
Mitchell
Lewis & Staver
est 1882

Measuring Pump Efficiency

with **Mike Eglitis**

Centrifugal Product Specialist since 1995

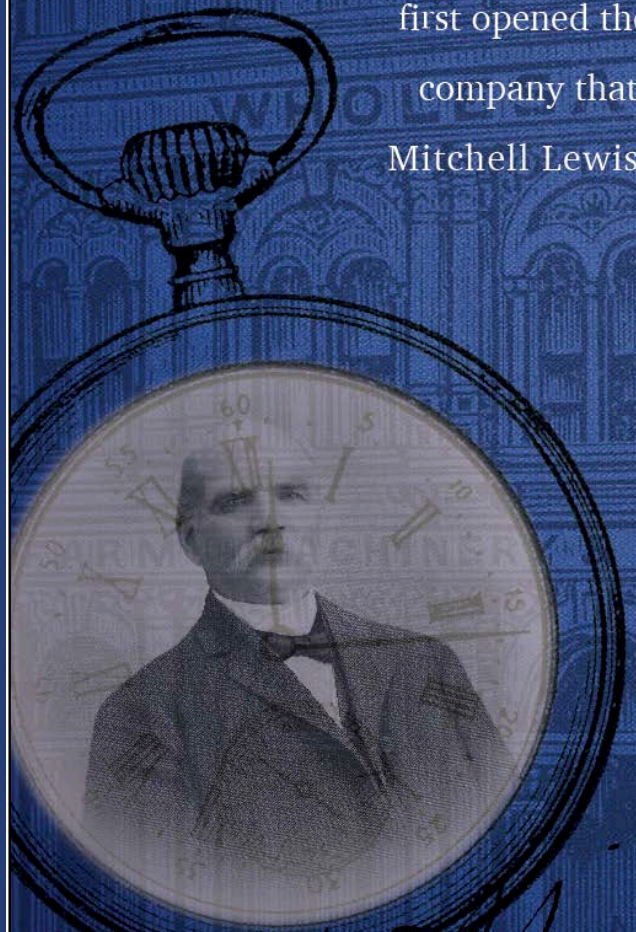
Mitchell Lewis & Staver Co.

Who is MLS?

Mitchell Lewis & Staver is the West's premiere value-added integrator of high quality pumps and motors, booster stations and custom applications. We are OEMs for UL listed electrical controls, including soft start systems and Variable Frequency Drives (VFDs) used in moving water and a variety of industrial materials.

Established in 1882, we service the Western United States, with locations throughout California, Oregon, Washington, Idaho, Utah and Arizona.

IT WAS SPRING OF 1882 at 148 Front Street in Portland, Oregon when William Henry Mitchell first opened the doors of the company that would become Mitchell Lewis & Staver.



Mitchell Lewis & Staver

DID YOU KNOW?

We were once a car company!
By 1908, Mitchell Motor Co. was manufacturing over 2000 automobiles annually, in 5 styles, employing 1600 workers in our Racine, WI plant.

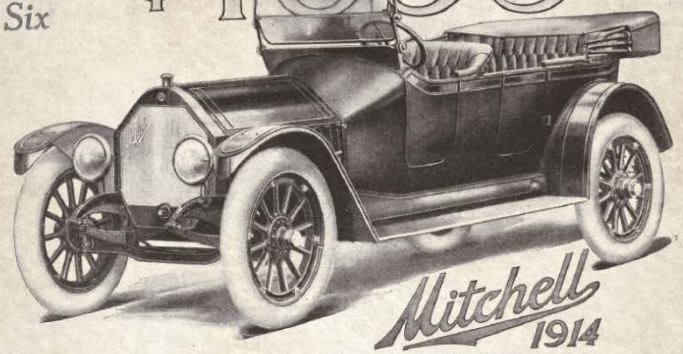
Check out our complete history at: ***www.mitchellewis.com/mlshistory***

Mitchell Lewis & Stayer est 1882

THE SATURDAY EVENING POST

The Little Six

$1895



The Original Mitchell Engineer

Again at the Head of the Mitchell-Lewis Motor Company
A Matchless Line for 1914

The Mitchell 1914 Line is being produced by Engineer John W. Bate, *the man who created the Mitchell car*, and the famous Mitchell *Baby Six*. After a year's rest he returns to Racine to place the Mitchell in a *stronger position than it has ever occupied.*

The Mitchell-Lewis Motor Company, *with unlimited capital at its command*, has surrounded Mr. Bate with the best facilities and the finest factory that it is possible to build. It will back the car with the most liberal *Service-Policy for car owners* that the business mind can conceive.

Eighty years of faithful service to the American public is the Company's Guarantee

This Means for the Mitchell Car for 1914

Quality—Efficiency—Long Life

Equipment of All Mitchell Models

Electric Self-Starter and Generator.
Electric Lights—Five Lamps.
Speedometer.
Mohair Top and Cover.
Rain Vision, Ventilating Quick Action Windshield.
Extra Removable Rim.
Double Extra Tire Carrier.
Pair Bow Holders.
License Plate Bracket.
Electric Horn.
Electric Exploring Lamp.
Complete Set of Tools, Pump, Jack.
All included in list price.

Prices F. O. B. Racine

The Mitchell Little Six is the most logical value on the market. It is a six-cylinder car of aristocratic design. It has fifty horse power, 132 inch wheel-base, five passenger capacity. It has a long, low, stylish streamline body, is luxuriously upholstered, is equipped with electric self-starter and generator, electric lights and all modern conveniences and sells for the reasonable price of $1,895

The Mitchell Big Six is very much the same design as the Little Six. It has sixty horse power, 144 inch wheel-base and seats seven passengers. It has big tires and the same splendid finish throughout as the Little Six, likewise the same fine equipment. Price, ... $2,350

The Mitchell Four has 120 inch wheel-base, forty horse power and seats five passengers. It is a splendid family car for little money. It is equipped precisely the same as the two sixes and sells for $1,595

No matter which one of the Mitchell cars you select, *you will make an investment.* You have *Bate's* word for it. You have *our* word for it. And the *service* that lies behind it is *ten times better than a guarantee.* We are going to make you like the car, like us and like the agent you deal with. In all respects this is to be a Mitchell year and you will love

The Car You Ought to Have at the Price You Ought to Pay

Mitchell-Lewis Motor Co.
Racine, Wis., U.S.A.

80 Years of Faithful Service to the American Public

Features of 1914 Mitchell

Left Hand Drive.
Center Control.
Tungsten Steel Valves.
T-Head Fully Enclosed.
Long Stroke Motor.
Rayfield Carburetor.
Gravity Gasoline Feed.
Roomy Streamline Body.
Timken Wheel Bearings.
Full Floating Rear Axle.
Big Tires—36 Inches.
Luxurious Upholstering.
Nickel Trimmings.
Demountable Rims.
Collin's Quick-Action Side Curtains

Prices F. O. B. Racine

866-748-8077 | mitchellewis.com

Corpromo122216

Mitchell Lewis & Stayer

Pump & Motor Efficiency

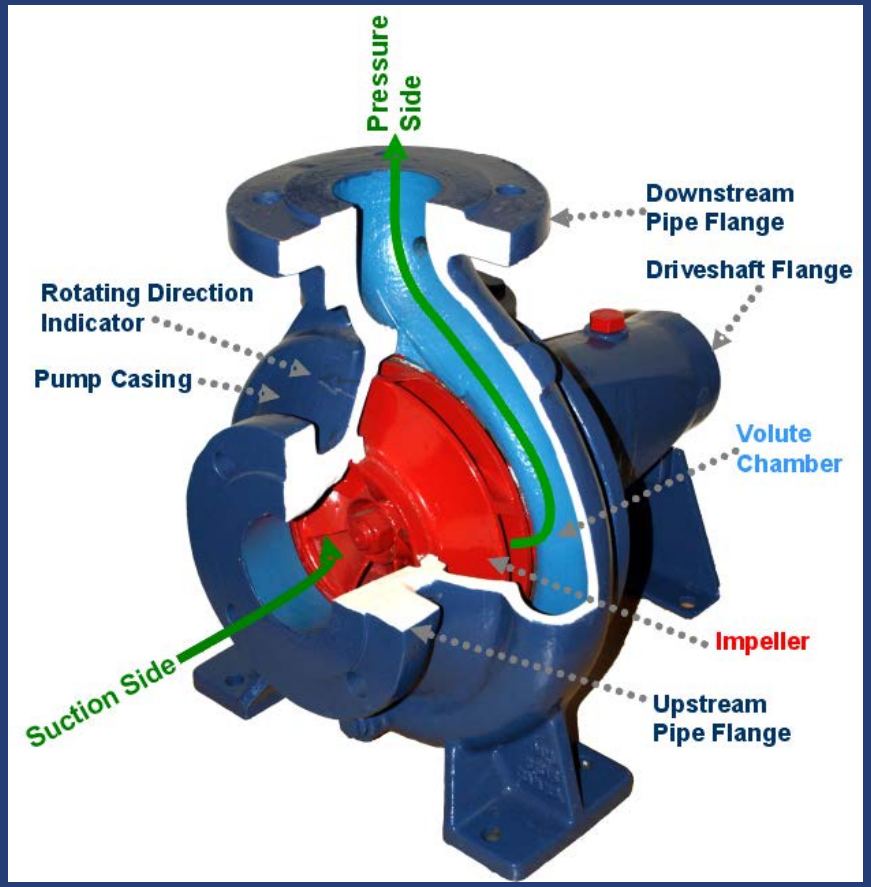
What is efficiency?

- Often measureable
- Minimizing waste
- Maximizing performance
- Maximizing value: money / time

Factors in efficiency–

- Fluid Dynamics: forces acting on the movement of fluid

Pump Mechanics



How does a pump move water?

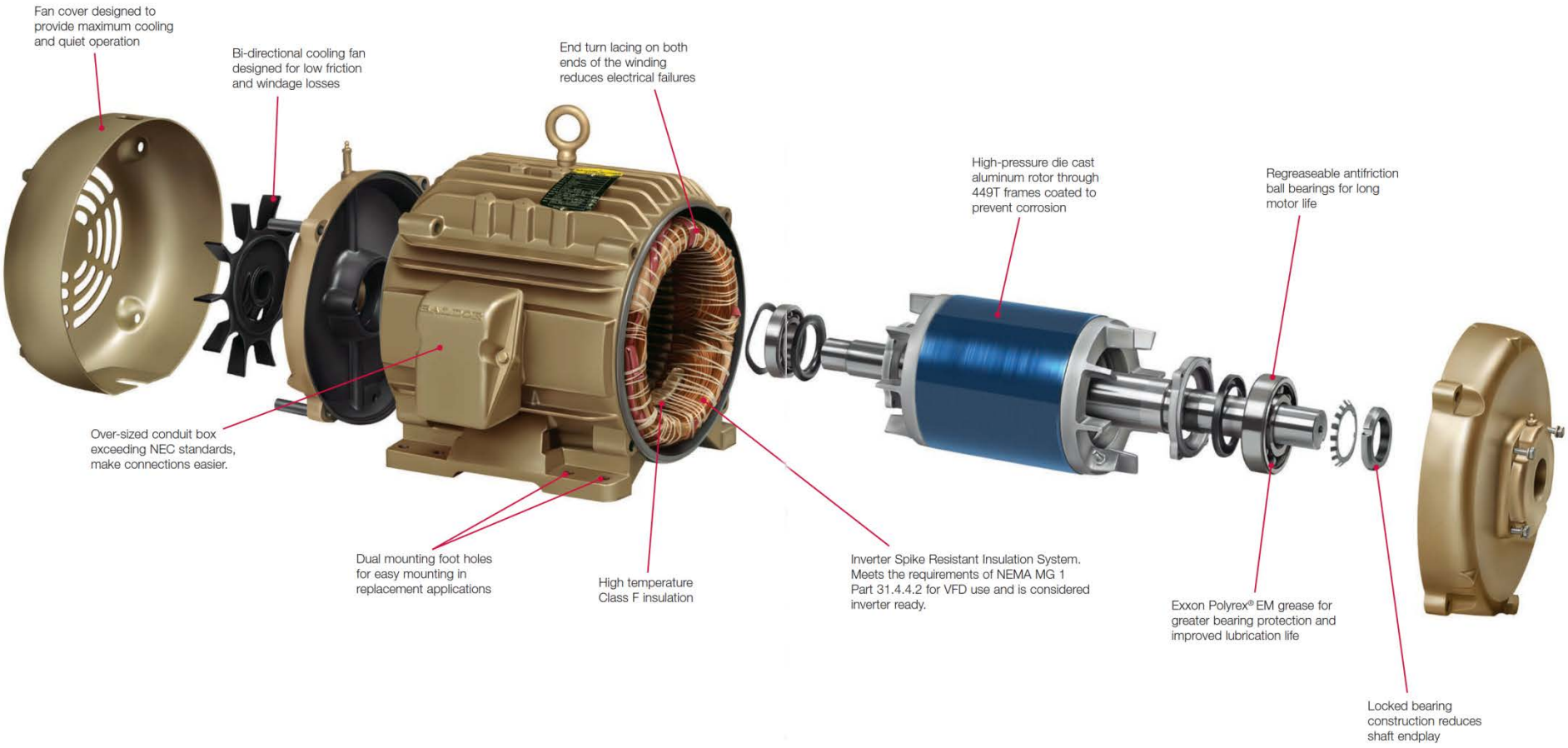
- Centrifugal pumps
- Impeller shape
- Factors in pump selection

Motor Efficiency

What makes up motor Efficiency?

- Conversion of Electricity to mechanical energy
- Energy losses- Wire resistance, brgs. fans, connectors, which cause Heat.

Motor Efficiency



Measuring Motor & Pump Efficiency

- “Wire to Water Efficiency” formula:

$$\frac{\text{GPM x Total Head}}{\text{5300 x KW input}}$$

DOE Mandated Motor Performance Standards

- June 1, 2016 DOE issues new performance standards for electric motors.

U.S. Department of Energy Integral Horsepower Motor Rule

Effective June 1, 2016

The U.S. DOE passed a final rule that covers 1 – 500 HP (0.75 – 370 kW) three phase electric motors. This new law will supersede the existing Energy Independence and Security Act of 2007.

The motors regulated under expanded scope meet the following nine characteristics:

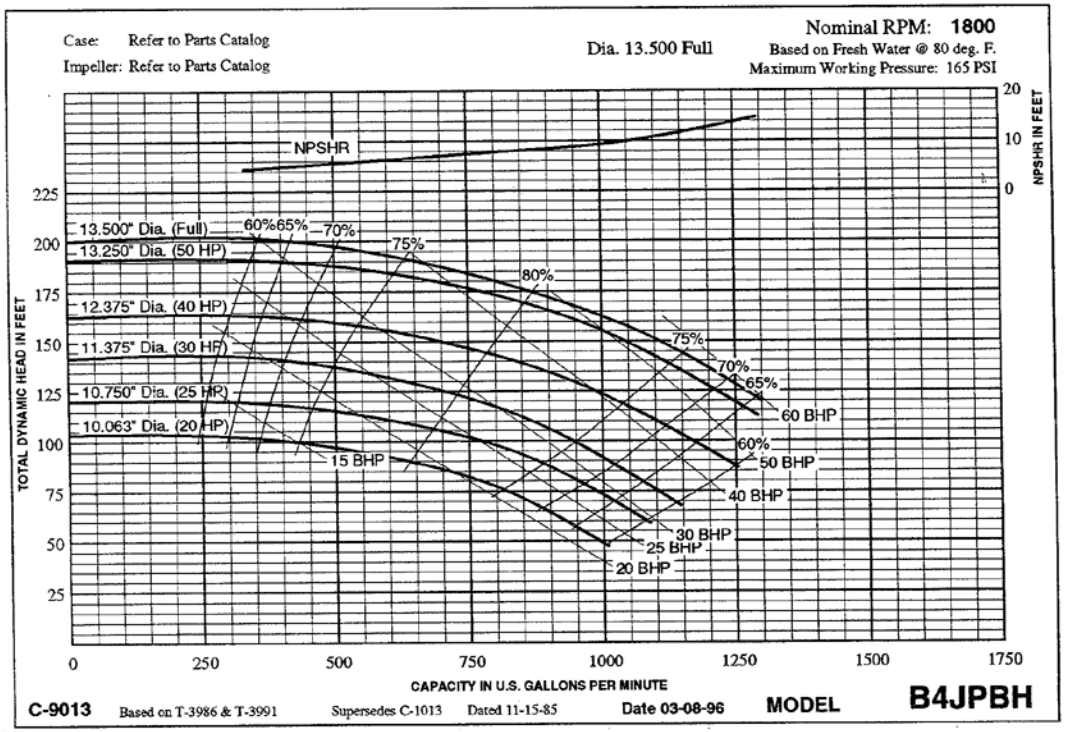
1. Is a single speed motor,
2. Is rated for continuous duty (MG 1) operation or for duty type S1 (IEC),
3. Contains a squirrel-cage (MG 1) or cage (IEC) rotor,
4. Operated on polyphase alternating current (AC) 60-hertz sinusoidal line power,
5. Has 2-, 4-, 6-, or 8-pole configuration,
6. Is rated 600 volts or less,
7. Have a three or four digit NEMA frame size (or IEC metric equivalent), including those designs between two consecutive NEMA frame sizes (or IEC metric equivalent) or an enclosed 56 NEMA Frame size (or IEC metric equivalent).
8. Has no more than 500 horsepower, but greater than or equal to 1 horsepower (or kilowatt equivalent),
9. and meets all the performance requirements of a NEMA design A, B or C electric motor or an IEC design N or H electric motor.

Several categories of motors were previously covered at lower efficiency levels or exempt. These motors now must be produced to premium efficiency levels (NEMA MG 1-2011, Table 12-12, 20A or 20B).

BERKELEY®

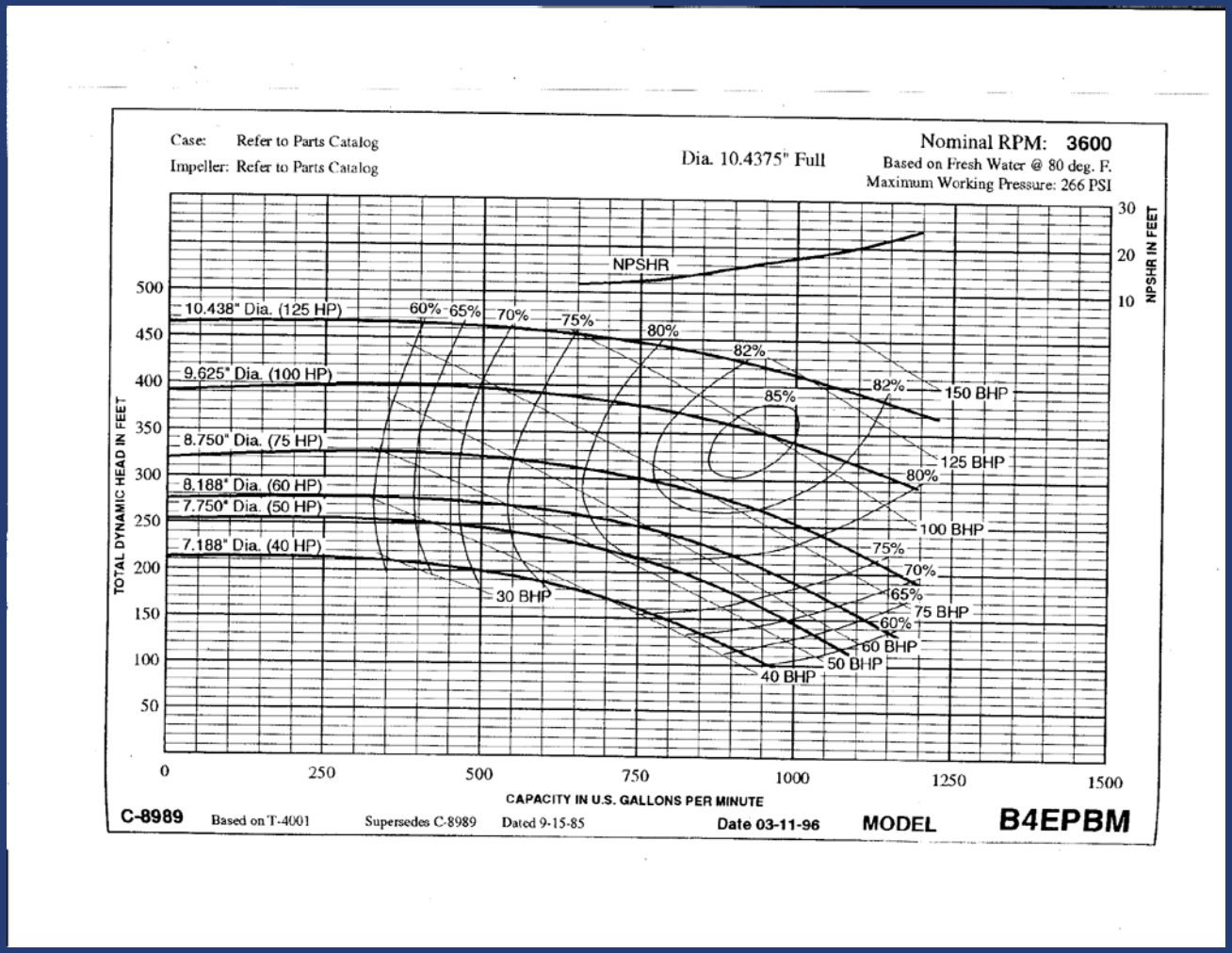
MOTOR DRIVE

CURVE	4075
DATE	02-26-96
PAGE	9.01
SUPERSEDES	
Curve 4075	Page 9.01
Dated 01-02-86	



C-9013 Based on T-3986 & T-3991 Supersedes C-1013 Dated 11-15-85 Date 03-08-96 MODEL **B4JPBH**

Pump Curves


Case: Refer to Parts Catalog
Impeller: Refer to Parts Catalog
Dia. 10.4375" Full
Nominal RPM: 3600
Based on Fresh Water @ 80 deg. F.
Maximum Working Pressure: 266 PSI
NPSHR
10.438" Dia. (125 HP)
9.625" Dia. (100 HP)
8.750" Dia. (75 HP)
8.188" Dia. (60 HP)
7.750" Dia. (50 HP)
7.188" Dia. (40 HP)
60%
65%
70%
75%
80%
82%
85%
82%
80%
75%
70%
65%
60%
150 BHP
125 BHP
100 BHP
75 BHP
60 BHP
50 BHP
40 BHP
30 BHP
TOTAL DYNAMIC HEAD IN FEET
NPSHR IN FEET
CAPACITY IN U.S. GALLONS PER MINUTE
C-8989
Based on T-4001
Supersedes C-8989
Dated 9-15-85
Date 03-11-96
MODEL
B4EPBM

Pump to Application Efficiency

- Pressure reading at discharge
- Flow meter
- Use of amp meter
- Create a performance curve
- Consult WaterTec
- Findings: Outside best operations point on the curve?

Findings: Best operation points on the curve?

On either side of this issue
you could be adding cost.

- To the left: smaller pump?
- To the right: larger pump?

Is a VFD a solution?

Pros:

- Reducing power consumption
- Pipe fill mode
- Adjustable speeds
- Remote control and monitoring

Cons:

- Upfront investment
- Doesn’t address all scenarios
- Timely technical service

VFD Multi-speed Curve

ated	: 123.0 ft
Fluid density, rated / max	: 1.000 / 1.000 SG
Viscosity, rated	: 1.00 cP
Cq/Ch/Ce/Cn [ANSI/HI 9.6.7-2010]	: 1.00 / 1.00 / 1.00 / 1.00
Impeller diameter, rated	: 11.38 in

VFD Multi-speed Curve

r diameter, rated : 8.19 in

Factors in Pump Efficiency Loss
(in the field)

1. Heavy Use / Age of the Pump / Abrasives in the water

- Impeller wear
- Reduced efficiency (worn down)
- Performance shifts to right of BEP
- Vibration
- Suction line issues

2. Motor Issues

- Above rated amperage operation
- Vibration, bearings, mechanical wear
- Heat
- Vibration

3. Irrigation System

- Worn sprinkler nozzles
- Leaks
- System changes
- Water source conditions
- Incorrect pipe sizing

New motors vs. Old motors

A. Old Motors

- Size
- Construction/weight
- Large cooling openings
- Air gap

B. New Motors

- More compact
- Steel or aluminum frames
- 2017 DOE standard compliance
- Resilient
- Improved wiring

C. Point of Motor Replacement

- Operating at high amperage
- Vibration
- Rewind or purchase a new motor

Pump: Rebuild or Replace

A. Rebuild or Replace a Pump

- **Berkeley**: replaceable parts
- Pump End Kit
- **Cornell**: expensive parts
- Order what is needed

B. Age of Pump

- Is the pump a current model with available parts?
- If not, a new pump is recommended

Conclusions

- Start with a good plan.
- Up front, consider future needs.
- Design the most efficient system.
- Engage the tools of technology to focus on the causes and in determining a solution.