

C AND C PUMPS AND SUPPLY

ILLINOIS RURAL WATER ASSOCIATION

OBLONG, IL MAINTENANCE TRAINING SESSION | DECEMBER 6, 2022

 **GLOBAL PUMP**
866-360-PUMP
www.globalpump.com



MUNICIPAL • NEW FOCUS • SAME PASSION
ENGINEERED SOLUTIONS • QUALITY PRODUCTS • EXCEPTIONAL SERVICE

PUMP STATION MAINTENANCE | HOW TO MEET SARAH AND BRAD

WHAT DO ALL PUMP SYSTEMS HAVE IN COMMON? THEY ALL REQUIRE CARE AND MAINTENANCE 10 WAYS TO MEET SARAH AND BRAD

10. OVERWORK YOUR PUMP
9. STARVE YOUR PUMP
8. CHOKE YOUR PUMP
7. FRY YOUR PUMP
6. STAB YOUR PUMP
5. STRESS YOUR PUMP
4. SHAKE YOUR PUMP TO PIECES
3. POISON YOUR PUMP
2. DROWN YOUR PUMP
1. NEGLECT YOUR PUMP



MUNICIPAL - NEW FOCUS - SAME PASSION
Engineered Solutions • Quality Products • Exceptional Service

Sarah Towle P.E.
Engineered Sales
618-491-9067
stowle@candcpumps.com
13085 Rt. 37, Marion, IL 62959
4317 Bridgeton Industrial Dr, Bridgeton, MO 63044

Marion, IL 618-997-2311
St. Louis, MO 314-780-0185
candcpumps.com

- ✓ Engineered Solutions
- ✓ Stocked Warehouses
- ✓ CLA-VAL Experts
- ✓ Sales & Rentals
- ✓ Service & Repairs
- ✓ Installation
- ✓ Custom Fabrication
- ✓ On-call 24/7



MUNICIPAL - NEW FOCUS - SAME PASSION
Engineered Solutions • Quality Products • Exceptional Service

Brad Riggs
618-606-0105
briggs@candcpumps.com
13085 Rt. 37, Marion, IL 62959
4317 Bridgeton Industrial Dr, Bridgeton, MO 63044

Marion, IL 618-997-2311
St. Louis, MO 314-780-0185
candcpumps.com

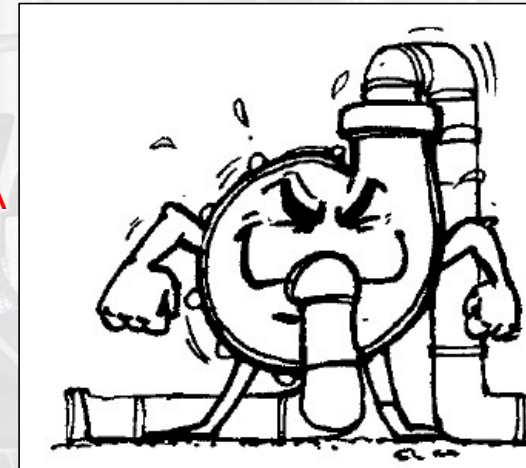
- ✓ Engineered Solutions
- ✓ Stocked Warehouses
- ✓ CLA-VAL Experts
- ✓ Sales & Rentals
- ✓ Service & Repairs
- ✓ Installation
- ✓ Custom Fabrication
- ✓ On-call 24/7

#10 | OVERWORK YOUR PUMP

**WHAT DO ALL PUMP SYSTEMS HAVE IN COMMON?
THEY ALL REQUIRE CARE AND MAINTENANCE
10 WAYS TO MEET SARAH AND BRAD**

FREQUENT STARTS

1. CAN DAMAGE MOTOR WINDING INSULATION | **HEAT CAN'T DISSIPATE**
 - **ATL: 7 TO 10X FLA | SOFT START: 3 TO 5X FLA | VFD: NEVER EXCEEDS FLA**
2. HIGH MECHANICAL STRESS DURING STARTING

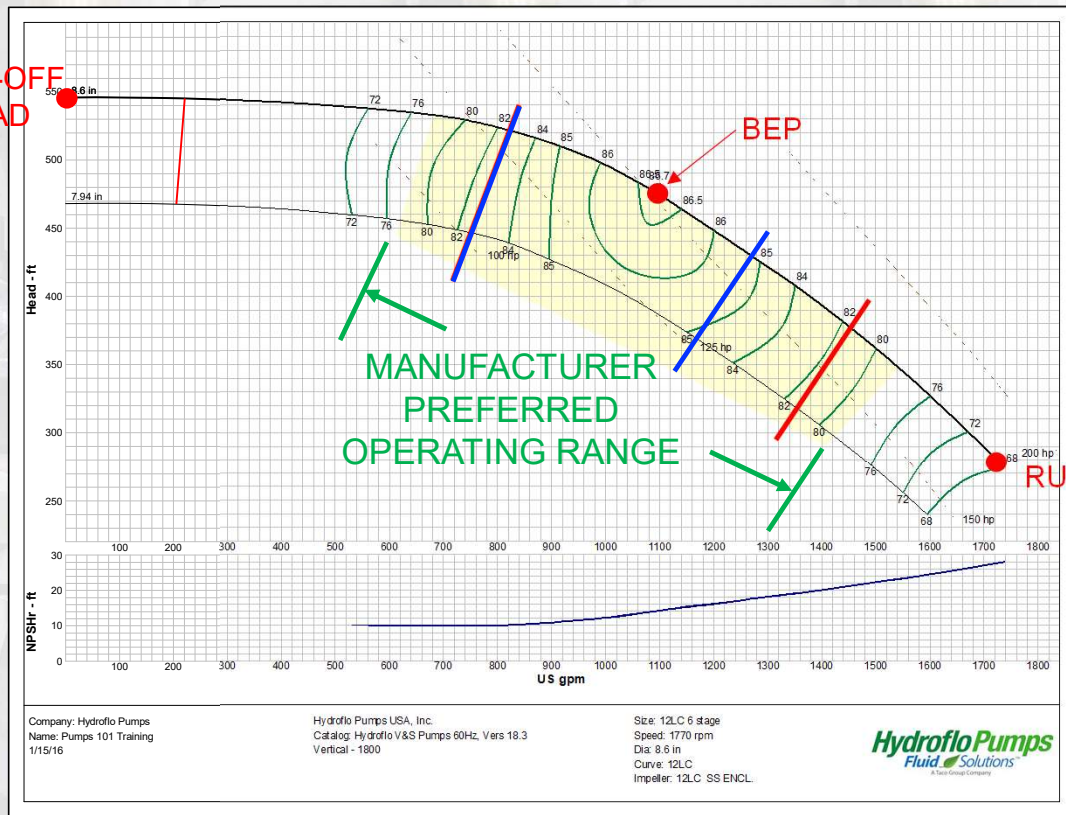


IGNORING ALLOWABLE OPERATING RANGE

1. INCREASES POTENTIAL FOR DAMAGING HYDRAULIC FORCES, VIBRATION, AND CAVITATION
2. ROUTINE OPERATION SHOULD BE WITHIN THE PREFERRED OPERATING RANGE TO MINIMIZE SHAFT DEFLECTION AND INCREASE RELIABILITY

BEP OPERATION | INCREASES RELIABILITY

1. FIRST, AND FOREMOST, OPERATE AT OR NEAR BEP
2. LESS SHAFT DEFLECTION – INCREASED RELIABILITY



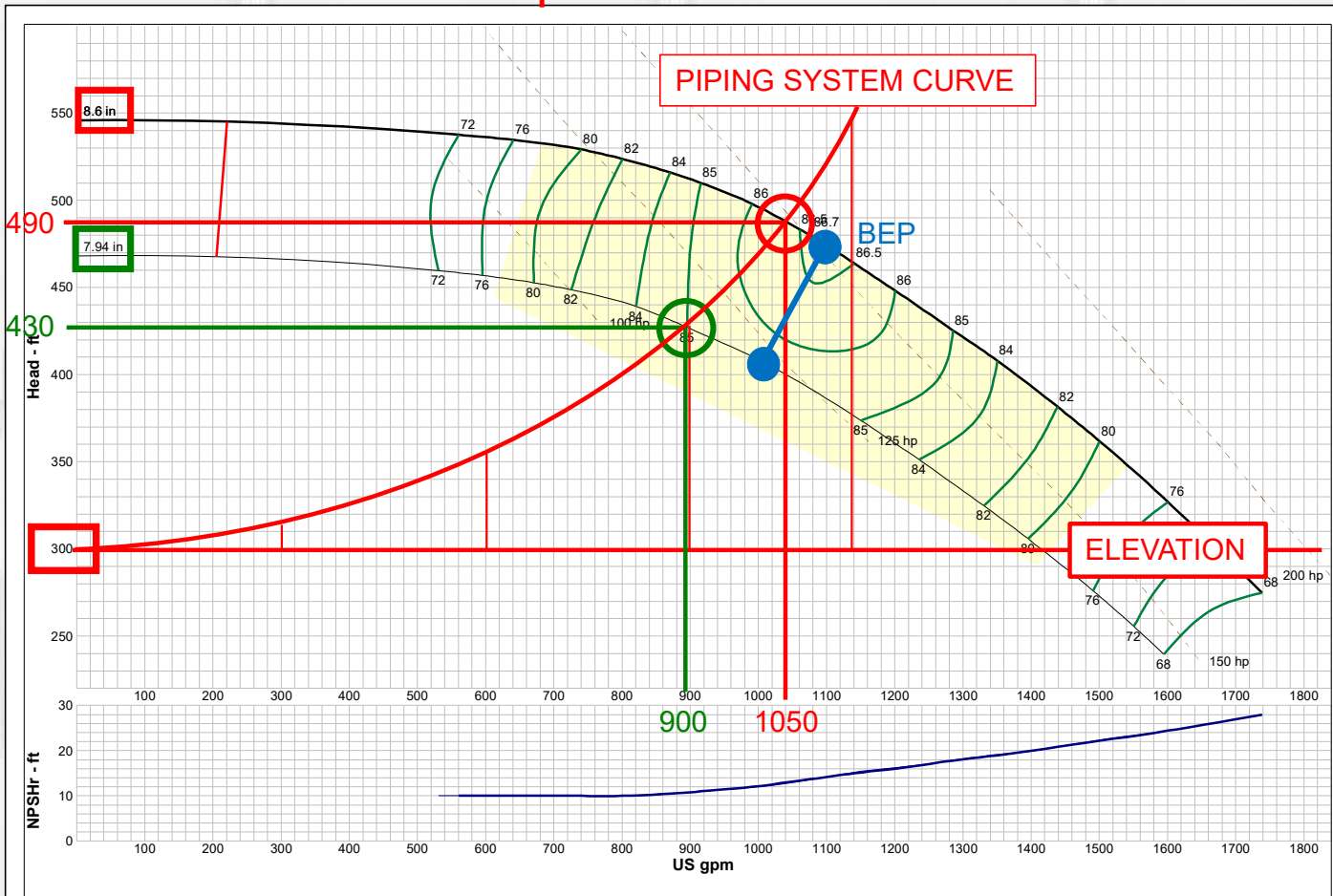
TYPICALLY OPERATE
 30% LEFT OR RIGHT
 OF BEP

30 YRS EXPERIENCE
 OPERATE 30% LEFT TO
 15% RIGHT OF BEP

PUMP BECOMES
 UNSTABLE LEFT OR
 RIGHT OF BEP



OPERATING YOUR PUMP ON THE CURVE | VARIABLE TRIM



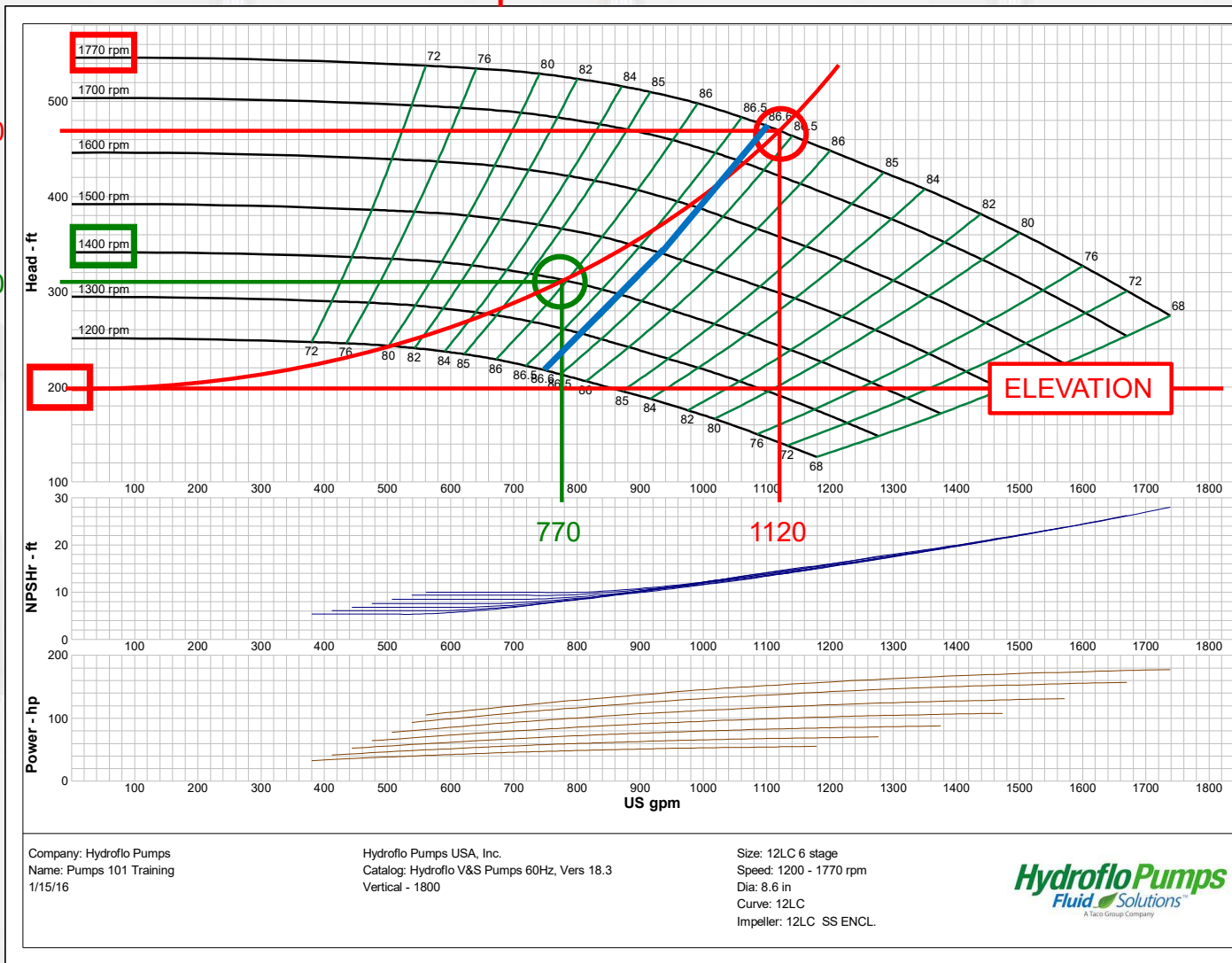
Company: Hydroflo Pumps
 Name: Pumps 101 Training
 1/15/16

Hydroflo Pumps USA, Inc.
 Catalog: Hydroflo V&S Pumps 60Hz, Vers 18.3
 Vertical - 1800

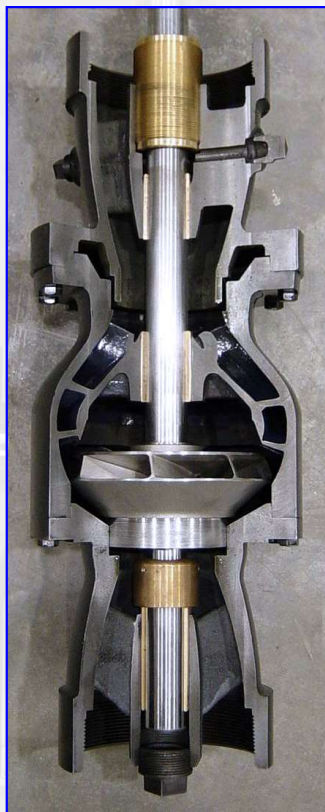
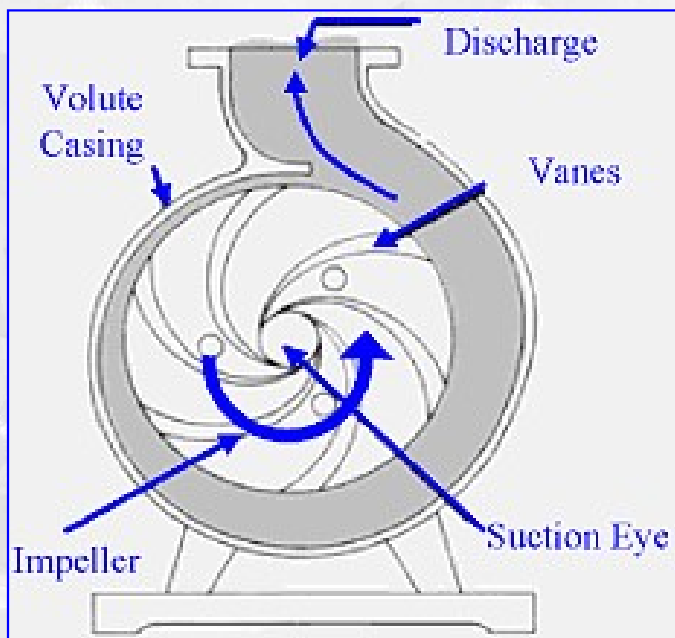
Size: 12LC 6 stage
 Speed: 1770 rpm
 Dia: 8.6 in
 Curve: 12LC
 Impeller: 12LC SS ENCL.



OPERATING YOUR PUMP ON THE CURVE | VARIABLE SPEED



HOW DOES A CENTRIFUGAL PUMP WORK?



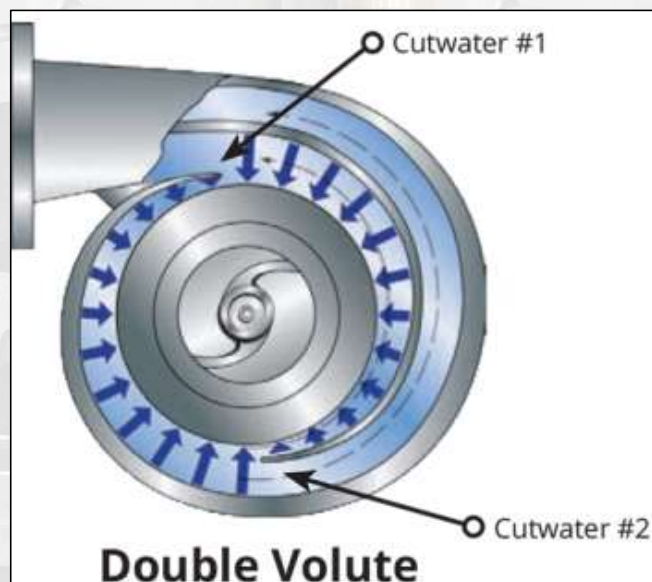
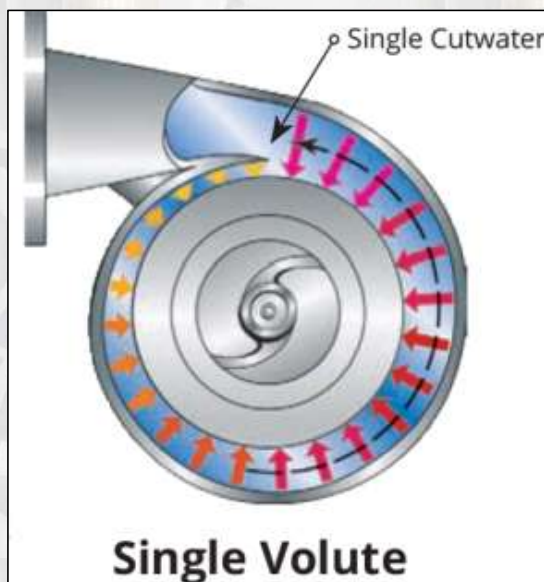
BERNOULLI'S PRINCIPLE

BP STATES: "...FOR AN IDEAL FLUID WITH LOW VISCOSITY, AN INCREASE OF THE SPEED OF THE FLUID OCCURS SIMULTANEOUSLY WITH A DECREASE IN PRESSURE ...".

SPEED IT UP | DROP THE PRESSURE – SLOW IT DOWN | INCREASE THE PRESSURE

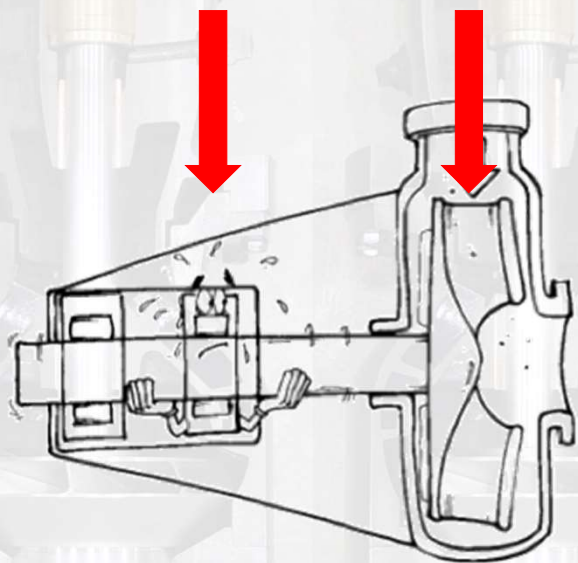
BEP OPERATION | INCREASES RELIABILITY

1. WHY DOES THE PUMP BECOME UNSTABLE?
2. THERE IS ALREADY UNEVEN PRESSURE DISTRIBUTION | RECIRCULATION AMPLIFIES IMBALANCE

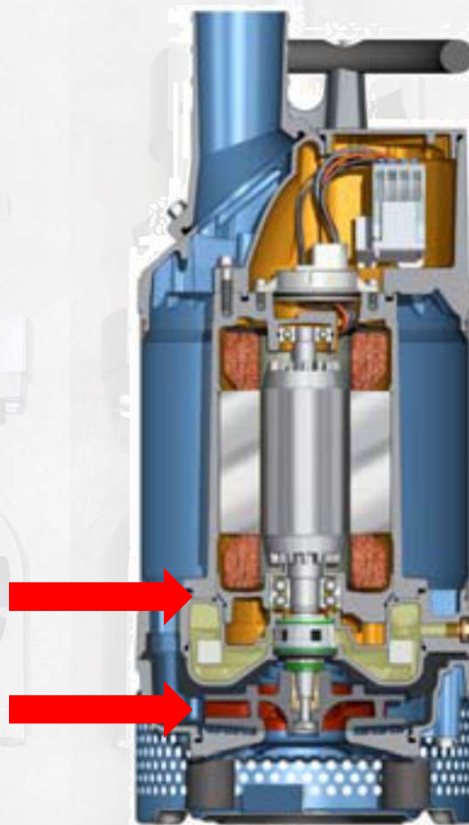


VERTICAL TURBINE DIFFUSERS

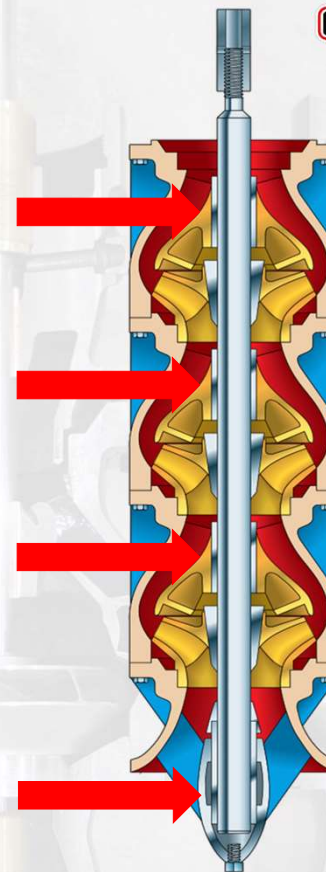
DIFFERENT PUMP DESIGNS | DIFFERENT RELIABILITY



END SUCTION | OVERHUNG
 LEAST FORGIVING OFF BEP



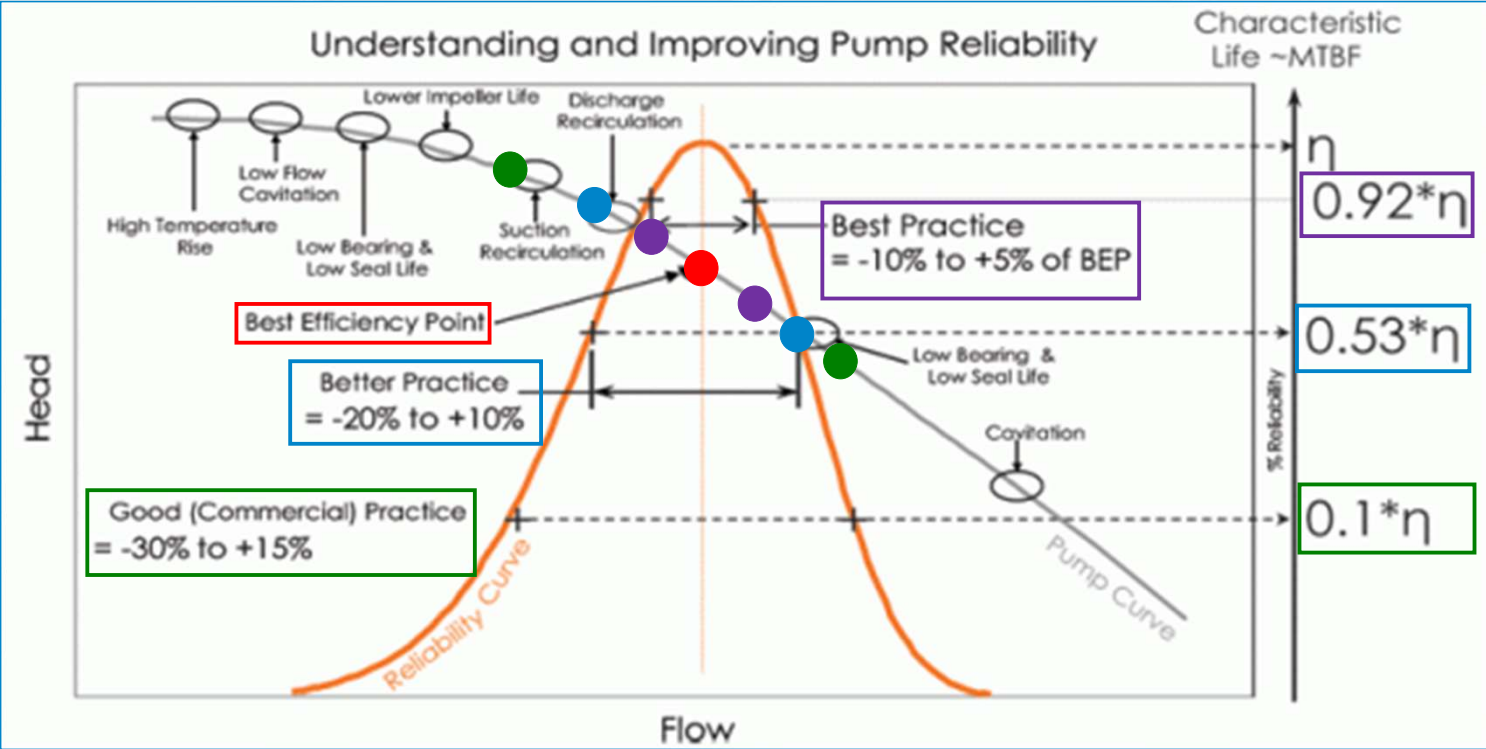
SUBMERSIBLE
 MORE FORGIVING OFF BEP



VERTICAL TURBINE
 MOST FORGIVING OFF BEP

OPERATING YOUR PUMP ON THE CURVE | HOW TO INCREASE RELIABILITY

ASSUME $\eta = 10$ YEARS



BEP OPERATION

1. BEP IS THE FLOW AND HEAD THE PUMP WAS DESIGNED FOR
2. MINIMIZES SHAFT DEFLECTION AND RECIRCULATION
3. **INCREASES PUMP RELIABILITY AND EFFICIENCY**



#9 | STARVE YOUR PUMP

**WHAT DO ALL PUMP SYSTEMS HAVE IN COMMON?
THEY ALL REQUIRE CARE AND MAINTENANCE
10 WAYS TO MEET SARAH AND BRAD**

“LESS THAN 0.5% OF A PLANT’S MAINTENANCE BUDGET IS SPENT ON LUBRICANTS, BUT THE DOWNSTREAM EFFECTS OF POOR LUBRICATION CAN IMPACT AS MUCH AS 30% OF A PLANT’S TOTAL MAINTENANCE COSTS EACH YEAR.” – **EXXONMOBIL CASE STUDY**

LUBRICATION

1. REDUCES FRICTION BETWEEN (2) SURFACES:

- MITIGATES WEAR (LOSS OF METAL)
- DECREASES HEAT GENERATION AT MOVING ELEMENTS

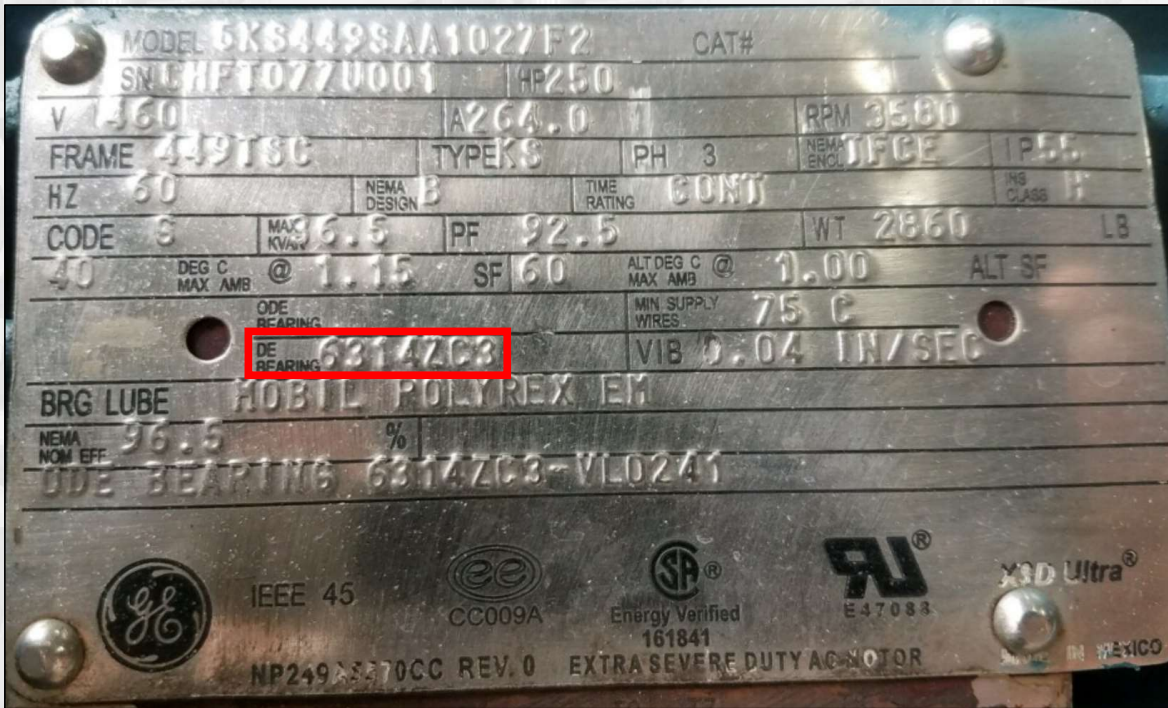
2. LUBRICANT DOES NOT LAST FOREVER:

- MOISTURE, DIRT, AND HEAT DEGRADE LUBRICANTS OVER TIME
- ADHERE TO MANUFACTURER’S LUBRICATION SCHEDULES | **KEEP GOOD RECORDS**



#9 | STARVE YOUR PUMP

**WHAT DO ALL PUMP SYSTEMS HAVE IN COMMON?
THEY ALL REQUIRE CARE AND MAINTENANCE
10 WAYS TO MEET SARAH AND BRAD**



GEI 56128-L

XII. Lubrication Guide
 (Excerpt from: GEK-72836E)

Table 5: Motor Lubrication Guide

Type of Service	Typical Examples	HP Range	Lubrication Interval (Yrs.)	
			Horizontal	Vertical
Easy	Valves, door openers, portable floor sanders, motor operating infrequently (one hour per day)	1 - 7.5	10	9
		10 - 40	7	3
		50 - 150	4	1.5
		200 - 350	3	9 months
Standard	Machine tools, air-conditioning apparatus, conveyors (one or two shafts), garage compressors, refrigeration machinery, laundry machinery, oil well pumps, water pumps, woodworking machinery	400 - 1000	1	---
		1 - 7.5	7	3
		10 - 40	4	1
		50 - 150	1.5	6 months
Severe	Motor for fans, MG-sets, etc., that run 24 hours per day, 365 days per year; coal and mining machinery; motors subject to severe vibration; steel mill machinery	200 - 350	1	3 months
		400 - 1000	6 months	---
		1 - 7.5	4	1.5
		10 - 40	1.5	6 months
Very Severe	Dirty, vibrating applications; where end of shaft is hot (pumps and fans); high ambient temperature	50 - 150	9 months	3 months
		200 - 350	6 months	1.5 months
		400 - 1000	3 months	---
		1 - 7.5	9 months	6 months
Very Severe		10 - 40	4 months	3 months
		50 - 150	4 months	2 months
		200 - 350	3 months	1 month
		400 - 1000	2 months	---

Table 6: Number of Grease Gun Pumps

Bearing Size on Motor Nameplate	Number of Pumps		Bearing Size on Motor Nameplate	Number of Pumps	
	16 Oz. Gun (Approx. 475 mL)	24 Oz. Gun (Approx. 700 mL)		16 Oz. Gun (Approx. 475 mL)	24 Oz. Gun (Approx. 700 mL)
6205	5	3	6312	40	27
6206	6	4	6314	50	35
6208	10	7	6315, C 2315	65	45
6210	25	17	6316	60	40
6213	35	23	6318, NU 318	75	50
6220	58	39	6320, NU 320, C	95	65
6309	20	13	2320		
6310	25	17	6321	153	102
			6324, NU324	246	164

i NOTE: A standard 10,000 PSI (69 kPa) 16 ounce (475 mL) grease gun delivers approximately 0.04 oz. (1.18 mL) of grease with each pump, and a 24 oz. (710 mL) gun delivers approximately 0.06 oz. (1.77 mL) of grease. The number of pumps listed represents approximately 20% of the total grease cavity volume in end shield.

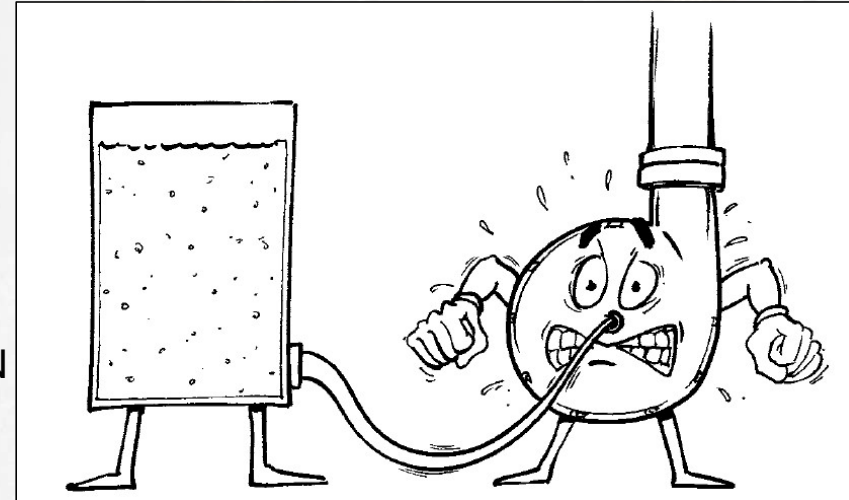


#8 | CHOKE YOUR PUMP

**WHAT DO ALL PUMP SYSTEMS HAVE IN COMMON?
THEY ALL REQUIRE CARE AND MAINTENANCE
10 WAYS TO MEET SARAH AND BRAD**

NET POSITIVE SUCTION HEAD

1. MAKE SURE NPSH(A) IS >3' MORE THAN NPSH(R):
 - WE CALCULATE NPSH(A)
 - MANUFACTURER DETERMINES NPSH(R)
 - NPSH(R): MINIMUM PRESSURE REQ'D AT PUMP SUCTION
2. HOW TO COMBAT NPSH(A) DEFICIENCY:
 - INCREASE WATER LEVEL OVER EYE OF IMPELLER
 - SLOW PUMP DOWN
3. AUDIBLE CAVITATION IS STRONG INDICATOR OF A SERIOUS PROBLEM
4. COLLAPSE OF VAPOR CAVITIES CAUSES EROSION OF IMPELLER AND OTHER INTERNAL COMPONENTS



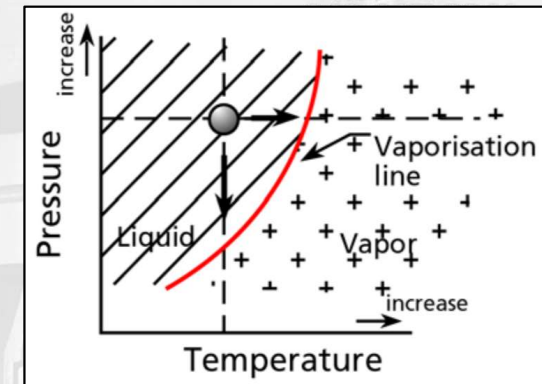
CAVITATION | WHAT IS IT?

CAVITATION EFFECTS:

- CAVITATION DECREASES FLOW THROUGH THE PUMP
- CAVITATION DRASTICALLY REDUCES LIFE OF PUMP (VIBRATION | EROSION)

WHAT IS CAVITATION?:

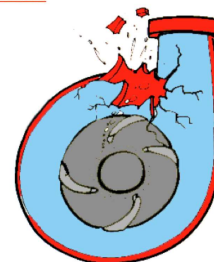
- ACCELERATING A FLUID TO HIGH VELOCITIES CREATES A DROP IN PRESSURE
- THIS DROP CAN LOWER THE FLUID PRESSURE BELOW FLUID'S VAPOR PRESSURE
- AT THIS POINT, THE FLUID "BOILS" CHANGING FROM A LIQUID TO A VAPOR
- AS THE FLUID CHANGES PHASE DURING CAVITATION, TINY BUBBLES FORM
- SINCE VAPOR TAKES UP CONSIDERABLY MORE VOLUME THAN FLUID, THESE BUBBLES DECREASE FLOW THROUGH THE PUMP
- AS THE LIQUID TRAVELS ALONG THE VANES, THE SURROUNDING PRESSURE INCREASES, THE FLUID RETURNS TO LIQUID AS THESE TINY BUBBLES COLLAPSE VIOLENTLY
- DURING THIS COLLAPSE, HIGH VELOCITY JETS IMPINGE ONTO SURROUNDING SURFACES
- THE FORCE OF THIS IMPINGEMENT LEADS TO MATERIAL LOSS, VIBRATION, BEARING, AND SEAL WEAR (SHAFT DEFLECTION)
- OVER TIME, CAVITATION CAN CREATE SEVERE EROSION PROBLEMS IN PUMPS, VALVES, PIPING



CONSTANT PRESSURE
 * WATER BOILS AT 212° F AT SEA LEVEL
 DROP PRESSURE:
 * WATER BOILS AT LOWER TEMPERATURE

EFFECTS OF CAVITATION

- Lost Efficiency
- Noise and Vibration – Sounds Like Pumping Gravel or Sand
- Increased Wear on Seals, Wear Parts, Bearings, etc...
- Mechanical Damage to Pump !
- A Pump Cavitates Easier at Higher Altitudes.



CAVITATION | IT'S NOT JUST PUMPS

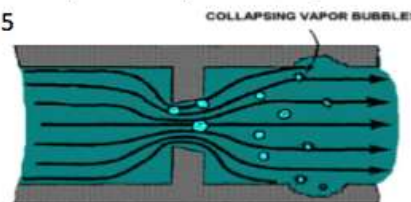
Cavitation

Cavitations can occur if the pressure of a fluid drops below the vaporization pressure for that fluid. When this occurs some of the fluid will change state from a liquid to a gas and form small vapor bubbles in the fluid itself. If the pressure of this vapor entrained fluid now increases above its vaporization point the vapor bubbles formed in the low pressure region will collapse. These collapsing vapor bubbles release high energy micro-jets that impinge on the surface of the vessel containing the fluid.

Figure 5 shows the formation of vapor bubbles as a fluid passes through an orifice. As the velocity of the fluid increases through the orifice and causes the pressure to decrease below its vaporization pressure, vapor bubbles are formed in the low pressure region.

When the velocity of the fluid decreases on the other side of the orifice the pressure increases. When the pressure exceeds the vaporization pressure these vapor bubbles collapse. They are formed in the low pressure region and releases high energy micro jets that impinge on the surface of the pipe. These high energy micro-jets erode the piping walls.

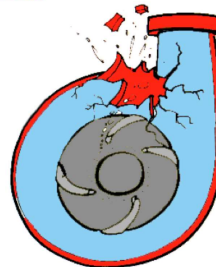
Figure 5



The release of the micro-jets creates random bursts of energy and broadband excitation within the vessel or piping containing the fluid. Cavitations can occur on the suction side of the pump if there is insufficient Net Positive Suction Head to keep the pumped product in a liquid state. It can also occur on the discharge side of the pump and usually caused by low discharge flow; a result of increasing the pump's internal recirculation by throttling the discharge.

EFFECTS OF CAVITATION

- Lost Efficiency
- Noise and Vibration – Sounds Like Pumping Gravel or Sand
- Increased Wear on Seals, Wear Parts, Bearings, etc...
- Mechanical Damage to Pump !
- A Pump Cavitates Easier at Higher Altitudes.

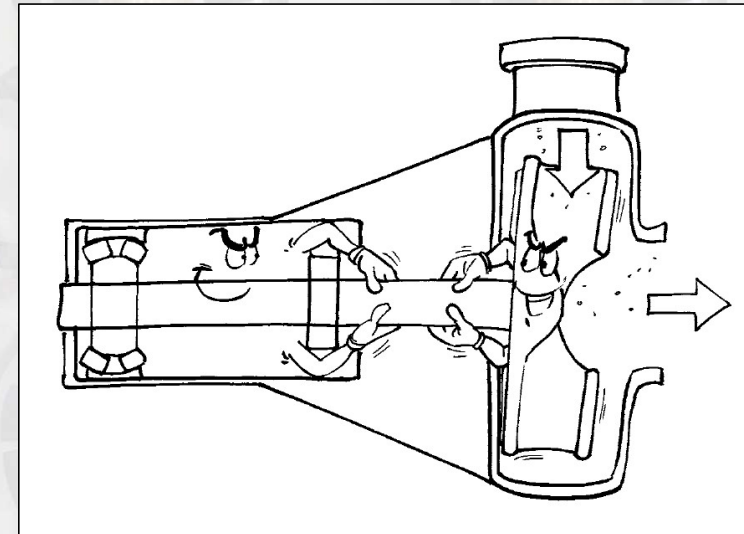


#7 | FRY YOUR PUMP

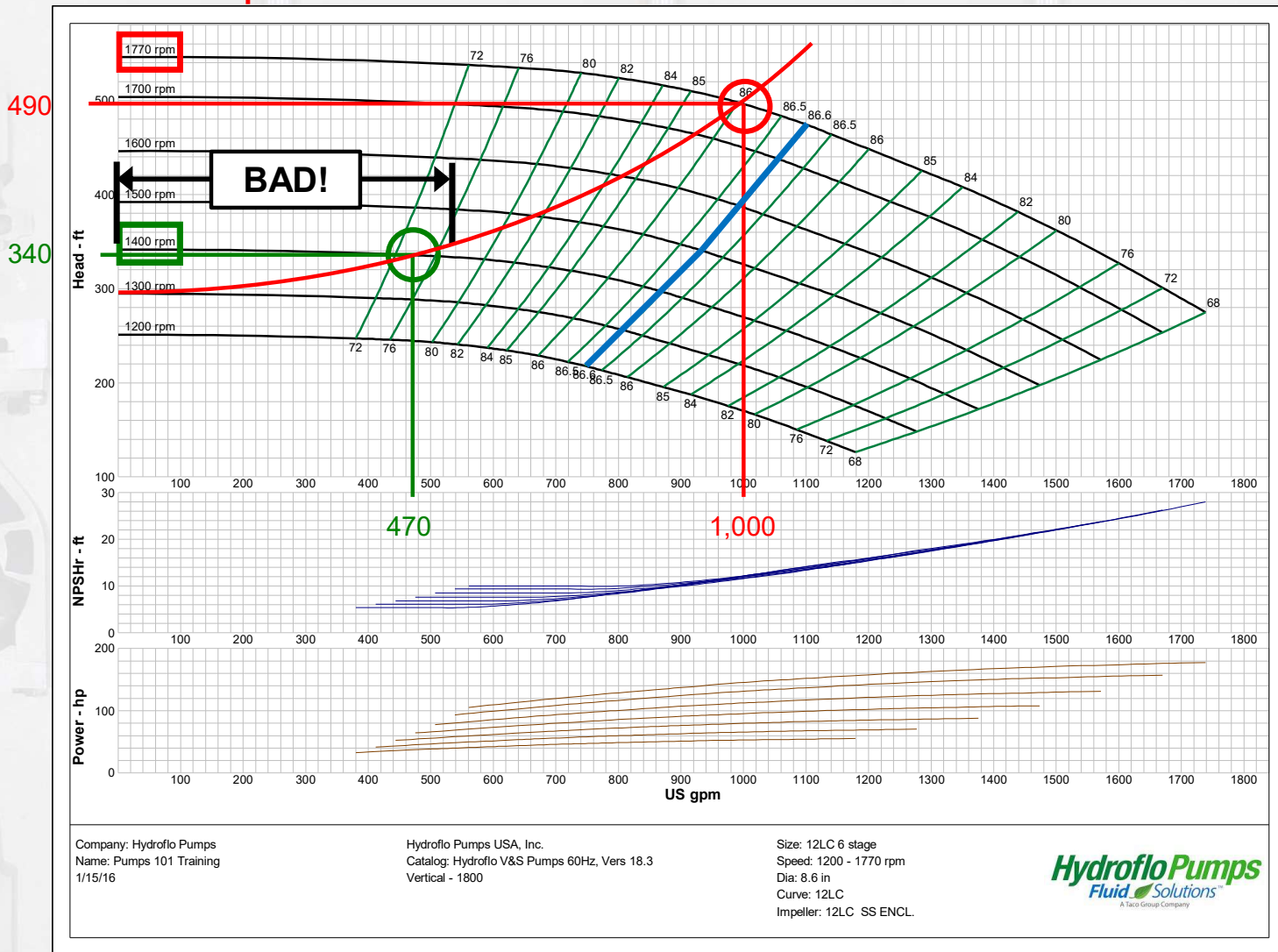
WHAT DO ALL PUMP SYSTEMS HAVE IN COMMON? THEY ALL REQUIRE CARE AND MAINTENANCE 10 WAYS TO MEET SARAH AND BRAD

OPERATING AT SHUTOFF HEAD

1. IF PUMP IS OPERATING NEAR SHUTOFF, A PROBLEM EXISTS:
 - PARTIALLY CLOSED VALVE
 - CLOGGED DISCHARGE LINE
 - VFD PARAMETERS (PUMP RUNNING TOO SLOW)
2. PUMP WILL OVERHEAT SINCE WATER IS RECIRCULATING IN VOLUTE
3. CONDITION MUST BE CORRECTED IMMEDIATELY TO PREVENT DAMAGE TO PUMP AND MOTOR



OPERATING AT SHUTOFF | DECREASED RELIABILITY



Company: Hydroflo Pumps
 Name: Pumps 101 Training
 1/15/16

Hydroflo Pumps USA, Inc.
 Catalog: Hydroflo V&S Pumps 60Hz, Vers 18.3
 Vertical - 1800

Size: 12LC 6 stage
 Speed: 1200 - 1770 rpm
 Dia: 8.6 in
 Curve: 12LC
 Impeller: 12LC SS ENCL.

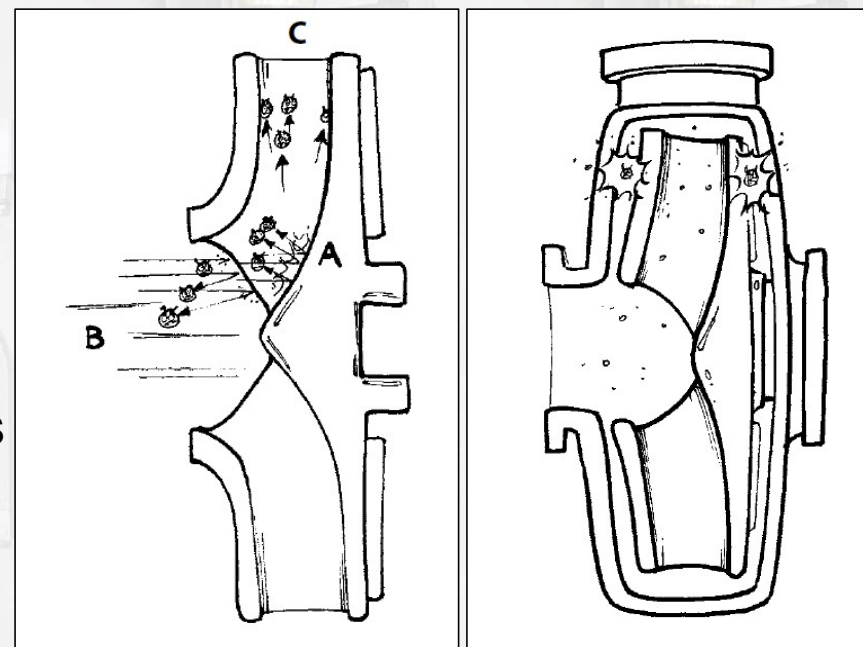


#6 | STAB YOUR PUMP

**WHAT DO ALL PUMP SYSTEMS HAVE IN COMMON?
THEY ALL REQUIRE CARE AND MAINTENANCE
10 WAYS TO MEET SARAH AND BRAD**

ABRASION DUE TO MATERIAL BEING PUMPED

1. IF EXCESSIVE ABRASIVE SOLIDS ARE PRESENT, PUMPS SHOULD BE CONSTRUCTED OF HARDENED MATERIALS
2. IF UNUSUAL MATERIAL IS DETECTED, LOOK UPSTREAM FOR COLLAPSED PIPES OR EROSION AROUND MANHOLES
3. PERIODIC MANHOLE/WETWELL CLEANING CAN DETECT PROBLEMS AND PROTECT THE PUMP SYSTEM

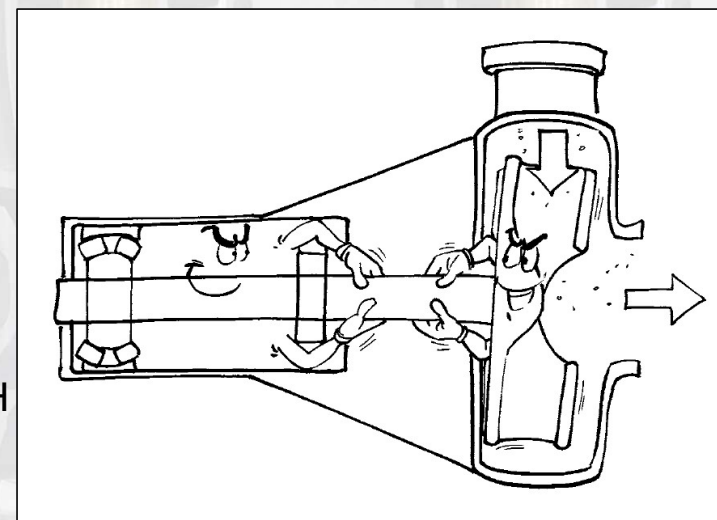


#5 | STRESS YOUR PUMP

**WHAT DO ALL PUMP SYSTEMS HAVE IN COMMON?
THEY ALL REQUIRE CARE AND MAINTENANCE
10 WAYS TO MEET SARAH AND BRAD**

PIPING MISALIGNMENT

1. EXTERNAL STRESS AT INLET AND DISCHARGE NOZZLES CAN CAUSE DEFLECTION OF BEARING FRAMES AND PUMP CASINGS
2. THIS CONDITION MAY OCCUR DURING INSTALLATION OR THROUGH THERMAL EXPANSION OR DIFFERENTIAL SETTLEMENT
3. MAKE SURE THAT HEAVY VALVES AND PIPING ARE SUPPORTED INDEPENDENT FROM PUMP SUCTION AND DISCHARGE NOZZLES
4. RUBBER EXPANSION JOINTS HANDLE THERMAL EXPANSION AND SETTLEMENT VERY WELL



#4 | SHAKE YOUR PUMP TO PIECES

**WHAT DO ALL PUMP SYSTEMS HAVE IN COMMON?
THEY ALL REQUIRE CARE AND MAINTENANCE
10 WAYS TO MEET SARAH AND BRAD**

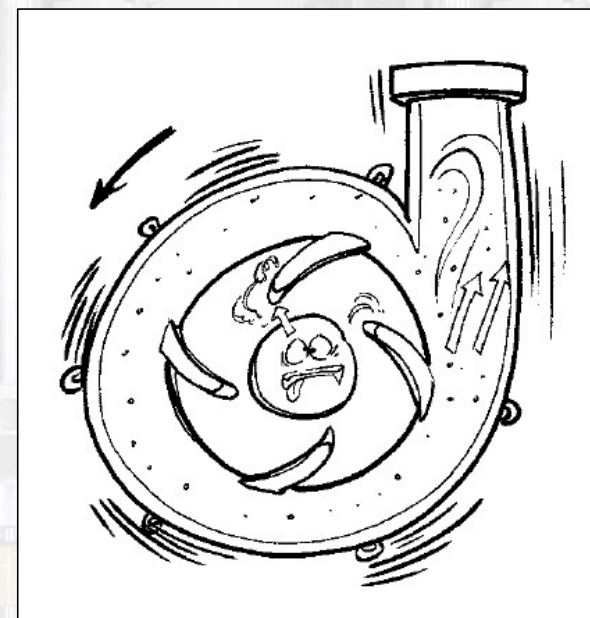
VIBRATION

1. THERE ARE NUMEROUS POTENTIAL SOURCES OF VIBRATION:

- OPERATING OUTSIDE ALLOWABLE RANGE (SHAFT DEFLECTION)
- MACHINE IMBALANCE OR SHAFT MISALIGNMENT (**LASER ALIGN**)
- RESONANCE WITH NATURAL FREQUENCY OF SYSTEM

2. VIBRATION MAY BE UNAVOIDABLE BUT CAN BE MINIMIZED:

- OPERATE NEAR BEP
- SET UP WITH GOOD BALANCING AND ALIGNMENT (**CCPS**)
- PROVIDE PROPER PUMP AND PIPE SUPPORT
- SECURELY ANCHOR PUMP BASE PLATE TO STRONG FOUNDATION



#3 | POISON YOUR PUMP

**WHAT DO ALL PUMP SYSTEMS HAVE IN COMMON?
THEY ALL REQUIRE CARE AND MAINTENANCE
10 WAYS TO MEET SARAH AND BRAD**

CORROSIVE FLUIDS

1. NOT TYPICALLY AN ISSUE WITH MUNICIPAL APPLICATIONS
2. RO PLANTS, HIGH CHLORINE, AND OTHER CHEMICALS
3. METAL SALTS (FERRIC CHLORIDE) CAN BE EXTREMELY DAMAGING
4. PROPER MATERIAL SELECTION:
 - 304SS OR 316SS
 - DUPLEX OR SUPER DUPLEX SS
 - PLASTIC PUMPS
 - FIBERGLASS PUMPS



#3 | POISON YOUR PUMP

**WHAT DO ALL PUMP SYSTEMS HAVE IN COMMON?
THEY ALL REQUIRE CARE AND MAINTENANCE
10 WAYS TO MEET SARAH AND BRAD**

DEZINCIFICATION

1. DEZINCIFICATION IS A CORROSION PROCESS IN WHICH ZINC IS SELECTIVELY LEACHED FROM BRASS AND BRONZE ALLOYS
2. NORMALLY, OCCURS WHEN ZINC IS 15% OR GREATER
3. RESULT IS A POROUS COPPER MATERIAL OF REDUCED STRENGTH
4. CHLORINE CONCENTRATIONS AS LOW AS 2 PPM CAN CAUSE DEZINCIFICATION
5. USE CI OR NICKEL-ALUMINUM-BRONZE OR BRONZE WITH LOW CONCENTRATION OF ZINC

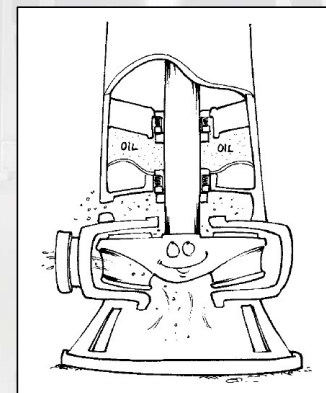
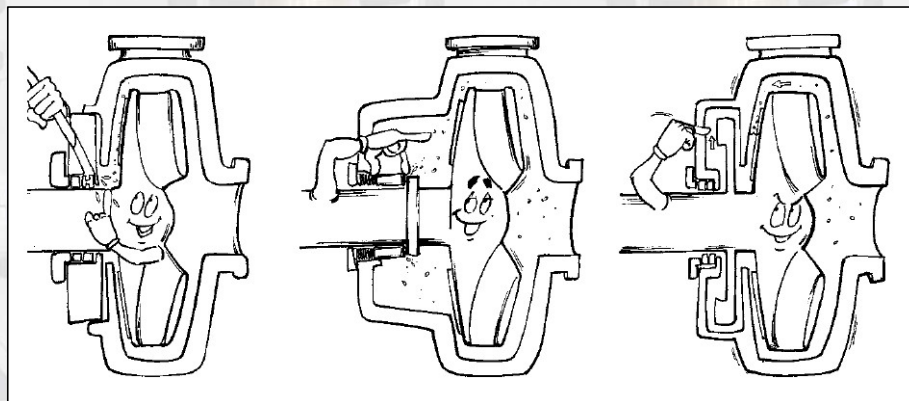


#2 | DROWN YOUR PUMP

WHAT DO ALL PUMP SYSTEMS HAVE IN COMMON?
THEY ALL REQUIRE CARE AND MAINTENANCE
10 WAYS TO MEET SARAH AND BRAD

SEAL LEAK MANAGEMENT

1. SEAL WATER FROM PACKING OR MECHANICAL SEAL SHOULD BE CARRIED AWAY FROM PUMP (MOTOR)
2. MAKE SURE GLAND IS ADJUSTED TO MINIMIZE LEAKAGE:
 - ABOUT A DROP EVERY SECOND IS ADEQUATE
3. THE STUFFING BOX DRAIN PIPE SHOULD BE DIRECTED TO FLOOR DRAIN
4. PROPERLY INSTALL PACKING TO MAINTAIN BACKPRESSURE ON THE PUMP CASING | SHAFT INTERFACE
5. PROMPTLY REPLACE FAILED MECHANICAL SEALS (MILKY WATER)



#1 | NEGLECT YOUR PUMP

**WHAT DO ALL PUMP SYSTEMS HAVE IN COMMON?
THEY ALL REQUIRE CARE AND MAINTENANCE
10 WAYS TO MEET SARAH AND BRAD**

MANUFACTURER RECOMMENDED SERVICE

1. CLOSELY FOLLOW THE PREVENTIVE MAINTENANCE PRACTICES OUTLINED IN THE IOM INCLUDING OPERATION CHECKS
2. TAKE CAREFUL NOTE OF ANY ABNORMAL SOUND OR VIBRATION AND TAKE ACTION TO PROMPTLY CORRECT ANY PROBLEMS
3. CHECK MOTORS AND ROTATING ELEMENTS TEMPERATURE (3 MONTHS)
4. VISUALLY INSPECT PUMPS AND MOTORS FOR COATING FAILURE AND OXIDATION AND REAPPLY PROTECTIVE COATINGS

