



Orange Empire Chapter

Pump Energy Efficiency Regulations

**Mark Handzel
Xylem - Bell & Gossett
September 2018**

Where pump regulation began . . .

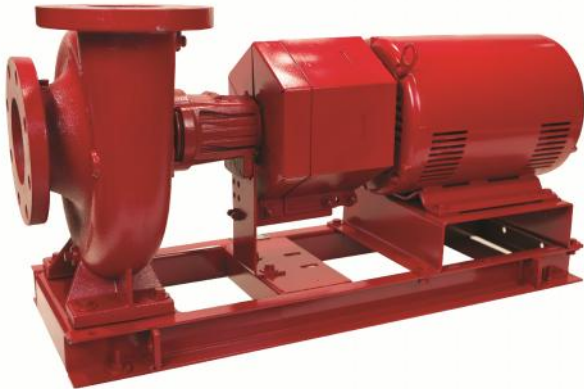
- The **U.S. Energy Policy and Conservation Act of 1975 (EPCA)** set forth a variety of provisions designed to improve energy efficiency. Part C of Title III establishes the "Energy Conservation Program for Certain Industrial Equipment." The covered equipment included electric motors, compressors, and pumps.
- This provision was not acted upon for pumps until 2011 when the U.S. Dept of Energy announced their intent to develop a Pump Energy Conservation Standard.

Dept of Energy Process

- DOE Working Group
 - product manufacturers,
 - energy advocates
 - Trade associations and
 - other interested parties.
- DOE vets Working Group recommendations to insure energy savings and fairness to all interested parties.
- DOE announces laws and allows time for manufacturers compliance.

- Key Working Group recommendations
 - Regulate pumps in alignment with EU
 - Promote the use of pumping systems (pumps, motors and VS drives)
 - Set efficiency standards to remove the 25% poorest performing pumps
 - Follow Hydraulic Institute Pump Test procedures
 - Allow four years for manufacturers to get in compliance.

Which Pumps are in DOE scope?



End Suction Frame Mtd



End Suction Close Coupled



Inline Close Coupled & Split Coupled



Submersible Vertical Turbine Pumps



Vertical Multi-Stage Pumps

More info on DOE Scope Limitations

- Clean Water Applications only
- BEP Power Input: 1-200 Hp
- BEP Flow Rate: 25 GPM or greater
- BEP Head: 459 feet or less
- Temperature: 14 – 248° F
- Nominal Speeds: 1800 and 3600 RPM

Which Pumps are NOT in DOE scope?



Double Suction Pumps



Circulator Pumps

Other Pumps NOT in DOE Scope

- Non-Clean Water Pump Designs (API, ASME, Slurry, Wastewater, etc.)
- Nuclear spec controlled Pumps
- Mil Spec Pumps
- Magnetic Drive Pumps
- Fire Pumps
- Sanitary Pumps (3-A Standard)
- Prime Assist Pumps
- Vertical Turbines with bowl size greater than 6"

Summary of National Benefits (U.S.)

- Environmental Benefits over a 30 year period

Cumulative emissions reductions:

- 16 million metric tons of carbon dioxide (CO₂)
- 73 thousand tons of methane (CH₄)
- 12 thousand tons of sulfur dioxide (SO₂)
- 23 thousand tons of nitrogen oxide (NO_x)
- 0.22 thousand tons of nitrous oxide (N₂O)
- 0.04 tons of Mercury (Hg)

DOE Timeline

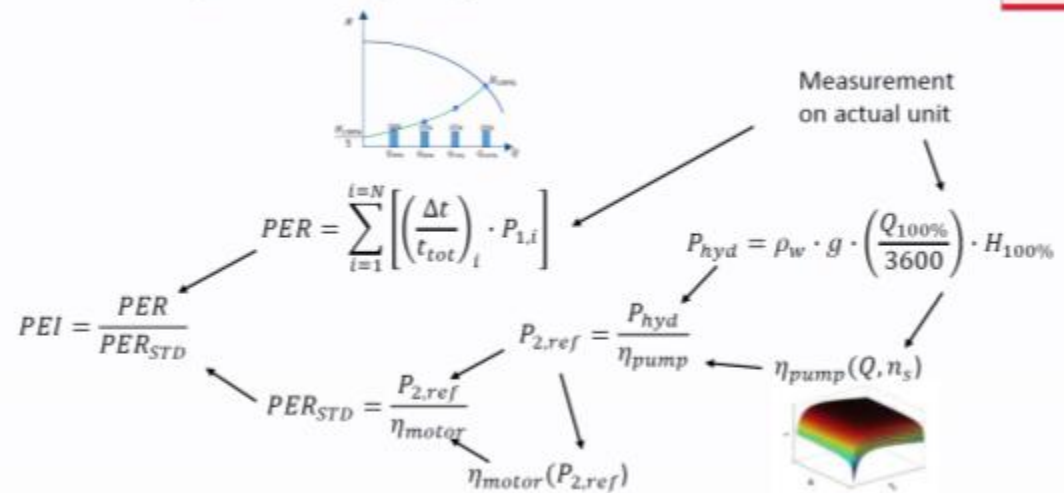
- Working Group: 2011 – 12
- DOE Final Rule released: January 2016
- Compliance Date: January 27, 2020

- DOE Pump Efficiency Index (PEI) established
- DOE Pump Test Procedure established
- PEI must be listed on pump nameplate

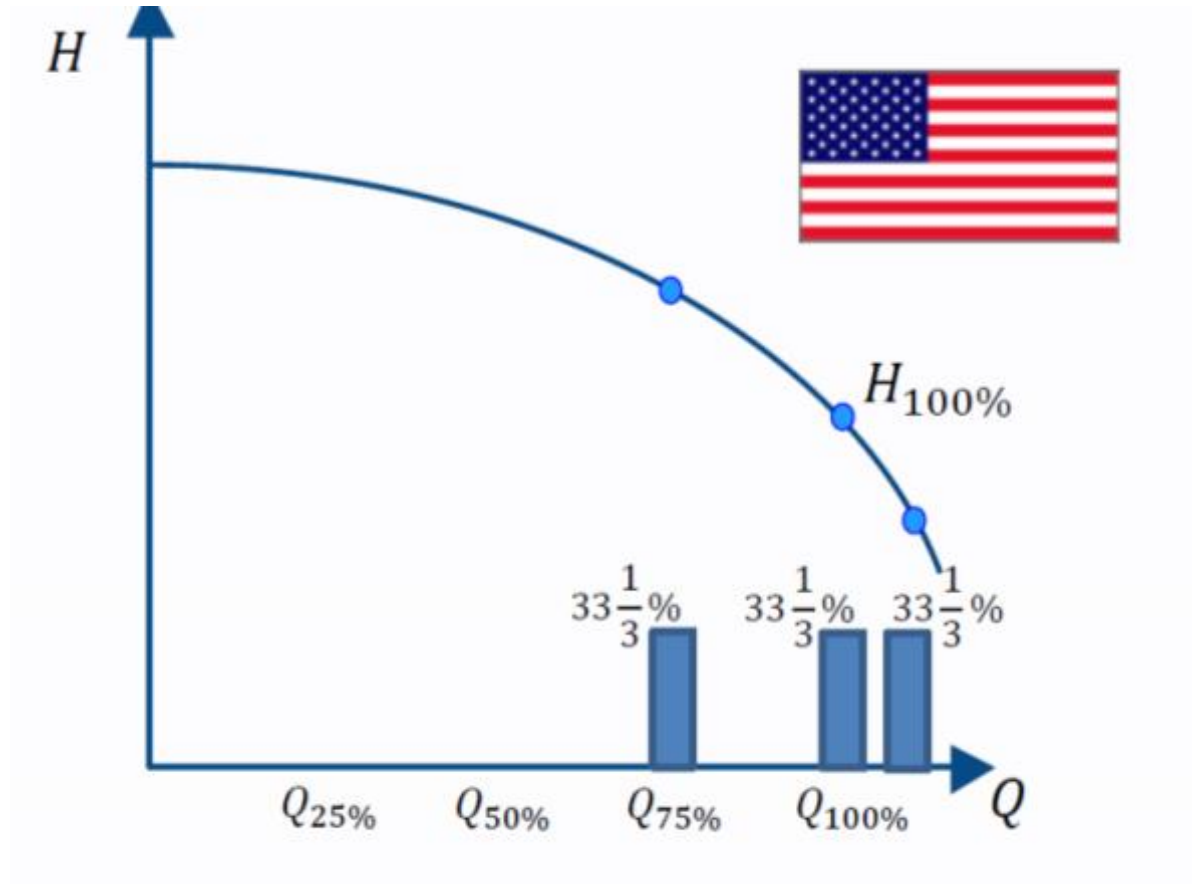
What goes into a PEI calculation?

- The DOE PEI metric consists of a ratio of the representative performance of the pump being rated over the representative performance of a pump that would minimally comply with any prospective DOE energy conservation standard for that pump type.


Pump Efficiency Index (PEI) in USA



Control Curves for Constant Load



PEI_{cl} Calculator


HYDRAULIC INSTITUTE ENERGY RATING

Pump Energy Index (PEI) Calculator

Load point data entry

Configuration:	Bare Pump
Rating Load Type:	Constant Load (CL)
Pump Brand:	Pinstripe
Basic / Individual Model Number:	4x3d / 4x3d
Impeller diameter and Nominal Speed:	9 inches @ 1800 rpm
PEI calculation method:	Section III

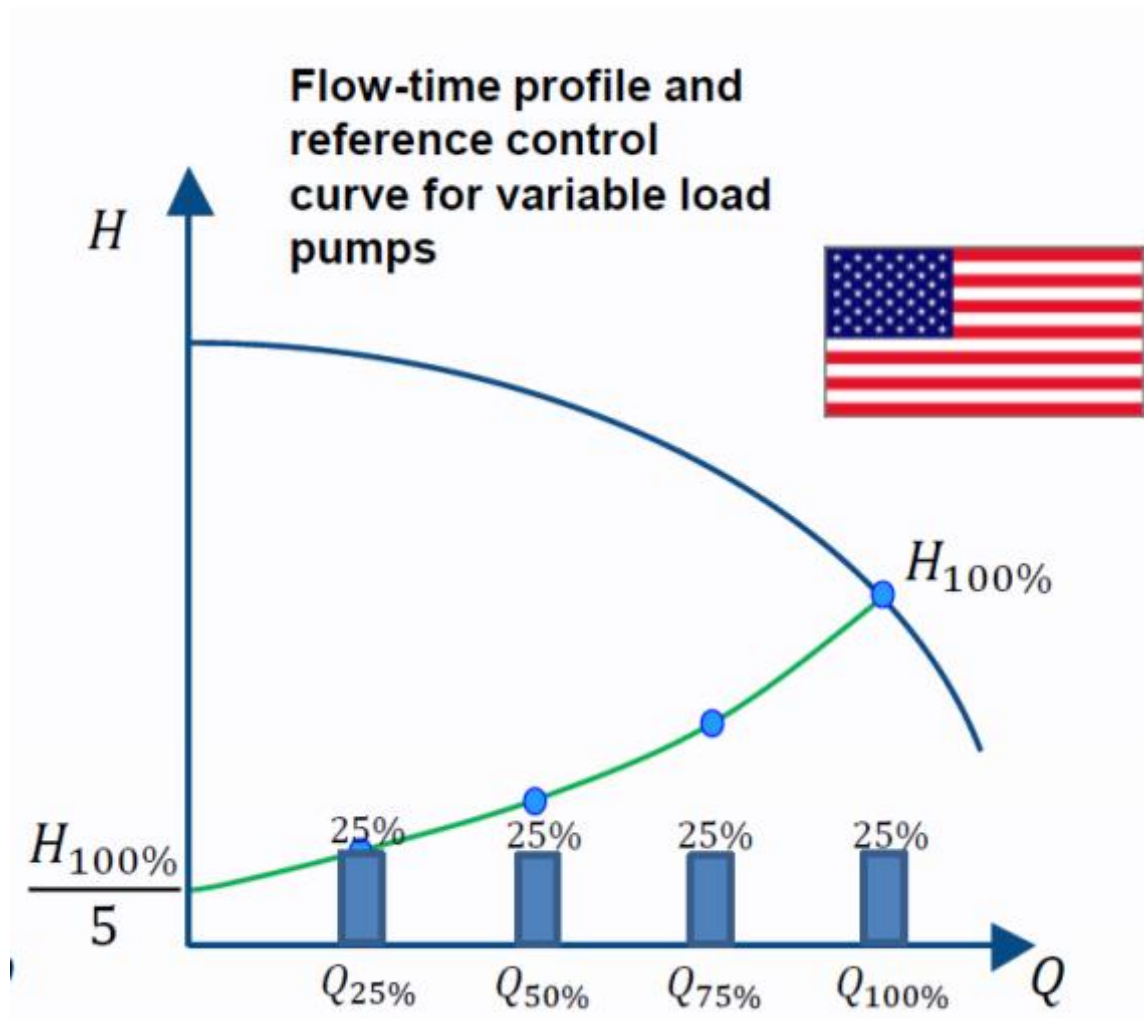
Can the pump be tested at 120% of BEP flow? Yes (75% / 100% / 110% load points)
 No (65% / 90% / 100% load points)

Values at Nominal Speed of Rotation


	@ 75% BEP	@ 100% BEP	@ 110% BEP	@ 120% BEP
Rate of flow (gpm)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
Head (ft)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
Pump Input Power (hp)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

[Back](#) [Calculate PEI & Energy Ratings](#) [Start over](#)

Control Curves for Variable Load



PEI_{VI} Calculator



Pump Energy Index (PEI) Calculator

Load point data entry

Configuration:	Pump + Motor w/ Continuous Controls
Rating Load Type:	Variable Load (VL)
Pump Brand:	Primorpe
Basic / Individual Model Number:	4c3d9 / 4c3d9
Impeller diameter and Nominal Speed:	9 inches @ 1800 rpm
Motor performance method:	Calculated
PEI calculation method:	Section VIII

Can the pump be tested at 120% of BEP flow? Yes (75% / 100% / 110% load points)
 No (65% / 90% / 100% load points)

Values at Nominal Speed of Rotation

	@ 75% BEP	@ 100% BEP	@ 110% BEP
Rate of flow (gpm)	<input type="text"/>	<input type="text"/>	<input type="text"/>
Head (ft)	<input type="text"/>	<input type="text"/>	<input type="text"/>
Pump Input Power (hp)	<input type="text"/>	<input type="text"/>	<input type="text"/>

[Back](#) [Calculate PEI & Energy Ratings](#) [Start over](#)

Nuances of the DOE PEI

- Pumps are rated using full impeller diameter only. For calculations with motors, Non-overloading Motor Hp is used.
- Multiple configurations can be rated:
 - Bare Pump only (always Constant Load)
 - Pump and Motor (always Constant Load)
 - Pump, Motor and Variable Speed Drive (always Variable Load)
- Two ways to determine PEI
 - Pump performance test must be used to determine PEI for Bare Pump
 - Extended Pump Product
 - Motor and VS Drive efficiency can be added to the pump PEI via calculation using nominal motor and VS Drive efficiency
 - Motor and VS Drive efficiency can be added to the pump PEI by testing complete pump, motor and VS drive (wire to water efficiency test). If this is done – must specifically link rating to motor and drive mfr used for the test.

DOE PEI Information

- Pumps with a PEI less than or equal to 1.00 can be sold in the United States after January 27, 2020. Power savings over a minimally compliant pump or savings over any other PEI can be easily calculated.

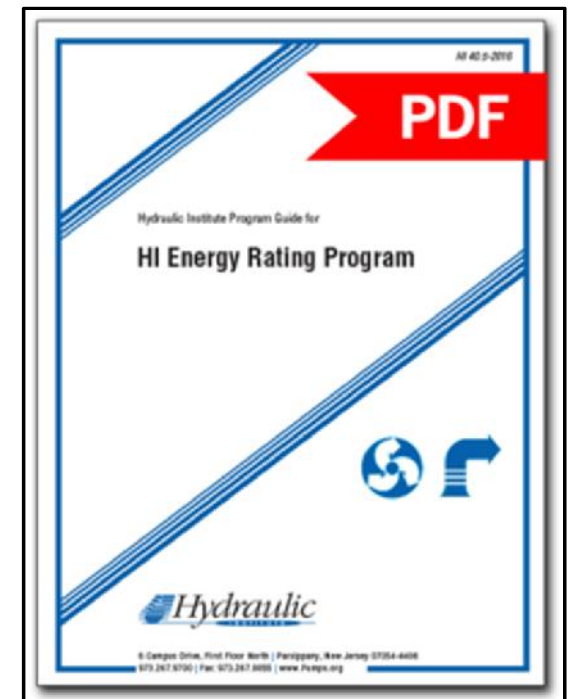


Efforts to get in compliance

- What are manufacturers doing to get in compliance?
 - Re-testing to confirm performance
 - Re-designing specific models
 - Testing with V.S. drives

Hydraulic Institute's involvement?

- Hydraulic Institute resource page:
www.pumps.org/doerulemaking
- Hydraulic Institute (HI) Energy Rating Program:
 1. Scope of program – Aligned with DOE
 2. Eligibility & how to participate
 3. The HI Energy Rating & Labels
 4. Testing & Listing of Pumps
 5. Proper Use
 6. Certificate Program
 7. HI Energy Rating Portal & Database



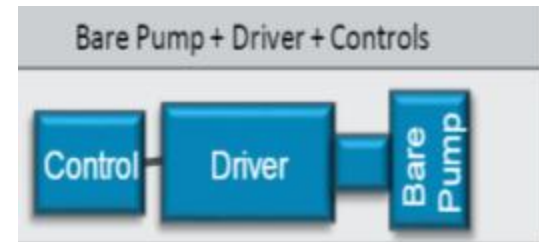
HI Energy Rating Program

Goals of the Program – Build on DOE Regulations

1. Develop a separate energy rating system for bare pump and extended products
2. Suitable for utility programs to enable deemed incentives.

Provide additional value by:

- Requiring third party lab certification
- Provide data required for deemed incentives
 - In reliable, consistent, simple, searchable and easy to use format
- Managed by HI with input and feedback from utilities to meet your needs



B&G/Hi Energy Rating Nomenclature

HI ER Nomenclature

e-1510 3BD-4P-PM

<u>Series</u>	<u>Model</u>	<u>Poles</u>	<u>Configuration</u>
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		2P	BP – Bare Pump
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		4P	PM – Pump & Motor
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			PD – Pump, Motor & Drive
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Sample HI Energy Rating information



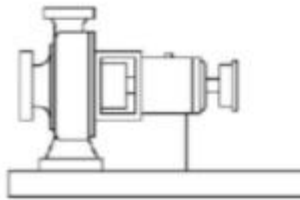
Bell & Gossett / e-1510 3BD-4P-BP e-1510 3BD-4P-BP

Xylem, Inc

Pump Energy Index

0.90

Baseline: 1.08



Energy Rating

18

HI Rating ID:

QLVME5

Basic model designation:

e-1510 3BD-4P-BP

Manufacturer's model designation:

e-1510 3BD-4P-BP

DOE product category:

ESFM

HI approved laboratory:

Xylem Inc. - Applied Water Systems - 000102

Full impeller diameter:

9.500 inches

Nominal speed:

1800 rpm

BEP flow rate:

533.69 gpm

BEP head:

82.12 ft

BEP Driver input power:

14.02 hp

Rated motor power:

15.00 hp

Date listed:

Oct 23, 2017

Hydraulic Institute(HI) Pump Energy Rating Labels

- Hydraulic Institute Energy Rating labels now available
- <http://er.pumps.org/ratings/home>

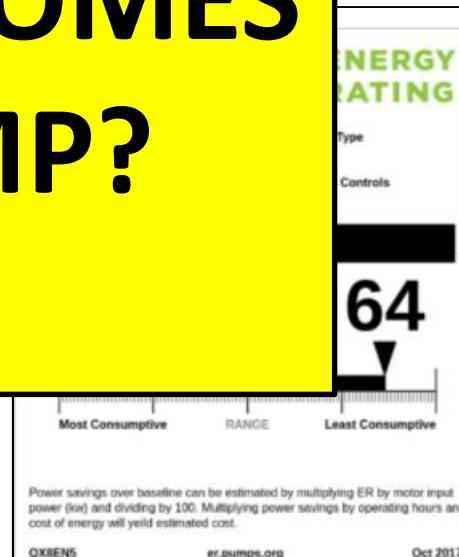
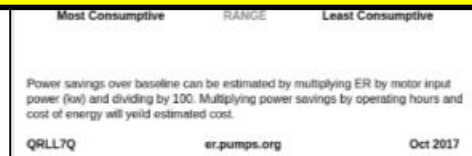


HI ER Label examples

- Bare Pump
- Pump & Motor (Same as bare pump since motors is highly efficient)
- Pump, Motor and continuous controls (i.e. VS Drive)



WHAT LABEL COMES ON MY PUMP?



What HI ER Label is applied?

Order a Pump End Only –

you get the Constant Load Bare Pump PEI Label

Order a Pump & Motor –

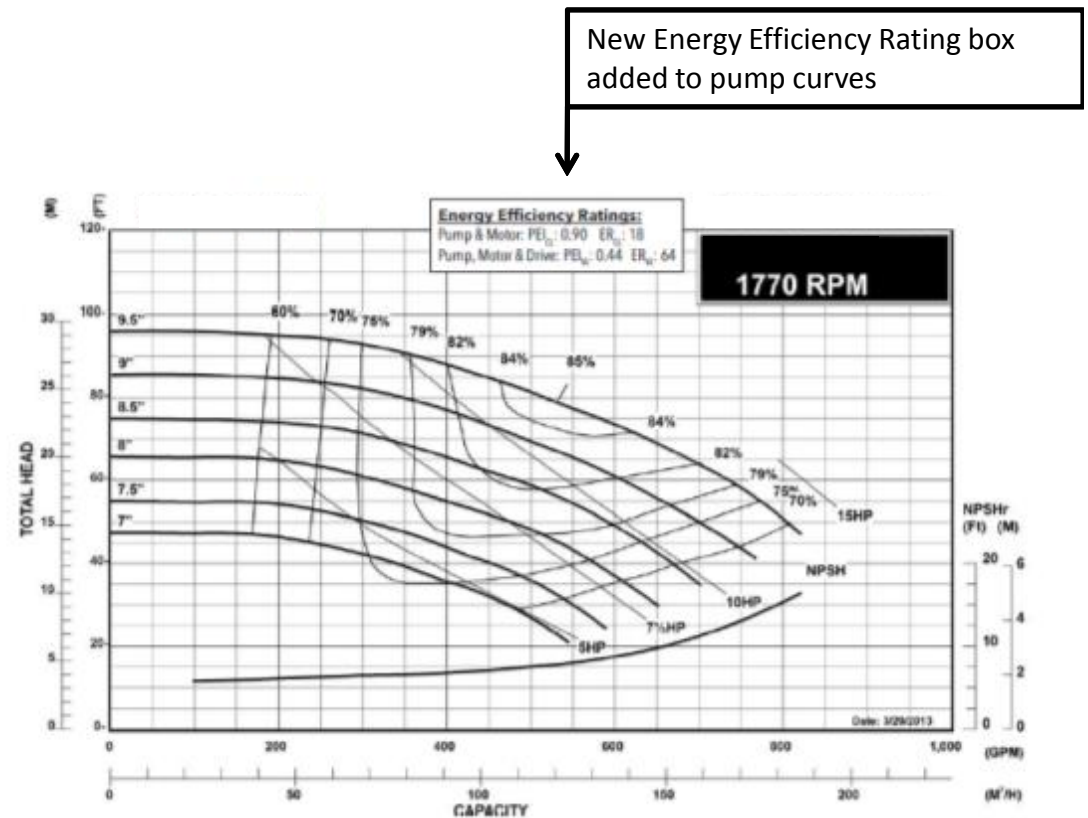
You get the Constant Load Pump & Motor Label

Order a Pump, Motor and VS Drive

You get the Variable Load Pump, Motor & Drive Label


Where can I see DOE PEI and HI ER data?

- Each Mfgr will vary
- New “Energy Efficiency Rating” box added to each curve.
- Online databases also available. . .



ASHRAE STANDARD 90.1

- 90.1 Committee is currently working on the 2019 version of the standard which will be released in late 2019.
- Verbiage being added to require the used of DOE compliant pumps



ANSI/ASHRAE/IESNA Standard 90.1-2010
(Supersedes ANSI/ASHRAE/IESNA Standard 90.1-2007)
Includes ANSI/ASHRAE/IESNA Addenda listed in Appendix F

ASHRAE STANDARD

Energy Standard for Buildings Except Low-Rise Residential Buildings



I-P Edition

See Appendix F for approval dates by the ASHRAE Standards Committee, the ASHRAE Board of Directors, the IESNA Board of Directors, and the American National Standards Institute.

This standard is under continuous maintenance by a Standing Standard Project Committee (SSPC) for which the Standards Committee has established a documented program for regular publication of addenda or revisions, including procedures for timely, documented, consensus action on requests for change to any part of the standard. The change submittal form, instructions, and deadlines may be obtained in electronic form from the ASHRAE Web site (www.ashrae.org) or in paper form from the Manager of Standards. The latest edition of an ASHRAE Standard may be purchased from the ASHRAE Web site (www.ashrae.org) or from ASHRAE Customer Service, 1791 Tullie Circle, NE, Atlanta, GA 30329-2306. E-mail: orders@ashrae.org. Fax: 404-321-5478. Telephone: 404-636-8400 (worldwide), or toll free 1-800-527-4723 (for orders in US and Canada). For reprint permission, go to www.ashrae.org/permissions.

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Other DOE Pump Efficiency Regulations?

- Dedicated Purpose Pool Pumps
 - DOE Working Group 2015-16
 - Reached consensus agreement with DOE requiring V.S. Motors
 - Goes into effect July 2021



- Circulator Pumps
 - DOE Working Group 2015-2016
 - Recommended requiring ECM motors only
 - Proposal was never implemented by DOE



Utility Rebates for Pumps

New construction and retrofit:

- \$25/HP for 3-40 HP
- \$4/HP for 50-200 HP



Based on DOE PEI:

- Constant speed PEI less than 0.96
- Variable speed PEI less than 0.49

Other utilities expected to follow:

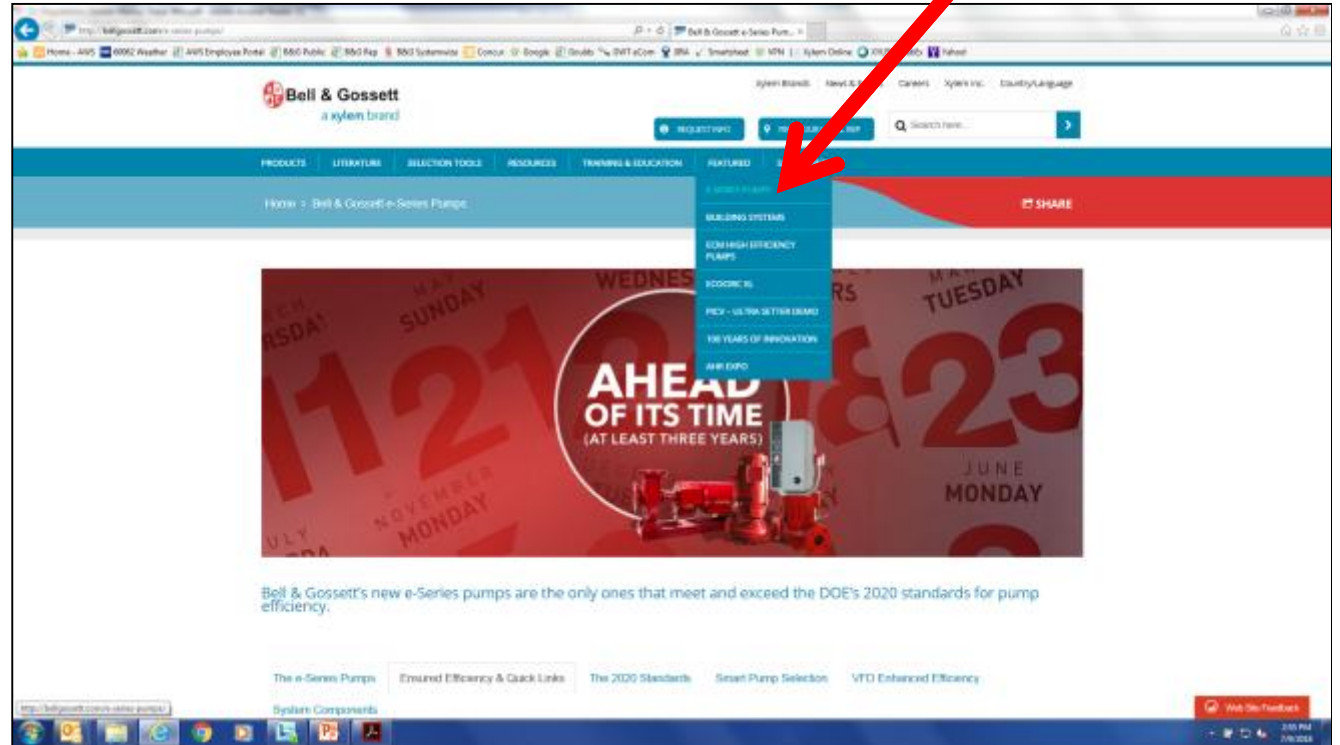


PG&E MIDSTREAM WATER PUMP INCENTIVE PROGRAM 2018 Measure Tables

Rebate Code	Description	Rebate/Unit Measure
PM003	Constant Speed to Constant Speed Replacement, $\geq 3\text{HP} \leq 50\text{HP}$, PEI < 0.96	\$25/HP
PM004	Constant Speed to Constant Speed Replacement, $> 50\text{HP} \leq 200\text{HP}$, PEI < 0.96	\$4/HP
PM006	Variable Speed to Variable Speed Replacement, $\geq 3\text{HP} \leq 50\text{HP}$, PEI < 0.49	\$25/HP
PM0037	Variable Speed to Variable Speed Replacement, $> 50\text{HP} \leq 200\text{HP}$, PEI < 0.49	\$4/HP

Resources available

- B&G Public Website “Featured” Tab
- “Resources” Tab
- “E-Series Pumps”
- “Ensured Efficiency & Quick Links” Tab



Available resources

Clean Water Pump Energy Efficiency Information	URL
U.S. DOE Energy Conservation Standard for Clean Water Pumps	https://www.ecfr.gov/cgi-bin/retrieveECFR?n=pt10.3.431#sp10.3.431.y
U.S. DOE Uniform Test Procedure for Certain Clean Water Pumps	https://www.ecfr.gov/cgi-bin/retrieveECFR?n=pt10.3.431#ap10.3.431_1466.a
U.S. DOE Energy Conservation Standard for Water Pumps - Scope, Diagram, and Definitions	http://www.pumps.org/DOE_Pumps.aspx
Hydraulic Institute Frequently asked questions related to the U.S. DOE Energy Conservation Standard and Test Procedure for Water Pumps	http://pumps.org/EnergyEfficiency/DOE_Rulemaking/FAQs.aspx
Hydraulic Institute List of Certified Pump Test Labs	http://pumps.org/EnergyEfficiency/Pump_Test_Lab_Approval_Program/PTLAP_Approved_Labs.aspx
Database of State & Local Incentives for Renewables & Efficiency	http://www.dsireusa.org/

Questions?



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