

DOE Pump Regulations & HI Energy Rating Program



The Journey to Efficiency









Energy Policy & Conservation Act - 1975

- Created comprehensive approach to federal energy policy
 - Formed strategic petroleum reserves
 - DOE enforces minimum Energy Conservation Standards for appliances/equipment





Electrical Energy Savings Potential



The regulation is estimated to save 0.27 quadrillion BTU's over a 30 year period or approximately the annual electricity required by 1.5 million homes annually



Commercial & Industrial Pump





What Does This Mean To You?

5.



By January 27, 2020:

- 1. All covered pumps sold in U.S. must meet minimum efficiency standards
- 2. <u>25%</u> of currently offered pumps will <u>not be</u> <u>saleable</u> on January 27, 2020

Pumps must be labeled to show <u>energy efficiency</u> (PEI)

- 4. Pump testing <u>must</u> comply with specified procedures, data <u>must</u> be shared with DOE
 - The standards use holistic approach encompassing pump, motor and VFD

Accelerates the shift to higher efficient pumps through education and easier inclusion in utility incentive programs



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Scope of Commercial & Industrial Pump Rulemaking

Diagram	Nomenclature (DOE) / [Industry]	Relevant Taco Products	Scope Refinement	
	End Suction Frame Mount (ESFM) / [OH0, OH1]	FI Series – Base Mounted End Suction Pumps	Included Clean Water Pumps BEP Pump Power Input : 1 – 200 HP BEP rate of flow: 25 gpm or greater BEP head: 459 ft or less	
	End Suction Close Coupled (ESCC) / [OH7]	CI Series – Closed Coupled End Suction Pumps	 Temperature: 14 – 248 °F Nominal Speeds (RPM): 1800 (1440-2160) & 3600 (2880-4320) Radial Flow (n_s less than 5000) 	
	In-line (IL) / [OH3, OH4, OH5]	KV Series – Closed Coupled End Suction KS Series – Vertically Split Coupled In-Line Pumps 1900 Series	Excluded Non-clean water designs (API, ASME, Slurry, Wastewater, Etc.) Nuclear controlled Mil Spec Magnetic Driven Fire Pump (GT_TA_TC pumps)	
	Radially Split multi-stage vertical in-line diffuser casing (RSV) / [VS8]	N/A	 Sanitary (3-A std) Self-priming Prime Assist Circulators (Separate Rulemaking) 	
	Submersible Turbine (ST) / [VS0]	Hydroflo Pumps Fluid Solutions	 Pool Pumps (Separate Rulemaking) ST [VS0] with a bowl diameter > 6.0" 	



PEI is the rating that will determine DOE compliance

 The <u>Pump Energy Index (PEI)</u> metric is a ratio of the pump being rated (basic model, <u>PER_{CL} or PER_{VL}</u>) over the representative performance of a <u>minimally compliant</u> pump (PER_{STD}) for that specific pump type (e.g. ESCC or IL).

$$\mathsf{PEI}_{\mathsf{CL}} = \frac{\mathsf{PER}_{\mathsf{CL}}}{\mathsf{PER}_{\mathsf{STD}}} \le 1.00 \qquad \mathsf{PEI}_{\mathsf{VL}} = \frac{\mathsf{PER}_{\mathsf{VL}}}{\mathsf{PER}_{\mathsf{STD}}} \le 1.00$$

Only Pumps with a <u>PEI less than or equal to 1.00 can be sold</u> in the United States after January 27, 2020





Constant Load (CL):
 Bare Pump <u>or</u>
 Bare Pump + Motor



- Variable Load (VL): Bare Pump + Motor + Continuous Control
 - Also called the *Extended Product*







- Manufacturer can choose to rate pump as:
 - 1. Bare Pump

2. Pump and Motor



Or 3. Pump, Motor and Drive (*extended product*)



Variable Load (PER_{VL})





$\mathsf{PER}_{\mathsf{CL}}$ & $\mathsf{PER}_{\mathsf{VL}}$ Calculations

BEP rate

of flow

• Pump Energy Rating (PER)

Standard calculation to determine pump's average energy usage

Head

Efficiency

Driver or Pump Power Input

75%

Rate of Flow

100%

110%

$\ensuremath{\mathsf{PER}_{\mathsf{CL}}}\xspace$ Calculation



Where:

 P_i^{in} = measured or calculated input power to the motor at rating point I, for the rated pump w_i = weighting at load point, this is equal to 0.3333 I = 75%, 100% and 110% of BEP

PER_{VL} Calculation

 $PER_{VL} = \sum_{i} w_i (P_i^{in,c})$



Where:

 $P_i^{in,c}$ = measured or calculated input power to the motor at rating point I, for the rated pump w_i = weighting at load point, this is equal to 0.25 I = 25%, 50%, 75%, 100% of BEP

Note: All data is calculated to a fixed pole speed, for 2-pole = 3600 rpm, for 4-pole = 1800 rpm



The Testing Methodologies

Method 1: Testing

- Measures <u>wire-to-water</u> power consumption
- Inclusive of driver & controls, when applicable
- Describes <u>weighted average</u> <u>performance</u> of rated pump at specific load points



 ${\rm PER}_{\rm CL}\mbox{-}$ Constant Load 75%, 100% and 110% of BEP

Bare Pump + Motor + Drive



PER_{VL}- Variable Load 25%, 50%, 75%, and 100% of BEP

Method 2: Calculation

• Uses default loss calculations for a driver or driver and controls that are applied to bare pump test data.

NOTE: Results in a higher PEI value than test method

DOE testing based on HI 40.5-2016 Standard





- Minimally compliant pump (PER_{STD}) efficiency is a function of specific speed, the BEP flow, and a constant defined by the DOE based on pump survey data
- Equals a representative pump that would fall on the compliant line (25th percentile)







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Labeling Requirements

Performance labeling:

- PEI is the final metric used to determine if the rated equipment is compliant with the DOE standard
- The compliant (≤ 1.0) PEI_{CL} or PEI_{VL} is required to appear on the pumps permanent nameplate and all catalog and marketing material



The pump needs to display the following:

- PEI_{CL} or PEI_{VL}
- Pump's basic model number
 - As listed with the DOE
- Impeller diameter
 - Or space left for it if final trim is determined later in commerce

Note: All testing is based on performance at full impeller trim, max HP, normalized to 1800 or 3600 rpm



A NEW way to think about Efficiency





Now What?..

- 1. Look for labelling starting to appear in 2018 from all major pump manufacturers
- 2. Understand PEI so you can add requirements to specifications and use to compare pump options
- 3. 2020 is the regulation's effective date but many new pumps are being introduced now
- 4. Embrace high-efficiency pumping!
- 5. Contact **REP NAME** for any assistance



The Journey to Efficiency





HI Energy Rating Program

Program Goals:

- 1. Based on HI standards and DOE regulations
- 2. Develop rating system for bare pump & extended products
- 3. Suitable for utility programs to enable deemed incentives
- 4. Provides easy comparison to determine estimated energy savings

Provides additional value by:

- Third party lab approval
- Provides data required for utility deemed incentive programs
- Certificate program for value added to a bare pump in the commerce stream. ****Missed by DOE regulation****







HYDRAULIC ENERGY

- Yardstick approach
- Can be applied to:
 - Bare pump
 - Pump + motor
 - Pump + motor + drive/controls
 - Certificate option capture downstream savings from added drivers/controls
- Aligns with proven appliance label concept
- Ready now ahead of the 2020 DOE compliance date

Model #: 000000000000000000000	ESCC	
Nominal Speed: 3600	Motor	
	22	
Most Consumptive RANGE	Least Consumptive	



The HI Energy Rating - Calculation

 $ER = (PEI_{Baseline} - Rated PEI_{CL}/_{VL}) * 100$

ER Represents the percent power savings over the base case

Power Savings = $\frac{ER}{100} * Rated Motor Power$ Power Savings = $\frac{ER_1 - ER_2}{100} * Rated Motor Power$

Average PEI - Baseli	Average ER - Baseline & Standard Level			
DOE Type	Baseline	Standard level	Baseline	Standard level
ESCC 1800	1.09	1.00	0	9
ESCC 3600	1.09	1.00	0	9
ESFM 1800	1.10	1.00	0	10
ESFM 3600	1.09	1.00	0	9
IL 1800	1.11	1.00	0	11
IL 3600	1.12	1.00	0	12
RSV 1800	1.00	1.00	0	0
RSV 3600	1.00	1.00	0	0
ST 1800	1.00	1.00	0	0
ST 3600	1.06	1.00	0	6



The HI Energy Rating - Calculation

PEI to ER Calculation:

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ER = (Baseline – PEI_{CL/VL}) * 100
Example for variable load: ER = (1.09 – 0.49) * 100 = 60
Example for constant load: ER = (1.09 – 0.87) *100 = 22
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Energy Rating is a direct derivative of the PEI





Oct. 2016

Note: Energy Ratings are relative to the variables selected. Look at where the number lies within that particular label.



Power Savings Calculation - Example

50 HP ESCC Pump and Motor

50 HP ESCC Pump, Motor and Variable Speed Drive Use label to calculate <u>power savings</u> over baseline value



Multiply power savings by operating hours and cost of energy to yield <u>estimated cost savings</u> over baseline



HI Energy Rating Database

- HI Energy Rating Home Page: <u>http://er.pumps.org</u>
- Participants register, apply to participate and list pumps at the ER Program Portal
 - Customers and Utility program can search pumps



HI developed the standard, HI 40.6, for testing pumps and determining their efficiency in a uniform and consistent manner. The US Department of Energy (DOE) published an Energy Conservation Standard (ECS) and Uniform Test Procedure (TP) for Pumps on January 27, 2016; and in the uniform test procedure, HI 40.6 is incorporated by reference. The ECS and TP can be referenced at 10 CFR 431.465 and 10 CFR 431.464 & Appendix A to Subpart Y. www.ecfr.gov

HI manages a Pump Test Lab Approval Program (PTLAP) (HI 40.7, www.pumps.org/40.7), which enables pump test laboratories to establish through a third party that they have the knowledge, tools and processes in place, and are testing according to the HI 40.6 standard and managing their measurement equipment according to ISO 17025.

The HI Energy Rating (ER) Program (HI 40.5, www.pumps.org/40.5 builds on the ECS, TP and HI PTLAP. The HI ER Program defines process to participate in the program, scope of the program and requirements to list pumps with an Energy Rating.

As part of the program, this website allows corporations to apply to participate through the ER Program Portal, and the public to search for pump energy rating listings, and analyze the distribution of pumps in the program.

ER Program Portal **Q** Search Pumps

Register as an Energy Rating Program participant to create pump energy rating labels, QR codes, and more. Search for pumps by Basic Model Number, Manufacturer, and Rating ID - which can be found on the Hydraulic Energy Rating label distributed with the pump.

Utility Search

Analyze the Energy Ratings database to see how many pumps achieve a given Energy Rating range. This is especially helpful for utilities.



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HI Database – Search Tools





Certificate Program

ER certificate option is only applicable when a motor and/or control is added to a pump listed in HI's database



HI Certificate Program produces serialized certificate that can be used for deemed incentives

- Pump manufacturers
- Pump distributors/reps/packagers
- End users

Manufacturers are <u>required</u> to report PEI for basic models to DOE. They are <u>not required</u> to report "system" or extended product PEI.



Program Alignment









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ECM Utility Incentive Programs

Residential ECM Commercial ECM Res and Com ECM





The Incentives

- Rebate programs vary by utility (check yours!)
- Most deemed incentives based on variable speed ECM
- Future programs will feature HI Energy Rating label & extended product efficiency
- Automatic price reduction direct to reseller or to customer via mail-in rebate
- Rebates will be available past 2020





Teamwork to Savings

- We want to be your partner in reaching out to and working with utility incentive programs for your next project
- Although deemed incentives are coming almost all utilities have custom programs and we want to help you get that money
- ECM is the future
 - Taco is your source for education & information
 - Taco has the most extensive line of ECM circulators and pumps available shortly up to 30HP!

Let's partner to deliver energy savings, increased performance and advanced functionality!





• 98 years old, still family owned



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TacoComfort.com



Reference Links

- DOE Energy Conservation Standard for Pumps
 - <u>https://www.federalregister.gov/articles/2016/01/26/2016-00324/energy-conservation-program-energy-conservation-standards-for-pumps</u>
- DOE Test Procedure for Pumps
 - <u>https://www.federalregister.gov/articles/2016/01/25/2016-00039/energy-conservation-program-test-procedure-for-pumps</u>
- Hydraulic Institute DOE Rulemaking Page
 - <u>http://www.pumps.org/DOE_Pumps.aspx</u>
- Hydraulic Institute Energy Rating Portal
 - <u>http://er.pumps.org</u>
- Hydraulic Institute E-Store for Standards & Guides
 - <u>http://estore.pumps.org/HI_40-7.aspx</u>
- DSIRE Database of State Incentives
 - <u>http://www.dsireusa.org/</u>



Thank You



FOR MORE INFORMATION

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