Hydraulic Institute EU & US Regulatory Update & DOE Roundtable

March 9, 2017, 9:45 a.m. – 12:00 p.m.
We are committed to conduct our discussion today within the boundaries of the antitrust laws. These considerations are familiar to us, but I will briefly review some guidelines in order to comfort everyone that the discussion will stay on track. Our purpose today is to meet and discuss the matters before this Committee.

Throughout our meeting, keep the following in mind:

1. We will NOT discuss any specifics about pricing. Many of you in this room are customers, suppliers or competitors, and I know you appreciate that you should not discuss pricing levels in any meeting such as this one.

2. We will have NO discussion about groups getting together to force their point of view on others by refusing to deal, either explicitly or otherwise. We always work toward consensus, and competitive threats play no part in what we do.

3. We will NOT produce a set of demands or a joint position that one segment of this industry will mandate be followed by other segments. We can educate and persuade; we cannot demand.

As a general rule, if you have an antitrust-based concern about whether to make a particular comment, err on the side of keeping it to yourself.
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<td>Welcome / Roll Call</td>
<td>P. Gaydon</td>
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<td>9:50 – 9:55 a.m.</td>
<td>Overview &amp; Agenda</td>
<td>P. Gaydon</td>
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<td>9:55 – 10:15 a.m.</td>
<td>EU Update</td>
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<td>10:15 – 10:25 a.m.</td>
<td>Coffee Break</td>
<td>All</td>
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<td>10:30 – 10:50 a.m.</td>
<td>US Update</td>
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<td>10:50 – 11:50 a.m.</td>
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<td>12:00 p.m.</td>
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EUROPUMP
HI Update
Standards & Technical Commission
March 9th 2017
Orlando
Summary of EuP/ErP legislation for pumps and motors

- Little Energy saving found in Lot 28 and Lot 29

- Adoption/ Expected adoption
- Energy efficiency requirements
- Expected future requirements

- Clean water pumps
- Wastewater pumps
- EP (EEI<yy)
- EP (EEI<zz)
- EP (EEI<xx)

- Water pumps
- Circulators
- Motors
- IE2
- IE3 or IE2+VSD
- IE3 or IE2+VSD*

- MB>0.1
- MB>0.4
- EEI<0.23
- EEI<0.27

*Increased scope

EP = Extended Product

Summary of EuP/ErP legislation for pumps and motors

Little Energy saving found in Lot 28 and Lot 29
Extended Product Approach

Extended Product

Fluid Outlet

Fluid Inlet

Pump

Coupling

Electric Motor

Terminal box, or VSD

Mains

Load profile

Control

PEI
Extended Product Approach

Fluid Inlet → Fluid Outlet

Pump → Coupling → Electric Motor

Terminal box, or VSD → Mains

EuP/ErP – Pumps MEI
EuP/ErP - Electric Motors IEX

Extended Product Approach EEI

EEI

Load profile Control
Terminal box or VSD

HYDRAULIC INSTITUTE
Control curves used for variable flow systems and variable load pumps
Control curves used for constant flow systems and constant load pumps

Flow-time profile and reference control curve constant flow systems (HVAC)

Flow-time profile and reference control curve for constant load pumps
EEI, PEI definitions

• EU
  • $\text{EEI}_{\text{VF}}$: Variable speed pump \textit{and} fixed speed pump installed in variable flow systems
  
  • $\text{EEI}_{\text{CF}}$: Variable speed pump \textit{and} fixed speed pump installed in constant flow systems

• USA
  • $\text{PEI}_{\text{VL}}$: Variable speed pumps
  
  • $\text{PEI}_{\text{CL}}$: Fixed speed pumps
Variable flow, Constant flow systems

Extended product approach for water pumps in EU distinguish between variable flow system and constant flow systems.

Variable flow systems

Constant flow systems

EEI = 0.45

EEI = 0.75

Size

Variable speed pump unit

Fixed speed pump unit
Extended product approach for water pumps in USA distinguish between variable load pumps and constant load pumps.
Conclusions

• Extended Product Approach Methodology in EU and USA looks very similar but the implication is quite different

• In USA the same threshold will be set for both variable speed pumps and fixed speed pumps, which means that the worst performing fixed speed pumps in each category will be ruled out but most all variable load (speed) pumps will pass

• In EU the threshold will be determined by the application i.e variable flow or constant flow systems, which implies that the worst performing variable speed and fixed speed pumps are ruled out in each category and that fixed speed pumps will be ruled out in variable flow systems
Standards

ISO 9906 / HI 14.6

EU

MEI
EN 16480
Pumps - Minimum required efficiency of rotodynamic water pumps

EEI
EN 17038
Pumps - Methods of qualification and verification of the Energy Efficiency Index for rotodynamic pump units –

USA

HI 40.6
Methods for Rotodynamic Pump Efficiency Testing
Tests according to EN 16480

- describes tests and evaluation of the test results in respect to MEI
- refers to ISO 9906, grade 2B regarding test conditions, measurement accuracy, ...

Difference in significance of EN 16480 and ISO 9906:

- **ISO 9906** is applied for acceptance tests on single pumps to prove guaranteed performance data
- **EN 16480** is applied for tests on samples of a pump type/size to prove conformity with EU regulation (i.e. fulfilment of MEI\text{required})
Qualification (in-house) & Verification (3rd party)

MEI on Type Plate

MEI check

\[ \eta_{\text{meas}} = 0.95 \cdot \eta_{\text{min,req}} \]
US Regulatory Update & DOE Roundtable

Peter Gaydon,
Director, Technical Affairs
Hydraulic Institute
Certain Clean Water Pumps (Review)

- Published in the code of federal regulation (www.ecfr.gov) at 10 CFR 431 Subpart Y and Appendix A
- Became effective on February 24, 2016
- Any representations of the Pump Energy Rating (PER) and Pump Energy Index (PEI) must comply with the regulation by July 25, 2016
- Certification with DOE is required on January 27, 2020
  - www.pumps.org/doerulemaking
- PEI calculator (New)
- Frequently asked question page (New)
Introduction: DOE Rulemakings for “Certain Clean Water Pumps”

What is the purpose?
• Conservation of energy for clean water rotodynamic pumps

What does this mean?
• **Some** types of clean water pumps used within U.S. commerce will need to meet **minimum efficiency standards**

• The rules use a holistic approach **inclusive of the pump, motor and VFD** (when applicable)

• The testing of subject pumps must comply with specific test procedures and data must be certified to the DOE

• Pumps must be **labeled** to describe their energy performance
Summary

• The DOE Test Procedure, designates *HI 40.6-2014 Methods for Rotodynamic Pump Efficiency Testing* as the test method

• The DOE established the **Pump Energy Index (PEI)** as a new metric to rate the energy performance of pumps that are subject to DOE test procedure. The PEI is applied to pumps with **constant load (PEI_{CL})** and **variable load (PEI_{VL})**

• Both PEI_{CL} and PEI_{VL} describe the **weighted average performance** of the rated pump at load points, normalized to the weighted average performance of a minimally compliant pump without controls, inclusive of its electric motor and integrated continuous or non-continuous controls, if applicable.

• Standard level set so that **25%** of currently offered pumps will **not be saleable** on January 27, 2020. Estimated **savings** of **0.27 Quads** or approximately the annual electricity required by **1.5 million homes annually**.
Important Definitions

*Pump* means equipment that is designed to move liquids (which may include entrained gases, free solids, and totally dissolved solids) by physical or mechanical action and includes at least a bare pump and, if included by the manufacturer at the time of sale, mechanical equipment, driver, and controls.

*Clean water pump* means a pump that is designed for use in pumping water with a maximum non-absorbent free solid content of 0.016 pounds per cubic foot, and with a maximum dissolved solid content of 3.1 pounds per cubic foot, provided that the total gas content of the water does not exceed the saturation volume, and disregarding any additives necessary to prevent the water from freezing at a minimum of 14 °F.
Pumps Tested at Constant Load or Variable Load

Constant Load

Variable Load

Bare Pump + Driver + Controls

Control  Driver  Bare Pump
Performance Metric – PEI
Pump Energy Index ≤1.00 can be sold

• The Pump Energy Index (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.

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

\[
\text{Constant Load} \quad PEI_{CL} = \frac{PER_{CL}}{PER_{STD}}
\]

\[
\text{Variable Load} \quad PEI_{VL} = \frac{PER_{VL}}{PER_{STD}}
\]

OR
Future Regulations

1. Dedicated Purpose Pool Pumps (DPPP)

2. Circulator Pumps
Dedicate Purpose Pool Pumps

The DPPP working group negotiation was completed in 2016 and DOE published in the federal register (82 FR 5446)

1. Notice of Proposed Rulemaking (NOPR) for the Test Procedure
   • Specifies testing to HI 40.6

2. Direct Final Rule (DFR) and NOPR for the ECS simultaneously
   • The DFR indicates that the effective date for the ECS is May 18, 2017
     • Unless adverse comment is received by May 8, 2017
     • If the comments received provide reasonable basis for withdrawal of the DFR, DOE will instead proceed with the Proposed Rulemaking process.
Dedicate Purpose Pool Pumps

These proposed rules specify definitions and standard levels for

1. self-priming and non-self-priming pool filter pumps

2. pressure cleaner booster pumps.

3. Additionally integral sand and cartridge filter pool pumps must be distributed in commerce with a timer.
Circulator Pumps

ASRAC working group negotiations complete December 1, 2016

Working Group Members
- Gary Fernstrom - California Investor-Owned Utilities
- Joanna Mauer - Appliance Standards Awareness Project
- Charles White - Plumbing-Heating-Cooling Contractors Association
- Mark Chaffee - TACO, Inc.
- Laura Petrillo-Groh - Air-Conditioning, Heating, and Refrigeration Institute
- Gabor Lechner - Armstrong Pumps, Inc.
- David Bortolon - WILO USA
- Mark Handzel - Xylem, Inc.
- Rich Gussert - Grundfos Americas Corporation
- Peter Gaydon - Hydraulic Institute
- Russell Pate - Rheem Manufacturing Company
- Lauren Urbanek - Natural Resources Defense Council
- Scott Durfee - Nidec Motor Corporation
- Tom Eckman - ASRAC
- Joseph Hagerman - U.S. Department of Energy

ASRAC Negotiations for Energy Conservation Standard & Test Procedure
[https://www.regulations.gov/#!docketDetail;D=+EERE-2016-BT-STD-0004]
Circulator Pumps

The circulator pump working group reached consensus term sheet on 12/1/16

- ASRAC approved the term sheet in December 2016

- Working group recommended DOE publish NOPR and Final Rules by end of 2017

- Working group recommended circulator pumps will need to meet the standard level 4 years from the issuance of the final rule in the Federal Register

  - The working group fully supports the implementation of the term sheet.

  - However, there is uncertainty about if and when DOE will publish a NOPR due to the leadership changes at DOE and the 60 day regulatory freeze issued by President Trump.
Circulator Pumps

**Working Group Recommendations**

- DOE determined all circulator types (CP1, CP2 and CP3) with and without controls are all one equipment class.
  - They will all have to meet the same standard level

- Test procedure per HI 40.6-2016

- Test inclusive of motor and controls in least consumptive method
  - No control
  - Multi-speed
  - Manual speed control
  - Pressure control
  - Adaptive pressure control
  - Temperature control
  - Input signal control

- Standard level that would effectively shift the circulator pump market **from induction motor** technology to the more efficient **electrically commutated motor (ECM)** technology

- Estimates 0.7+ quads of energy savings or the annual energy use of 4 million homes.
Differentiation of CP2/3 and SVIL

**Dry Rotor**

<table>
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<th>In-Line Pump</th>
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<td>• Shaft power: 1 – 200 hp</td>
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<tr>
<td>• Does <strong>NOT</strong> include pumps with:</td>
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<tr>
<td>• hydraulic power @ WTW BEP ≤ 5 hp AND</td>
</tr>
<tr>
<td>• <strong>non-horizontal motor</strong></td>
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**CP2** [Dry Rotor 2-Piece]
- Hydraulic power @ WTW BEP ≤ 5 hp
- Close coupled
- “**horizontal motor**”

**CP3** [Dry Rotor 3-Piece]
- Hydraulic power @ WTW BEP ≤ 5 hp
- Mechanically coupled
- “**horizontal motor**”

**Expands scope of CIP regulation**
- Inline pumps below 1 hp are recommended be covered on same requirements of CIP regulation.
- Recommended due to substitution loophole with regulated circulators.
- NOPR will outline test procedure, metric and standard level consistent with CIP regulation.
- Compliance for SVIL pumps will be consistent with CIP regulation 01/27/2020
HI ENERGY SAVINGS ECOSYSTEM

The HI Ecosystem provides parallel paths to energy efficient pumping systems!

- **HI TRAINING**: Teaches Pump System Optimization and Assessment
- **MASTER CERTIFICATION**: Qualifies Pump System Auditors (Fall 2017)
- **HI TEST STANDARD**: Measure Energy Efficiency and is referenced by DOE
- **DOE**: Higher efficiencies required in 2020
- **LAB APPROVAL Program**: Ensures Higher Efficiency and Compliance to test standard
- **ENERGY RATING**: Quantifies real savings and qualifies product for utility rebates

40% Pumping systems account for 40% of Industrial Energy Usage

The HI Ecosystem provides parallel paths to energy efficient pumping systems!
Pump Test Lab Approval Program

In 2015 HI launched HI 40.7-2015 Pump Test Lab Approval Program (PTLAP)

• Voluntary program

• This program gives test laboratories the opportunity to be approved by HI. This demonstrates that the laboratory adheres to the requirements and procedures outlined in HI 40.6-2014 and ISO 17025 concerning test measurement equipment

• The Audit is conducted by an independent 3rd party auditor

• For more information on the program guide go to the following link for a free download

• http://estore.pumps.org/HI_40-7.aspx
HI Energy Rating Program

Goals of the Program

1. Develop a rating system for bare pump and extended products
   • Relative power of a product to a base case or another rated product

2. Suitable for utility programs to enable deemed incentives.

Provide additional value by:

• Third party lab approval
• Provide data required for UES or Standard Protocol measures
  • In reliable, consistent, simple, searchable and easy to use format
• Managed by HI with input and feedback from utilities to meet your needs
• Certificate program for value added to a bare pump in the commerce stream.  ****Missed by DOE regulation****
Roundtable – FAQ committee

Roundtable – Al Iseppon, Jim Volk, Mark Chaffee, Paul Ruzicka, Michael Coussens, Peter Gaydon, Mark Handzel

Moderated – Jamie Watkins

Discussion Points – 8 prepared questions, assigned to different committee members

Following each question the moderator can take questions related to what was presented and the roundtable can answer. The additional Q & A for each prepared question will be limited to 5 – 10 minutes.

Following presentation of all questions, we can open the Q&A to other questions, with the disclaimer that we may elect to take the question back for more thorough review before answering it.

Attendees will have a printout of all 51 FAQs, so they can reference the question when it is discussed.

Attendees will have form to submit questions for future consideration
Roundtable session

Goals of today’s session

1. Review the purpose of HI’s DOE frequency asked question committee
2. Review frequency asked questions received and reviewed by HI
3. Open Q & A on FAQs presented
4. Gain clarity on the requirements of the regulation
5. Collect additional questions for the committee review and develop formal responses
6. Collect topics that we need to ask DOE for clarity or make recommendations to DOE
Frequently Asked Questions – Review committee

Committee Purpose:

This committee shall support the purpose and aims of the Hydraulic Institute and is responsible for the following topic(s):

• Review of questions related to 10 CFR 431 Subpart Y (Pumps – Energy conservation standard), Appendix A to 10 CFR Subpart Y (Uniform test procedure) and Section 429.59 of 10 CFR 429 (Certification, compliance and enforcement)

• Develop committee consensus document for submittal to DOE for review and comment, and will be published by HI on its website benefit members and the industry.

Committee Scope:

All questions received by HI related to 10 CFR 431 Subpart Y, Appendix A to Subpart Y, Section 429.59 of 10CFR 429 and any related Hydraulic Institute Programs and Standards (ANSI/HI 1.1-1.2, 2.1-2.2, HI 40.5, HI 40.6, HI 40.7).
Committee Members

Committee Members:

Jamie Watkins (Chair) - Crane Pumps & Systems
Mark Chaffee - Taco Inc.
Michael Coussens – Peerless Pump Company
Kevin Fulton – Ebara International Corp
Peter Gaydon – Hydraulic Institute
Mark Handzel – Xylem Inc. - Applied Water Systems
Al Iseppon – Pentair – Berkeley
Paul Ruzicka – Xylem – Applied Water Systems
James Volk – Franklin Electric Company, Inc.

Special thanks to Sarah Widder of PNNL who supported the committee
Section of HI site dedicated to FAQs at www.pumps.org/doerulemaking & www.pumps.org/DOE_FAQs.aspx

- Committee has addressed 52 questions covering the following types of inquiries:
  - General
  - Scope
  - Compliance
  - Test Procedure

- All questions have been submitted to DOE:
  - 25 of the 52 have been highlighted, asking DOE to formally respond
  - 7 recommendations have been made to DOE
Roundtable question 1 (Mark Handzel)

• (Question 4) What is a basic model?
The basic model is the designation given to a pump or group of pumps of the same equipment class by the manufacturer when the pump is certified with a PEI_{CL/VL} to the DOE.

The regulation says: Basic model means all units of a given class of pump manufactured by one manufacturer, having the same primary energy source, and having essentially identical electrical, physical, and functional (or hydraulic) characteristics that affect energy consumption, energy efficiency, water consumption, or water efficiency; except that:

1. For RSV and ST pumps, all variations in numbers of stages of the bare pump must be considered a single basic model;
2. Pump models for which the bare pump differs in impeller diameter, or impeller trim, may be considered a single basic model; and
3. Pump models for which the bare pump differs in number of stages or impeller diameter and which are sold with motors (or motors and controls) of varying horsepower may only be considered a single basic model if:
   1. For ESCC, ESFM, IL, and RSV pumps, each motor offered in the basic model has a nominal full load motor efficiency rated at the Federal minimum (see the current table for NEMA Design B motors at 10 CFR 431.25) or the same number of bands above the Federal minimum for each respective motor horsepower (see Table 3 of Appendix A to Subpart Y of Part 431); or
   2. for ST pumps, each motor offered in the basic model has a full load motor efficiency at the default nominal full load submersible motor efficiency shown in Table 2 of appendix A to subpart Y of part 431 or the same number of bands above the default nominal full load submersible motor efficiency for each respective motor horsepower (see Table 3 of Appendix A to Subpart Y of Part 431).

In summary HI believes:

1. The Basic Model is the unit(s) of the same equipment class whose performance is reported to the DOE under a single PEI value.
2. Basic Model(s) listed as a bare pump can be sold with reduced diameter impeller trims or number of stages (RSV & ST) and all would have the same PEI value and it can be sold with different motors and/or controls with the same PEI rating
3. Basic Model(s) listed as a pump and motor can be sold with reduced diameter impeller trims or number stages (RSV & ST) and all would have the same PEI value, provided any trimmed or different stage count is distributed with a motor of an equivalent or higher efficiency level compared to its nominal.
Roundtable question 2 (Al Iseppon)

• (Question 15/16) Will repairs or retrofits of existing pumps sold prior to January 27, 2020 need to meet efficiency standards and will the repaired pumps require testing and is a kit of parts considered a pump or a part?
• It is HI’s understanding that the regulation applies to newly manufactured pumps that are manufactured in or imported into, the United States on or after January 27, 2020.

• *Manufacture* means to manufacture, produce, assemble, or import.

• *Manufacturer* means any person who manufactures a consumer product.

• HI does not believe a repair part for an existing pump manufactured prior to or after the compliance date is within scope of the standard and would not require testing or labeling.

• If the manufacturer sells a kit that can be assembled into a bare pump, it is a pump and must comply with the requirements of the regulations.
Roundtable question 3 (Jamie Watkins)

• (Question 12/13) We make pumps that are used in clean water applications but have been designed to suit multiple non-clean water applications including the passage of a certain amount of solids. Are my pumps within scope because they are used for clean water in addition to many other applications? Are refinery and chemical process pumps included in the rules coverage?
DOE established scope based on product definition, design intent and performance parameters not the application it is used in.

The determination of if the pump is within scope is based on the manufacturers determination if it meets DOE’s definition of clean water pump.

If the pump is designed for clean water per the definition of clean water pump and it satisfies the equipment class definitions as well as performance parameters, it is within scope.

If the manufacturer has made design considerations for the pump to enable it to safely handle liquids other than water or water with additional solids content or dissolved solids or water outside the temperature range that impact the power consumption of the pump, it would then potentially serve a different utility and not meet the definition of “clean water pump”. If the manufacturer has a question regarding scope, inquiries can be sent to the U.S. DOE and they will be considered on a case by case basis.

In the Test Procedure Notice of Proposed Rule, “DOE notes that, when determining whether a given pump would satisfy the definition of clean water pump, DOE would consider marketing materials, labels and certifications, equipment design, and actual application of such equipment.”

If a pump was designed for fluids other than clean water and is used in a refinery or chemical process, then it would NOT be covered. For example pumps complying with API 610 or ASME B73 would be designed for a utility other than clean water and would not be in scope of this regulation.
(Question 32/33) If a pump was manufactured prior to 2020, can it be sold/grandfathered after 2020? Is it assumed that when 2020 rolls around, pump warehouses should be empty of all pumps that don't comply?
Roundtable question 5 (Peter Gaydon)

(Question 7) DOE provided an Excel spreadsheet for PEI_{CL} and PEI_{VL} calculations. Are current versions available w/ latest "C" values?
• To HI’s knowledge DOE has not released an updated calculator that is consistent with the final rule.

• HI has requested that DOE provide an updated calculator so that it is accurate when used.

• HI has developed a calculator consistent with the methods outlined in 10 CFR 431 Subpart Y and the Uniform Test Procedure Appendix A to Subpart Y. The calculators are available at estore.pumps.org/peicalculator and er.pumps.org/pei.
Roundtable question 6 (Mark Chaffee)

(Question 39) If one uses the calculations to determine $\text{PER}_{CL/VL}$ rather than actual testing, how will those methods be verified? Do you have to verify your calculations with a certain number of tests to use the method?
• It is up to the manufacturer to verify that all testing and calculations are done per Appendix A to Subpart Y of 10CFR 431.
• At a minimum the bare pump must be tested to determine the best efficiency point and the pump power input at the required load points. Per the sampling plan at least 2 pumps must be tested so that a mean PEI can be calculated.
• The term “calculation” applies to the test method that uses default driver and control losses as outlined in sections III, V and VII of Appendix A to Subpart Y of 10 CFR 431.
• The representative PEI is per a sampling plan as outlined §429.59 Pumps (a) Determination of represented value. http://www.ecfr.gov/cgi-bin/text-idx?rgn=div5&node=10:3.0.1.4.17#se10.3.429_159
• The manufacturer is required to list the method used to determine PEI in the certification reporting and DOE will use the same method that is listed in the certification when any auditing is conducted.
Roundtable question 7 (Jim Volk)

(Question 35) How does this regulation affect a pump sales company that builds and assembles pumps in their shop? i.e., mix of trimming impellers, different pump manufacturers and multiple motor type and manufactures.
• Assuming the bare pump (wet end) is rated with a PEI when the sales company receives it.

• For trimmed impellers the PEI can remain, but the sales company will be responsible for adding the impeller diameter as distributed in commerce to the nameplate.

• Multiple motors that are compliant with DOE regulations (10 CFR 431.25) may be sold with the bare pump.
Roundtable question 8 (Jamie Watkins)

(Question 17) If an ST pump at 250 gpm exceeds 459 feet of head at BEP with 9 stages, is the entire 250 gpm offering (even with fewer stages) excluded?
• Yes the entire offering would be excluded.

• The scope criteria for clean water pumps are defined by the number of stages for testing (3 for RSV & 9 for ST). HI does not believe that a 9 stage ST or 3 stage RSV pump that exceed 200 shaft horsepower or 459 ft of head at the best efficiency point would fall within scope when sold with fewer impellers. This would also apply to single stage (ESCC, ESFM & IL) basic models where the full impeller diameter exceeds 200 shaft horsepower or 459 ft of head at the best efficiency point.