



Dedicated Purpose Pool Pumps (DPPP) Appliance Standards and Rulemaking Federal Advisory Committee (ASRAC) Working Group

First Meeting
Sept. 30 – Oct. 1, 2015

Department of Energy
Building Technologies Program

Agenda

Today's meeting will address the following topics:

- Overview of ASRAC and the negotiation process
- Brief discussion of rulemaking background
- Establishment of ground rules
- Establishment of schedule of meetings
- Discussion of scope and definitions of various varieties of pool pumps
- Discussion of potential metrics and test procedures applicable to dedicated-purpose pool pumps (DPPP)

Agenda

1 Introduction and Background

2 Administrative Items

3 Scope and Definitions

4 Metric and Test Procedure

5 Wrap Up

Agenda: Introduction and Background

Introduction and Background

I

Introduction to ASRAC

II

Introduction to the Negotiation Process

III

Working Group Charter

IV

Working Group Deliverables / Term Sheet

V

Rulemaking Background / Next Steps

Introduction to ASRAC

Appliance Standards and Rulemaking Federal Advisory Committee (ASRAC)

- DOE chartered the ASRAC in 2012 to further improve the DOE process of establishing energy conservation standards.
- ASRAC is solely advisory in nature, with focus on appliance standards, rulemaking issues and solutions.
- ASRAC tasks originate from discussions between DOE and ASRAC members; all ASRACs must have the following:
 - Clear goals,
 - A timeframe for task completion, and
 - A target date for presenting formal recommendations to DOE.

Introduction to ASRAC

ASRAC Working Groups

- ASRAC may vote to form working groups to investigate each task in detail and gather additional input from stakeholders.
 - If ASRAC votes to form a working group, DOE will publish a Federal Register notice soliciting nominations for members.
- Working group efforts are presented to ASRAC, and ASRAC deliberates and forms recommendations to DOE.
 - Working groups never present recommendations directly to DOE
- DOE may withdraw a task from ASRAC at any time.
- If a consensus recommendation is not reached for a particular task within a given timeframe, ASRAC will alert DOE that no recommendations will be made.
 - DOE will either withdraw the task, or give the working group more time.
 - If the task is withdrawn, DOE will proceed with its “normal” rulemaking activities.

Introduction to the Negotiation Process

General Review of Negotiation Process

- Per the notice of intent, the basis for this negotiation is as follows:
 - DOE needs to fully comply with statutory mandates. Congress mandates that DOE establish energy conservation standards that are technologically feasible and economically justified.
 - Stakeholders strongly support a consensual rulemaking effort.
- To the maximum extent possible consistent with its legal obligations, DOE will consider the consensus of the working group as the basis for the rulemaking moving forward.
- A key principle is consensus by all interests.
- Good faith negotiation is required.
- Participants need to provide DOE with data to support deliberations.
- DOE is committed to performing much of the same analysis as it would during a normal standards rulemaking process and to providing information and technical support to the working group.

The Working Group Charter

At the July 30 meeting (EERE-2013-BT-NOC-0005-0056), ASRAC chartered the DPPP Working Group to:

- Establish federal standards for pool pumps, and
- Provide input on a test method.

ASRAC authorized a two-tier process:

1. In the first 3 months (by **December 29, 2015**) discuss available industry data, scope of pool pumps in question, and potential test procedure or metric, and report back to ASRAC on progress.
2. If after 3 months ASRAC further extends the charter, DOE will conduct analysis based on data and recommendations to-date and re-convene the committee to discuss levels.

Working Group Deliverables

In order to recommend federal standards for pool pumps, the Working Group may provide input on:

- ☐ Scope of pool pumps for which energy conservation standards established in this rulemaking will apply
- ☐ Definitions necessary to clearly establish scope
- ☐ The metric used in the evaluation of energy conservation standards
(*e.g.*, Energy Factor (EF), Pump Energy Index (PEI), etc.)
- ☐ The testing method used to support the selected metric

The Working Group should also provide industry data to support DOE's analysis.

Introduction to the Term Sheet

The Working Group will develop a *Term Sheet* including its recommendations to ASRAC and DOE.

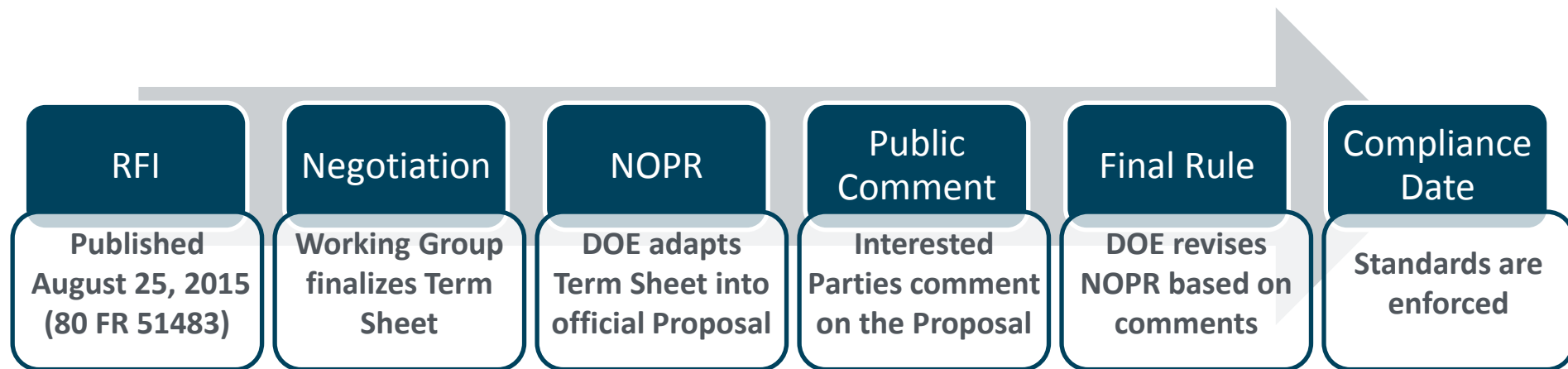
The *Term Sheet* reflects the Working Group's intent.

- When developing regulatory language, DOE may slightly alter the wording of the term sheet; however, DOE will adhere to the original intent to the maximum extent possible consistent with its legal obligations.
- An example term sheet, from the Pumps rulemaking negotiation, is available here:

<http://www.regulations.gov/#!documentDetail;D=EERE-2013-BT-NOC-0039-0091>

After the Term Sheet – Next Steps

After the term sheet is agreed upon, DOE must draft a NOPR and complete the Rulemaking process.



NOTE: DOE may issue a Direct Final Rule instead of completing a full NOPR and Final Rule process.

Background: Energy Conservation Standard History

Date	Rulemaking	DOE Publication
6/13/2011	Pumps	Commercial and Industrial Pumps (CIP) Request for Information http://www.regulations.gov/#!documentDetail;D=EERE-2011-BT-STD-0031-0001
2/01/2013	Pumps	CIP Notice of Public Meeting and Availability of Framework Document http://www.regulations.gov/#!documentDetail;D=EERE-2011-BT-STD-0031-0014
7/23/2013	Pumps	ASRAC: Notice of Intent to Establish the CIP Working Group to Negotiate a NOPR for Energy Conservation Standards for CIP. http://www.regulations.gov/#!documentDetail;D=EERE-2013-BT-NOC-0039-0001
6/19/2014	Pumps	The CIP Working Group formally recommended that DOE initiate a separate rulemaking for Dedicated-Purpose Pool Pumps (DPPPs). (Term Sheet Recommendation #5B at p. 2) http://www.regulations.gov/#!documentDetail;D=EERE-2013-BT-NOC-0039-0092
4/02/2015	Pumps	Energy Conservation Standards for Pumps; Notice of Proposed Rulemaking (NOPR) and Public Meeting. http://www.regulations.gov/#!documentDetail;D=EERE-2011-BT-STD-0031-0040
5/08/2015	DPPP	Energy Conservation Standards for DPPPs; Request for Information (RFI) http://www.regulations.gov/#!documentDetail;D=EERE-2015-BT-STD-0008-0001
8/25/2015	DPPP	ASRAC: Notice of Intent to Establish the Dedicated Purpose Pool Pumps Working Group to Negotiate a NOPR for Energy Conservation Standards http://www.regulations.gov/#!documentDetail;D=EERE-2015-BT-STD-0008-0012

Agenda

1 Introduction and Background

2 Administrative Items

3 Scope and Definitions

4 Metric and Test Procedure

5 Wrap Up

Agenda: Administrative Items

Administrative Items

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Ethics Briefing

II

Schedule

III

Ground Rules

Ethics Briefing

Schedule

Preliminary Schedule Plan

- Three, two-day meetings before the end of 2015
 1. Meeting One: September 30 – October 1
 2. Meeting Two: October 28-29 (Proposed)
 3. Meeting Three: December 3-4 (Proposed)
 - ❖ We will return to scheduling after we discuss ground rules (alternates, quorums, etc.)
- Working Group is required to report back to ASRAC by December 29, 2015.
- After December 2015, the Working Group will take a hiatus while DOE conducts analyses.
- If ASRAC extends the charter, upon completion of analyses, the Working Group will reconvene, likely in spring 2016, to consider recommending energy conservation standard levels.

Ground Rules

Key items to resolve:	Decision
Alternate working group members	
1. Are alternate working group members allowed?	Yes/No
2. Can alternate working group members vote?	Yes/No
Quorum	
3. What level of attendance constitutes a quorum (out of 11)?	___ ??? .
Consensus Per the Negotiated Rulemaking Act (NRA), consensus must be unanimous unless the working group unanimously agrees to a different definition.	
4. How many negative votes would the group allow as part of a consensus (out of 11)?	___ ??? .

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Agenda: Scope and Definitions

Scope and Definitions	
I	Existing Regulatory and Voluntary Programs
II	Introduction to Scope and Definitions
III	Introduction to Preliminary Pool Pumps Varieties
IV	Preliminary Shipments and Energy Use
V	Establishment of Scope and Definitions
VI	Additional Scope Deliberations

Existing Regulatory and Voluntary Programs

DOE is aware of three existing domestic regulatory and voluntary programs for pool pumps:

1. ANSI/APSP/ICC-15a 2013
2. State Regulations
3. ENERGY STAR
4. Consortium for Energy Efficiency (CEE)

The following slides will discuss each program at a high level.

ANSI/APSP/ICC-15a 2013

Applicable to:

- Pool filtration pumps and motor combinations

Program Requirements:

- Prohibits split-phase, shaded-pole, or capacitor start—induction run motors.
- Requires two or more motor speeds (≥ 1.0 THP only)
- Requires low speed to be $\leq$ one-half maximum motor speed (≥ 1.0 THP only)
- Requires any high speed override capability to be temporary; motor shall not remain at high speed for over 24-hours.
- Requires reporting of motor data.
- Requires testing and reporting of Energy Factor (EF) (gal/Wh)

Requirement Type:

- Voluntary

Notes

- Concerns over replacement market
- 25-30% of shipments are energy efficient models
- 80-85% of energy usage from inground filtration pumps
- Differentiating characteristics
 - Inground pool filtration pumps primarily square flange
 - Booster/aboveground pumps may use C-face
- Compliance:
 - PG&E conducting randomized study of 100 pools
 - IPSA has submitted a report on compliance under CEC proceeding

State Regulations; CA Title 20; Pool Pumps

Applicable to:

- Pool filtration pumps and motor combinations

Program Requirements:

- Prohibits split-phase, shaded-pole, or capacitor start—induction run motors.
- Requires two or more motor speeds (≥ 1.0 THP only)
- Requires low speed to be $\leq$ one-half maximum motor speed (≥ 1.0 THP)
- Requires any high speed override capability to be temporary; motor shall not remain at high speed for over 24-hours.
- Requires reporting of motor data.
- Requires testing and reporting of Energy Factor (EF) (gal/Wh)

Requirement Type:

- Statutory (State Regulation); similar requirements adopted in AZ, CT, FL (new const. only), and WA.
- CEC may be modifying Title 20 with a focus toward motors utilized on new pumps and replacement market

ENERGY STAR

Applicable to:

- Residential inground pool pumps
 - Single-speed, Multispeed, Variable-speed, or Variable-flow
 - $0.5 < \text{Total HP} \leq 4$
 - Single Phase

Program Summary

- **Metric:** Energy Factor (EF) -- (gal/Wh)
- **Requirement:** Energy Factor (EF) ≥ 3.8 at the most efficient speed at curve A.
- ❖ Note: Program also includes a demand response criteria.

Requirement Type:

- Voluntary

CEE High Efficiency Residential Swimming Pool Initiative

Applicable to:

- Residential inground pool filtration and circulation pumps

Program Summary

- **Metric:** Energy Factor (EF) -- (gal/Wh)
- **Requirement:**

Efficiency Level	Lower Speed ¹ Energy Factor	Low Speed Energy ² Factor	High Speed ³ Energy Factor
CEE Tier 1	No requirement	≥3.8	≥1.6
CEE Tier 2	≥12.0 (ERROR?)	≥5.5	≥1.7

¹ Where “lower speed” is the optimal or most efficient speed for the pool pump.

² Where “low speed” is either the minimum speed for two speed pumps or half the maximum speed for variable speed pumps.

³ Where “high speed” is the maximum operating speed of the pump.

Requirement Type:

- Voluntary
- CEE considering changing requirements to have a minimum flow rate to address most eff. speed concerns
- CEE made an error – Tier 2 lower speed should be 9-9.5. Errata sheet intended to be released.

Agenda: Scope and Definitions

Scope and Definitions

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Existing Regulatory and Voluntary Programs

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Introduction to Scope and Definitions

Introduction to Scope

- **Scope** refers to the specific subset of pumps for which this rulemaking will establish Test Procedures and Energy Conservation Standards.
- The working group may provide input on **scope**.
- Equipment category, design features, capacity, and other parameters such as phase or horsepower may be used to establish **scope**.

Introduction to Definitions

- **Definitions** give clear and unambiguous meaning to the categories and parameters used to establish **scope**.
- For example without a clear definition, the term “motor horsepower” could mean many things.
 - Nameplate Shaft HP, Total Shaft HP, Input Power in HP, etc.

Introduction to Scope and Definitions (Continued)

Scope and Definitions in context of this rulemaking

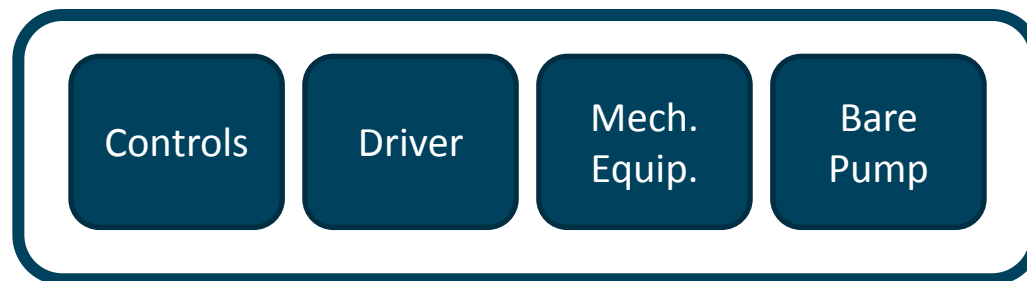
- The goal of this working group is to recommend Energy Conservation Standards for **Dedicated-Purpose Pool Pumps (DPPPs)**.
- To clearly and unambiguously establish *scope*, the working group must *define* exactly what varieties of pumps are **DPPPs** for the purpose of this rulemaking.
- **Dedicated-Purpose Pool Pump** could comprise various categories of pumps (e.g., filter pump, booster/auxiliary pump, spa pump, etc.).

Introduction to Definitions: The Pump

Based on the CIP Working Group term sheet, DOE proposed the following definition for *pump*:

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

PUMP =



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Introduction to Preliminary Pool Pumps Varieties

The following slides provide high level descriptions of preliminary pool pump varieties identified by DOE

Preliminary Pool Pump Varieties	
1.	Filter Pumps; Inground pools
2.	Filter Pumps; Aboveground pools
3.	Booster/Auxiliary Pumps
4.	Inflatable Pool Pumps (integrated filter system)
5.	Portable Spa / Portable Spa Pumps
6.	Pool Cover Pumps
7.	Solar-Powered Pool Pumps

NOTE: These are common descriptions and not proposed definitions. Definitions and technical features will be considered later

1 & 2: Filter Pumps; Inground and Aboveground Pools

General Description of a Filter Pump

- End suction pump designed specifically to circulate water through a filter in a pool.
- Require a filter strainer (basket) to operate
 - Can be integral or sold separately



Integral Basket Strainer



Basket Strainer Sold Separately

Sources: <http://www.Hayward-pool.com/images//pools/products/large/Tristar.jpg>

[http://www.amerimerc.com/Category/imageG.asp?CommercialPump_C-CCSeries.m.jpg\\$CommercialPump_C-CCSeries.a.jpg\\$CommercialPump_C-CCSeries_1.othr.jpg\\$CommercialPump_C-CCSeries_2.othr.jpg](http://www.amerimerc.com/Category/imageG.asp?CommercialPump_C-CCSeries.m.jpg$CommercialPump_C-CCSeries.a.jpg$CommercialPump_C-CCSeries_1.othr.jpg$CommercialPump_C-CCSeries_2.othr.jpg)

3: Booster/Auxiliary Pumps

General Description of a Booster/Auxiliary Pump

- A pump intended for purposes other than a primary pool filter pump, *i.e.*, a pool cleaner Booster/Auxiliary pump or supply water to a water feature.



Source:

[http://i.ebayimg.com/00/s/MzQ4WDQ0NA==/z/FmkAAOxycmBSsmhc/\\$_3.JPG?set_id=2](http://i.ebayimg.com/00/s/MzQ4WDQ0NA==/z/FmkAAOxycmBSsmhc/$_3.JPG?set_id=2)

4: Inflatable Pool Pumps

General Description of an Inflatable Pool Pump

- Pump that is sold in a package with an inflatable/collapsible pool or as a replacement pump for use with an inflatable/collapsible pool.
- Typically sold with an integrated filter system.



Source:

<http://www.backyardocean.com/RP800-Pool-Filter-Pump-p/0600166.htm>

http://i01.i.aliimg.com/photo/v0/1740070531/Filter_pump_inflatable_pool_filter_pump_solar.jpg

5: Portable Spas / Portable Spa Pumps

General Description of a Portable Spa and Portable Spa Pump

- A portable spa is an inflatable/collapsible spa sold as a complete unit with pump, heater, and filtration unit.
- A portable spa pump is the pump sold in a package with a portable spa, or as a replacement for use with a portable spa.



Source:

<http://www.ebay.com/itm/5-PERSON-PORTABLE-SPA-PATIO-CAMPER-RV-TRAVEL-HOT-TUB-w-FILTER-PUMP-/381058414329>

6: Pool Cover Pumps

General Description of a Pool Cover Pump

- Pump that is used to remove water from the top of a pool cover.



Source:

<http://chrystella.co.uk/blog/wp-content/uploads/2011/05/swimming-pool-cover-pump.jpg>

<http://www.poolcoverpumppreviews.com/wp-content/uploads/2011/04/rule-pool-cover-pump-1800-g.jpg>

7: Solar-Powered Pool Pumps

General Description of a Solar-Powered Pool Pump

- Pump that circulates water in a pool and uses a motor powered by photovoltaic cells.



Sources:

<http://www.cleanenergy-cr.com/images/solar-pool-pump-filter-1.jpg>

<http://www.cleanenergy-cr.com/images/solar-pool-pump-filter-2.jpg>

Agenda: Scope and Definitions

Scope and Definitions

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Preliminary Shipments and Energy Use Estimates

Preliminary Pool Pump Varieties	Average HP	Hours of Use	2014 Sales ¹ (millions)	2013 Stock (millions)	2013 Stock Energy Use (TWh) ^{3,4}	2013 Stock FFC Energy Use (Quads)	30-year Shipments FFC Energy Use (Quads) ⁵
1. Filter Pumps; Inground	1.5	2000	0.522	5.1	14	0.17	0.70
2. Filter Pumps; Aboveground	1.5	2000	0.173	2.0	5.5	0.07	0.22
3. Booster Pumps	0.75	900	0.115 ²	1.2	1.2	0.01	0.05
4. Inflatable Pool Pumps (integrated filter system)	N/A	N/A					
5. Portable Spa Pumps	N/A	N/A					
6. Pool Cover Pumps	N/A	N/A					
7. Solar-Powered Pool Pumps	N/A	N/A					

¹ Annual Sales 2011-2014 provided by APSP

² Characterized as 'pressure cleaner booster' pumps.

³ 2014 Stock estimated from total above ground and in ground pools (2013 APSP data)

⁴ UEC estimates from CA IOU Analysis of Standards Proposal for Swimming Pool and Portable Spa Equipment (CEC 2013)

⁵ 30-year estimate from 2021-2050

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Defining “Dedicated-Purpose Pool Pumps”

In order to include pump varieties within the scope of this rulemaking, they must be clearly differentiated from non-pool pumps, such as those in the Pumps NOPR.

- Definitions should be based on design, physical features, performance characteristics, sales configuration, etc.; not application.

In order to provide context to establish clear and unambiguous definitions for each variety of dedicated-purpose pool pump, this section includes:

1. Examples of existing pump-related definitions,
2. Key challenges to establishing pool pump definitions, and
3. Descriptions and key characteristics of each preliminary pool pump variety.

Key Challenges: Differentiating From ESCC and ESFM

DOE NOPR Proposal for ESCC and ESFM Definitions

End suction close-coupled (ESCC) pump means an *end suction pump* in which: (1) The motor shaft also serves as the impeller shaft for the bare pump... and (3) The pump does not include a basket strainer.

End suction frame mounted (ESFM) pump means an end suction pump wherein: (1) The bare pump has its own impeller shaft and bearings and so does not rely on the motor shaft to serve as the impeller shaft... and (3) The pump does not include a basket strainer.

End suction pump means a single-stage, rotodynamic pump in which the liquid enters the bare pump in a direction parallel to the impeller shaft and on the side opposite the bare pump's driver-end. The liquid is discharged through a volute in a plane perpendicular to the shaft.

The Working Group's definitions must clearly differentiate pool pump varieties from ESCC, ESFM, and other pump definitions proposed in the Pumps NOPR.

Key Challenges: ESCC vs Booster/Auxiliary Pump

End suction close-coupled (ESCC) pump means an *end suction pump* in which: (1) The motor shaft also serves as the impeller shaft for the bare pump... and (3) The pump does not include a basket strainer.

End Suction Close-Coupled Pump



“Booster/Auxiliary Pump”



Key Challenge: Can a “Booster/Auxiliary Pump” be differentiated from an ESCC Pump?

Source: (Left) http://www.pricepump.com/cen_pumps.aspx?model=OH&from=Thumbnails
(Right) http://edc.poolsupplyworld.com/wimages/product_image/unnamed_55843.jpg?500x500

Key Challenges: ESCC vs Filter Pump

End suction close-coupled (ESCC) pump means an *end suction pump* in which: (1) The motor shaft also serves as the impeller shaft for the bare pump... and (3) The pump does not include a basket strainer.

End Suction Close-Coupled Pump



“Filter Pump”



Key Challenge: Apart from a filter strainer (basket), what differentiates a “Pool Filtration Pump” from an ESCC Pump?

Source: (Left) http://www.pricepump.com/cen_pumps.aspx?model=OH&from=Thumbnails
(Right) <http://www.Hayward-pool.com/images//pools/products/large/Tristar.jpg>

1 & 2: Filter Pumps; Inground and Aboveground Pools

Filter Pumps; Inground and Aboveground Pools	
Description	An end suction pump designed specifically to circulate water in a pool and that requires a filter strainer to operate
Distinguishing Characteristics	Sold with integrated basket strainer or requires a basket strainer
Priming	Typically: Inground—self priming; Aboveground—non-self priming
HP Range	Most Commonly ~0.5-~3HP; Max Range up to ~30HP
Speeds	Single Speed, Multi Speed, Variable Speed
Phase	1 or 3 Phase
Annual Sales	522,000 inground; 173,000 aboveground
Energy Use	14 TWh/5.5 TWh – annual stock (1.5 HP, 2000 Hours/yr) 0.70 quad/0.22 quad – 30 year shipments
RFI Responses	General agreement that these should be within the scope
Other Issues	• Should “self priming” determine equipment classes? • Should inground and aboveground be considered separately? • Opportunity for energy savings from controls

NOTES FROM GROUP ON FILTER PUMPS

- RFI – APSP required > 20GPM
- Term “Pool Circulating Pump”
- Probably made of plastic
- Head and flow range
- Temperature range
- Inground are self priming >95% of time. With Strainer basket.
- Rated to work at 40C, comply with UL, Shaft is threaded (not Keyed),
- .5HP – 3HP (majority)
- 1 Phase (majority)

1 & 2: Filter Pumps; Inground and Aboveground Pools

Working Group Definition:

[Working Group definitions will be drafted here]

Potential Definition for Consideration:

Pool filter pump means an end suction pump designed specifically to circulate water in a pool and that:

1. Includes an integrated basket strainer, or
 2. Does not include an integrated basket strainer, but requires a basket strainer for operation, as stated in manufacturer literature provided with the pump.
- ❖ Based on NSF/ANSI 50-2014 “Equipment for Swimming Pools, Spas, Hot Tubs and Other Recreational Water Facilities,” a pool filter pump can either be sold with an integral basket strainer, or be sold without one, so long as it states in its “installations instructions, on a data plate, or on an attached label that the pump is to be installed with a strainer confirming to the requirements in [the NSF/ANSI 50-2014] Standard.”

3: Booster/Auxiliary Pumps

Booster/Auxiliary Pumps	
Description	End suction pump intended for purposes other than a primary pool filtration; e.g., pool cleaner pump or water feature pump.
Distinguishing Characteristics	Difficult to distinguish from “end suction close coupled” (ESCC) pump per CIP proposed definitions.
Priming	Unknown
HP Range	Most Commonly ~0.5~3HP; Max Range up to ~30HP
Speeds	Typically Single Speed
Phase	1 or 3 Phase
Annual Sales	114,000 (may be underestimate compared to CA IOU input)
Energy Use	1.2 TWh – Annual Stock; 0.05 quad – 30 yr ship (0.75 HP, 900 hrs/yr)
RFI Responses	HI: Auxiliary pool pumps <1 HP should be excluded; difficult to adequately differentiate them from other CIP ESCC pumps <1 HP. CA IOUs: Support coverage because of significant load
Other Issues	• How to distinguish from general ESCC pumps? • Energy savings not expected from use of controls on booster pumps • Multi-speed/variable speed filter pumps may reduce the need for booster pumps

3: Booster/Auxiliary Pumps

Working Group Definition:

[Working Group definitions will be drafted here]

4: Inflatable Pool Pumps

Inflatable Pool Pumps	
Description	Pump sold in a package with an inflatable/collapsible pool, or as a replacement pump for use with an inflatable/collapsible pool.
Distinguishing Characteristics	- Typically sold with an integrated filter. - Often sold with the pool itself as a kit.
Priming	Manual Prime
HP Range	<1HP
Speeds	Single Speed
Phase	1 Phase
Annual Sales	Not available
Energy Use	Not available
RFI Responses	APSP: Should not be separately regulated
Other Issues	- Set standards for only the pumps portion of the system? - Cover the system, but test the pump portion as part of TP? - Questions regarding modularity: Can the pump portion be removed from filter/cleaner, etc.?

4 : Inflatable Pool Pumps

Working Group Definition:

[Working Group definitions will be drafted here]

5 : Portable Spa Pumps

Portable Spa Pumps

Description	Pump sold in a package with an inflatable/collapsible spa or as a replacement pump for use with an inflatable/collapsible spa.
Distinguishing Characteristics	- Typically sold with an integrated filter and heater. - Often sold with the spa itself as a kit.
Priming	Self Priming
HP Range	<1HP
Speeds	Single Speed
Phase	1 Phase
Annual Sales	Not available
Energy Use	Not available
RFI Responses	HI: Spa pumps >1HP are covered by the CIP rulemaking CA IOUs: Spa pumps should be excluded APSP: Requests portable spas be covered as an entire piece of equipment, rather than only covering the pump portion.
Other Issues	Questions regarding modularity: Can the pump portion be removed from filter/cleaner, and heater (for testing)?

5 : Portable Spa Pumps

Working Group Definition:

[Working Group definitions will be drafted here]

6 : Pool Cover Pumps

Pool Cover Pumps	
Description	Pump that is used to remove water from the top of a pool cover.
Distinguishing Characteristics	Portable, Connects to garden hose
Priming	Sump-Style Pump
HP Range	<1HP
Speeds	Single Speed
Phase	1 Phase
Annual Sales	Not available
Energy Use	Not available
RFI Responses	CA IOUs: Should exclude from rulemaking
Other Issues	None

6 : Pool Cover Pumps

Working Group Definition:

[Working Group definitions will be drafted here]

7 : Solar-Powered Pool Pumps

Solar-Powered Pool Pumps

Description	Pump that circulates water in a pool and uses a motor powered by photovoltaic (solar) cells.
Distinguishing Characteristics	• Uses solar panel to power pump • Uses Direct Current (DC) to operate • May have backup power coming from the electric grid
Priming	Sump-Style Pump
HP Range	Most Commonly ~.05 HP; Maximum 1.5HP
Speeds	Single Speed
Phase	N/A; Use Direct Current
Annual Sales	Not available
Energy Use	Not available
RFI Responses	CA IOUs: Investigate saturation of DC pool pumps to determine if they warrant inclusion
Other Issues	None

7 : Solar-Powered Pool Pumps

Working Group Definition:

[Working Group definitions will be drafted here]

Agenda: Scope and Definitions

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Scope Proposals

Pool Pump Varieties	Include/ Exclude	Additional Scope Limitations (e.g., phase, HP)?
1. Filter Pumps; Inground		
2. Filter Pumps; Aboveground		
3. Booster/Auxiliary Pumps		
4. Inflatable Pool Pumps (integrated filter system)		
5. Portable Spa / Pumps		
6. Pool Cover Pumps		
7. Solar-Powered Pool Pumps		

Agenda

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- 3 Scope and Definitions
- 4 Metric and Test Procedure
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Agenda: Metric and Test Procedure

Metric and Test Procedure

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Metric Overview

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Test Procedure Overview

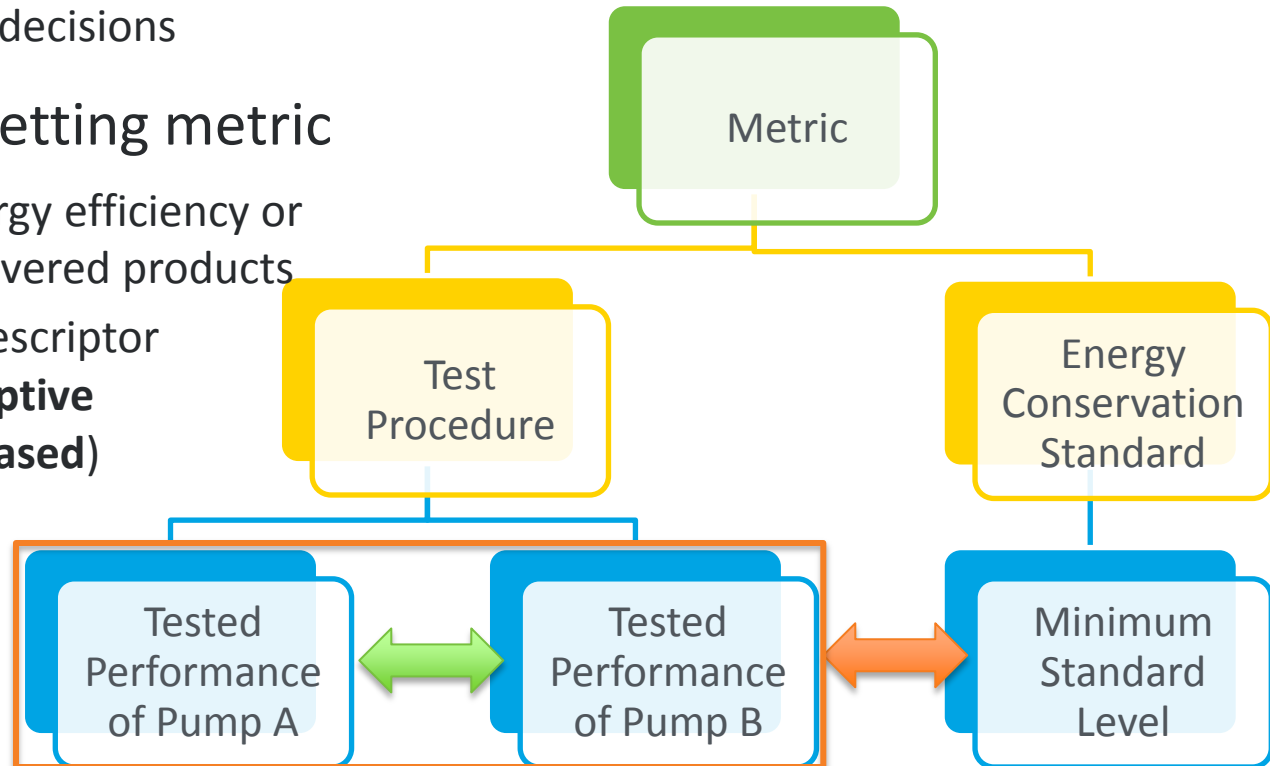
Metric Overview

The objective of a *metric*

- Be objectively measurable
- Be representative of the energy use or efficiency of the equipment
- Differentiate performance among pump models and pump configurations
- Compare the efficiency of a given pump model to a minimum standard level
- Inform purchasing decisions

DOE limitations on setting metric

- Must describe energy efficiency or energy use for a covered products
- Must be a single descriptor (i.e., ***either prescriptive or performance- based***)



Metric: Performance vs. Prescriptive

Performance Metrics

- Based on tested performance of a unit, with possible calculations
- More complex, but allows for versatility to better reflect aspects of the equipment
 - *i.e.*, allows for different flows, motor speeds, pump configurations, and other aspects to be factored into the metric
- Examples of Performance Metrics :
 - **Energy Factor (EF)** – the volume of water pumped in gallons per watt-hour of electric energy consumed by the pump motor (gal/Wh)
 - Used by ENERGY STAR and CEE
 - Required to be reported by CEC
 - **PEI_{CL} and PEI_{VL}** – an index of the weighted average power of the tested pump to a “standard minimally compliant pump.” (more on those metrics later)
 - General clean water pumps rulemaking proposes to use these metrics

Prescriptive Metrics

- Defines requirements about the pump
- Can be less complex
- Examples:
 - Motors ≥ 1 HP must have at least two speeds

Review of DPPP Metrics Used in Existing Programs

Metric	Energy Factor (EF)	Pump Energy Index (PEI)
Scope	Pump + Motor + Controls	Pump + Motor + Controls
Referenced by	- ENERGY STAR; CEC – Title 20; AZ, CT, FL, and WA; - CEE – High Efficiency Swimming Pool Initiative	DOE’s Pumps Test Procedure NOPR. 80 FR 17586. (April 1, 2015).
Units	Volume of water pumped in gallons per watt-hour of electric energy consumed by the pump motor (gal/Wh)	Dimensionless (index)
Typical Additional Requirements	- Prescriptive motor efficiency and design requirements - Demand Response requirements	None

Metric: Energy Factor

Energy Factor (EF)

- Describes the volume of water pumped in gallons per watt-hour of electric energy consumed by the pump motor (gal/Wh) **at a single speed and load point**
- Well-known in the industry

Example Voluntary EF Requirements:

Consortium for Energy Efficiency High Efficiency Residential Swimming Pool Initiative

Efficiency Level	Lower Speed EF ¹	Low Speed EF ²	High Speed EF ³
CEE Tier 1	No requirement	≥ 3.8	≥ 1.6
CEE Tier 2	≥ 12.0	≥ 5.5	≥ 1.7

1. “Lower speed” is the optimal or most efficient speed for pool pump, likely ranging from 600 to 1200 RPMs
2. “Low speed” is either the minimum speed for two speed pumps or half the maximum speed for variable speed pumps, typically 1275 RPM
3. “High speed” is the maximum operating speed of the pump, usually 3450 RPM

ENERGY STAR

Product Type	Requirements
Single Speed Pump	EF ≥ 3.8 for the single speed
Multi-speed, Variable-speed, and Variable flow pump	EF ≥ 3.8 for the most efficient speed Most efficient speed: the speed with the highest EF for a given pump

Metric: Pump Energy Index

Pump Energy Index (PEI)

- A ratio of the performance for a given pump model (PER_{CL} or PER_{VL}) over the performance of a minimally compliant pump of the same equipment class serving the same hydraulic load (PER_{STD}).
- Referenced by DOE's Pumps TP NOPR. April 1, 2015. (80 FR 17586)

Pump Energy Index	Constant Load Pump Energy Index (PEI_{CL})	Variable Load Pump Energy Index (PEI_{VL})
Ratio	$PEI_{CL} = \left[\frac{PER_{CL}}{PER_{STD}} \right]$	$PEI_{VL} = \left[\frac{PER_{VL}}{PER_{STD}} \right]$
Pump Energy Rating	$PER_{CL} = \sum_i \omega_i (P^{in}_i)^*$	$PER_{VL} = \sum_i \omega_i (P^{in}_i)^*$
PER Load Profile	i = 75, 100, and 110% of BEP Flow	i = 25, 50, 75, and 100% of BEP Flow
PER_{STD}	PER_{CL} for Minimally Compliant Pump of the Same Equipment Class Serving the Same Hydraulic Load	
Applicable Pump Configurations	Pumps Sold without Continuous or Non-Continuous Controls	Pumps Sold with Continuous or Non-Continuous Controls
*Where: w_i = weight at each load point i P^{in}_i = power input to the "pump" at the driver, inclusive of the controls if present, (hp) i = Percentage of flow at the Best Efficiency Point (BEP) of the pump		

- In response to DOE's DPPP RFI (80 FR 26475 ; May 8, 2015) HI recommended using PEI and HI 40.6 as the basis for the DPPP metric and test procedure.

Summary: DPPP Metric

	Metric	Pros	Cons
Performance	EF	- Recognized and understood in the DPPP market - Used in other programs (ENERGY STAR, California, etc) - DPPP RFI comments from CA IOUs encouraging metric	Does not currently account for energy savings from variable speed controls
	PEI	- Consistent with general pumps - Flexible for many configurations of pumps with any motors or controls - Captures energy savings of controls (PEI_{VL}) - DPPP RFI comments from HI encouraging metric	Inconsistent with existing DPPP programs and regulations
Prescriptive		- Used in other programs - Straightforward requirements	Limits flexibility

Agenda: Metric and Test Procedure

Metric and Test Procedure

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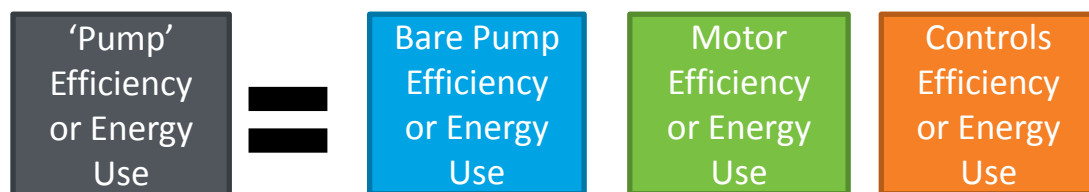
III

Test Procedure Overview

Pump Configuration Considerations

The metric and/or test procedure may vary as a function of **pump configuration**

- How are DPPP typically sold?
 - DOE understands most DPPP are sold as packaged products with a pump and motor (and possibly controls), not as bare pumps
- What configurations of pumps does the metric and test procedure need to be applicable to?
- How should such equipment be tested?
 - Wire to water testing only?
 - Testing + calculations?



Rated As	Test Method	Applicable Pump Configurations
Bare Pump	Calculate Only	
Pump + Motor	Test or Calculate	
Pump + Motor + Controls	Test or Calculate	

Agenda: Metric and Test Procedure

Metric and Test Procedure

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Test Procedure Overview

A test procedure should:

- Determine the representative performance of the equipment
- Be applicable to all configurations, varieties, and designs of pool pumps in the defined **scope**
 - TP may vary for different configurations, varieties, and designs
- Be specific, repeatable, and unambiguous (like a recipe or instructions)
- Not be overly burdensome to conduct
 - TP may vary for different configurations, varieties, and designs

A test procedure is used to determine representative values of:

- Energy efficiency or energy use (based on the **metric**)
 - This will be used to verify compliance with any future standards
- Other relevant pool pump characteristics (e.g., total horsepower, BEP efficiency, motor efficiency, etc)

Review of Test Procedures Used in Existing Programs

Program	ANSI/APSP/ICC 15a-2013	ANSI/HI 1.6	ANSI/HI 40.6	IEEE 114-2001
Scope	Pump + Motors	Pumps	Pumps	Motors
APSP		X		X
CEC Title 20		X		X
CEE	X			
DOE Comm. / Industrial Pump			X	
ENERGY STAR	X	X		

Review of Test Procedures (Cont.)

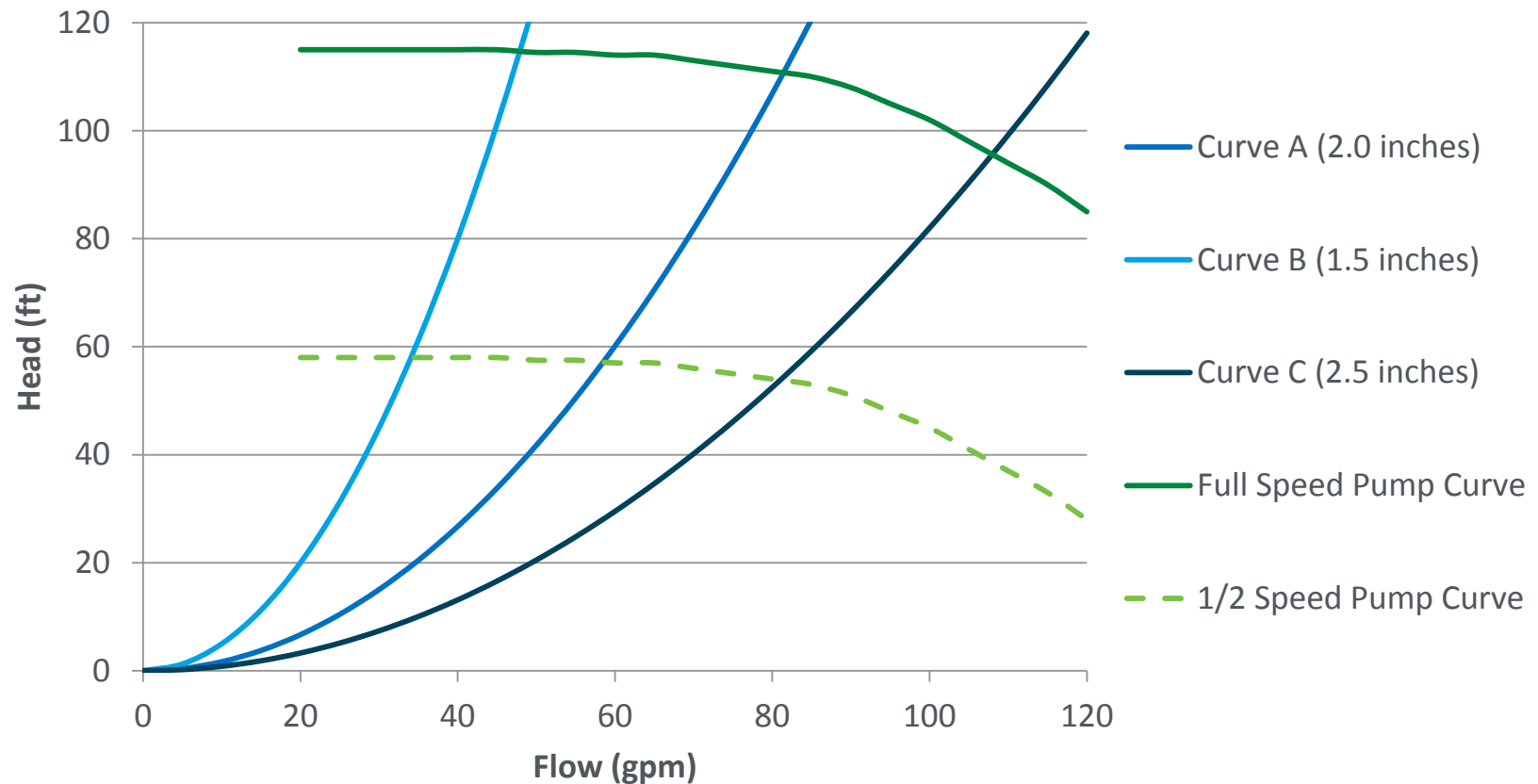
Test Method	Summary	Notes / Issues
APSP 15/15a	Tests pump at various speed at 3-4 load points described by 3-4 system curves; also includes prescriptive requirements for controllers, motors, heaters, etc.	References ANSI/HI 1.6-2000
HI 1.6	Tests pump at nominal speed at along pump curve to determine pump efficiency, BEP, and pump input power. Wire to water testing for pumps + motor (+ controls).	Superseded
HI 14.6		Acceptance test; supersedes 1.6
HI 40.6		Based on HI 14.6
General pumps TP NOPR	Test pumps at various speeds along pumps curve or system curve	Incorporates by reference 40.6

Test Procedure: ANSI/APSP/ICC-15 & 15a

Residential Swimming Pool and Spa Energy Efficiency			
Title			
Scope	Pumps	Motors	Controls
Metric	EF	Motor efficiency; prescriptive design requirements	Prescriptive design requirements
Referenced test methods	ANSI/ HI 1.6-2000	IEEE 114 – 2001	N/A
Additional requirements	N/A	Motors with a capacity of 1 THP be multi-speed	multi/variable-speed pumps shall have at least 2 speeds Filtration speed no more than ½ motor's max rotation speed

- Referenced by CEE and consistent with ENERGY STAR test method
- Note: 15a includes some addendums to 15 – addendums are mostly clarifications to 15

Test Procedure: Energy Factor Reference Curves



Single speed – default speed

Multi-speed – test at each speed

Variable speed – Highest, half, lowest, BEP

Test Procedure: System Curves & Energy Factor

- Curves are identical for APSP, CEC, and ENERGY STAR
- Different programs references slightly different documents, but the method is the same

Curve	APSP/ICC-15a & ENERGY STAR	CEC Title 20	Pipe size
A	$H = 0.0167 \times F^2$	$H = 0.0167 \times F^2$	$\approx 2.0''$
B	$H = 0.050 \times F^2$	$H = 0.050 \times F^2$	$\approx 1.5''$
C	$H = 0.0082 \times F^2$	$H = 0.0082 \times F^2$	$\approx 2.5''$
	H = total system head in feet of water F = flow rate in gpm	H = total system head in feet of water F = flow rate in gpm	

- Energy Factor is calculated the same among APSP, CEC, and ENERGY STAR

APSP/ICC-15a	CEC Title 20	ENERGY STAR
$EF = \frac{\text{Flow (gpm)} \times 60}{\text{Power (watts)}}$	$EF = \frac{\text{Flow (gpm)} \times 60}{\text{Power (watts)}}$	$EF = \frac{Q \times 60}{P}$
		Q = the flow rate in GPM P = power in watts

Test Procedure: General Pumps TP NOPR

Title	Uniform Test Method for the Measurement of Energy Consumption of Pumps		
Scope	Pumps	Pump + Motors	Pump + Motors + Controls
Metric	$PEI_{CL} = \left[\frac{PER_{CL}}{PER_{STD}} \right]$	$PEI_{CL} = \left[\frac{PER_{CL}}{PER_{STD}} \right]$	$PEI_{VL} = \left[\frac{PER_{VL}}{PER_{STD}} \right]$
Where:	$PER_{CL/VL} = \sum_i \omega_i (P^{in}_i)$ $PER_{STD} = PER_{CL}$ for Minimally Compliant Pump of the Same Equipment Class Serving the Same Hydraulic Load w_i = weight at each load point i P^{in}_i = power input to the “pump” at the driver, inclusive of the controls if present, (hp) i = Percentage of flow at the Best Efficiency Point (BEP) of the pump		
PER Load Profile	$i = 75, 100, \text{ and } 110\%$ of BEP Flow	$i = 25, 50, 75, \text{ and } 100\%$ of BEP Flow	PER Load Profile
Referenced test method	HI 40.6-2015 with minor modifications		
Additional testing provisions	Calculations to account for DOE minimum efficiency motor with assumed part load losses	Optional calculations account for paired motor efficiency	Defined system curve and optional calculations to account for paired motor + continuous control

Test Procedure: HI 1.6, 14.6, 40.6

All HI procedures describe a similar test method

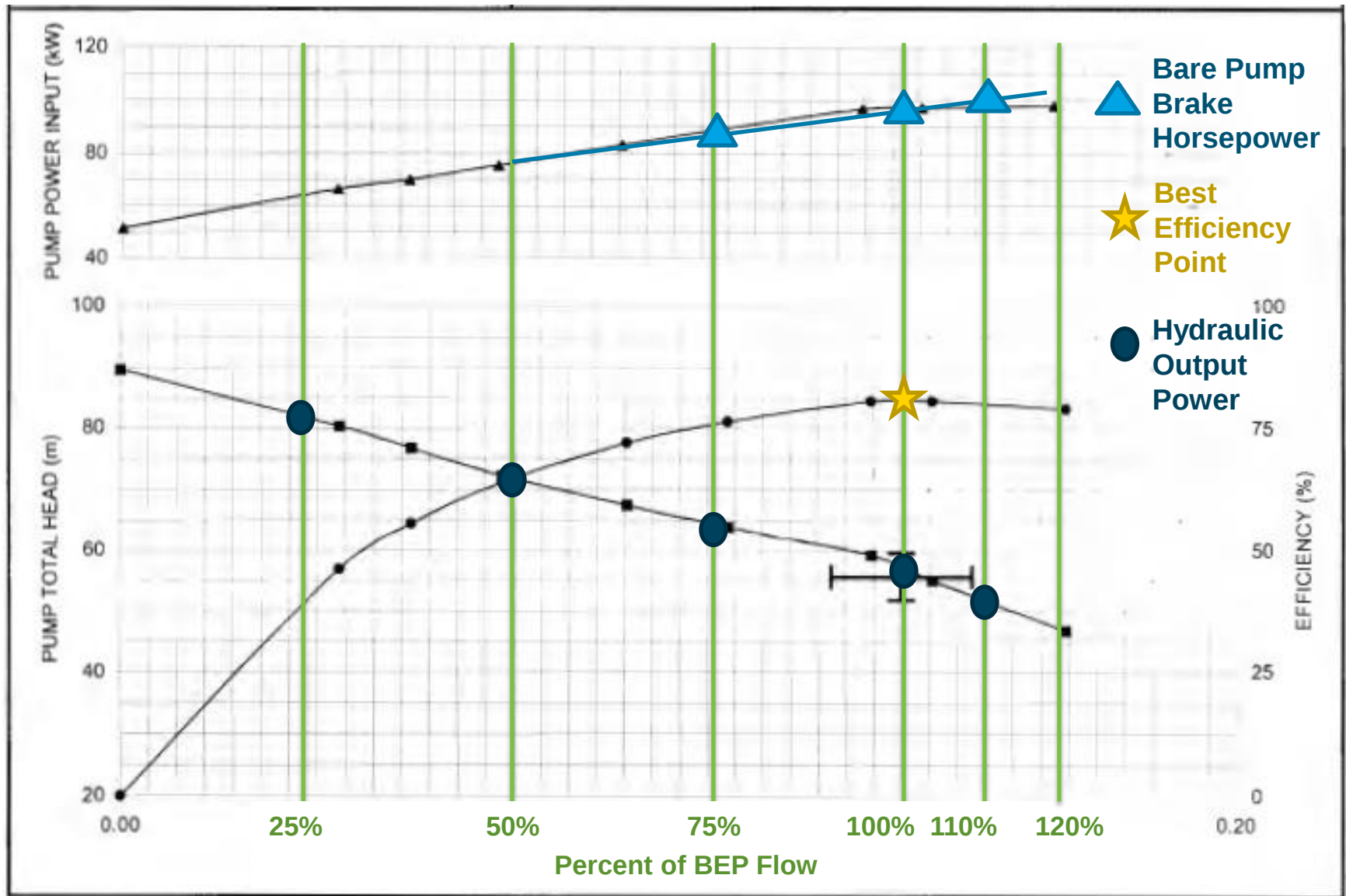
- HI 1.6 → 14.6 | HI 40.6 is in “harmony with 14.6 and derived from 14.6”

All HI procedures henerally describes how to determine, at a given speed, key pump performance characteristics across a range of flow and head conditions (*i.e.*, load points)

- HI test methods do not account for possibility of controls
- DOE Pumps test procedure NOPR modifies and amends HI 40.6 to accommodate controls to determine PEI_{VL}

Title	Methods for Rotodynamic Pump Efficiency Testing	
Scope	Pumps	Pumps + Motors (+ Controls)
Metrics	Best efficiency point (BEP); pump efficiency; pump power input; flow; head	BEP; overall efficiency; driver power input; flow; head

Pump Curve Example – Determining Bare Shaft Input Power



Summary: DPPP test procedure

- What are the important metric to measure with the DPPP test procedure?
 - EF/PEI, BEP?, connectivity?, motor characteristics?
- What configurations of pumps should be able to be tested with the DPPP test procedure?
- Should the DPPP test procedure have a calculation-based option?
- What test method should the DPPP test procedure be based on?
 - HI 1.6/14.6
 - HI 40.6
 - APSP-2013
 - Other test procedure?
- What system curve/load points should the DPPP test procedure use?
 - EF Curves A, B, C, and/or D
 - PEI_{VL} reference system curve
 - Other load points

Pump Configuration	Calculation-based	Testing-based
Bare Pumps		
Pumps + Motors		
Pumps + Motors + Controls		

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