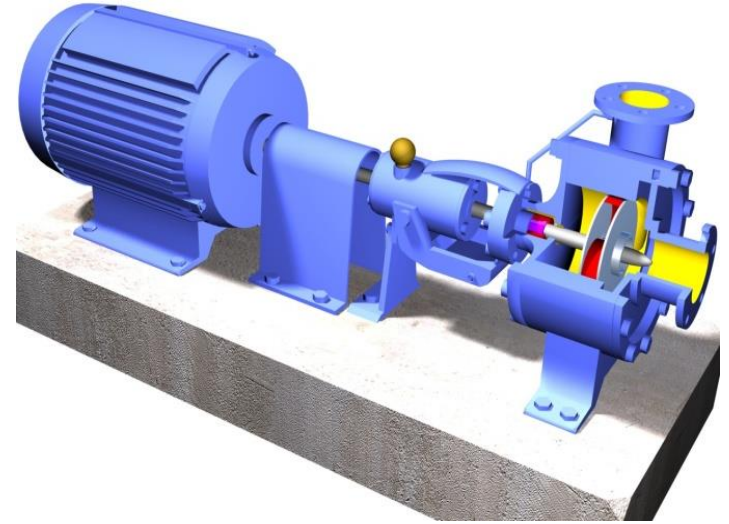


ASRAC Pumps Working Group

Scope



Agenda

■ Scope

- Federal Preemption
- Feasibility/timeline if DOE does a follow-on rulemaking
- Clearly define scope for this negotiation: Pump Types (VOTE?)
 - Review aggregated results of new surveys if available
 - Include revised shipments estimates
- Clearly define scope for negotiation: Coverage (VOTE)
 - Clean Water
 - Exclusions
 - Parameters
- Define covered product (VOTE)

■ Metric

- Details of possible metric, calculation methods, and standard setting
- VOTE

Scope for the Negotiation

In Scope?	Pump Type	ANSI/HI Nomenclature
Yes	End Suction Frame Mounted/Own Bearings	OH0, OH1
Yes	End Suction Close Coupled	OH7
Yes	Inline	OH3, OH4, OH5
Yes	Radial Split (Multistage) Vertical	VS8
Yes	Submersible Vertical Turbine (Multistage)	VS0
Maybe	Double Suction	BB1, OH4 double suction
Maybe	Axially Split	BB1 (2 stage), BB3
Maybe	Radial Split - Horizontal	BB2 (2 stage), BB4
Maybe	Radial Split – Vertical (Immersible)	N/A
Maybe	Vertical Turbine	VS1, VS2
Maybe	Circulators	CP1, CP2, CP3
No - OK	Axial/Mixed Flow	OH00, VS3
No - OK	Positive Displacement	Multiple
No - OK	Wastewater, sump, slurry, solids handling pumps	Multiple
No - OK	API 610 and ASME/ISO chemical process pumps	N/A
No - OK	Fire Pumps (Certified to NFPA 20)	N/A
No - OK	Self-Priming/Prime Assist Pumps	N/A
No - ?	Marine, Navy, and Nuclear Pumps	
No - ?	Sanitary Pumps	
No – still to be refined	Pumps outside certain parameters of power, flow head, temperature, speed, and bowl diameter	N/A

Scope Discussion – Exclusions

	Exclusions	Notes	To be updated with input from HI
OK – 1/31	Wastewater, Sump, Slurry, Solids Handling	Requires further definition. Wastewater should not be excluded.	
OK – 1/31	API 610 Pumps		
OK – 1/31	ASME/ISO Chemical Pumps		
OK – 1/31	Fire Pumps	Excluded if certified to NFPA 20 by UL or FM.	
OK – 1/31	Self-priming pumps		
OK – 1/31	Prime-assisted pumps		
OK – 1/31	Positive Displacement Pumps		
OK – 1/31	Axial/Mixed Flow Pumps		
	Marine, Navy, and Nuclear Pumps?	Materials will be different. Quantity is low. Data are not available. HI will look into physical differences in those markets.	
	Sanitary Pumps?	Food-grade. Specific physical design requirements that impact efficiency. Significant incremental cost. HI will look into physical differences.	

- Definitions to be worked on later.
- PROPOSAL FOR VOTE: This rulemaking will explicitly exclude the following types of pumps: **listed as ‘OK – 1/31’ in the table above.** Other exclusions may be added in the future.
 - Vote results: Unanimous
- PROPOSAL FOR VOTE: This rulemaking will explicitly exclude the following types of pumps: **listed as ‘OK – 3/4’ in the table above.** Other exclusions may be added in the future.
 - Vote results:

Scope Discussion - Parameters

■ HI Standards Parameter Proposal (for only HI recommended pumps):

Parameters	Notes
Pumps designed for clean water	To be defined (also including anti-
Full impeller diameter	OK
1-200 HP (shaft power at BEP) (applies to all stages)	OK
25 gpm and greater (at BEP)	OK
459 feet of head maximum (at BEP)	OK
Design temperature range from -10 to 120 degrees C	OK
2 and 4 pole only Pumps designed for nominal 2 and 4 pole motor speeds	(DOE to confirm that this would not exclude PM?) Possible issue with referring to pump speed rather than motor speed.
6" or smaller bowl diameter (VT-S/HI VS0)	

To be updated with input from HI

■ PROPOSAL FOR VOTE: For pumps recommended by HI, this rulemaking will be limited to pumps with the following characteristics: **Z**.

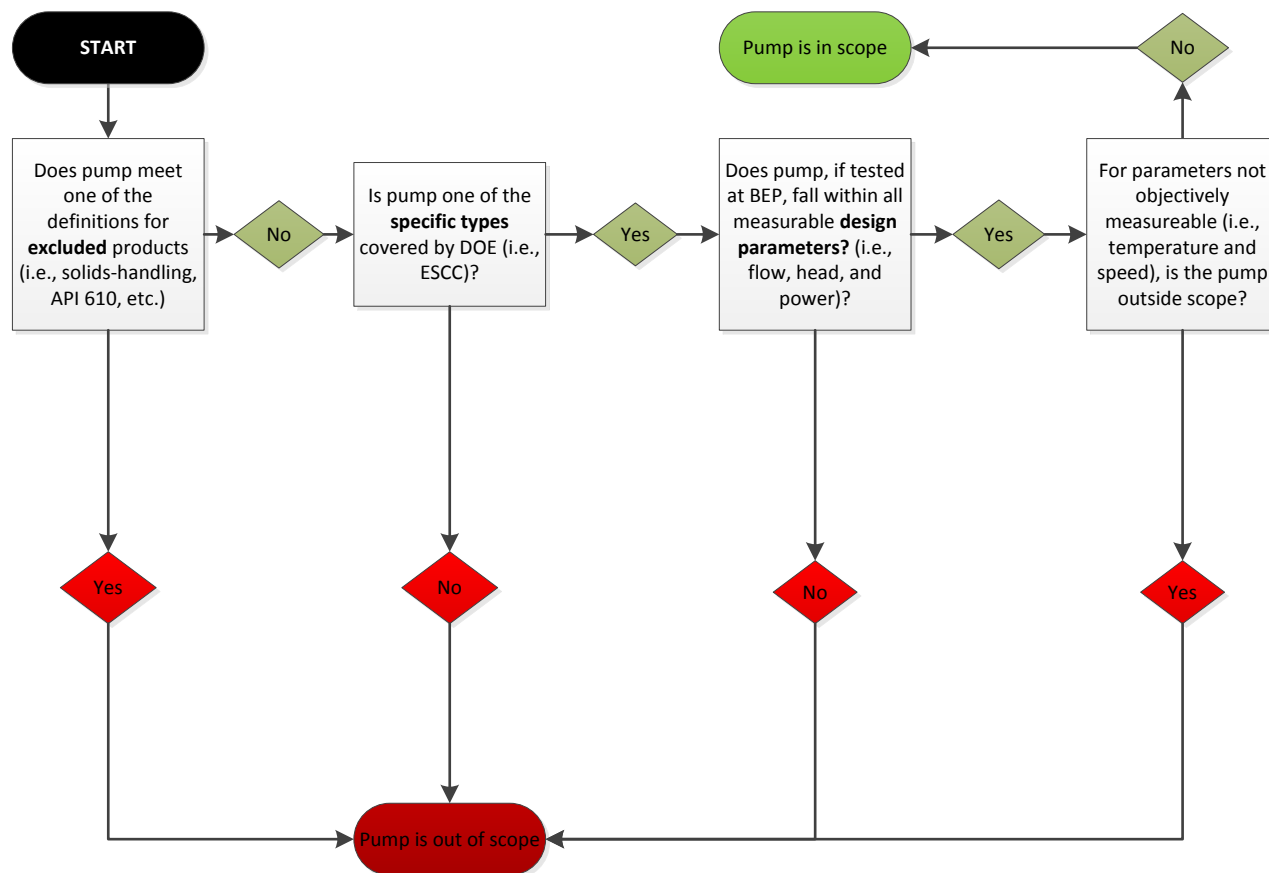
- **Vote results:**

EU 547 Standard – Water Pumps Scope

- Rotodynamic pumps for pumping clean water between -10°C and 120°

Equipment Nomenclature	ANSI/HI Nomenclature	Scope of Coverage
End suction own bearings (ESOB)	OH0/OH1	Pressures up to 16 bar, Specific speed between 6 and 80 rpm, Minimum rated flow of 6 m ³ /h, Maximum shaft power of 150 kW, Maximum head of 90m at nominal speed of 1,450 rpm and a maximum head of 140m at nominal speed of 2,900 rpm
End suction close coupled (ESCC)	OH7	
End suction close coupled inline (ESCCi)	OH3/OH4(/OH5)	
Vertical multistage (MS-V)	VS8	Pressures up to 25 bar, Specific speed between 6 and 80 rpm, Maximum rated flow of 100 m ³ /h, Nominal speed of 2,900 rpm NO HEAD OR POWER LIMIT
Submersible multistage (MSS)	VS0	Nominal outer diameter of 4" or 6", Nominal speed of 2,900 rpm, Operating temperature within a range of 0°C and 90°C NO FLOW, HEAD, OR POWER LIMIT

Pump Coverage Decision Flow Chart



Clean Water Definition

■ Definition from EU 547:

- **'Clean water'** means water with a maximum non-absorbent free solid content of 0.25 kg/m^3 , and with a maximum dissolved solid content of 50 kg/m^3 , provided that the total gas content of the water does not exceed the saturation volume. Any additives that are needed to avoid water freezing down to -10°C shall not be taken into account.

■ Defining 'clean water' may not be necessary for this rulemaking. Instead:

- Define excluded types (i.e., solids-handling, API 610, etc.)
- Define specific covered types (i.e., ESCC, ESFM, etc.)
- Define specific parameters (i.e., flow, head, etc.)
- → If pump is not of an excluded type, is of a specific covered type, and meets specified design parameters, pump is covered.

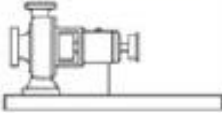




Scope for the Negotiation

In Scope?	Pump Type	ANSI/HI Nomenclature
Yes	End Suction Frame Mounted/Own Bearings	OH0, OH1
Yes	End Suction Close Coupled	OH7
Yes	Inline	OH3, OH4, OH5
Yes	Radial Split (Multistage) Vertical	VS8
Yes	Submersible Vertical Turbine (Multistage)	VS0
Maybe	Double Suction	BB1, OH4 double suction
Maybe	Axially Split	BB1 (2 stage), BB3
Maybe	Radial Split - Horizontal	BB2 (2 stage), BB4
Maybe	Radial Split – Vertical (Immersible)	N/A
Maybe	Vertical Turbine	VS1, VS2
Maybe	Circulators	CP1, CP2, CP3

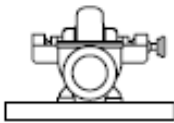
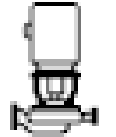
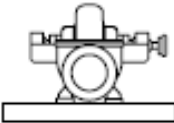
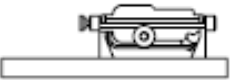
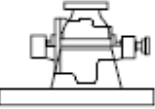
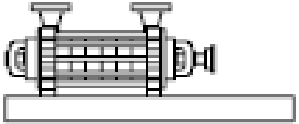
■ **PROPOSAL FOR VOTE:** This rulemaking will explicitly exclude the following types of pumps: **Z**. Other exclusions may be added in the future.

- **Vote results:**

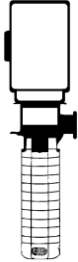




Scope Discussion – Lot 11/HI Proposal

PUMP TYPES			
	EU Nomenc.	ANSI/HI Nomenc.	Description
	ES0B	OH0	Flexibly Coupled Horizontal, Frame Mounted Centrifugal
		OH1	Flexibly Coupled Horizontal, Foot Mounted Centrifugal
	ESCC	OH7	Close Coupled Single Stage, End Suction
	ESCCI	OH3	Flexibly Coupled Vertical, In-Line Centrifugal
		OH4	Rigidly Coupled Vertical, In-Line Centrifugal
	No eqv.	OH5	Close Coupled Vertical, In-Line Centrifugal
	MS	VS8	In-line casing diffuser
	MSS	VS0	Close Coupled, Submersible Diffuser Centrifugal 4" or 6" Bowl Diameter Only

Scope Discussion – Lot 11+ (Part 1)

	DOE Nomenclature	ANSI/HI Nomenclature	Description
	Double Suction (DS)	BB1 (1 stage)	Between bearings, axially split (one-stage)
		Need follow-up from HI	Overhung, rigidly coupled, vertical, in-line (double suction)
	Axially Split Multi-Stage (AS)	BB1 (2 stage)	Between bearings, axially split (two-stage)
		BB3	Between bearings, axially split (multi-stage)
	Radial Split Horizontal (RS-H)	BB2 (2 stage)	Between bearings, radially split (two-stage)
		BB4	Between bearings, radially split, single casing (multi-stage)

Scope Discussion – Lot 11+ (Part 2)

	DOE Nomenclature	ANSI/HI Nomenclature	Description
	RS-V or VT	Need follow-up from HI	Vertically suspended, radial split, immersible
	Vertical Turbine (VT)	VS1	Vertically suspended, single casing, discharge through column, diffuser
		VS 2	Vertically suspended, single casing, discharge through column, volute
	Axial-Mixed (A-M)	OH00	Flexibly coupled, horizontal, axial flow
		VS3	Vertically suspended, single casing, discharge through column, axial flow

Scope Discussion – Shipments

To be updated when new data are available

	Pump Type	# Manufacturers Reporting	Range of Industry Shipments Estimated by Manufacturers (0-200 HP) (2012)	Estimated Shipments Based on Manufacturer Reports and Market Share (1-200 HP) (2012) [US Production]	Estimated Shipments on Census (1-200 HP) (2010) [Shipments+ Imports-Exports]	NOTES
Lot 11	ESCC	High	24,000 - 460,000	134,000	1,454,000	
	ESFM	High	22,000 - 480,000	92,000	106,800	
	IL	High	8,000 - 90,000	85,000	199,600	
	RS-V	Medium	20,000 - 63,000	88,000	2,280	
	VT-S	Medium	8,000 - 470,000	23,000	3,500	
Lot 11+	DS	High	900 - 50,000	27,000	6,600	
	AS	Low	400 - 1,600	3,000	150	
	RS-H	Low	2,600 - 71,000	300	2,820	
	VT	Medium	1,300 - 22,000	2,000	12,600	

Scope Discussion - Shipment Distribution

To be updated when new data are available

	Pump Type	ANSI/ HI Nomenclature	0-1 HP	1-3 HP	3-10 HP	10-25 HP	25-50 HP	50-100 HP	100-200 HP	200-500 HP	>500 HP	TOTAL
Lot 11	ESCC		8%	13%	55%	18%	6%	0%	0%	0%	0%	100%
	ESFM		1%	7%	26%	25%	35%	4%	1%	0%	0%	100%
	IL		20%	25%	28%	17%	7%	3%	1%	0%	0%	100%
	RS-V											
	VT-S											
Lot 11+	DS		0%	3%	13%	17%	23%	25%	15%	4%	0%	100%
	AS											
	RS-H											
	VT											

Distributions look okay
 DS above 500 HP should be higher

Scope Discussion - Connected Load (kW)

To be updated when new data are available

	Pump Type	ANSI/ HI Nomenclature	1-3 HP	3-10 HP	10-25 HP	25-50 HP	50-100 HP	100-200 HP	TOTAL
Lot 11	ESCC		27,910	391,586	335,038	232,395	30,019	3,343	1,020,291
	ESFM		10,064	118,819	306,130	916,529	211,455	85,043	1,648,040
	IL		39,310	142,126	234,541	199,308	157,871	160,104	933,259
	RS-V								
	VT-S								
Lot 11+	DS		1,079,175	1,501	60,770	182,823	400,366	483,590	1,146,130
	AS								
	RS-H								
	VT								

Scope Discussion – Energy Use

To be updated when new data are available

	Pump Type	ANSI/ HI Nomenclature	Estimated Shipments (1-200 HP)	Wtd Avg HP Manufacturer Data (1-200 HP)	Median Shaft HP based on HI survey (1-200 HP)	Connected Load A (kW)	Connected Load B (kW)	Average Percent Load	Estimated Hours of Operation (US) A	Estimated Hours of Operation (EU) B	Annual Energy Use A (TWh)	Annual Energy Use B (TWh)
Lot 11	ESCC		134,000	10	17	1,020,291	1,699,388	74%	1,913	2,250	1.44	2.83
	ESFM		92,000	24	21	1,648,040	1,441,272	74%	2,188	2,250	2.67	2.40
	IL		85,000	15	18	933,259	1,141,380	74%	3,000	4,000	2.07	3.38
	RS-V		88,000	Not reportable	11	N/A	722,128	74%	2,823	1,500	N/A	0.80
	VT-S		23,000	10	4	165,606	68,632	74%	1,500	1,000	0.18	0.05
Lot 11+	DS		27,000	57		1,146,130		74%	3,000		2.54	
	AS		3,000	56		125,312		74%	3,224		0.30	
	RS-H		300	Not reportable		N/A		74%	2,823		N/A	
	VT		2,000	78		116,123		74%	1,699		0.15	

Notes:
 Unclear what manufacturer HP data represents (hydraulic, shaft, motor?). May not account for motor efficiency.
 Average percent load is based on an assumed average flow of 50%.

Scope Discussion - Circulator Energy Use

To be updated
when new data
are available

■ Shipments Data

- HI: 1.7 million [1/25-3 HP, wet and dry]
 - likely includes some small pumps that are not circulators
- Advocates: 2 million [0-1/4 HP]
- DOE: 1.5 million [0-3 HP, wet only]

■ Estimated Annual Operating Hours

- HI: 2160 [Provided]

■ Average motor draw

- HI: 1/10 HP (78W) [Calculated]
 - Does not seem realistic. 78W is less than the operating electric power draw for most common “1/25 HP” nameplate circulators. HI survey collected data on 1/25 - 3HP nameplate circulators.
- Other: 2/10 HP (155W)
 - Using the assumption that HI collected nameplate HP and applying 50% efficiency

■ Average Load

- Assume power draw is constant across loads

■ Annual Energy Use [1 year of shipments]

- HI: 0.285 TWh [Provided]
- Advocates: 1.0 TWh [Calculated]
- Other: 0.57 TWh
 - [1.7 mil, 2160 hours, 1/10 HP hydraulic, 50% motor/pump eff]

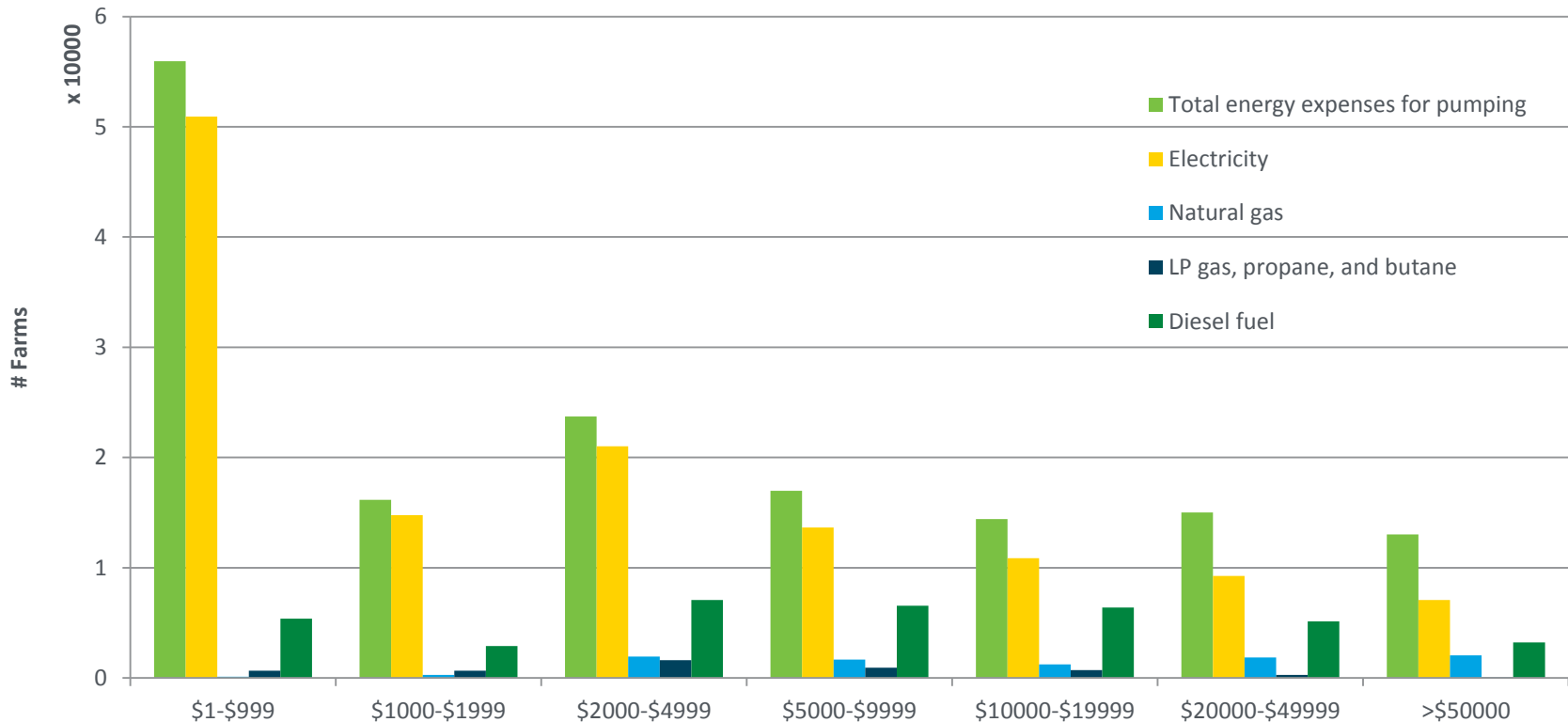
Scope Discussion - Other Requested Data

Data to be presented when available

- DOE requested data on the following, but did not request to aggregate the results:
 - Circulator Energy Savings Estimates
 - Percent shipments variable speed
 - Estimated potential energy savings from switching to ECM (constant speed)
 - Estimated potential energy savings accounting for variable load
- Other data for circulators:
 - Incremental cost of ECM vs AC Induction
 - Aggregate industry conversion cost
 - Availability of ECMs
 - Testing costs and issues

Engine Data - Farm & Ranch Irrigation Survey

- Annual Energy Expenses by Type



- DOE did not receive sales data on pumps sold with engines

Other Data: Sales of Pumps with Motors

To be updated when new data are available

	Pump Type	% Shipments Packaged with Motor*	% Shipments Packaged with Motor and VFD*
Lot 11	ESCC	65%	3%
	ESFM	66%	8%
	IL	92%	9%
	RS-V	Not reportable	
	VT-S	Not reportable	
Lot 11+	DS	75%	7%
	AS	95%	Not reportable
	RS-H	Not reportable	
	VT	72%	3%

*Shipment weighted average.
 NOTE: These percentages are for illustration purposes only and are not expected to be representative of the actual market.

- DOE did not receive data on sales of pumps with motors and VFD by HP

Data Requested for Eng/Econ Analysis

■ Already requested of manufacturers

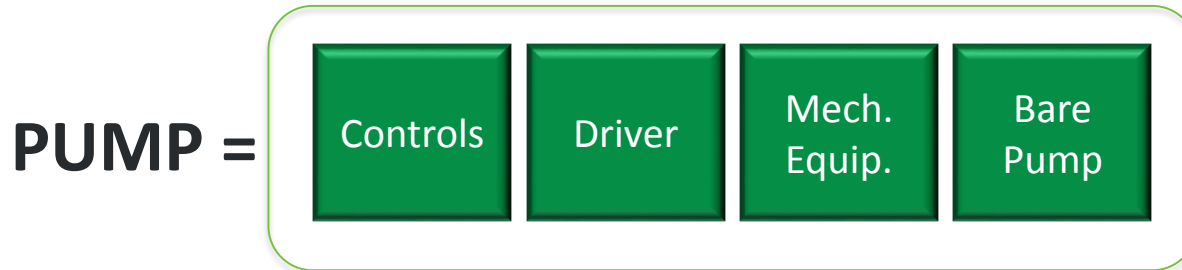
- Circulators
 - Shipments by model
 - Load profiles
 - Availability of ECMs and incremental cost of ECM vs AC Induction
 - Conversion costs
 - Testing costs and issues
- Pumps (Lot 11 and additional equipment classes)
 - Shipments by model
 - Efficiency distribution
 - Performance data at multiple part load points
 - Shipments and performance data by speed

■ Additional data needed

- Load profiles by application
- Duty points
- Drive performance data or AHRI 1210 certified data
- ECM performance data

Possible Definition of Covered Product

- **'Pump'** is a device that moves **liquids** by physical or mechanical action and includes a bare pump and, **as manufactured**, mechanical equipment, driver, and controls.



- **Notes:**
 - Using the term “manufactured” allows flexibility in application.
 - Does how we define covered product determine what is pre-empted? Yes.
 - GC to provide information on this for next meeting.
 - There is a waiver process related to pre-emption.
- **PROPOSAL FOR VOTING:** The covered product, a ‘pump’ will be defined as in the above paragraph.
 - **Vote results:**

General Description of 'Pump' Components

- **'Bare pump'** is a device that moves liquids by physical or mechanical action excluding mechanical equipment, driver, and controls.
 - ~~TBD based on the various pump types/equipment classes considered for coverage.~~
- **'Mechanical equipment'** is any component that transfers energy from the driver to the bare pump.
 - ~~may include belts, gears, couplings, or other equipment.~~
- **'Driver'** is the machine providing mechanical input to drive the bare pump through the mechanical equipment, and may include an electric motor, natural gas or diesel engine, or steam-driven turbine.
- **'Controls'** means any device that can be used to control the driver, including those that automatically adjust the speed of the driver in response to system feedback.

- **General agreement in regard to the definitions as written above.**
- **PROPOSAL FOR VOTING:** The components of a 'pump' will be defined as in the above paragraphs.
 - **Vote results:** NO VOTE

Voting Record - Scope Process

- **PROPOSAL FOR VOTING:** For the purposes of this working group, everything is in scope until this group by their decision-making rules by consensus decides to exclude them.
 - **Vote results:** Unanimous [1/31/14]

Voting Record – Scope Exclusions

	Exclusions	Notes
OK – 1/31	Wastewater, Sump, Slurry, Solids Handling	Requires further definition? Look at EU documents. (Gray water should not be excluded.)
OK – 1/31	API 610 Pumps	
OK – 1/31	ASME/ISO Chemical Pumps	
OK – 1/31	Fire Pumps	Excluded if certified to NFPA 20 by UL or FM.
OK – 1/31	Self-priming pumps	
OK – 1/31	Prime-assisted pumps	
OK – 1/31	Positive Displacement Pumps	
OK – 1/31	Axial/Mixed Flow Pumps	
TBD	Marine, Navy, and Nuclear Pumps?	Materials will be different. Quantity is low. Data are not available. HI will look into physical differences in those markets.
TBD	Sanitary Pumps?	Food-grade. Specific physical design requirements that impact efficiency. Significant incremental cost. HI will look into physical differences.

- General agreement to exclude the pump types in the table above. Definitions to be worked on later.
- PROPOSAL FOR VOTE: This rulemaking will explicitly exclude the following types of pumps: **listed as ‘OK – 1/31’ in the table above**. Other exclusions may be added in the future.
 - Vote results: Unanimous [1/31/14]