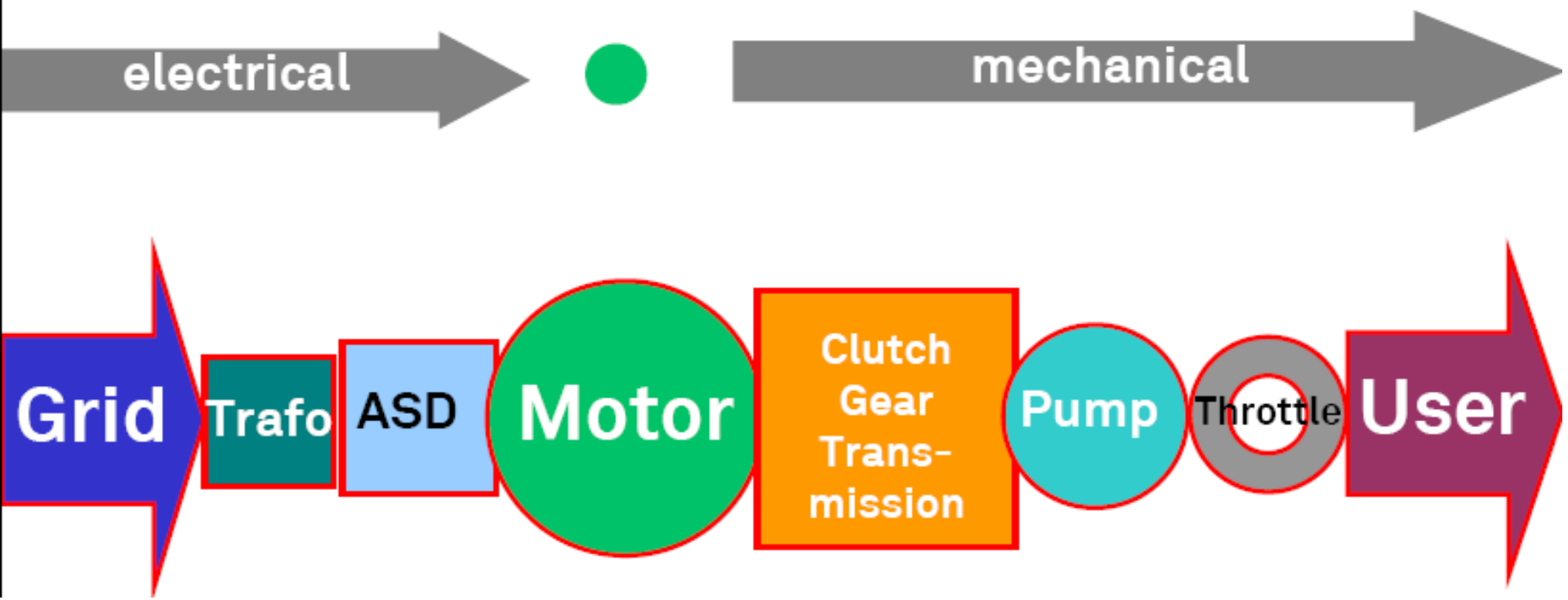


50% of distributor sales go to small OEM's



% Units

Boteler, CEE Sept 2009



- 1-System efficiency - controlling power by matching system speed and load requirements**
- 2-Replacement of pre-EPact motors instead of repair**
- 3- Prescriptive incentive for definite purpose motors**
- 4-Super Premium Motors with two bands more efficiency**

Energy Options	Connected HP	Improved Efficiency	Existing Efficiency	Percent Change	Kilowatts Saved per Hour	Kilowatts Saved per year	Percentage Of System Opportunity
1-System Efficiency	1,000,000	92.0%	80.0%	15.0%	121,630	486,521,739	100.0%
2-Crush for Credit	1,000,000	95.8%	91.0%	5.3%	41,075	164,298,332	34%
3-Definite Purpose	1,000,000	92.4%	90.4%	2.2%	17,862	71,447,726	15%
4-Super Premium	1,000,000	96.5%	95.8%	0.7%	5,649	22,594,568	5%

Based on 4,000 hours per year operation

Legislation	Date Passed	Product Covered	Implementation Date	Next steps
Energy Policy Act of 1992	Nov-92	1- 200 HP General Purpose Polyphase Motors to 12-11 level	Jan-97	None
Small Motors	Nov-92	42/48 and 56 frame single and polyphase general purpose motors	Pending	Notice of Public Rule expected in October, NEMA Members do not support
EISA	Dec-07	1-200 HP general Purpose Polyphase Motors to 12-12 level add [7] categories of definite purpose motors at 12-11 levels	Dec-10	Implementation 12/19/2010
Climate House Authorizing Bill	Jun-09			Both House and Senate bills go to conference when approved
Item 1		Authorize DOE to contract a motor market study	Pending passage and appropriations	
Item 2		Authorize DOE to implement a crush for credit early retirement program of \$30 / HP	Pending passage and appropriations	
Climate Senate Authorizing Bill	Pending		Senate vote expected October /November of 2009	Both House and Senate bills go to conference when approved
Item 1		Authorize DOE to contract a motor market study	Pending passage and appropriations	
Item 2		Authorize DOE to implement a crush for credit early retirement program of \$30 / HP	Pending passage and appropriations	
Item 3		R.Boteler CEE Sept 2009 A tax incentive for advanced technology motors of \$120/ HP	Pending passage and appropriations	19