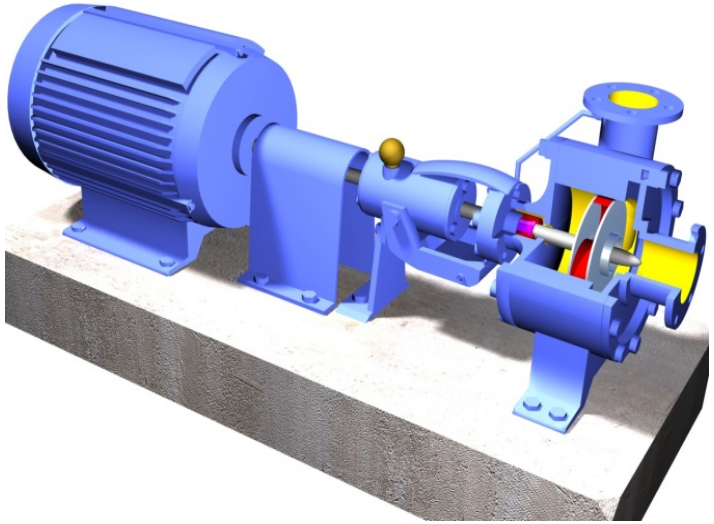
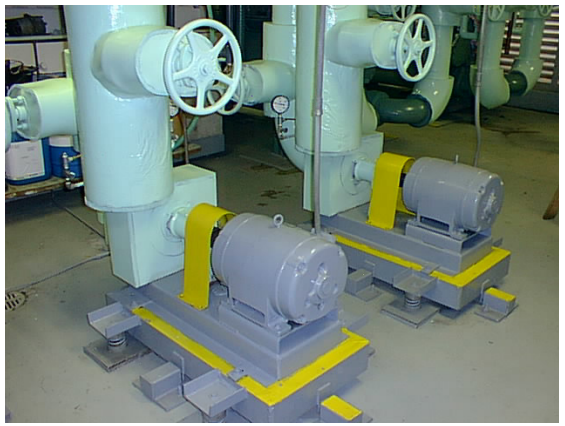
ASRAC Pumps Working Group

DOE Regulation and Metric Proposal








U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

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BUILDING TECHNOLOGIES PROGRAM
December 19, 2013

Pump Configurations

- A ‘pump’ is typically sold one of three ways:
  1. Bare pump

  2. Pump + motor

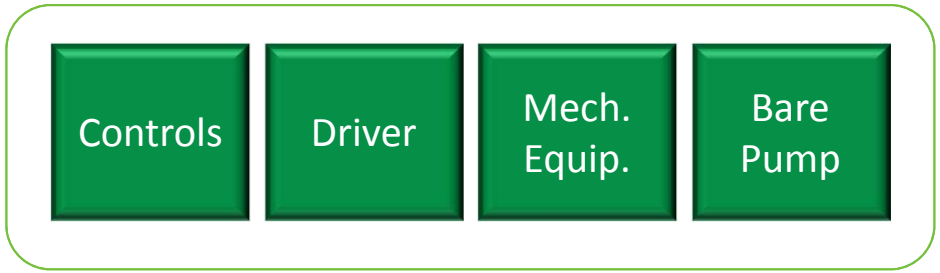
  3. Pump + motor + controls

- DOE does not expect to consider:
  - Drivers other than electric motors, e.g., engines, steam turbines
    - Only applies to estimated ~1-2% of clean water pumps
  - Mechanical equipment, e.g., belts, gears
    - Not typically relevant to clean water pumps

Proposed Definitions

- '***Pump***' is a device, inclusive of mechanical equipment, driver, and -- when present -- controls, that moves fluids by physical or mechanical action.

PUMP =



  - **'Bare pump'** will be defined as inclusive of the various pump types/equipment classes considered for coverage.
  - '**Mechanical equipment**' may include belts, gears, or other equipment.
  - '**Driver**' may include an electric motor, natural gas or diesel engine, or steam-driven turbine.
  - '**Controls**' means any device that automatically adjusts the speed of the motor in response to system feedback, including, but not limited to, Variable Frequency Drives (VFDs).

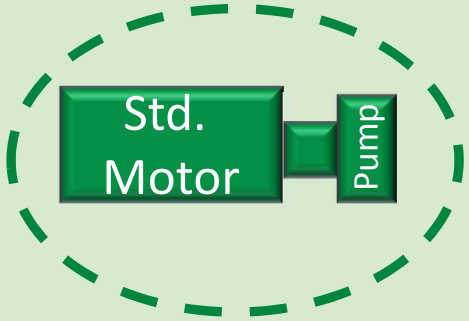
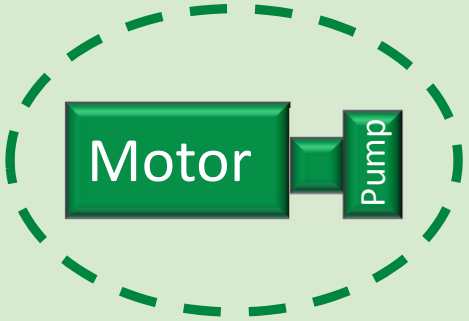
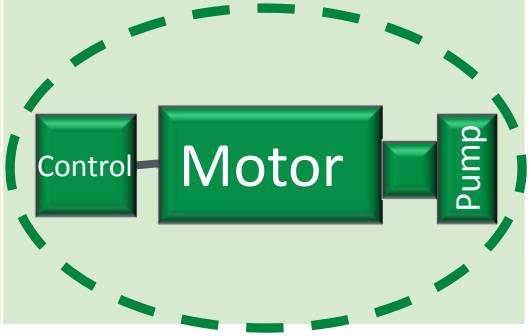
Metric Applicability to Pump Configurations

Metrics	Bare Pump	Pump+Motor	Pump+Motor+Controls
Pump Efficiency	✓	Does not capture motor efficiency	Does not capture control losses or benefits
Overall Efficiency	✓ (w/ std. motor)	✓	Does not capture power reduction
Weighted Avg. Electric Input Power	✓ (w/ std. motor)	✓	✓

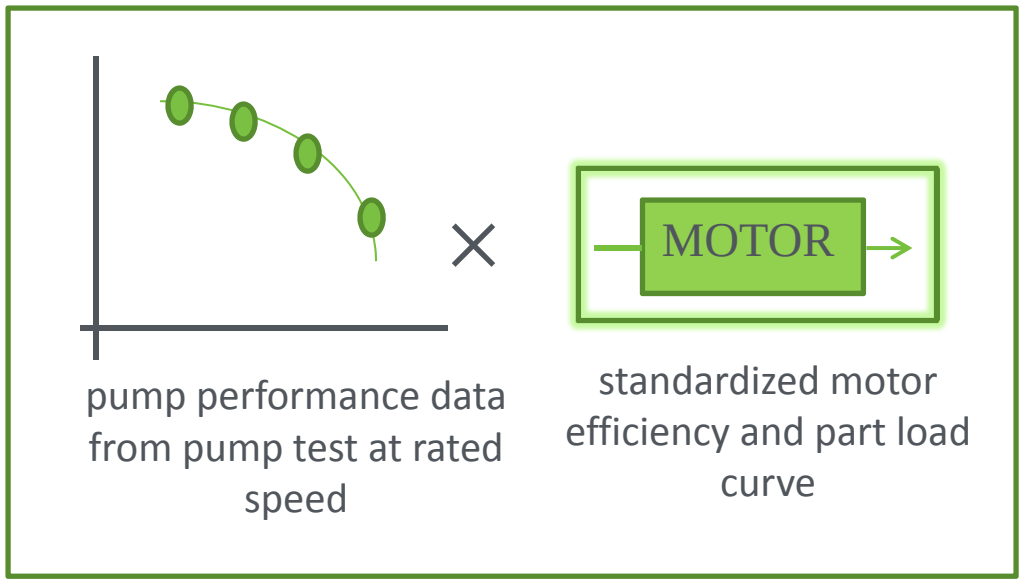
✓ The only metric that captures efficiency implications of all components of a 'pump' and therefore works for all configurations is an electric input power based metric.

- By using a single metric, each pump configuration may have its own equipment class set with a unique standard or equipment could be combined into one set with higher efficiency motors and controls as design options.

Testing Overview

	Bare Pump	Pump +Motor	Pump+Motor+Controls
Equipment tested	Test bare pump alone	Option A: Test bare pump alone and combine with motor performance data Option B: Test pump+motor	Option A: Test bare pump alone and combine with motor+controls performance data Option B: Test pump+ motor+controls
Variable load profile device	Throttling	Throttling	Speed reduction
Covered equipment			

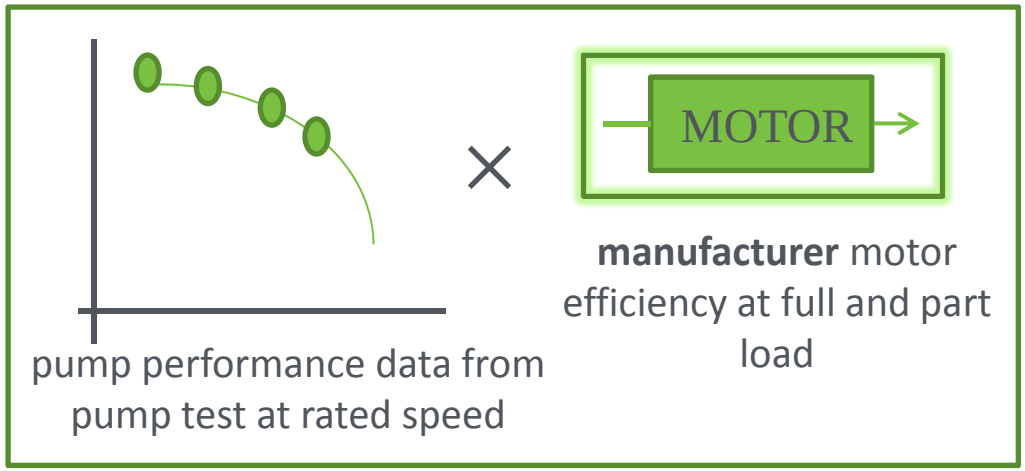
Bare Pump



- Standard motor will be AC Induction, NEMA Design B, open enclosure.
  - HP used will be next HP above brake horsepower at 120% BEP.
  - Poles will be based on speed at which pump is being rated.
- Standard full load motor efficiency based on Federal standards.
- Standard motor part-load curves based on DOE Motor Masters database.

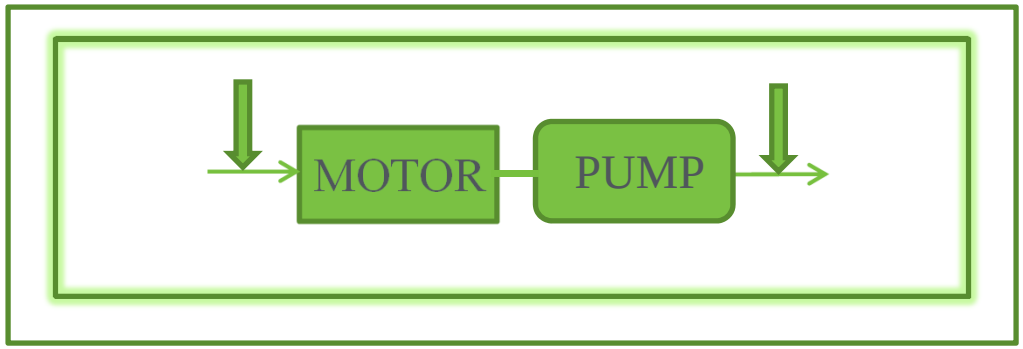
Pump+Motor

A



Manufacturer can pair its pump data with manufacturer motor data tested in accordance with DOE motor TP.

B

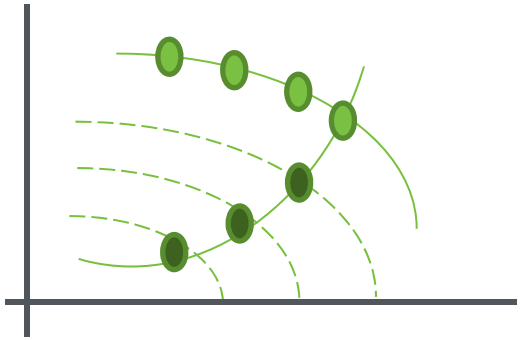


Manufacturer can measure power of pump+motor combo.

- 'A' will be required except for submersible pumps or in certain other cases – e.g., when shaft input power cannot be measured, or potentially when motor is not covered by DOE standard and cannot be rated with DOE motor TP.

Pump+Motor+Controls

A



pump performance from pump test at rated and reduced speed

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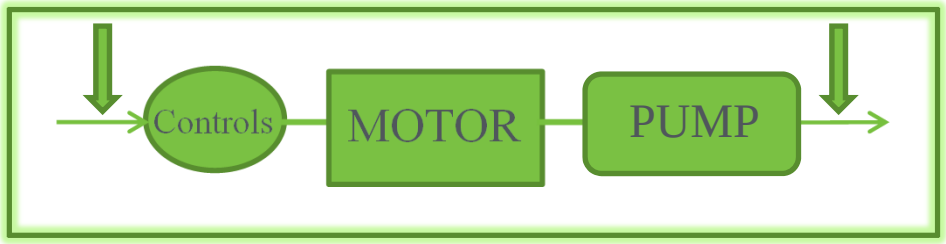
manufacturer motor/VFD performance map from AHRI 1210 or similar – **certified or test data**

Manufacturer can pair its pump data with tested motor+VFD data.

B



Manufacturer can measure power of pump+motor+ controls combo.

- Pumps with ECMs or other motor technologies with multiple or variable speeds may be tested as pump+motor+controls.
- Quadratic system curve will be specified for part-load points.
- 'A' will be required except for submersible pumps or in certain other cases – e.g., when shaft input power cannot be measured or controls cannot be rated with AHRI 1210.
- Because AHRI 1210 is a voluntary standard, manufacturer burden will be taken into account for both approaches.