NMRWA
PUMPS & MOTORS REFRESHER

Presented by: TP Pump

SPEAKER: JIM BASSETT

AGENDA

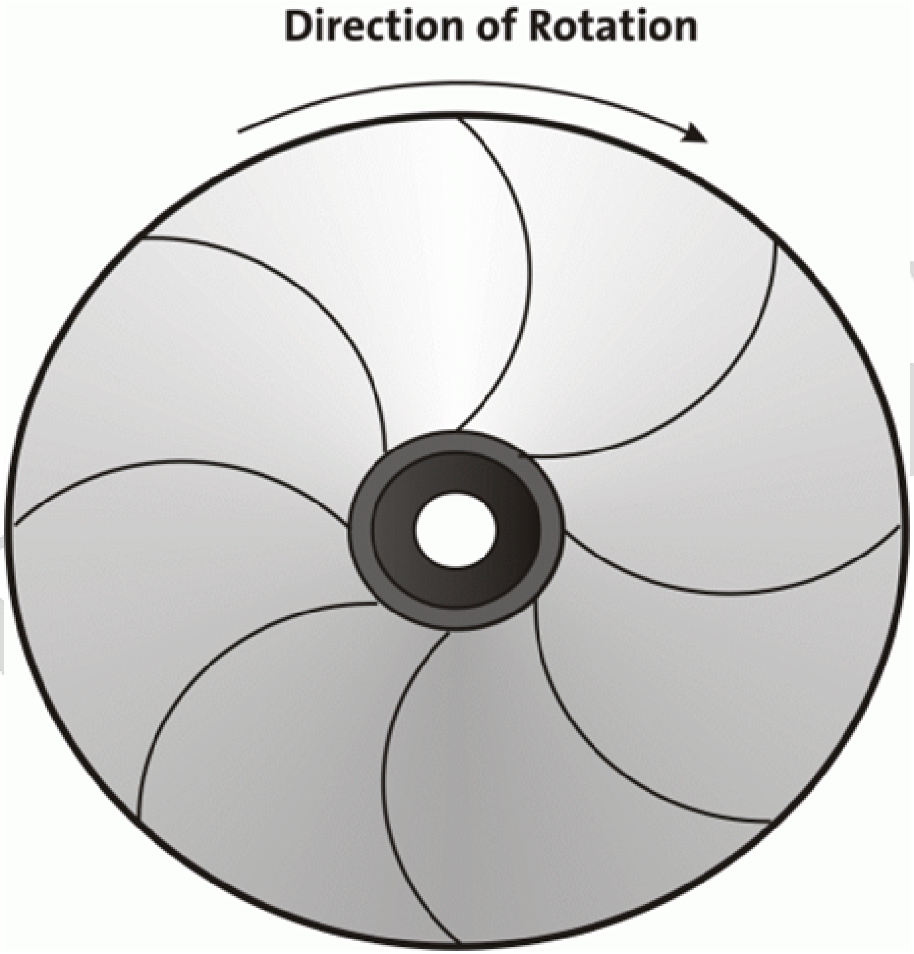
SECTION VII PUMPS & MOTORS

- CENTRIFUGAL vs.. POSITIVE DISPLACEMENT
- TYPES OF CENTRIFUGALS & APPLICATIONS
- TYPES OF POSITIVE DISPLACEMENT & APPLICATIONS
- PUMP COMPONENTS & PART I.D.
- HEADS & PUMP CURVES
- COMMON OPERATIONAL PROBLEMS

CENTRIFUGAL PUMPS

- LARGE VOLUMES @ RELATIVELY LOW HEADS
- FLOW CHANGES WHEN HEAD CHANGES
- SINGLE OR MULTIPLE STAGES

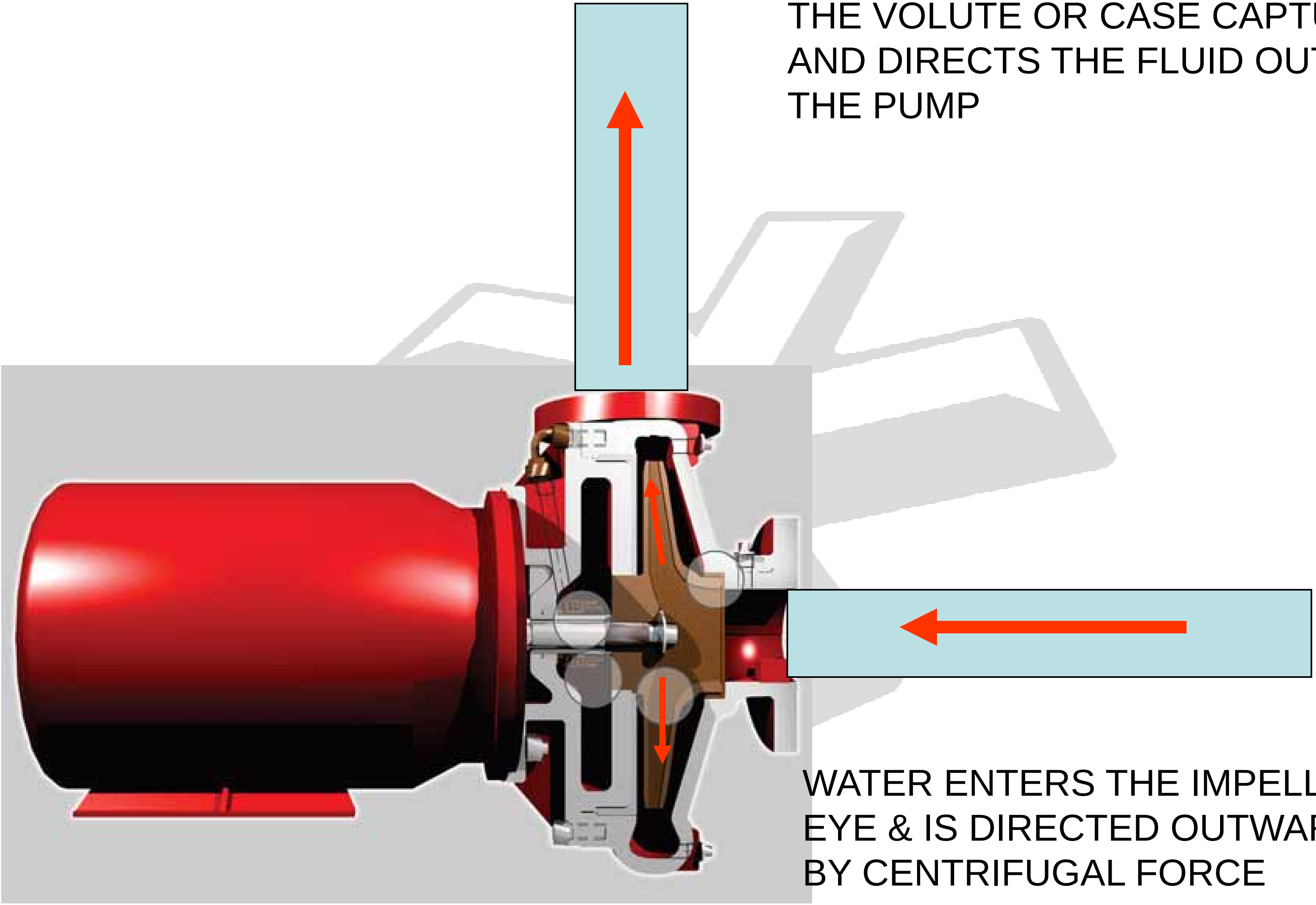
Impeller Direction of Rotation



Centrifugal Force

CW ROTATION

THE VOLUTE OR CASE CAPTURES AND DIRECTS THE FLUID OUT OF THE PUMP

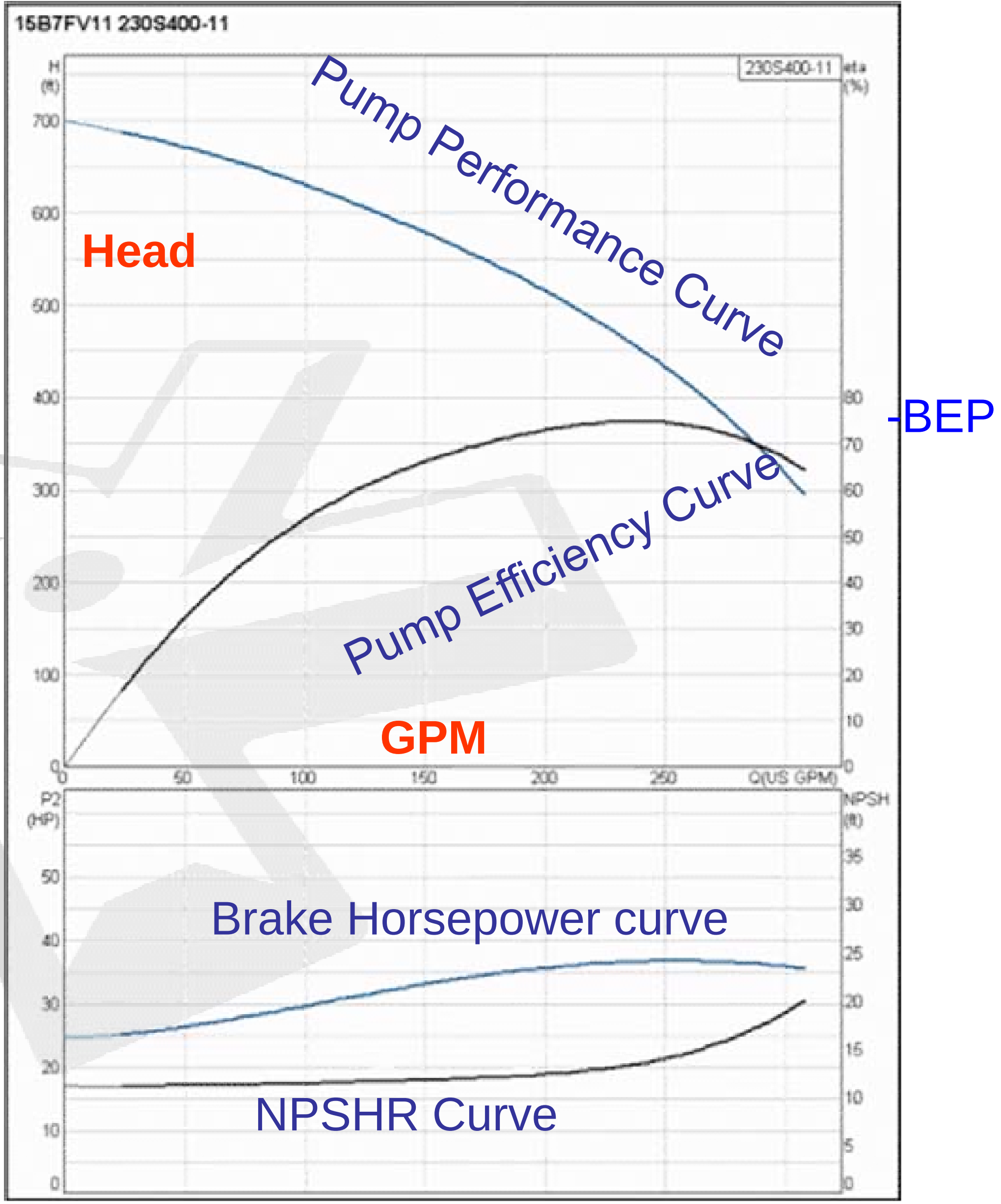


WATER ENTERS THE IMPELLER EYE & IS DIRECTED OUTWARD BY CENTRIFUGAL FORCE

Typical Pump Submersible Curve Format

Note: model shown
230S400-11
40 HP
11 STAGE

BEST EFFICIENCY POINT
(BEP) : 230 GPM
77% @ 480 FT.

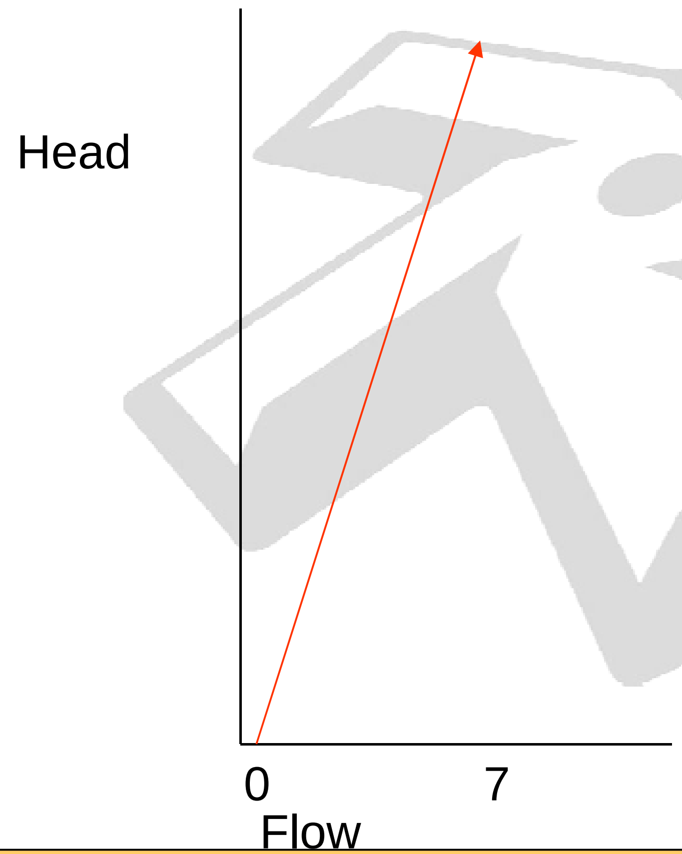


POSITIVE DISPLACEMENT PUMPS

- HIGH HEAD @ LOW FLOWS

- FLOW DOESN'T CHANGE WHEN HEAD CHANGES

Typical POSITIVE DISPLACEMENT Pump Curve Format



APPLICATIONS & TYPES OF CENTRIFUGALS

Rural Water Supply

Suction side
Storage tanks
50,000 gallons
each

Grundfos
Submersible
Well pumps

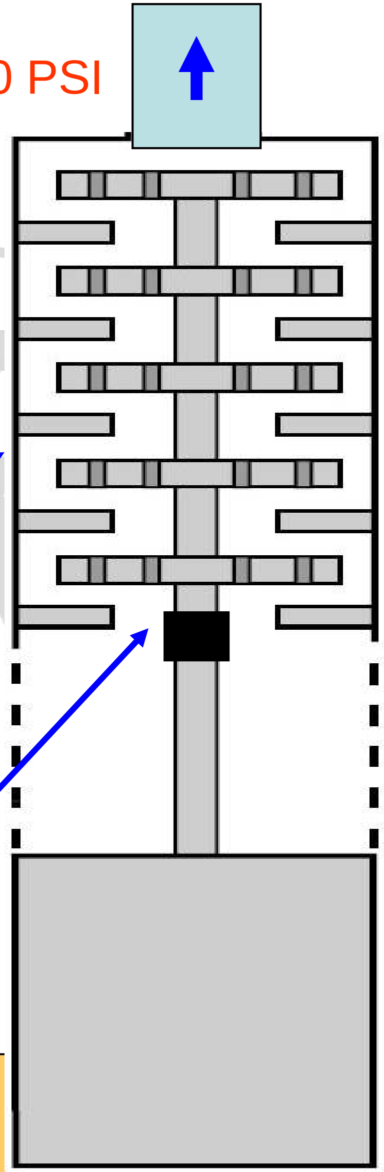
Discharge side
Storage tank

BoosterpaQ

2 miles of
pipe line

Centrifugals - Series

Example:
Each stage is rated 10 GPM @ 40 PSI



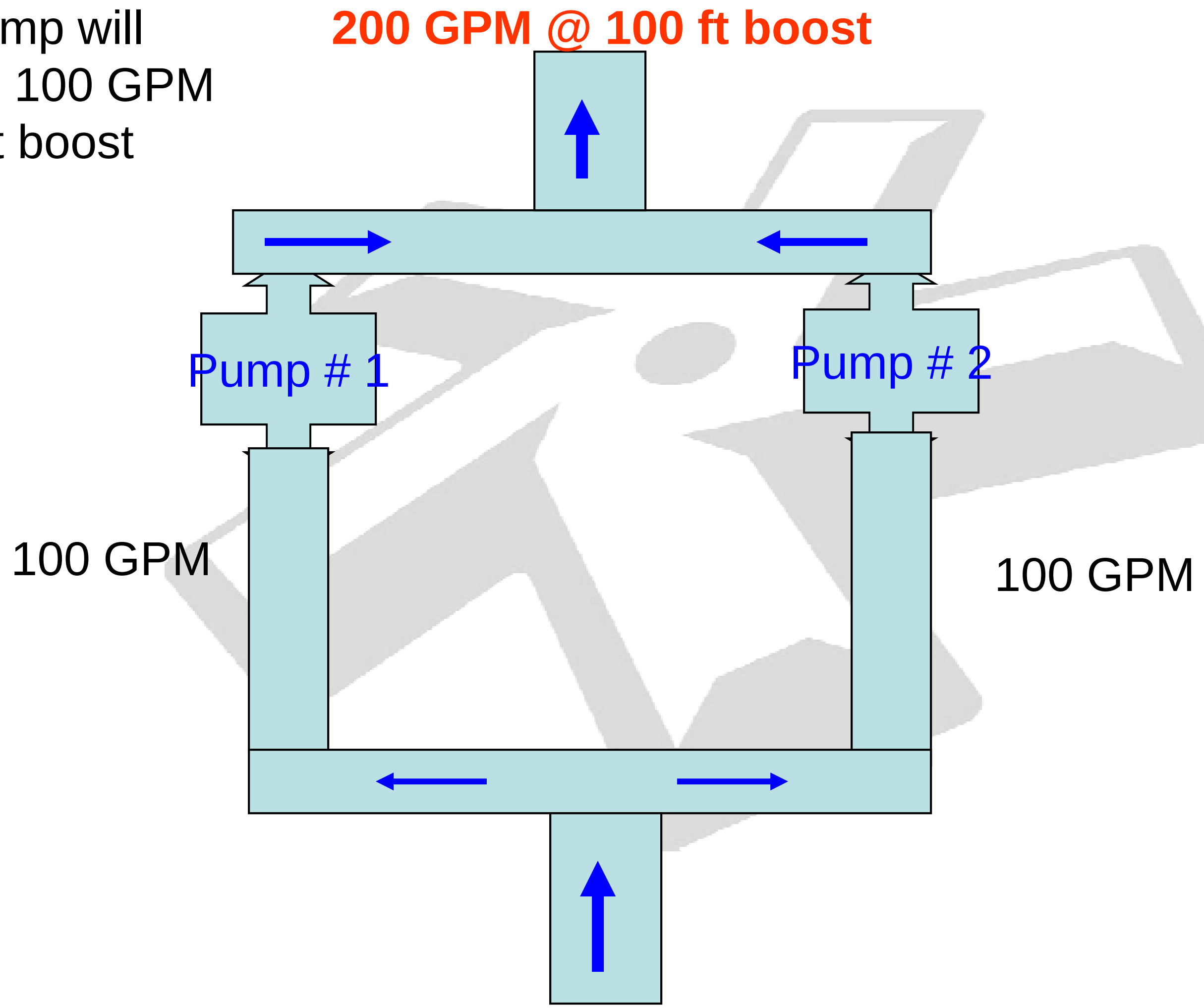
10 GPM @ 200 PSI
10 GPM @ 160 PSI
10 GPM @ 120 PSI
10 GPM @ 80 PSI
10 GPM @ 40 PSI

Each stage progressively boost the pressure

Water enters thru bottom of the pump end

Centrifugals - Parallel

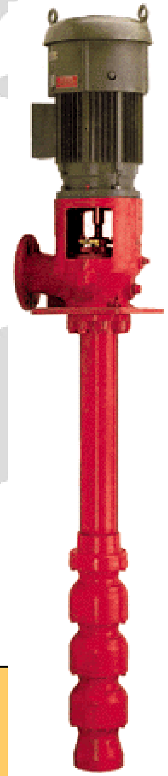
Each pump will
Produce 100 GPM
@ 100 ft boost



CENTRIFUGAL TYPES

BASIC TYPES OF CENTRIFUGALS

- END SUCTION
- SPLIT CASE
- TURBINE



TYPES OF CENTRIFUGALS

END SUCTION

BASE / FRAME MOUNTED

CLOSE COUPLED

TYPES OF CENTRIFUGALS

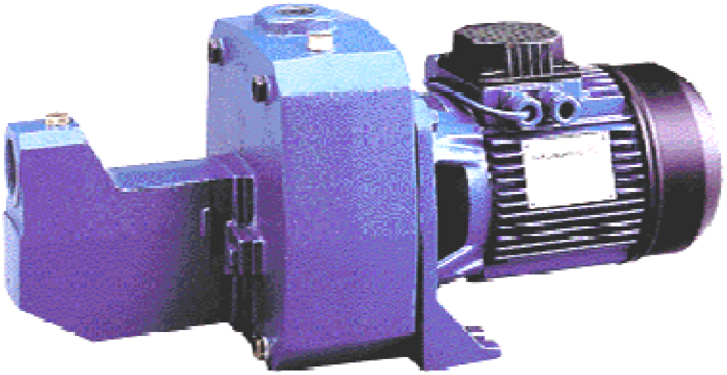
END SUCTION vs.. SELF PRIMING

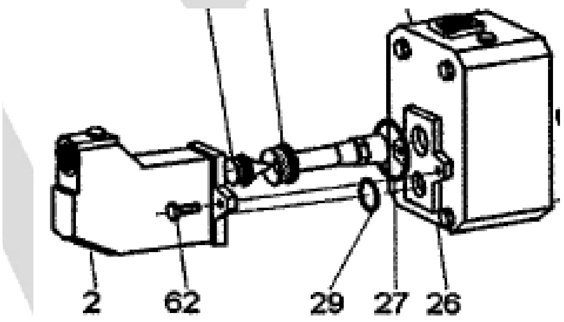
TYPES OF CENTRIFUGALS

END SUCTION

EJECTOR ASSEMBLE

DEEP WELL





RESIDENTIAL
SHALLOW WELL JET

TYPES OF CENTRIFUGALS

VERTICAL IN LINE

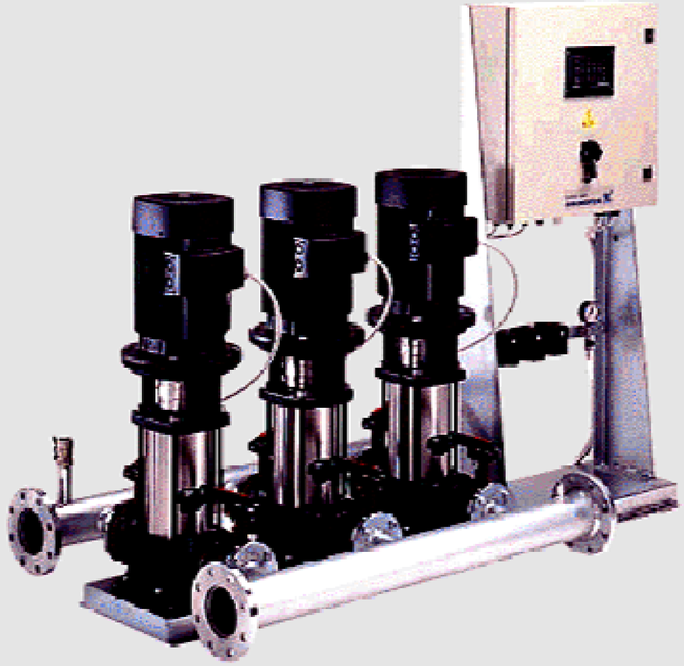
SINGLE IMPELLER

MULTI-STAGE

TYPES OF CENTRIFUGALS

PACKAGED SYSTEMS

Single Pump Package



Multiple Pumps

TYPES OF CENTRIFUGALS

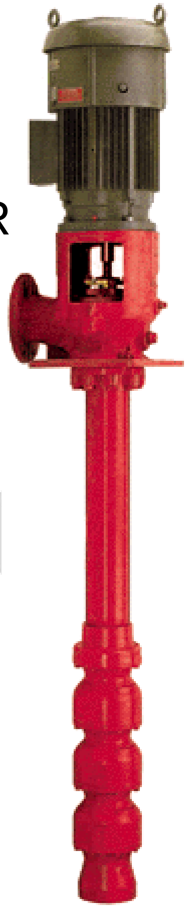
SUBMERSIBLE

MULIT-STAGE WELL

SUMP

TYPES OF CENTRIFUGALS

SHORT SET
W/ VHS MOTOR

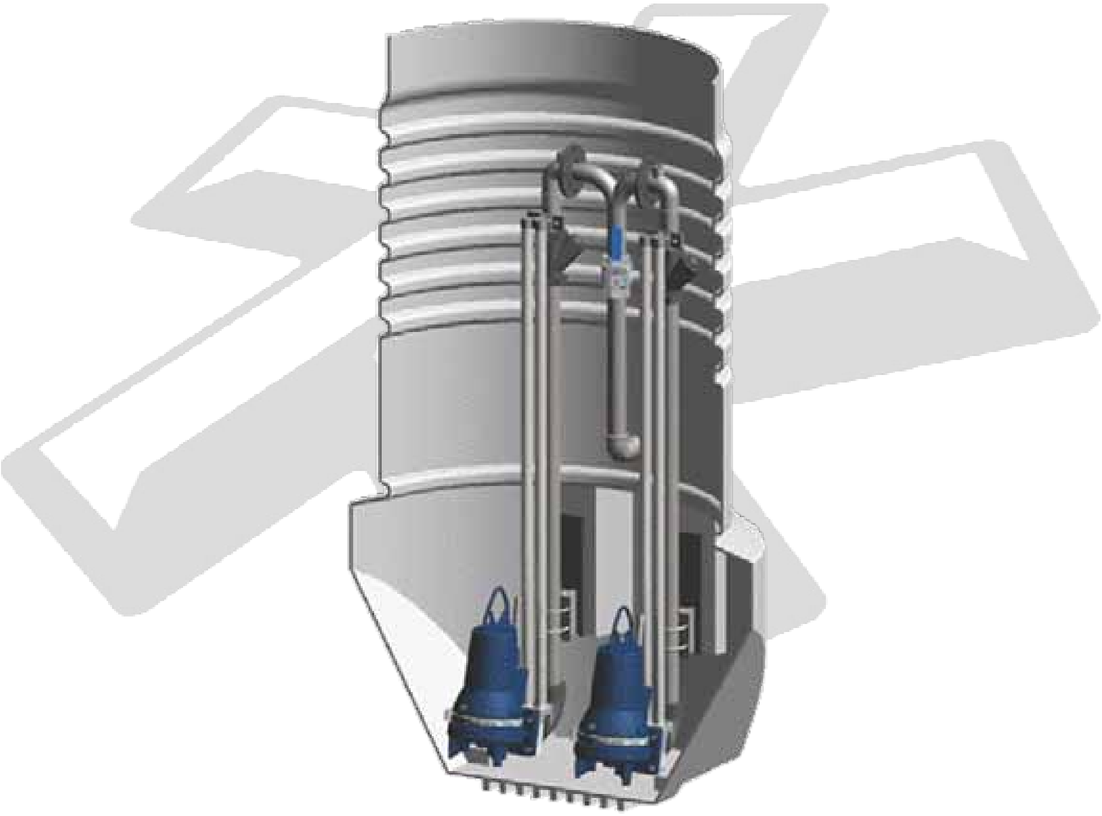


TURBINE

SUBMERSIBLE

TYPES OF CENTRIFUGALS

SEWAGE / EFFLUENT

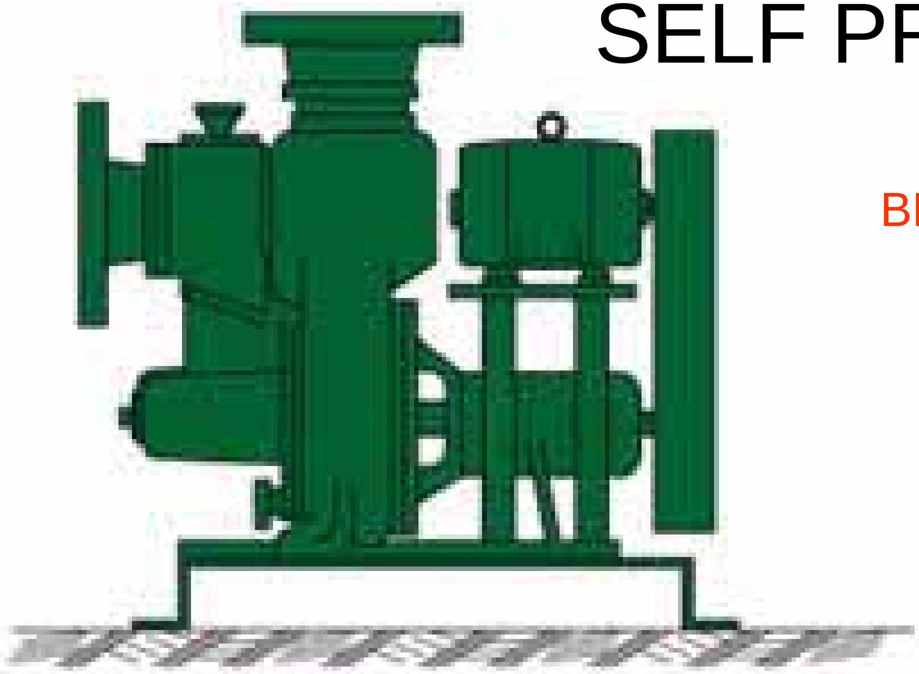


Submersible Non-Clog Pumps

S8FX

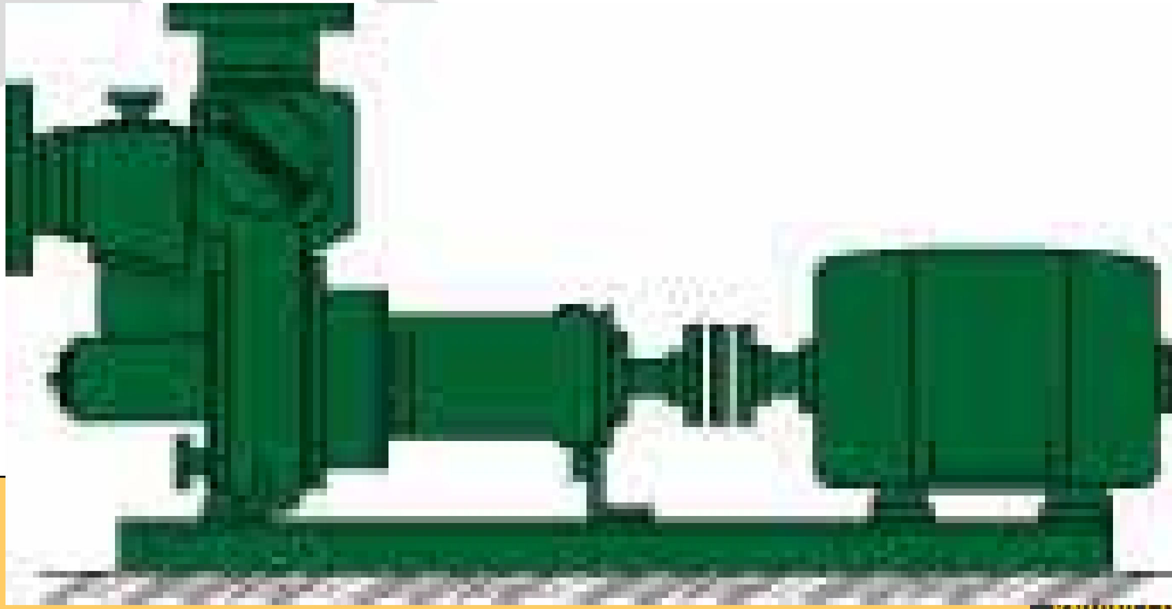
S12L

SELF PRIMING TRASH PUMPS



BELT DRIVEN / REDUCED RPM

DIRECT DRIVEN



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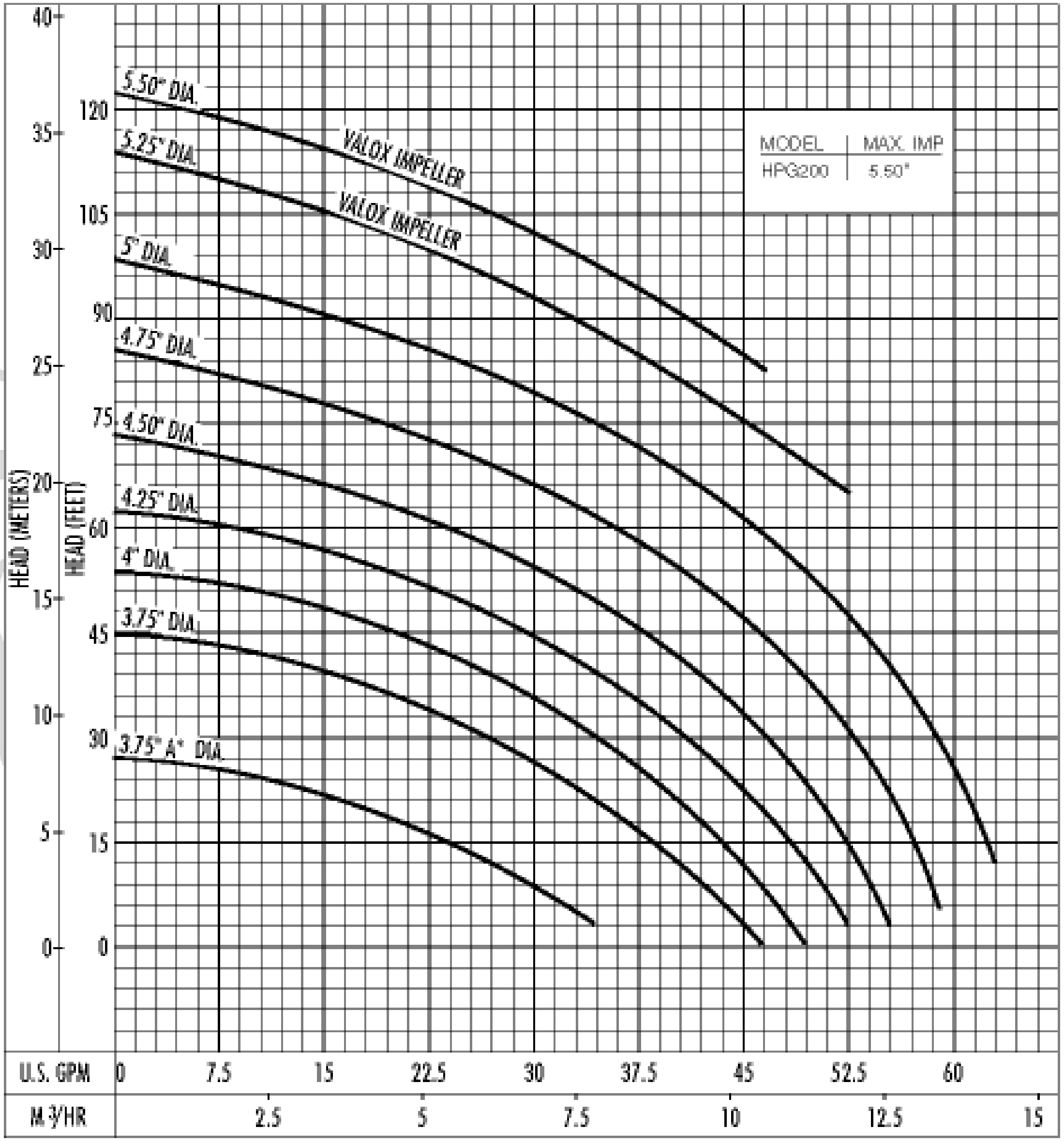
KNOWLEDGE FOR SOLUTIONS.

Hydromatic Grinder: HPG

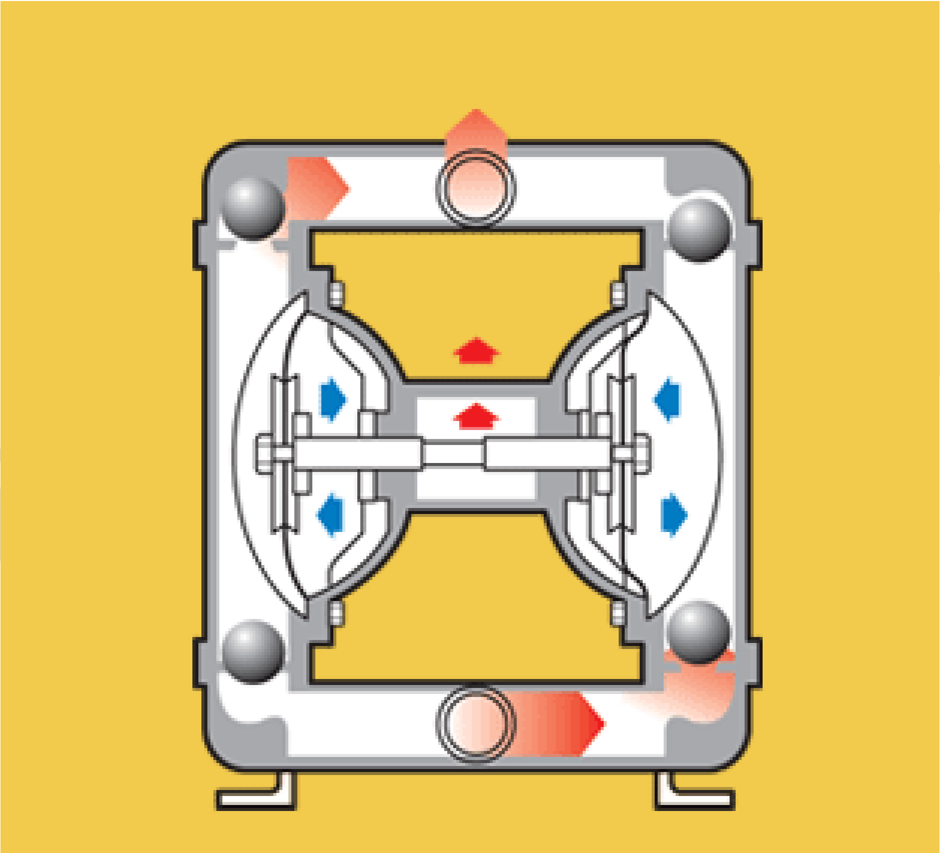


Submersible Sewage Grinder Pumps

APPLICATIONS – POSITIVE DISPLACEMENT

POSITIVE DISPLACEMENT TYPES

- DIAPHRAGM
- ROLLER / PERISTALTIC
- PISTON / PLUNGER
- PROGRESSIVE CAVITY
- GEAR OR LOBE
- ROTARY SCREW



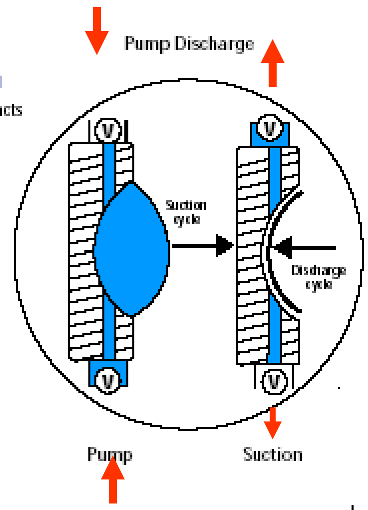
POSITIVE DISPLACEMENT PUMPS

DIAPHRAGM PUMPS – Chemical Metering

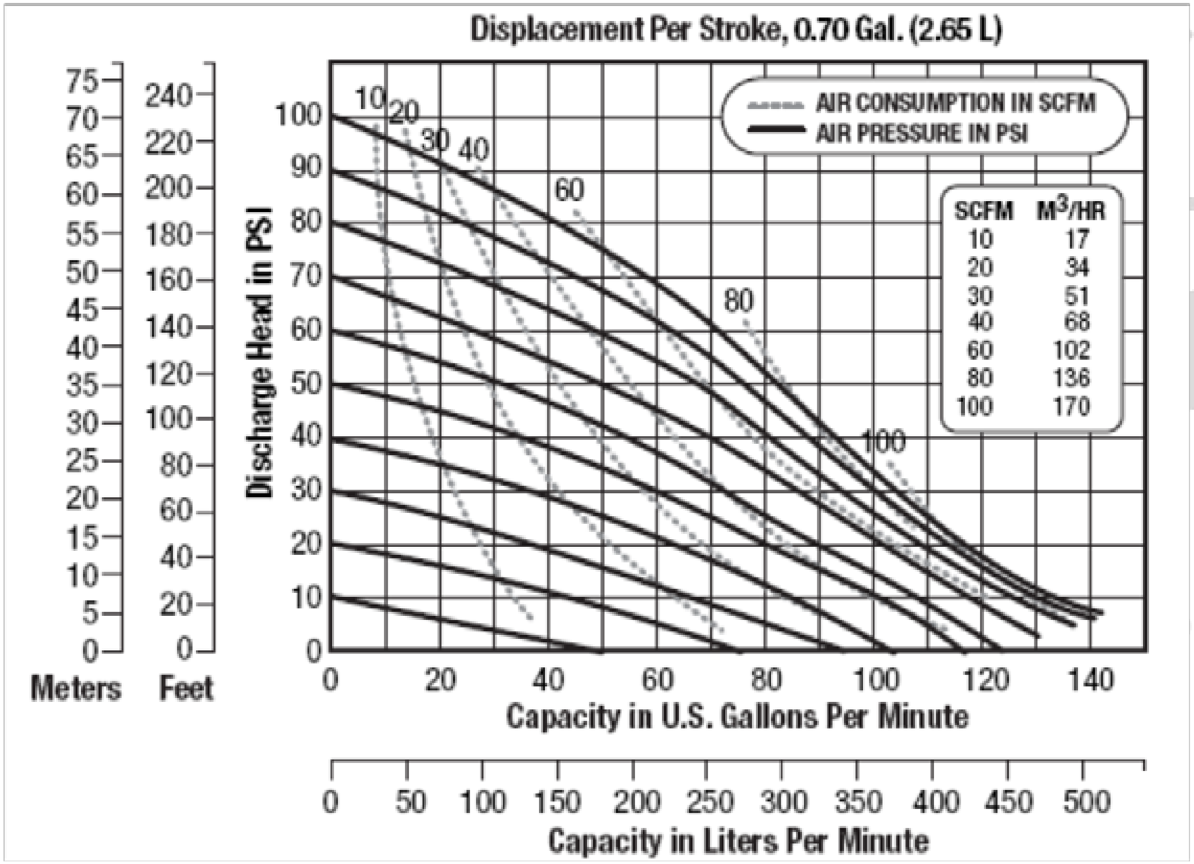
SUCTION DISCHARGE

Principle of Operation

1. The electronic solenoid retracts the diaphragm when power is applied.
2. This causes the suction valve(s) to open and fluid flows into the diaphragm cavity
3. When the solenoid is deactivated, a spring returns the diaphragm and forces fluid out the discharge valves.



POSITIVE DISPLACEMENT PUMPS



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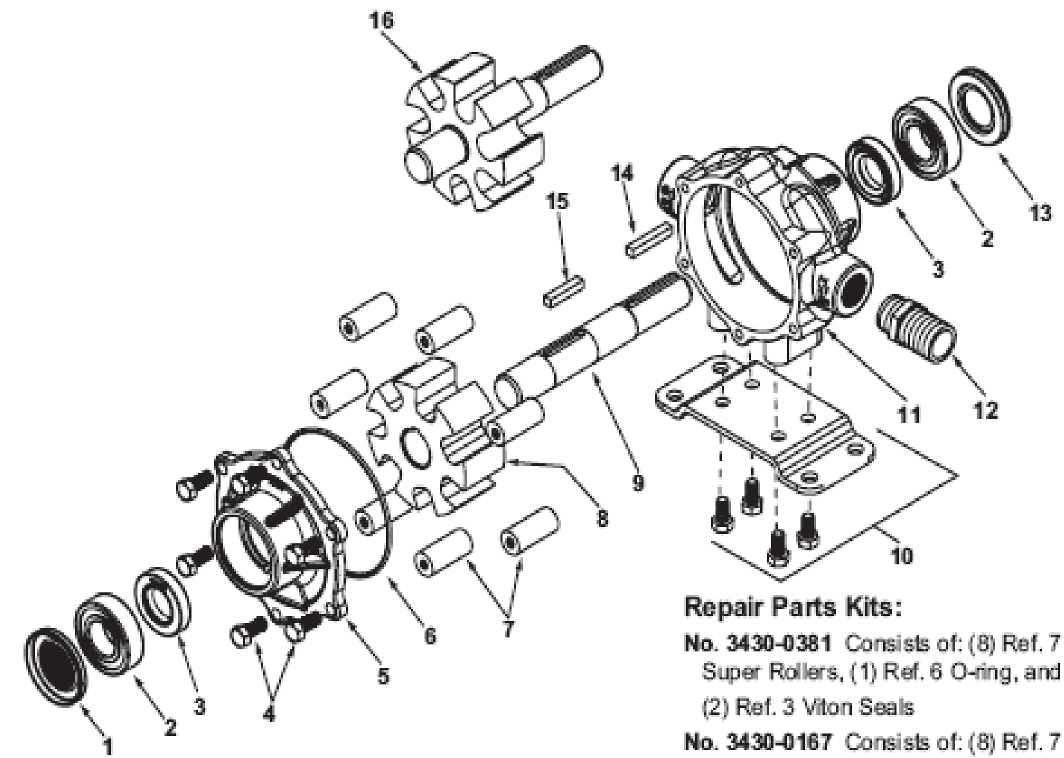
ROLLER



Note: When ordering parts, give quantity, part number, description and complete model number. Reference numbers are used ONLY to identify parts in the drawing and NOT to be used as order numbers.

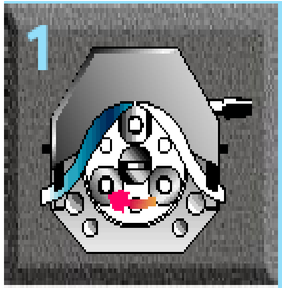
Repair Parts Kits:

No. 3430-0381 Consists of: (8) Ref. 7 Super Rollers, (1) Ref. 6 O-ring, and (2) Ref. 3 Viton Seals

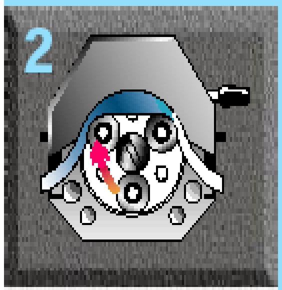
No. 3430-0167 Consists of: (8) Ref. 7 Polypropylene Rollers, (1) Ref. 6 O-ring, and (2) Ref. 3 Viton Seals

No. 3430-0623 Consists of: (1) Ref. 8 Phenolic rotor, (1) Ref. 9 Shaft, and (1) Ref. 15 Key

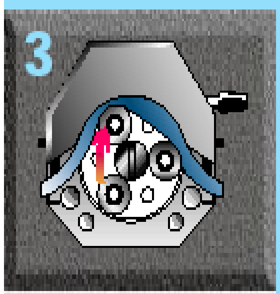
PERISTALTIC



A Masterflex pump head consists of only two parts: the rotor and the housing. The tubing is placed in the tubing bed—between the rotor and housing—where it is occluded (squeezed).



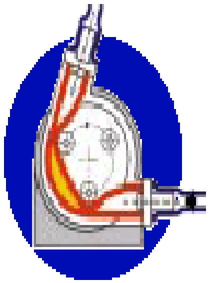
The rollers on the rotor move across the tubing, pushing the fluid. The tubing behind the rollers recovers its shape, creates a vacuum, and draws fluid in behind it.



A "pillow" of fluid is formed between the rollers. This is specific to the ID of the tubing and the geometry of the rotor. Flow rate is determined by multiplying speed by the size of the pillow. This pillow stays fairly constant except with very viscous fluids.

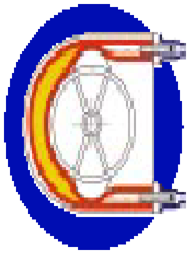
Dry-Running Design

This pump design incorporates a unique tube bed that always ensures that one roller is occluding the hose. Termed dry-running because rollers that do not operate in a lubricated bath occlude the hose. Dry running pumps are available in models capable of discharge pressures up to 60 psig. Unique dual-hose versions provide a nearly pulse-free flow stream.

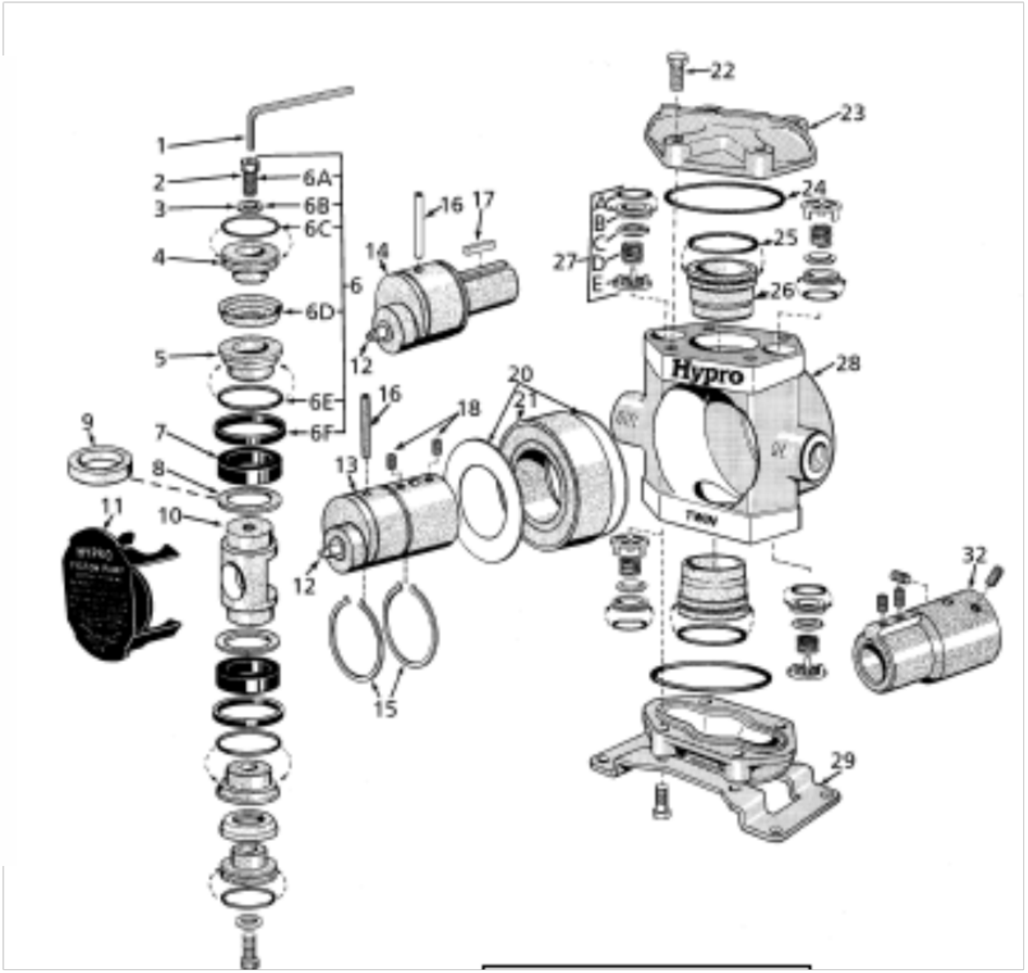


Lubricated Bath Design

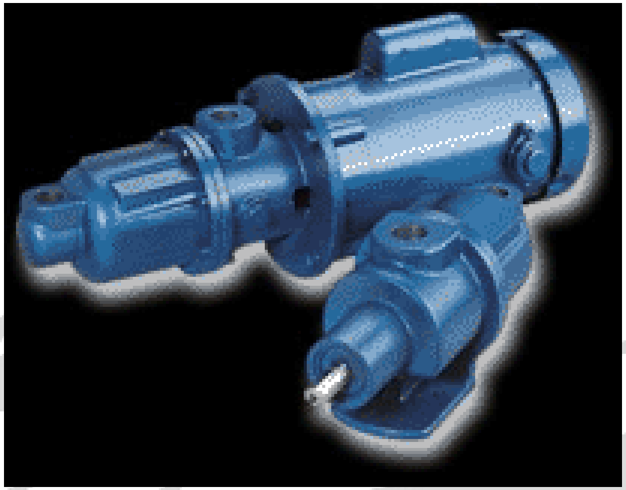
Used in PK series only, this design uses two sliding shoes on the rotor to occlude the hose. The rotor and hose operate in a lubricated bath that reduces friction on the hose and provides the long life typical of this type of hose pump design. These pumps are capable of operating at discharge pressures up to 220 psig (15 bar).



PISTON / PLUNGER



PROGRESSIVE CAVITY TYPE

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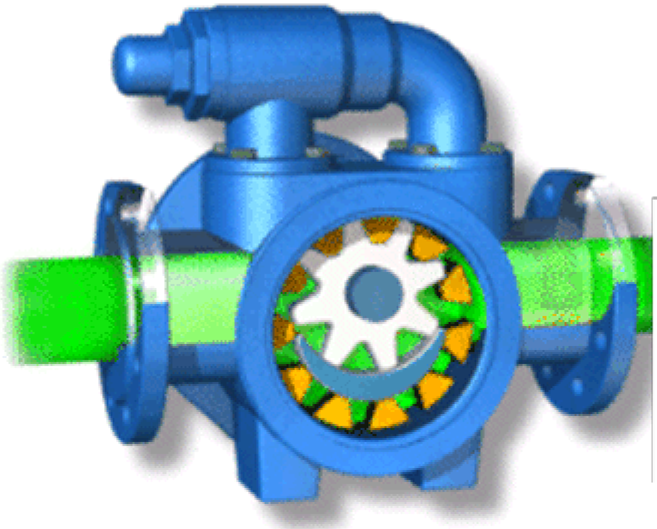
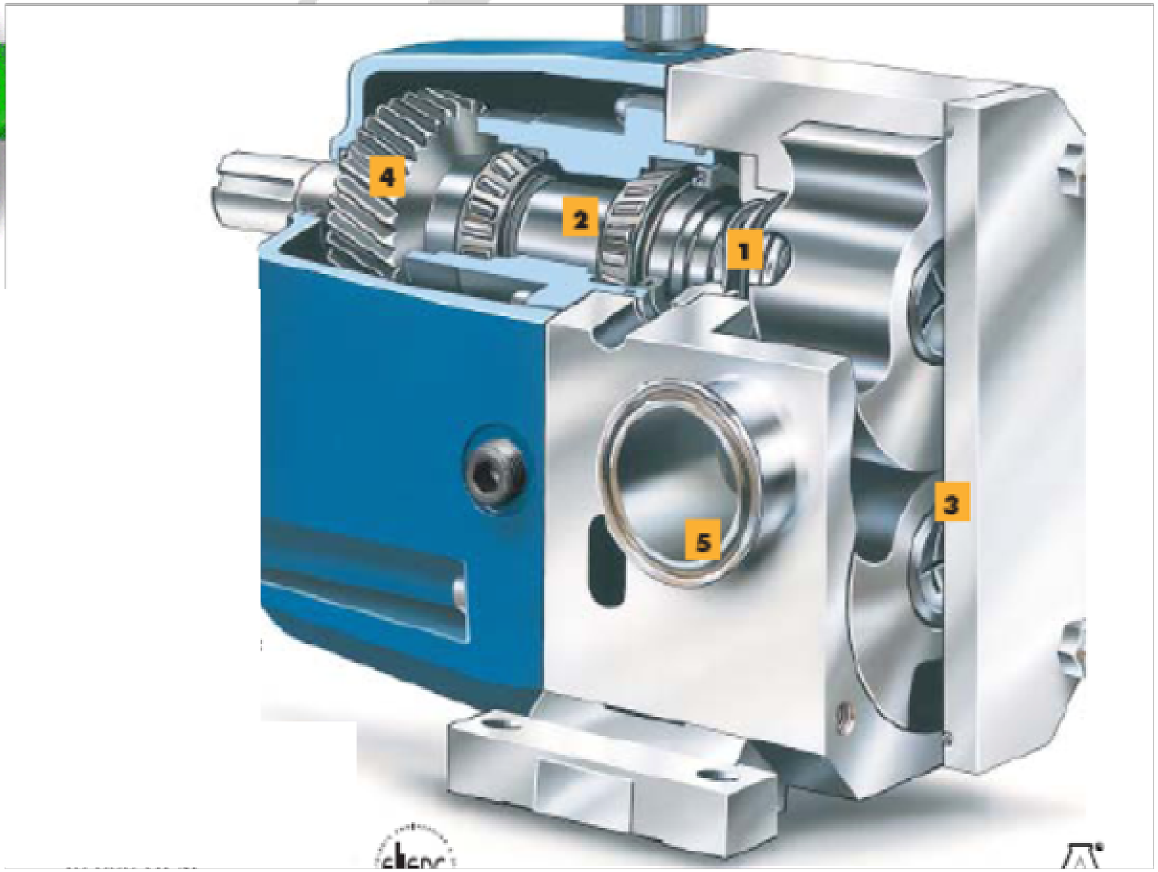
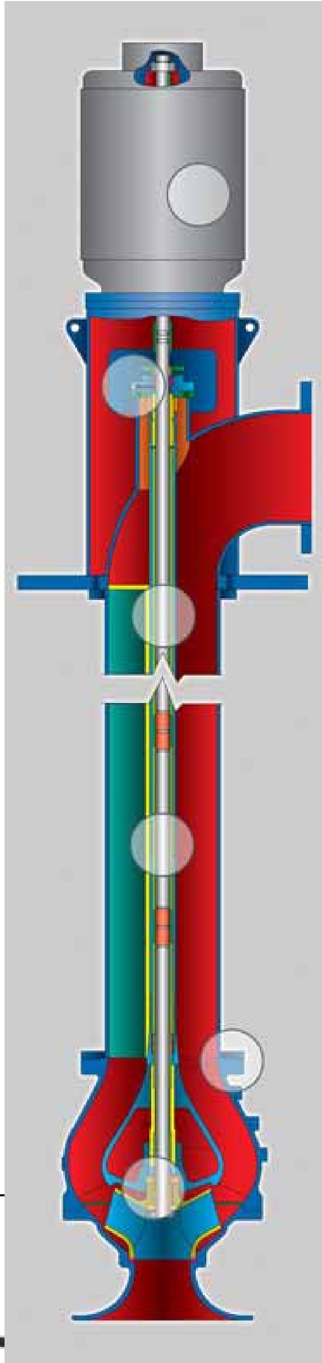
GEAR / LOBE PUMPS

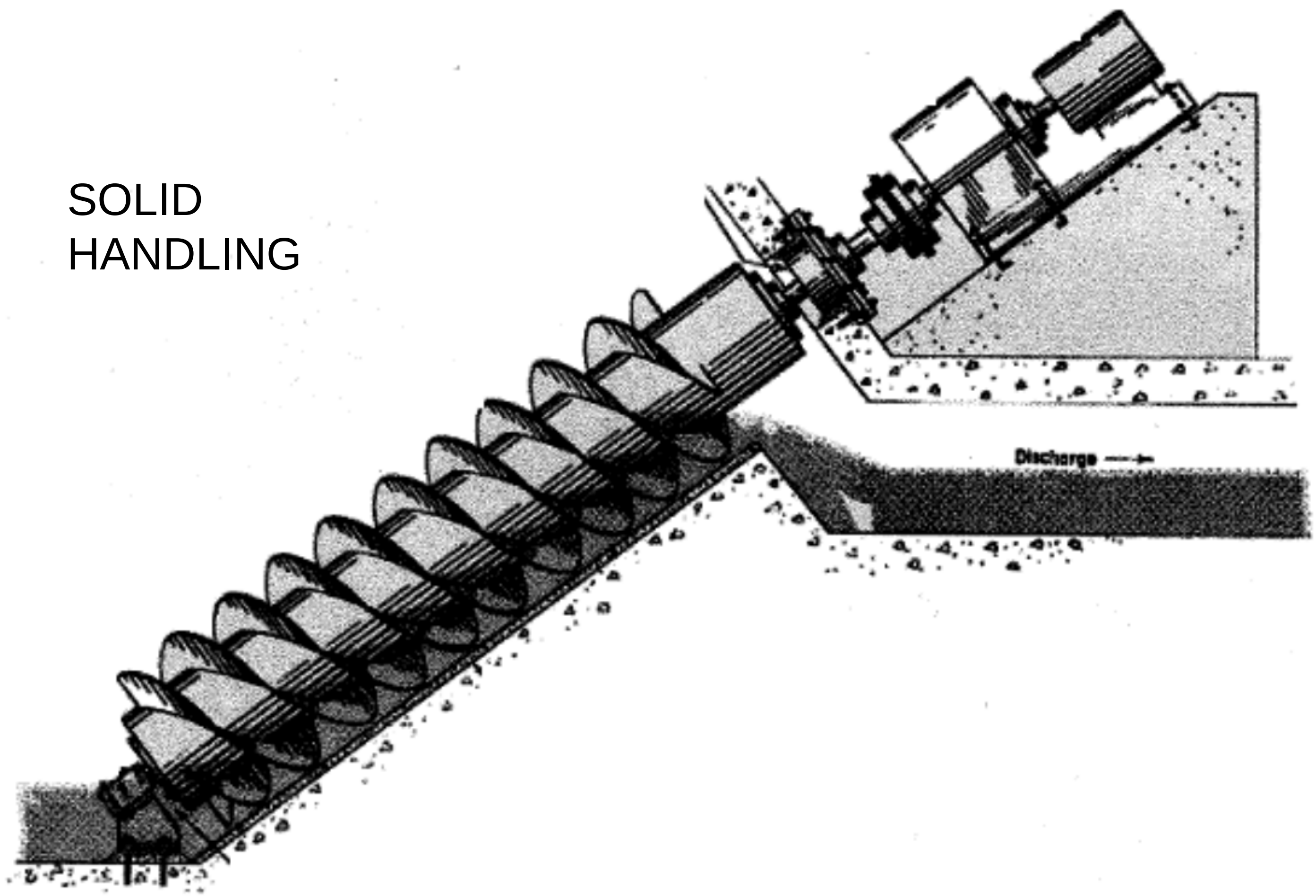




Rotary Screw



SOLID
HANDLING



HYBRID PUMP

SUBMERSIBLE GRINDER/ PROGRESSIVE CAVITY UNIT

The HPD200 is a completely submersible sewage grinder pump for residential applications. Complete packaged systems also available.

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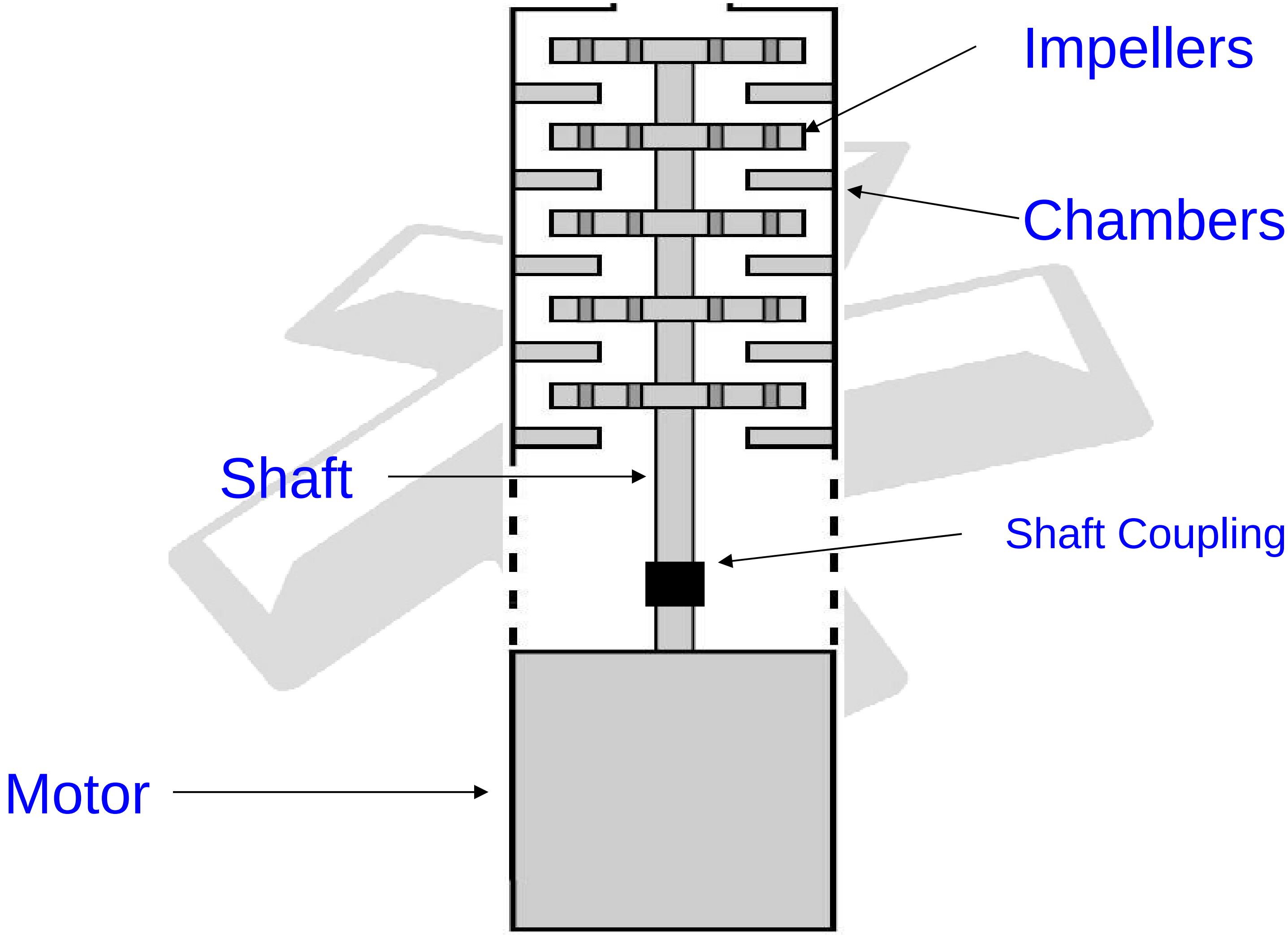
BASIC PUMP COMPONENTS

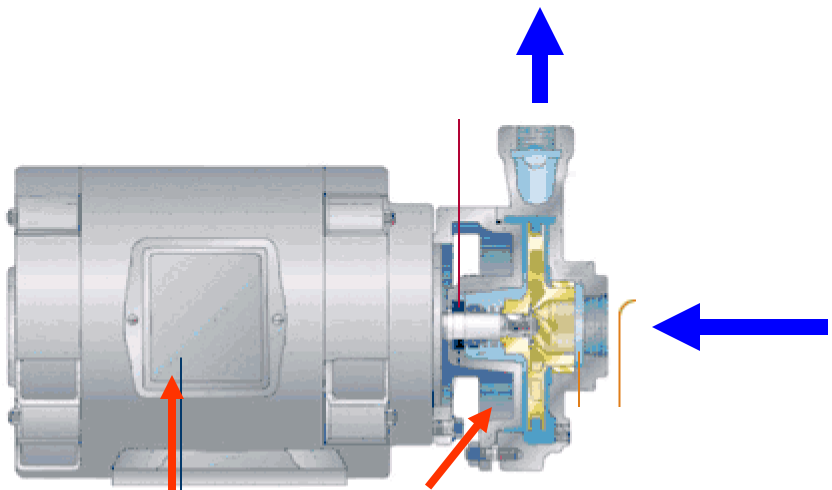
PARTS I.D.

Main Parts of a Submersible Pump



END SUCTION

DISCHARGE



INLET

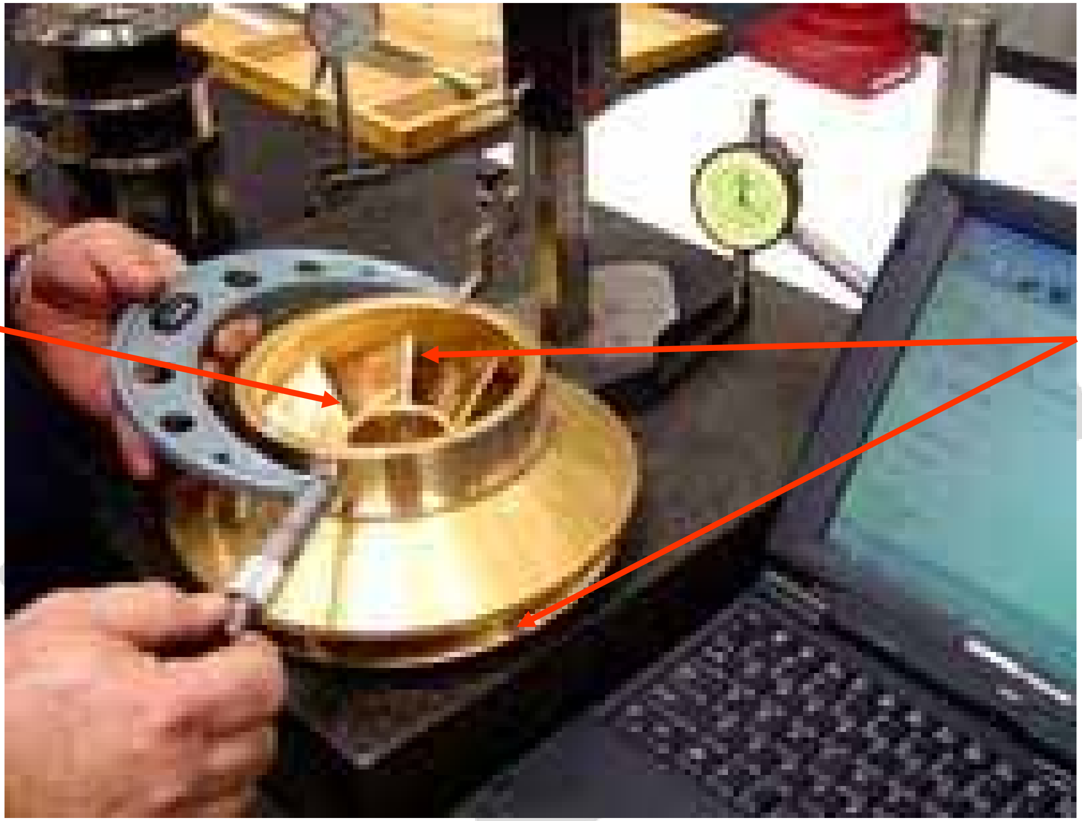
LIQUID END
TAG DETAILS MODEL,
SERIAL # , FLOW, HEAD

DRIVE OR MOTOR
TAG DETAILS HP,
VOLTAGE, RPM,
FRAME, E.T.C.

BASIC PARTS

- IMPELLER – CREATES THE FLOW OF LIQUID
- IMPELLER EYE – CHANNELS FLUID INTO IMPELLER VANES
- IMPELLER VANES – ASSIST IN ADDING CENTRIFUGAL FORCE TO FLUID

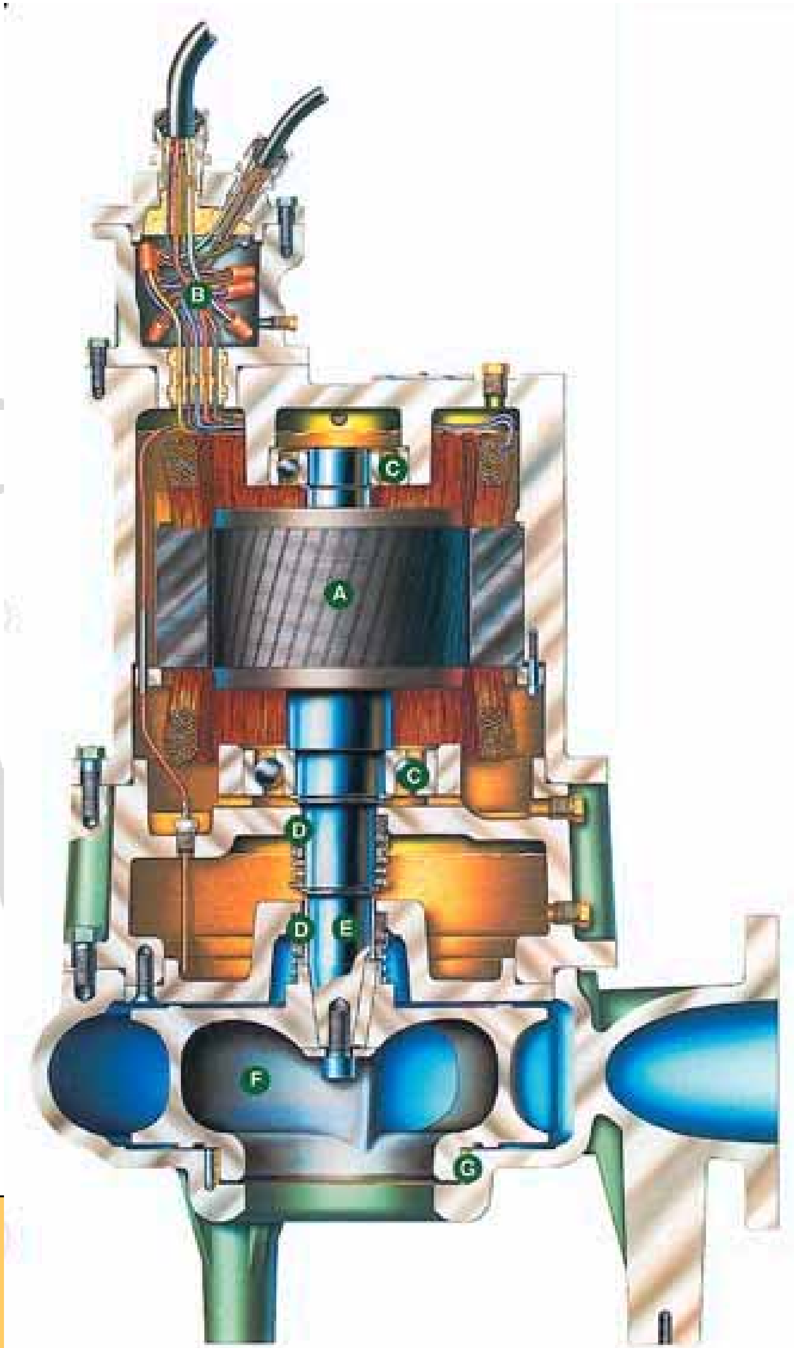
Impeller Eye



Impeller Vanes

IMPELLER - Non-Clogs

Dual Seal Non-Clog Pumps



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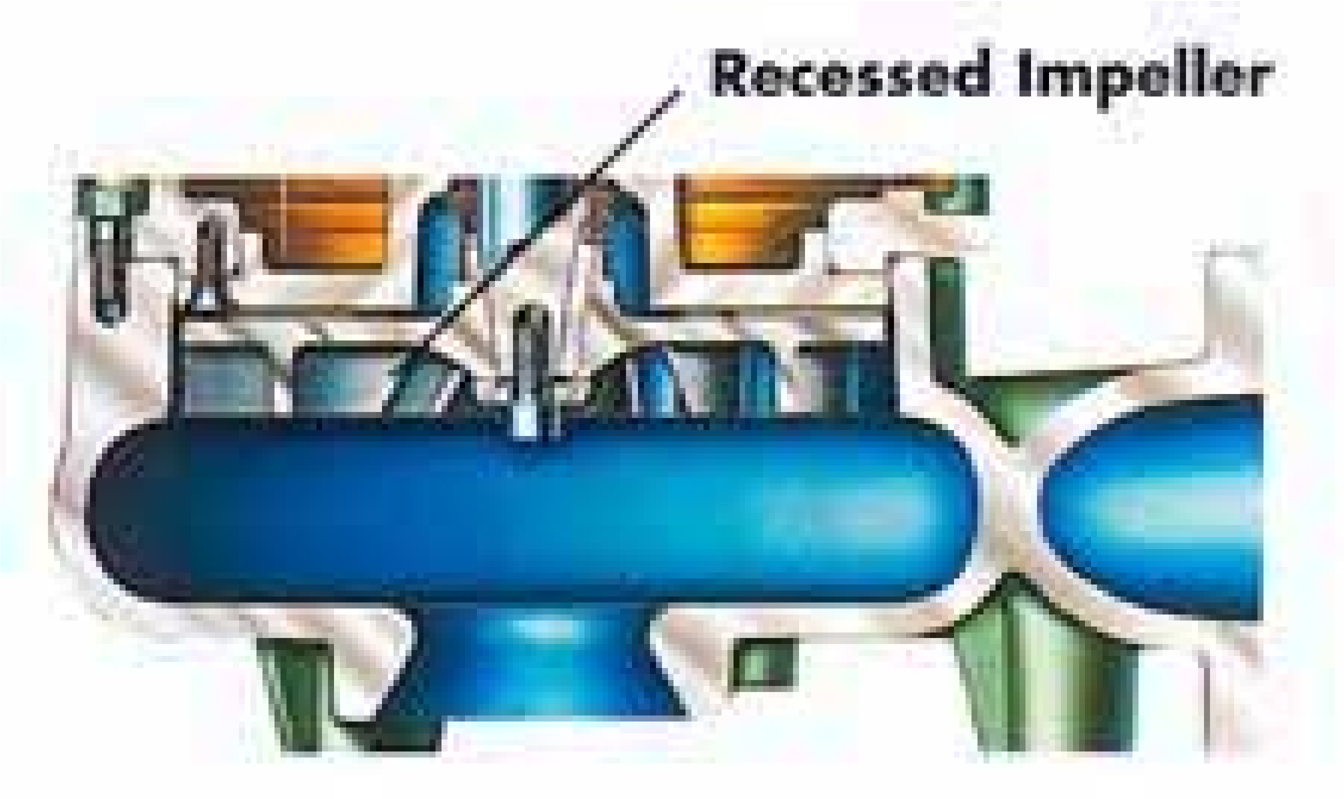
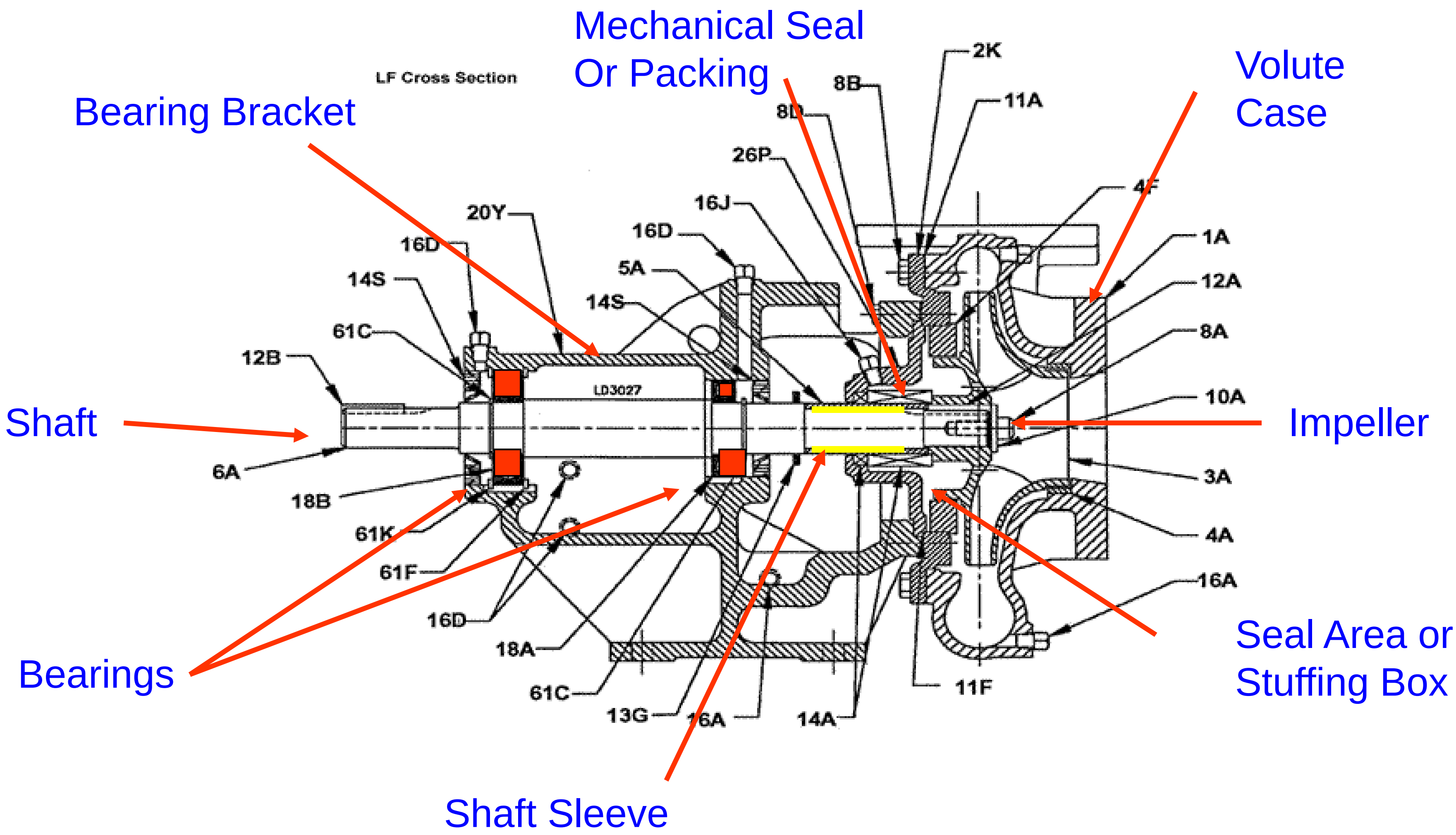
IMPELLER – VORTEX OR OPEN


Recessed Impeller

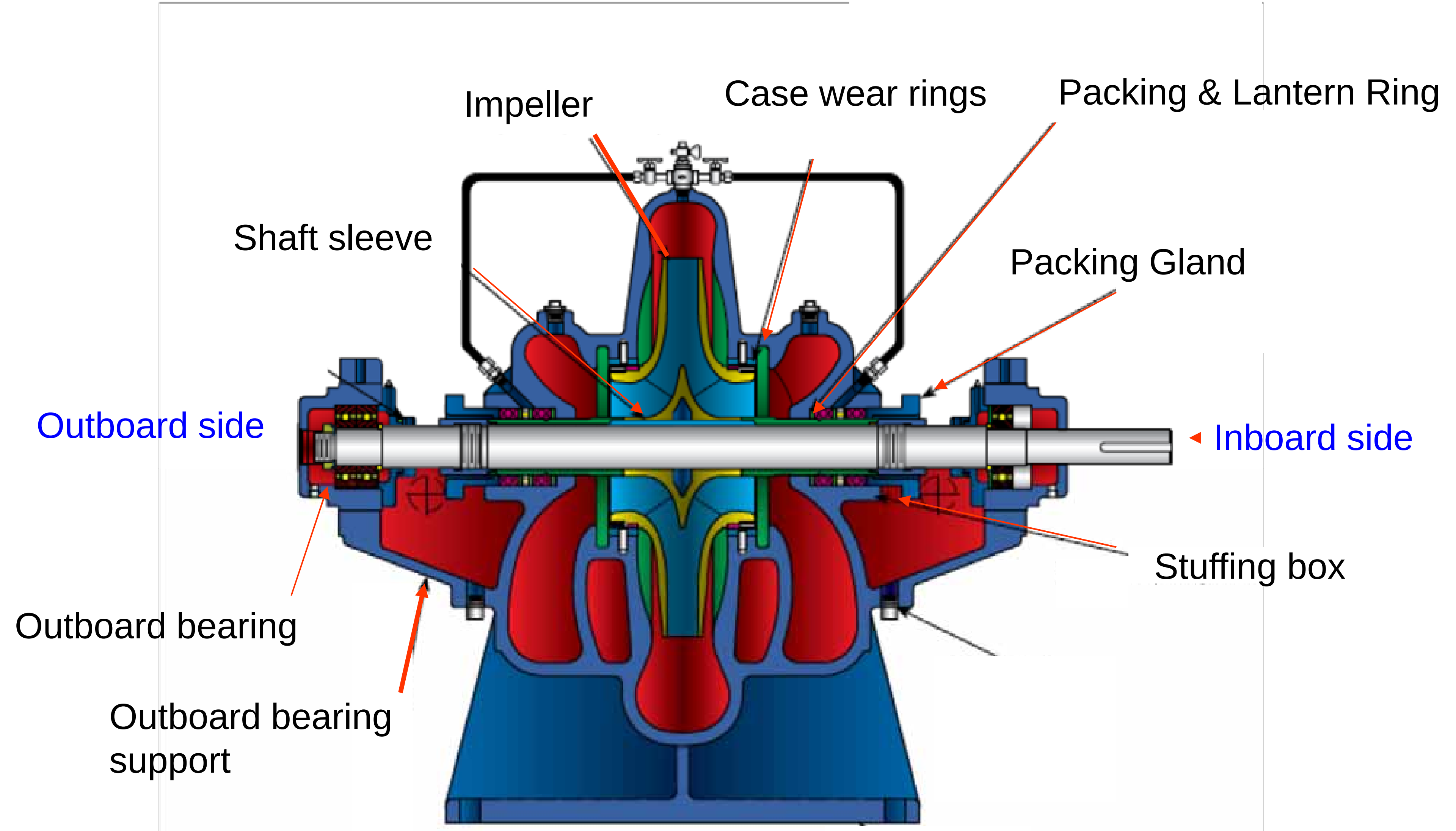
BASIC PARTS

- SHAFT – THIS ALLOW THE TRANSFER OF ENERGY FROM THE MOTOR TO THE IMPELLER
- SHAFT SLEEVE- THIS IS A WEAR ITEM TO PROTECT THE SHAFT.
- BEARINGS- THESE KEEP THE BASIC ALIGNMENT THRU-OUT THE ROTATING ASSEMBLY & HANDLE THRUST & AXIAL LOADS

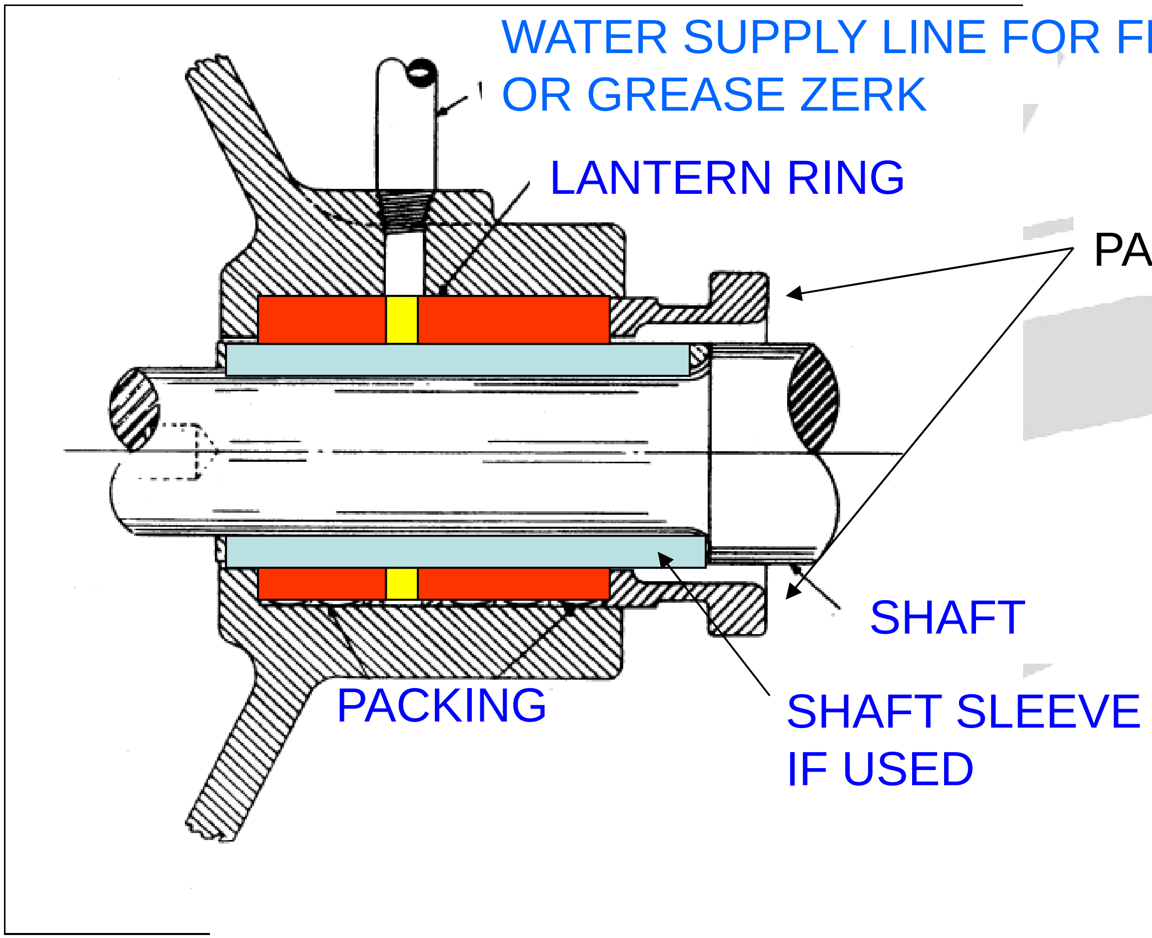
End Suction Parts Break Down



HORIZONTAL SPLIT CASE



STUFFING BOX WITH LANTERN RING



MAINTENANCE
TIGHTEN TO APPROX. 30-45 DRIPS PER SEC.

MECHANICAL SEALS

STATIONARY SEAT

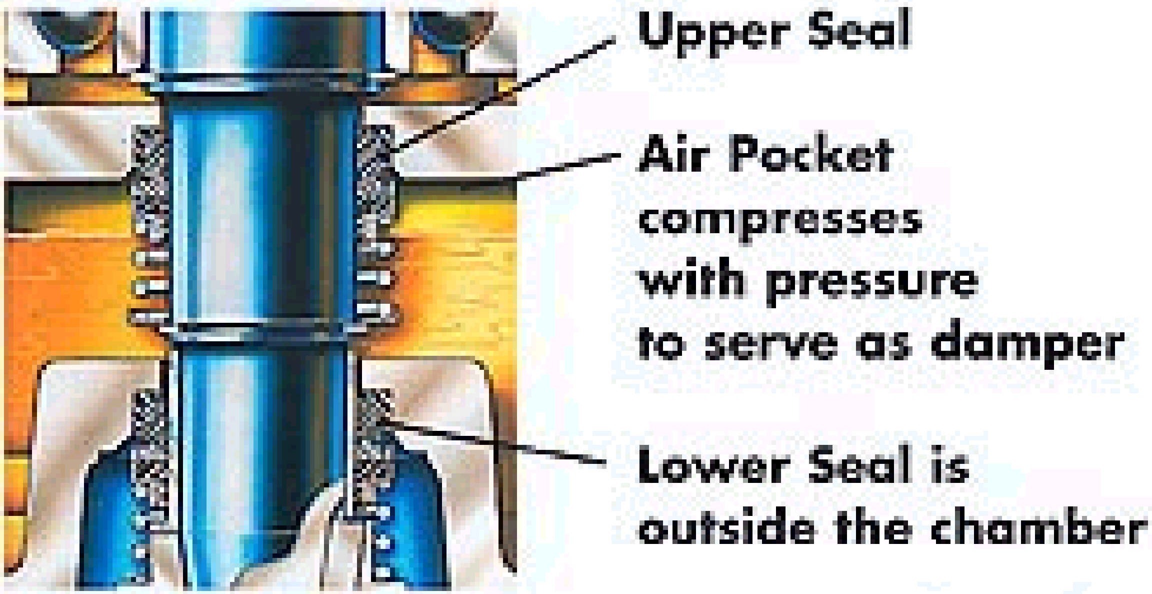
ROTATING HEAD

SPRING

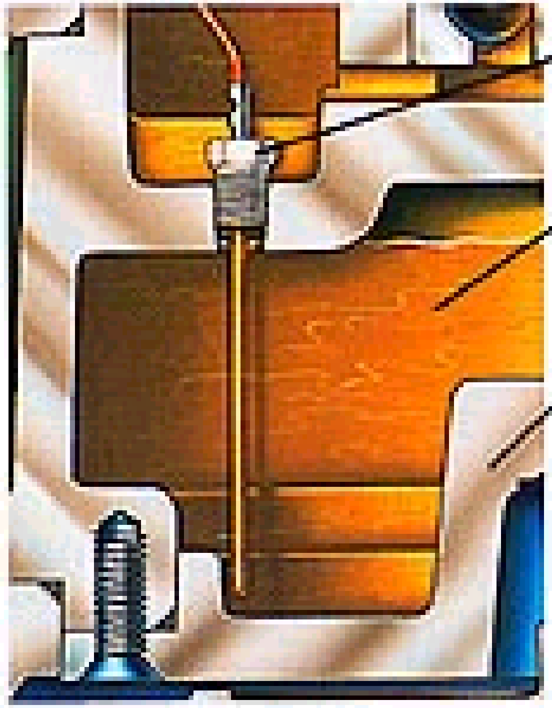
JOHN CRANE TYPE 21

CARTRIDGE TYPE

DUAL SEAL DESIGNS



The mechanical dual seal system protects your motor from media contamination to provide you exceptionally long pump service.



SEAL FAILURE PROBES

HYDROMATIC
Pentair Pump Group

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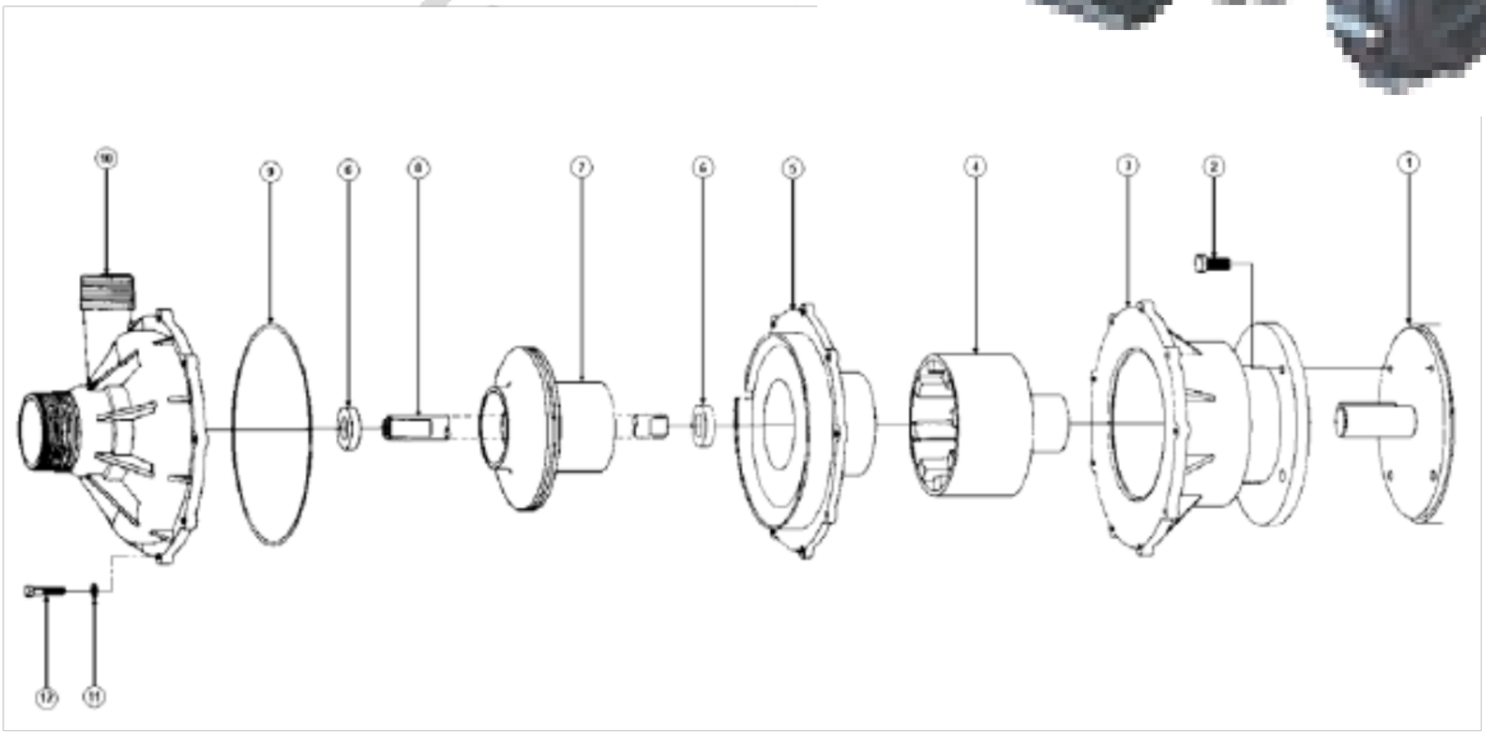
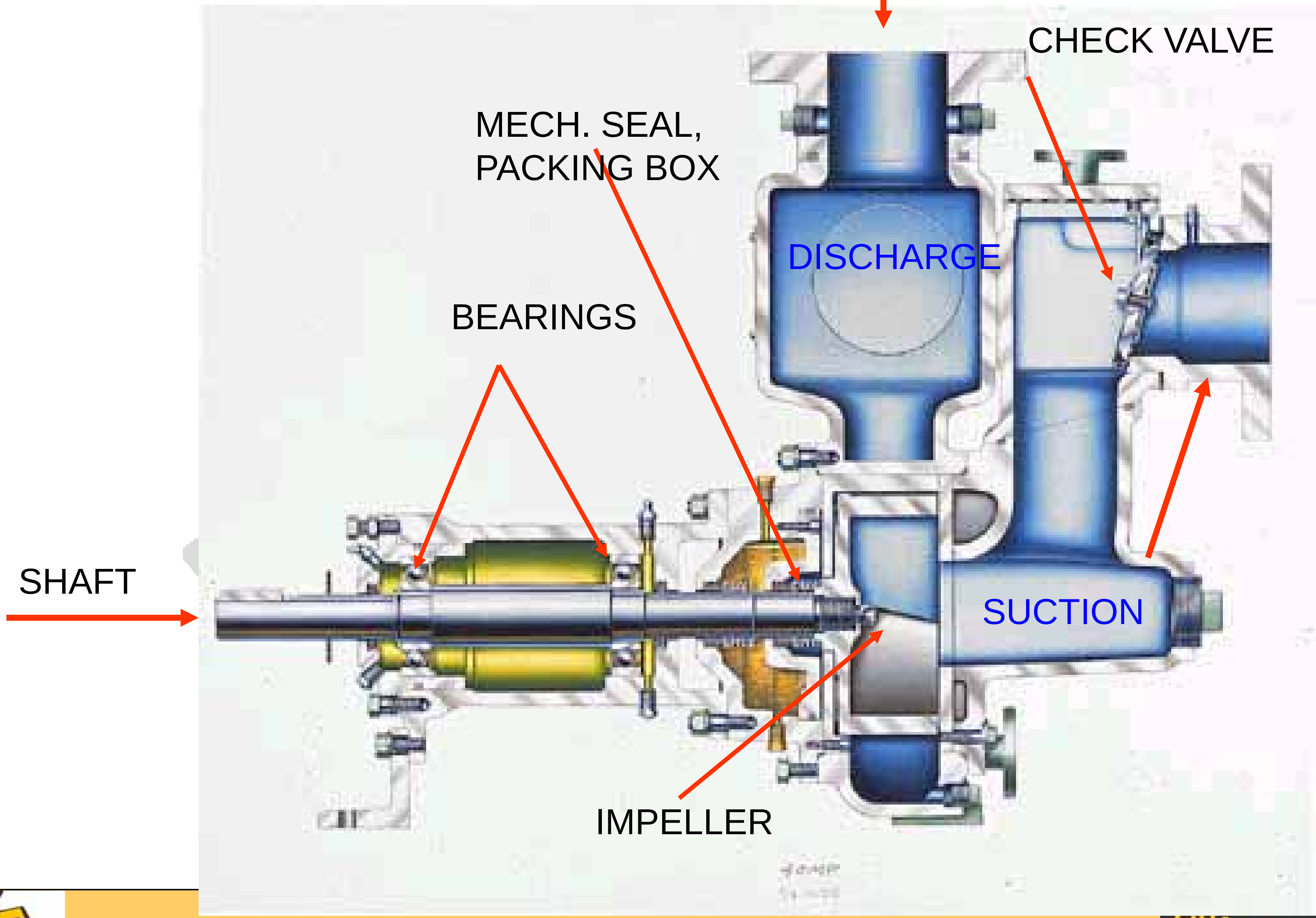
Seal-less Magnetic Driven



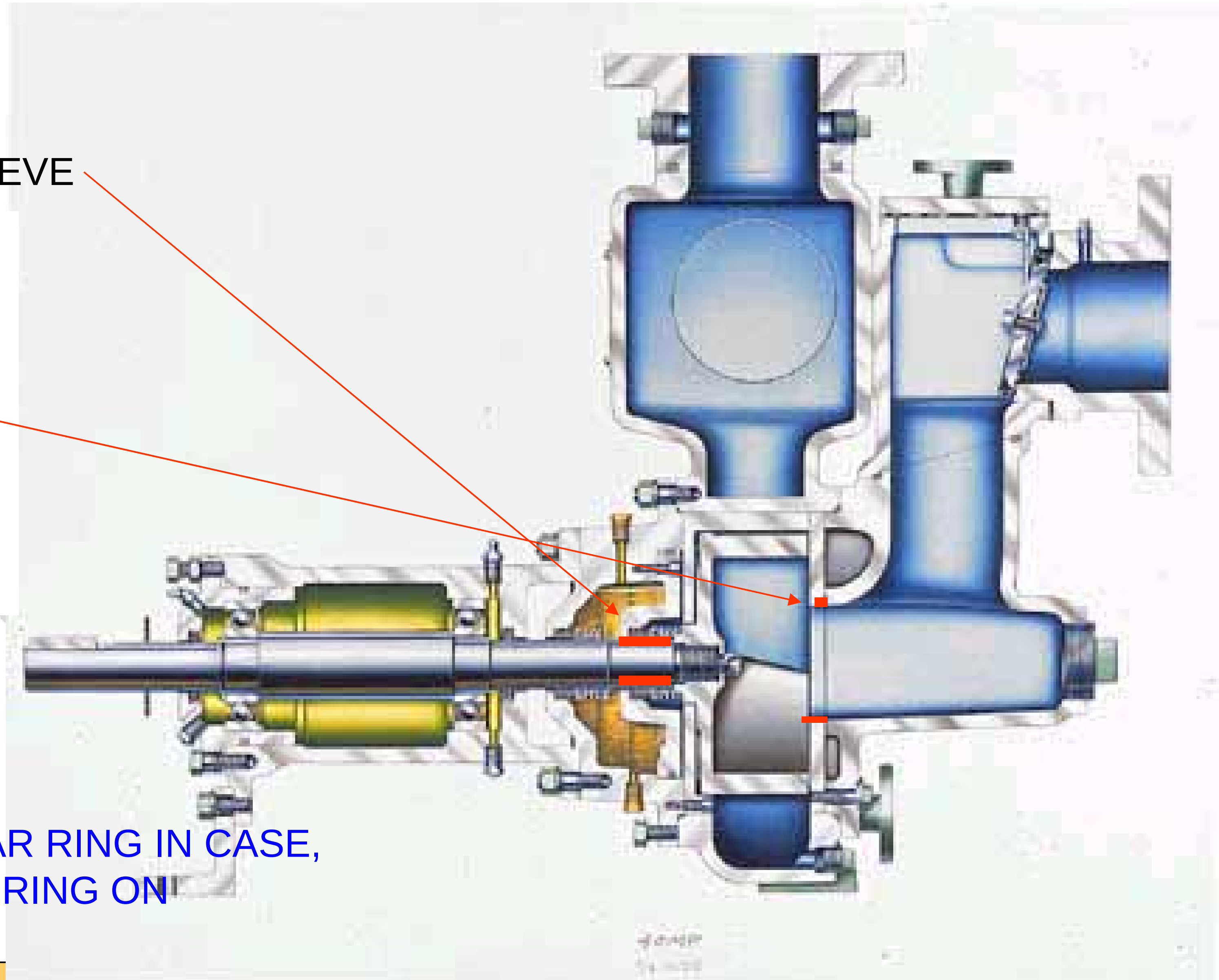
GUESS THE PART NAME



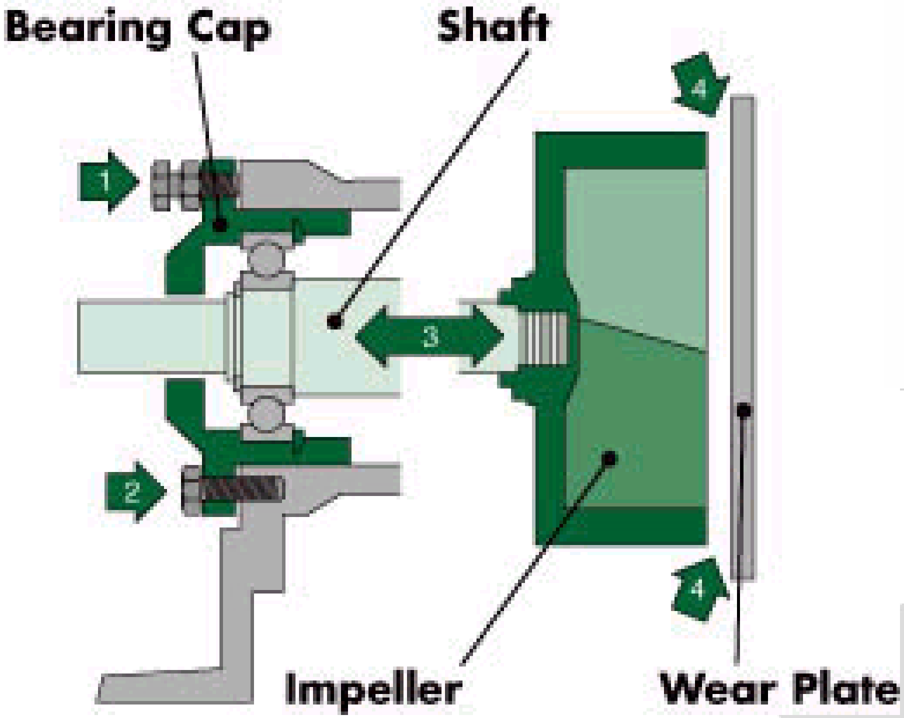
WHERE WOULD THIS PART GO?

SHAFT SLEEVE

WEAR RINGS



NOTE: CASE WEAR RING IN CASE, IMPELLER WEAR RING ON IMPELLER



HYDROMATIC
Pentair Pump Group

HEADS / FLOWS & PUMP CURVES

THE FOLLOWING STEPS MUST BE TAKEN WHEN SIZING A PUMP

- DETERMINE THE GPM (GALLONS PER MINUTE) REQUIRED.
- DETERMINE THE SUCTION HEAD
- DETERMINE THE DISCHARGE HEAD
- DETERMINE THE TOTAL HEAD
- DETERMINE THE FRICTION LOSS
- DETERMINE THE TDH (TOTAL DYNAMIC HEAD)

Save this Formula

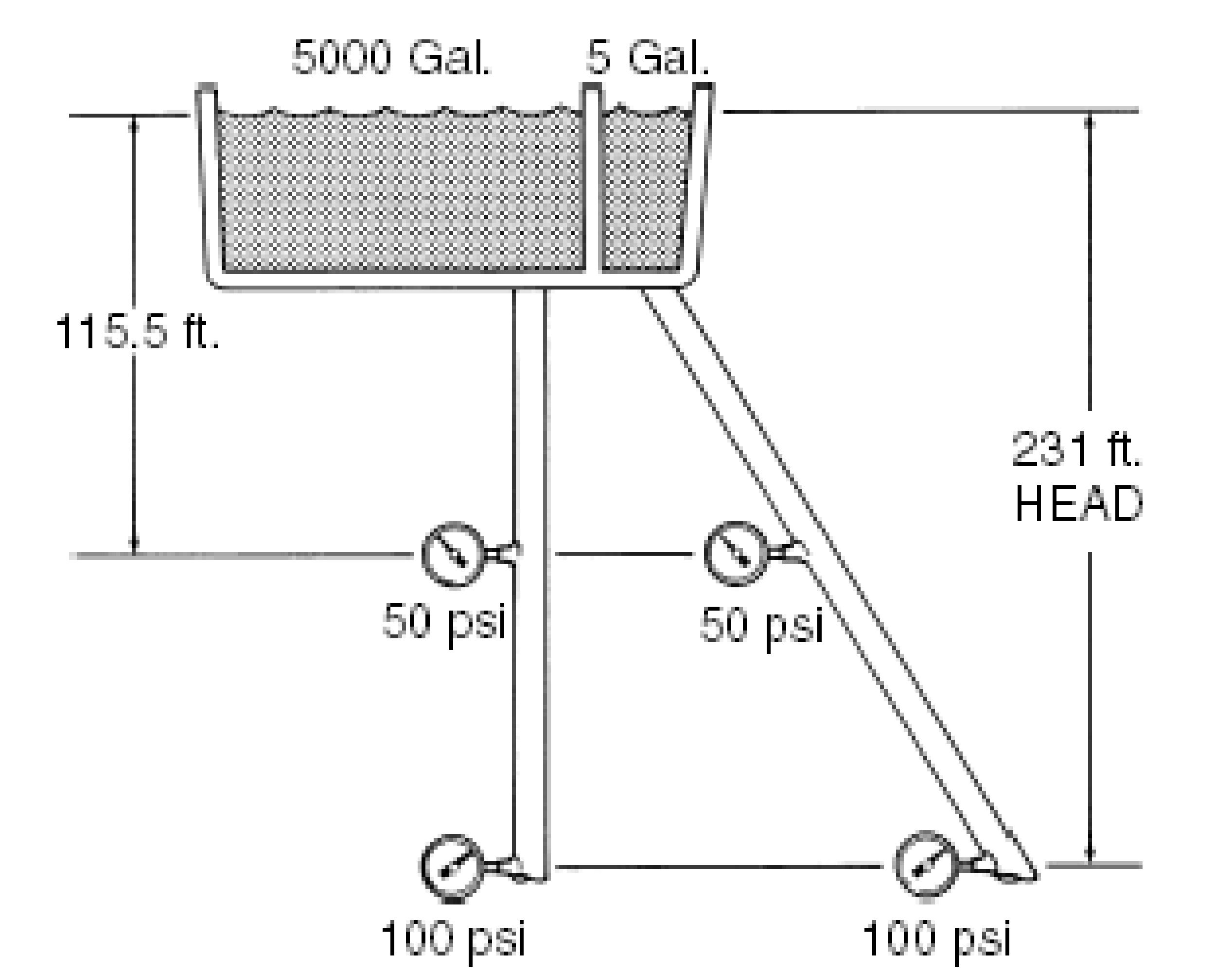
- PSI X 2.31 = FEET HEAD

Example 43.3 PSI X 2.31 = 100’

- FEET X .433 = PSI

Example 100’ X .433 = 43.3 PSI

PRESSURE VS FEET OF HEAD



Head (H)

Centrifugal pumps are not rated in developed pressure (P), but rather in developed head.

A pump will develop only as much head as required to over come resistance to flow.

<u>Total Dynamic Head (TDH) is found by adding:</u>

Pumping level (Well Static Level or draw down level)

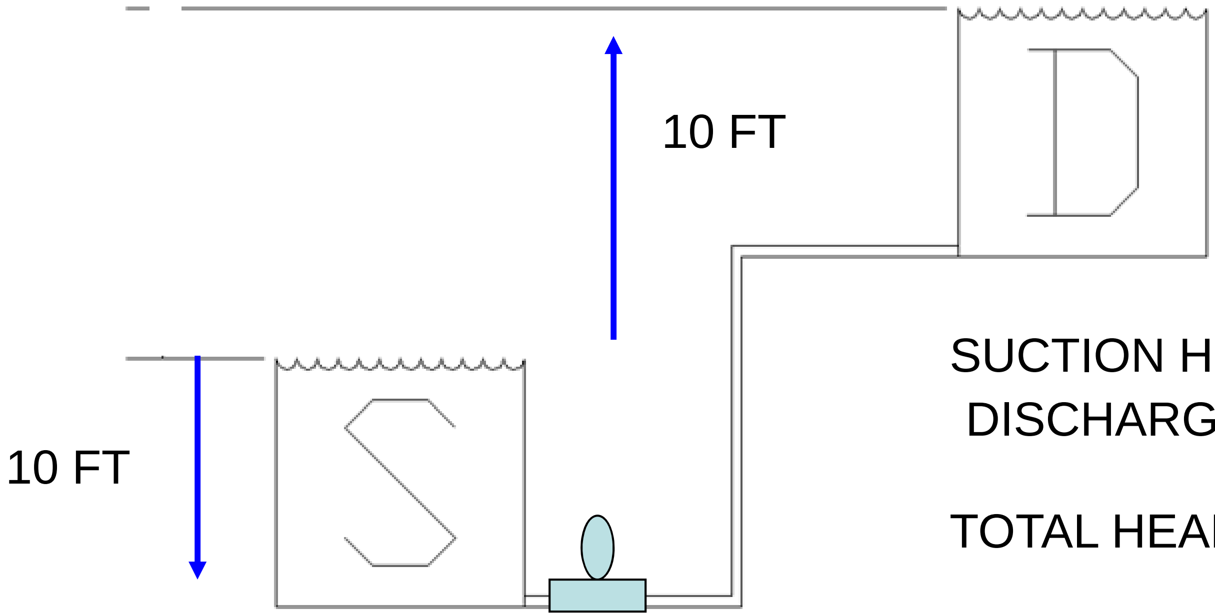
Elevation (Additional feet required to delivery flow)

Pressure (PSI converted to feet for controls / storage)

Friction Loss (Feet of resistance from pipe, fittings, valves)

SUCTION vs. DISCHARGE HEAD

Note Piping Arrangements

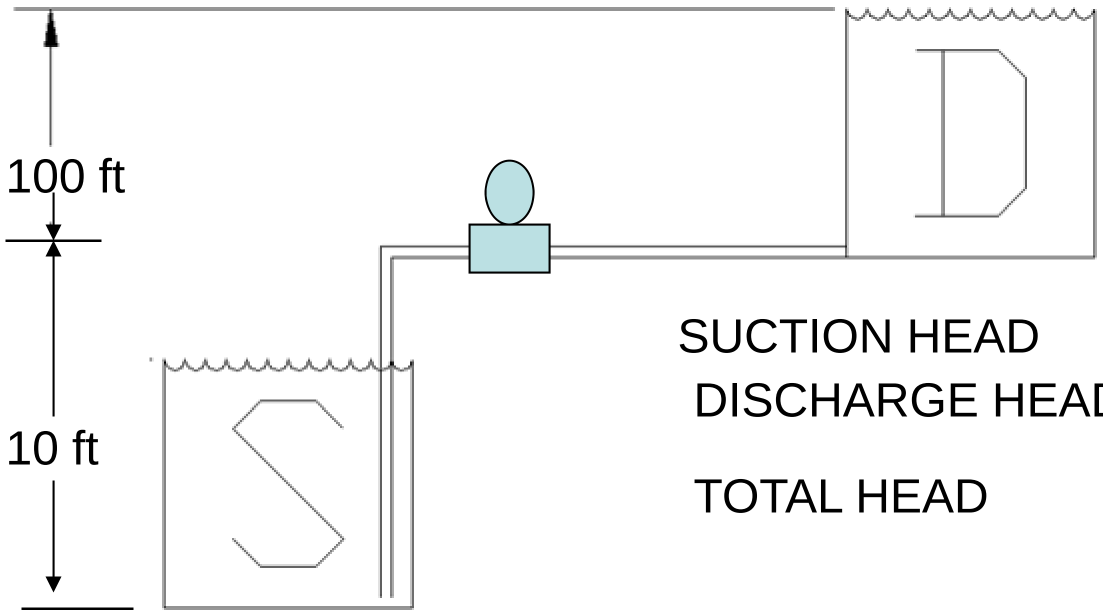


SUCTION HEAD 0 FT
DISCHARGE HEAD 10 FT

TOTAL HEAD = 10 FT

SUCTION vs. DISCHARGE HEAD

Note Piping Arrangements

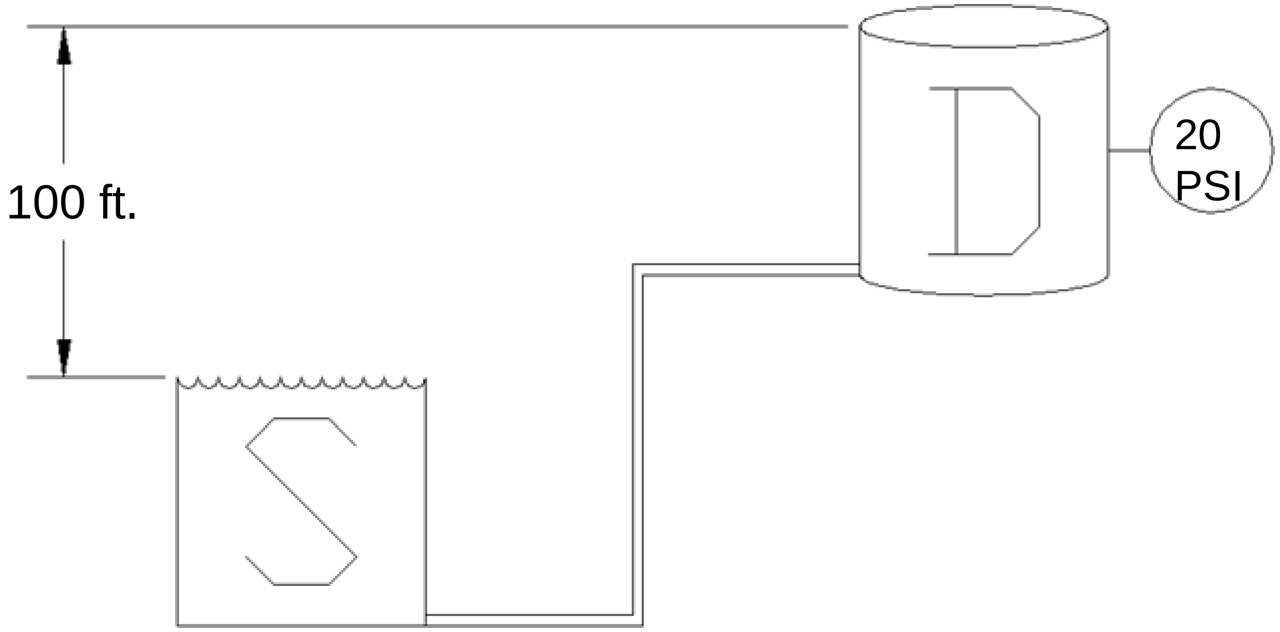


SUCTION HEAD = 10FT

DISCHARGE HEAD = 100 FT

TOTAL HEAD = 110 FT

Determining Pressure Head



P = 20 PSI or P = 46 ft
Add H = 100 ft

Pressure Head = 146 ft

THE C FACTOR?

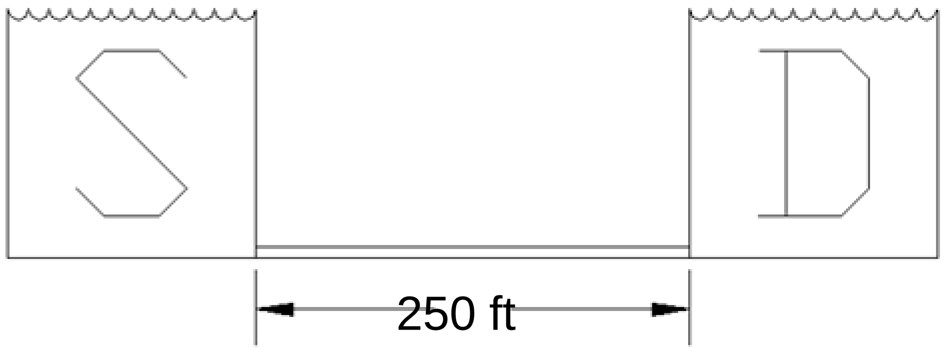
- AS WATER MOVES THRU A PIPE, IT RUBS AGAINST THE INSIDE OF THE PIPE.
- THERE ARE FOUR FACTORS TO CONSIDER WHEN DETERMINING FRICTION LOSS.

THE C FACTOR?

- THE PIPE SIZE OR INSIDE DIAMETER.
- THE FLOW (VOLUME) THRU THE PIPE.
- THE LENGTH OF THE PIPE.
- **THE C FACTOR**: IS KNOWN AS THE COEFFICIENT OF FRICTION. IT REPRESENTS THE ROUGHNESS OF THE INSIDE OF THE PIPE WALL.

Friction Head

Is the resistance to flow thru a given diameter of pipe, fittings or valves



Example: @ 16 GPM

1” Sch 40 pipe F.L. = 16.5 ft per 100 ft or 16.5 x 2.5 = 41.25 ft F.L. 17.86 PSI

1” Sch80 pipe F.L. = 26.3 ft per 100 ft or 26.3 x 2.5 = 65.75 ft F.L. 28.47 PSI

Determining Friction Head

VELOCITY CHART & FRICTION OF WATER

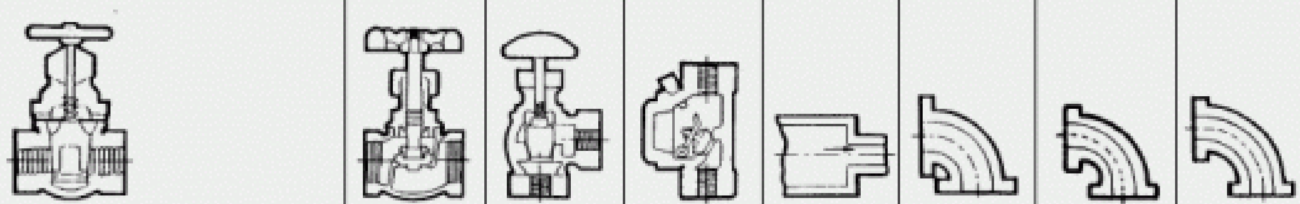
(new steel pipe) at 60° F

1 INCH

	STANDARD WEIGHT STEEL - SCH. 40			EXTRA STRONG STEEL - SCH. 80		
	1.049" Inside Diameter			.957" InsideDiameter		
FLOW U.S. GPM	VELOCITY (Ft./Sec.)	VELOCITY (Head Ft.)	**HEAD LOSS (Ft./100 Ft.)**	VELOCITY (Ft./Sec.)	VELOCITY (Head Ft.)	**HEAD LOSS (Ft./100 Ft.)**
2	0.74	.009	**.385**	.89	.01	**.599**
3	1.11	.019	**.787**	1.34	.03	**1.19**
4	1.48	.034	**1.270**	1.79	.05	**1.99**
5	1.86	.054	**1.90**	2.23	.08	**2.99**
6	2.23	.077	**2.65**	2.68	.11	**4.17**
8	2.97	.137	**4.50**	3.57	.20	**7.11**
10	3.71	.214	**6.81**	4.46	.31	**10.80**
12	4.45	.308	**9.58**	5.36	.45	**15.20**
14	5.20	.420	**12.80**	6.25	.61	**20.40**
16	5.94	.548	**16.50**	7.14	.79	**26.30**
18	6.68	.694	**20.60**	8.03	1.00	**32.90**
20	7.42	.857	**25.20**	8.92	1.24	**40.30**
22	8.17	1.036	**30.30**	9.82	1.50	**48.40**
24	8.91	1.23	**35.80**	10.70	1.80	**57.20**
26	9.65	1.45	**41.70**	11.60	2.10	**66.80**
28	10.39	1.68	**48.10**	12.50	2.40	**77.10**
30	11.10	1.93	**55.00**	13.40	2.80	**88.20**
35	13.00	2.62	**74.10**	15.60	3.80	**119.00**
40	14.80	3.43	**96.10**	17.90	5.00	**154.00**
45	16.70	4.33	**121.00**	20.10	6.30	**194.00**

Fitting Friction

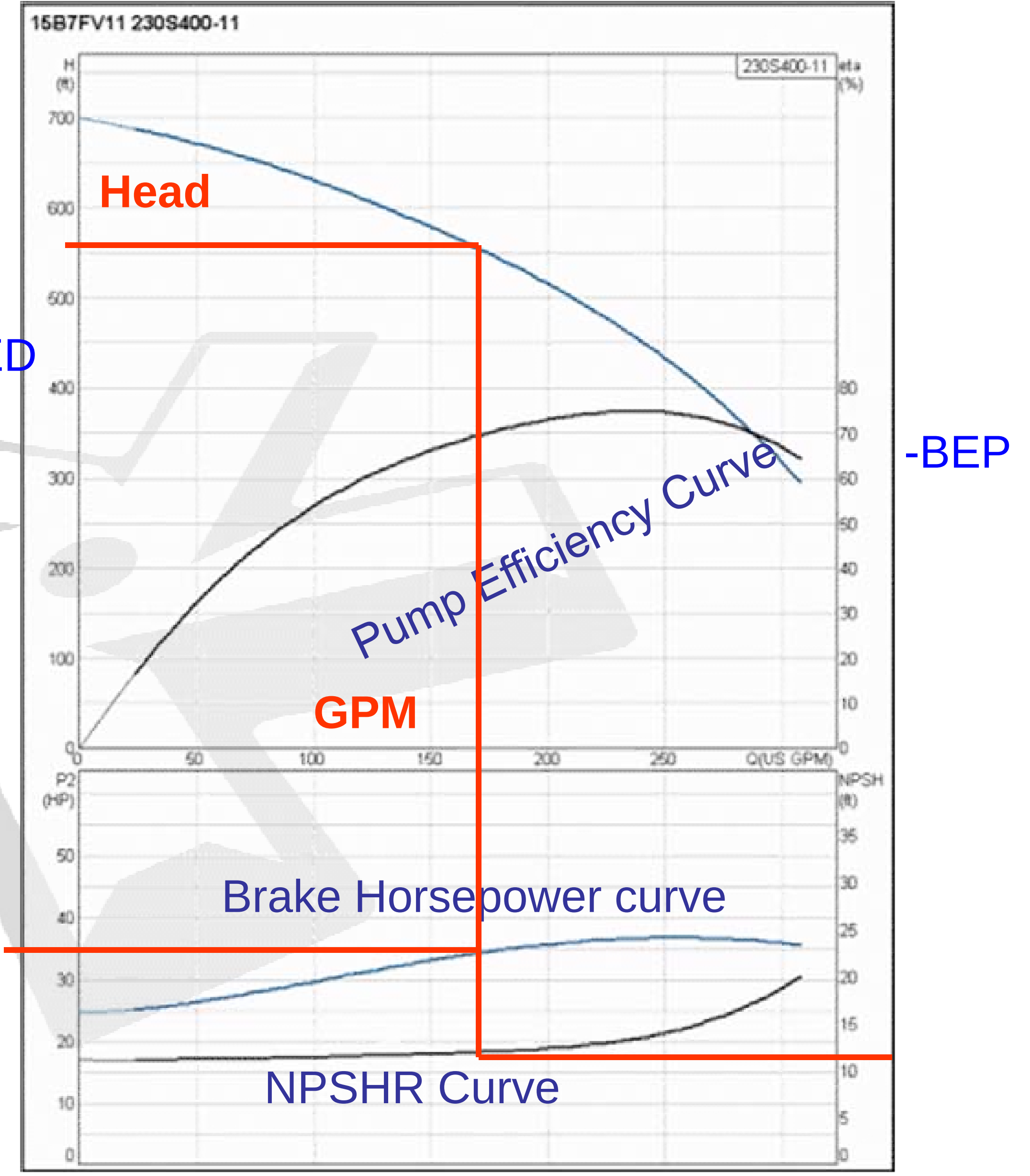
FRICTION LOSSES THROUGH PIPE FITTINGS & VALVES



SIZE OF PIPE (Inches)	GATE VALVE WIDE OPEN	GATE VALVE 1/4 CLOSED	GATE VALVE 1/2 CLOSED	GATE VALVE 3/4 CLOSED	GLOBE VALVE- WIDE OPEN	ANGLE VALVE- WIDE OPEN	CHECK VALVE- WIDE OPEN	ORDINARY ENTRANCE TO PIPE LINES	STD. 90° ELBOW	MEDIUM SWEEP 90° ELBOW	LONG SWEEP 90° ELBOW
STRAIGHT PIPE IN FEET (EQUIVALENT LENGTH)											
1/8"	.14	.85	5.00	19.00	9.00	5.00	2.00	.46	.74	.65	.50
1/4"	.21	1.25	7.00	26.00	12.00	6.00	3.00	.60	1.00	.86	.70
3/8"	.27	1.80	9.00	36.00	16.00	8.00	4.00	.75	1.40	1.15	.90
1/2"	.41	2.10	12.00	44.00	17.60	7.78	5.18	.90	1.60	1.55	1.10
3/4"	.55	2.90	14.00	59.00	23.30	10.30	6.86	1.40	2.30	2.06	1.50
1"	.70	3.40	18.00	70.00	29.70	13.10	8.74	1.60	2.70	2.62	2.00
1-1/4"	.92	4.80	24.00	96.00	39.10	17.80	11.50	2.50	3.60	3.45	2.50
1-1/2"	1.07	5.60	28.00	116.00	45.60	20.10	13.40	3.00	4.50	4.03	2.90
2"	1.38	7.00	36.00	146.00	58.60	25.80	17.20	3.50	5.40	5.17	3.60
2-1/2"	1.65	8.40	41.00	172.00	70.00	30.90	20.60	4.00	6.50	6.17	4.40
3"	2.04	10.00	52.00	213.00	86.90	38.40	25.50	5.00	8.50	7.67	5.50
3-1/2"	2.10	12.50	60.00	246.00	100.00	52.00	24.00	5.50	10.0	8.50	6.30
4"	2.40	14.00	70.00	285.00	116.00	57.00	27.00	6.50	12.0	9.50	7.20

WHEN SELECTING A PUMP

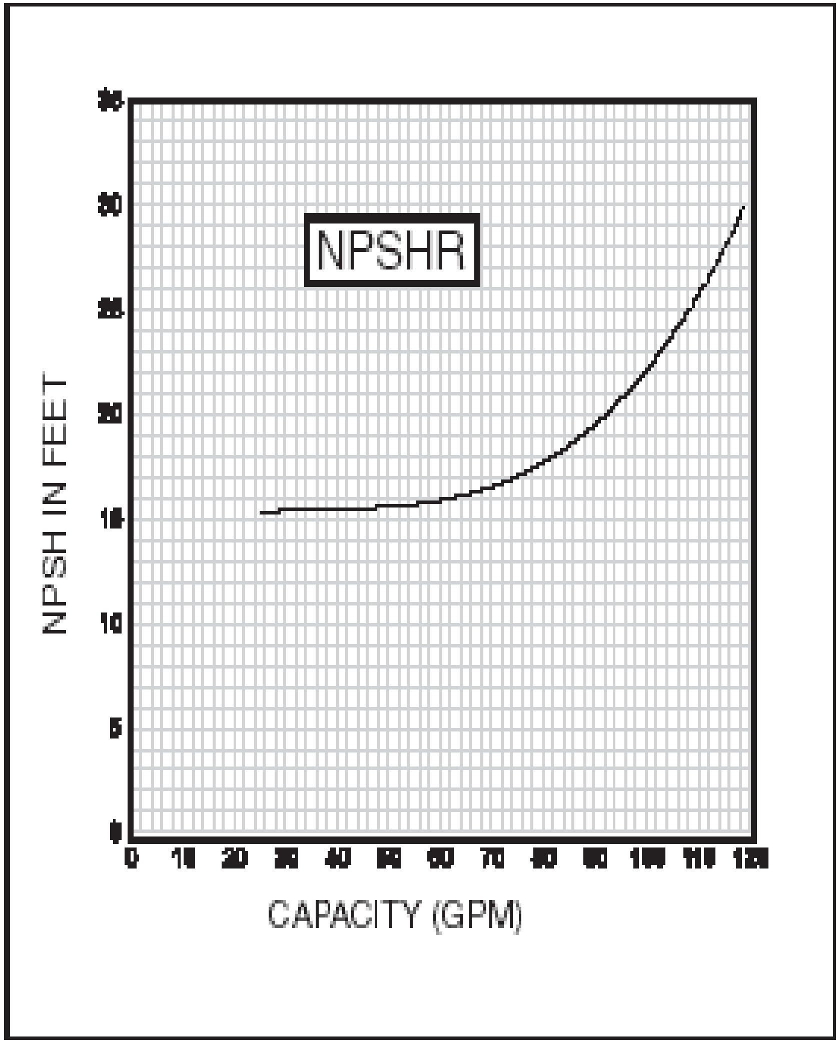
1. START WITH TDH NEEDED
2. DROP DOWN TO GPM NEEDED
3. CHECK % EFFICIENCY
4. CHECK HORSE POWER
5. CHECK NPSHR



What is NPSHR?

(Net Positive Suction Head)

CAN BE DEFINED AS THE HEAD THAT CAUSES LIQUID TO FLOW THROUGH THE SUCTION PIPING AND FINALLY ENTER THE EYE OF THE IMPELLER.



TWO TYPES

NPSHR =

NET POSITIVE SUCTION HEAD REQUIRED.

NPSHA =

NET POSITIVE SUCTION HEAD AVAILABLE.

OR in the case of submergible

MINIMUM SUBMERGENCE.

What is NPSHA?

Atmospheric pressure assist fluids in flowing into the eye of a pump

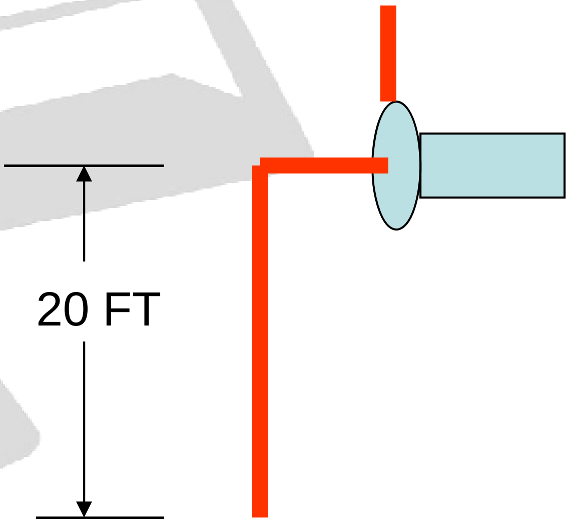
Take NPSHA	28.2
Minus NPSHR	15.0
A positive #	13.2

Indicates volume can be passed thru impeller

- Atmospheric Pressure Charts at various altitudes
- @ sea level = 33.9’
- @ 4000’ = 29.2’
- @ 5000’ = 28.2’
- @ 6000’ = 27.2’

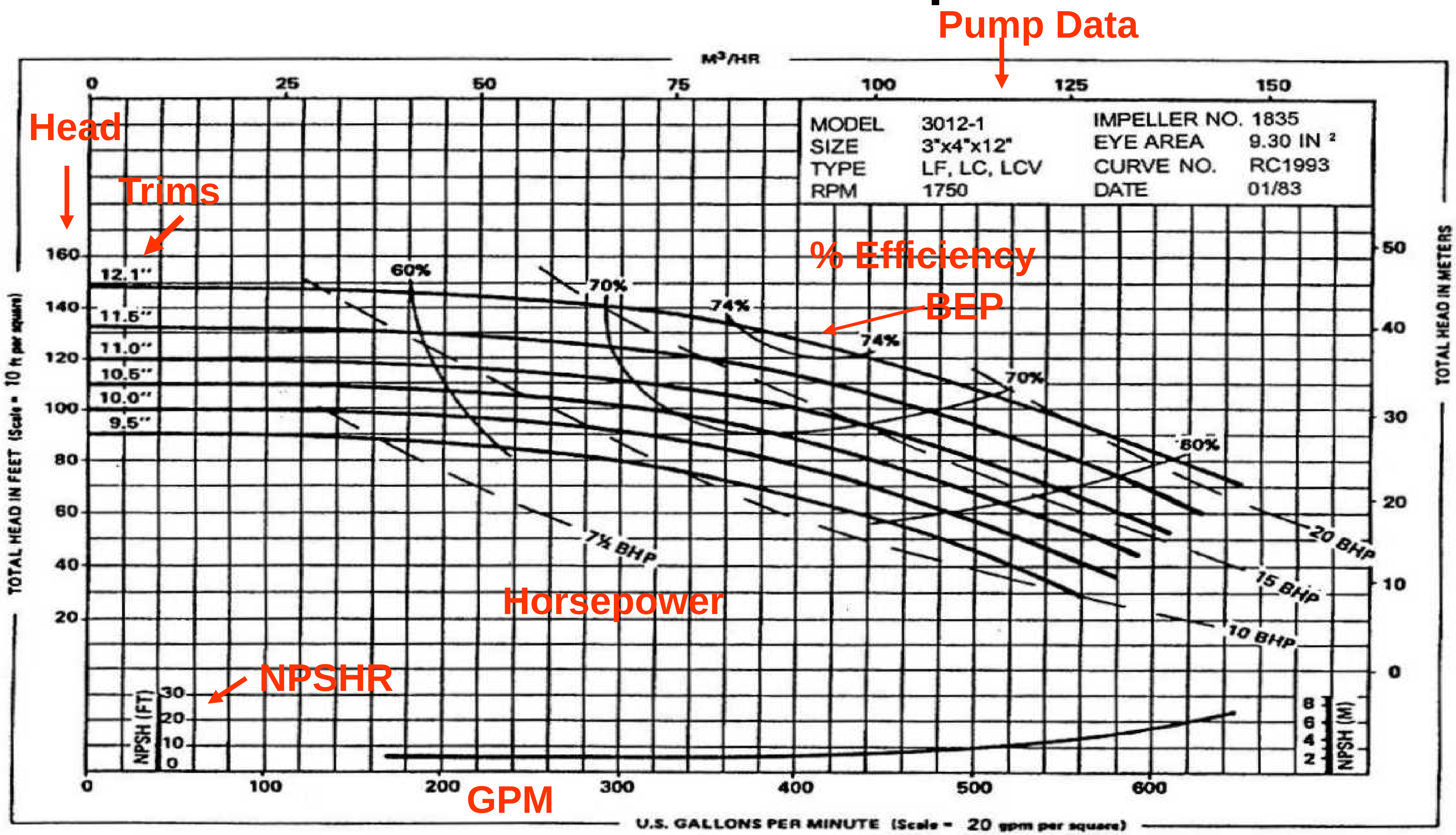
Negative Suction Head

- Atmospheric Pressure Charts at various altitudes
- @ sea level = 33.9'
- @ 5000' = 28.2'
- @ 6000' = 27.2'

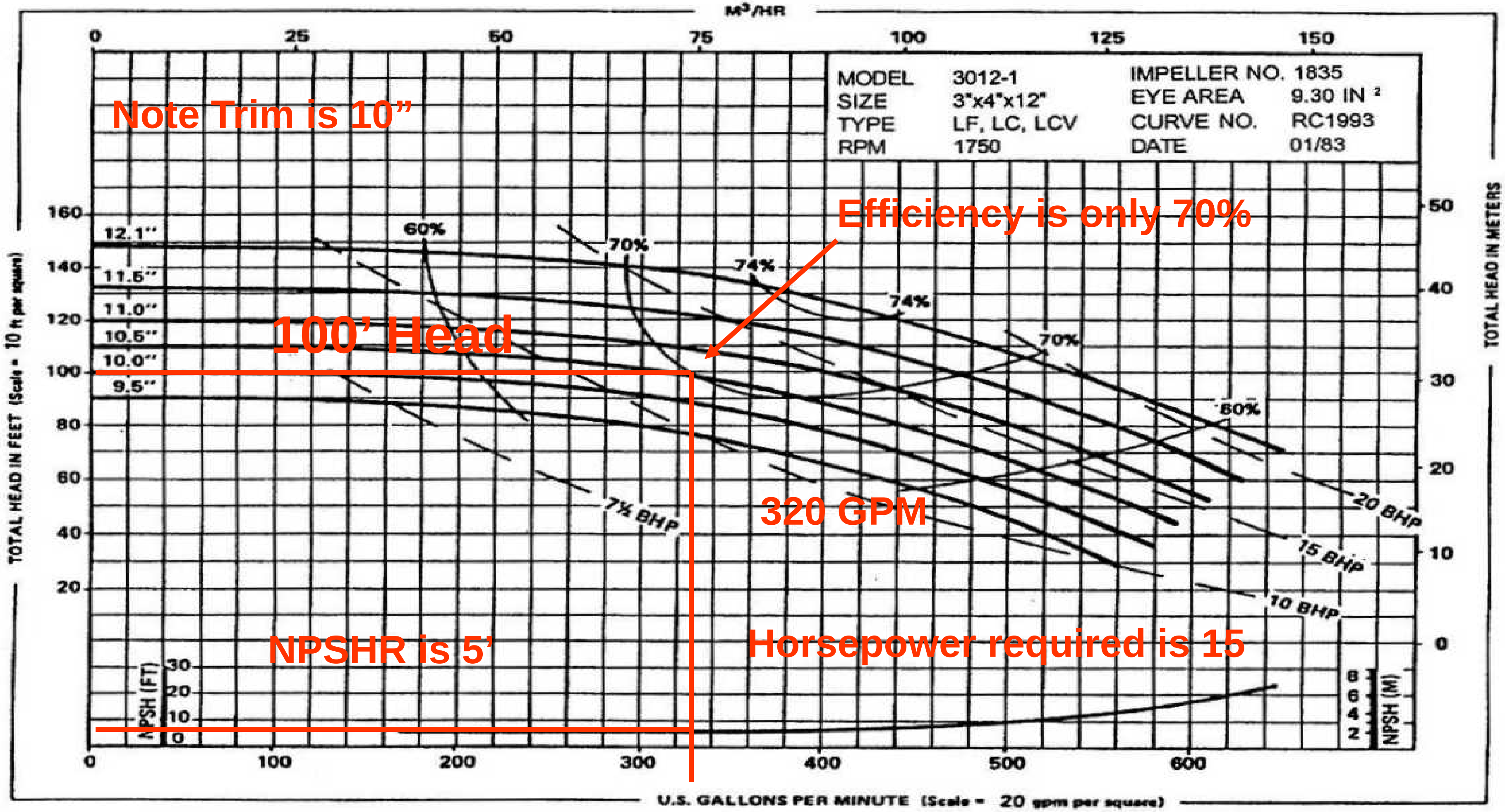


- **TEST QUESTION DO NOT EXCEED 20 FT**

End Suction Pump Curve



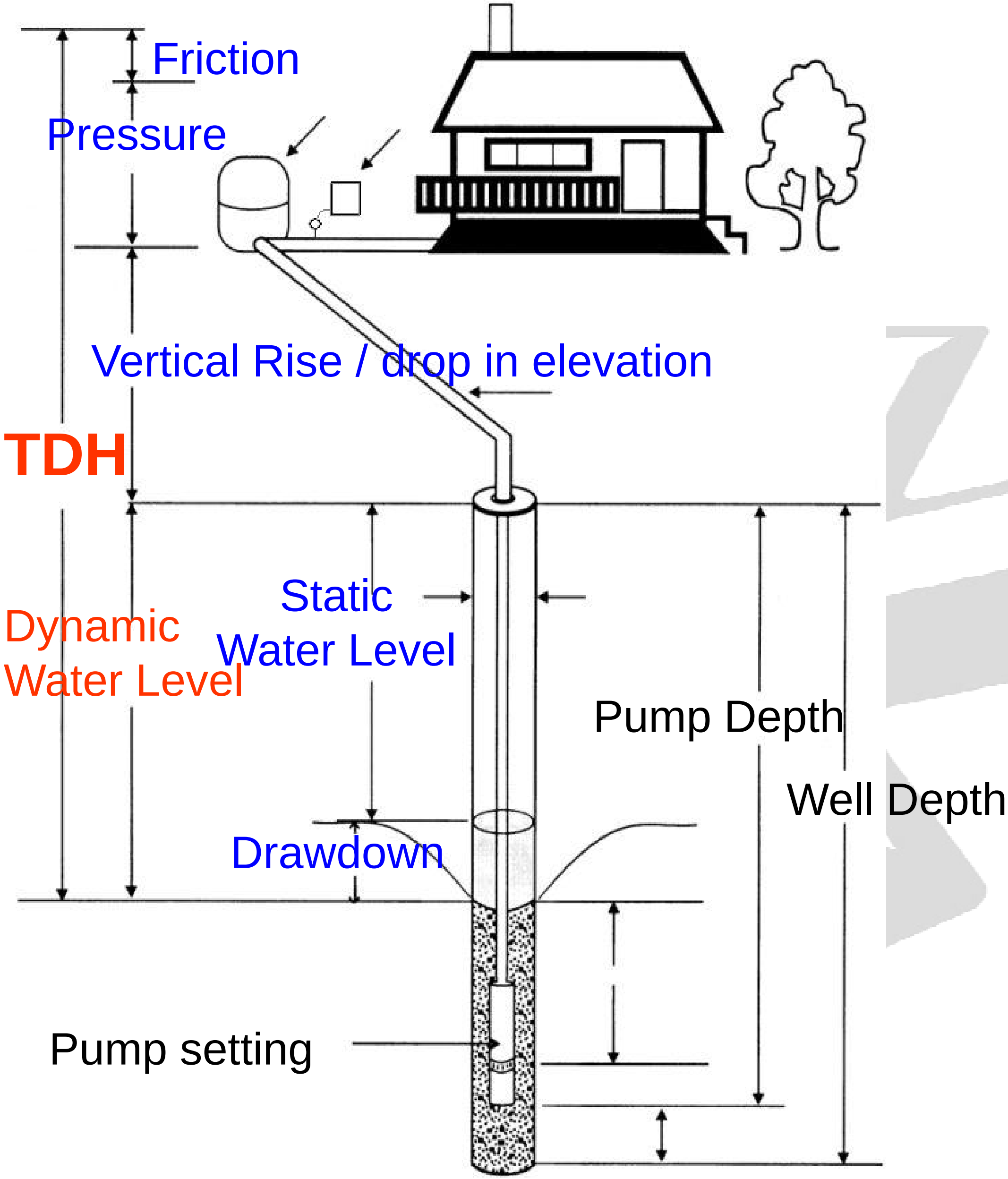
Sizing with a trimmed pump curve



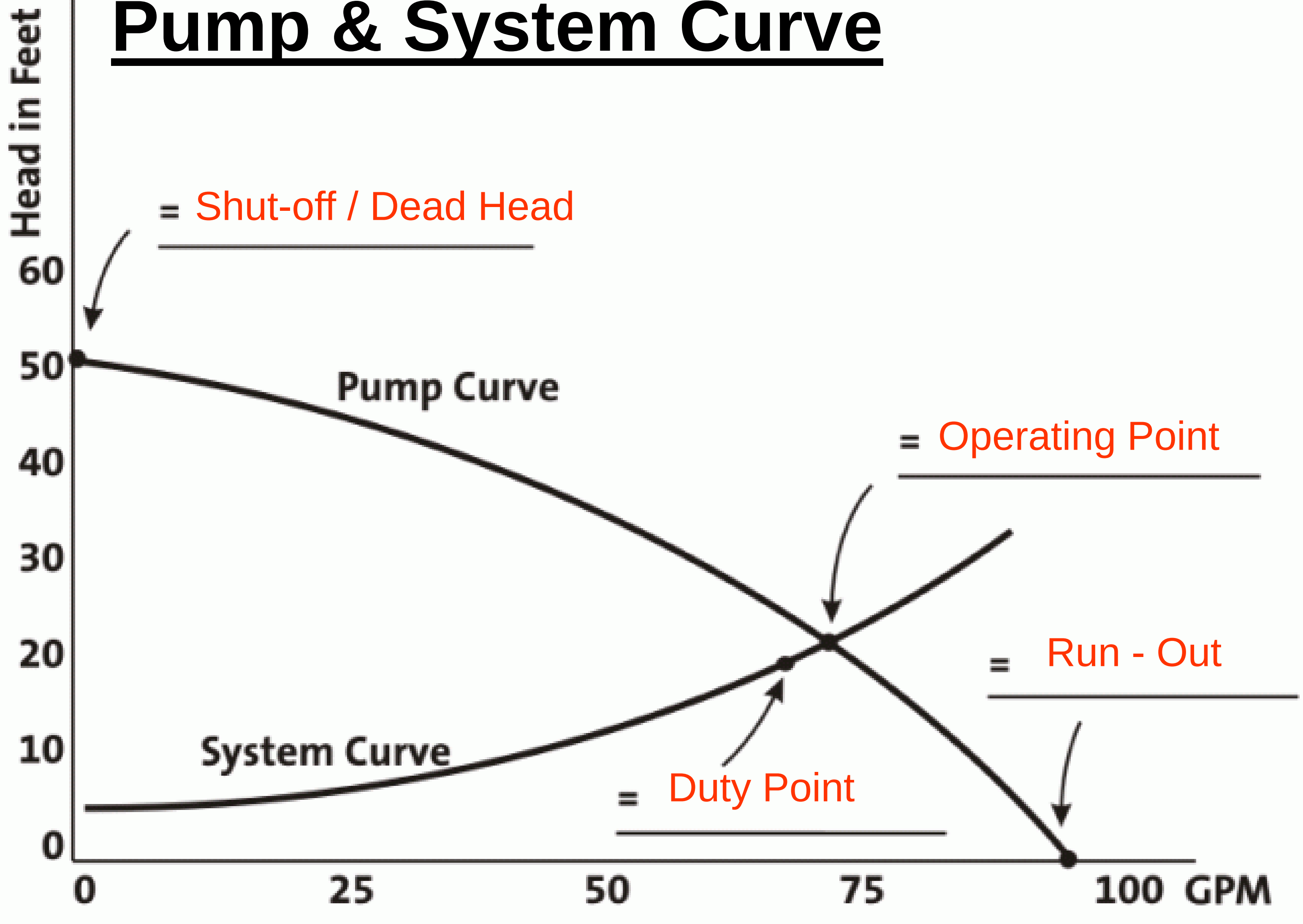
Summary

Calculating TDH

(Total Dynamic Head)

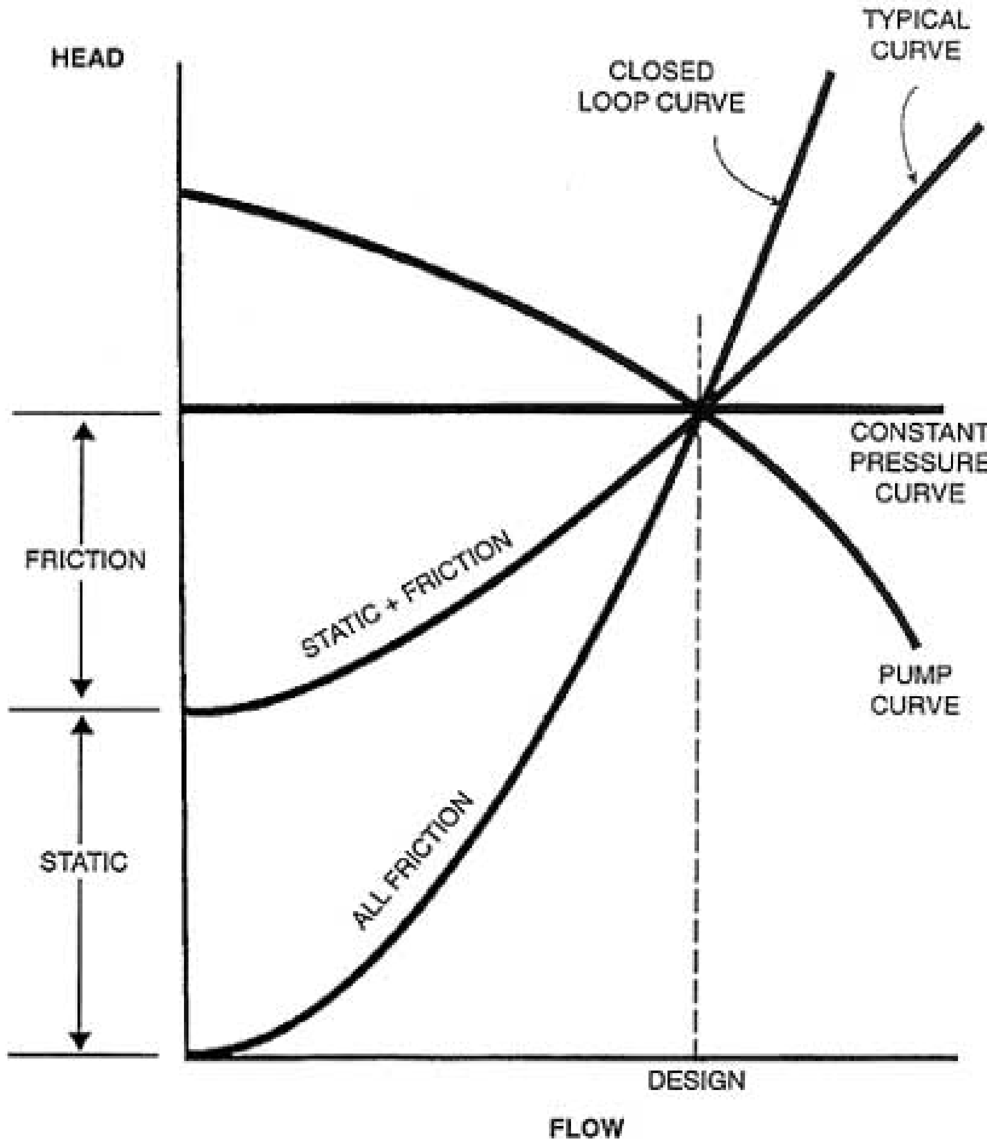


Pump & System Curve



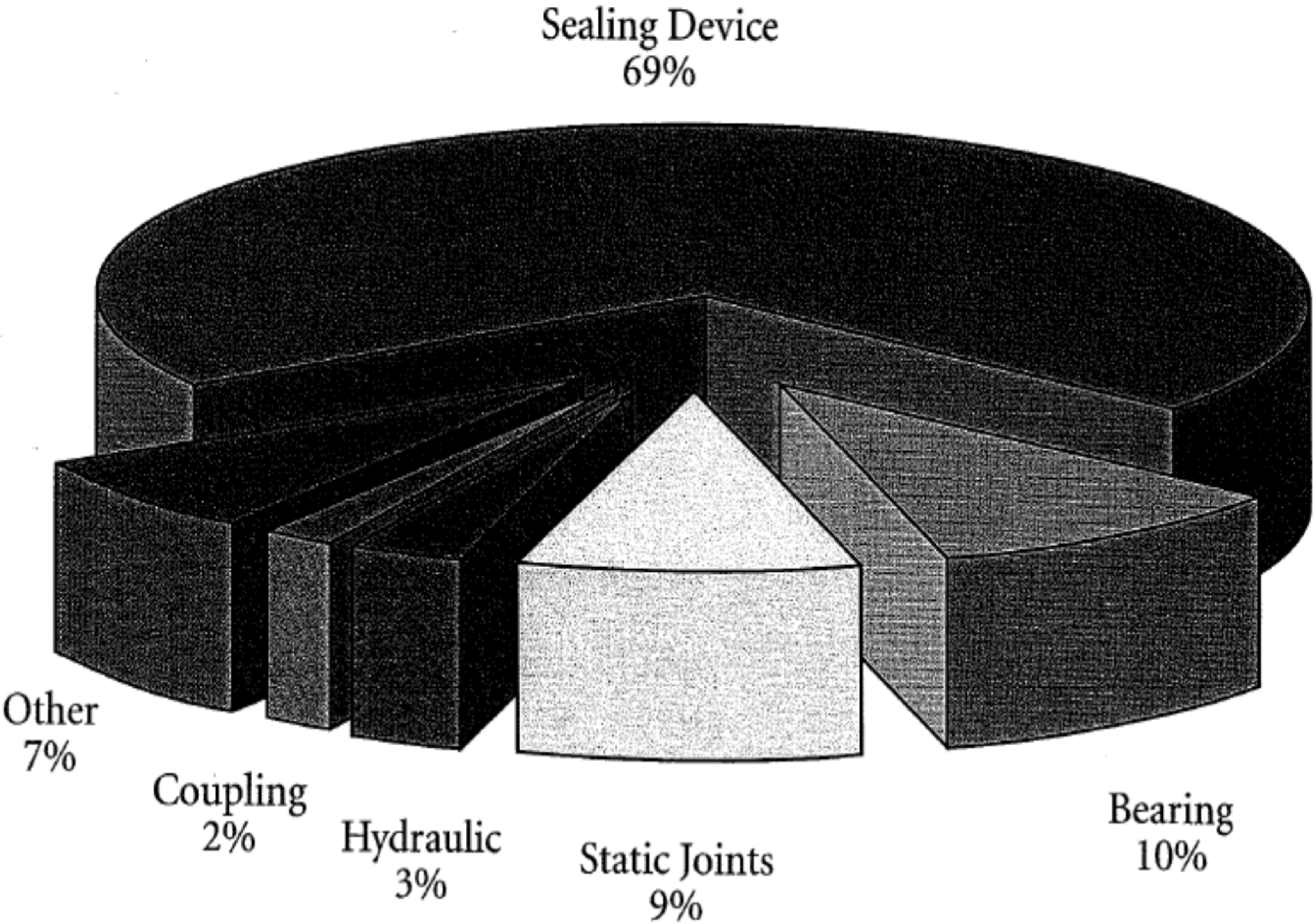
BASIC SYSTEM HEAD CURVES

Variance can be anywhere from a flat horizontal line depicting constant pressure to an almost vertical curve when the head is predominantly frictional resistance.



COMMON OPERATIONAL PROBLEMS

MOST COMMON CAUSE OF EQUIPMENT FAILURE'S



What is Cavitation?

- The affects of cavitation vary from mild to extreme, under mild conditions the pumps may last for years with only a slight reduction in efficiency and no noticeable noise.
- Extreme cavitation will result in rapid destruction of impellers and or diffusers and is normally accompanied by audible (rattling) noise (sounds like gravel).

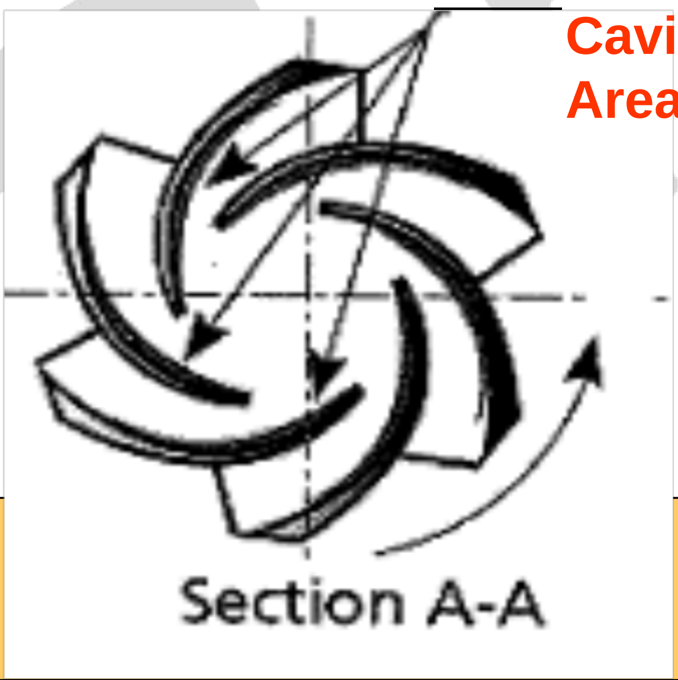
What is Cavitation
(as relates to water)

- Cavitation begins as the formation of vapor bubbles due to low pressure (Boiling off the liquid).
- The bubbles form at the position of the lowest pressure, normally in the vicinity of the impeller eye.
- The bubbles collapse as they move to a higher pressure zone.

What is Cavitation?

- This collapse is so rapid and violent that the forces generated are large enough to cause minute pockets of fatigue failure, pitting metal surfaces that are adjacent to the collapsing vapor/bubbles.

Potential Cavitation Areas



CAUSES OF Cavitation

- LOSS OF DISCHARGE PRESSURE DUE TO OPEN HYDRANTS OR LINE BREAKS
- CLOSED SUCTION VALVE
- OBSTRUCTION IN THE SUCTION LINE
- LOW SUCTION HEAD DUE TO DROP IN WATER LEVEL

Cavitation

- You can control pump cavitation by throttling the discharge valve.
- Can cavitation be a problem in piping & valves?

Yes

AIR LOCKING

AIR LOCKING IS CAUSED BY AIR OR DISSOLVED GASES THAT BECOME TRIPPED IN THE PUMP VOLUTE OR PIPING PREVENTING FLUID FROM ENTERING THE IMPELLER.

AIR LOCKING IS MOST OFTEN CAUSED BY LEAKS IN THE SUCTION LINE.

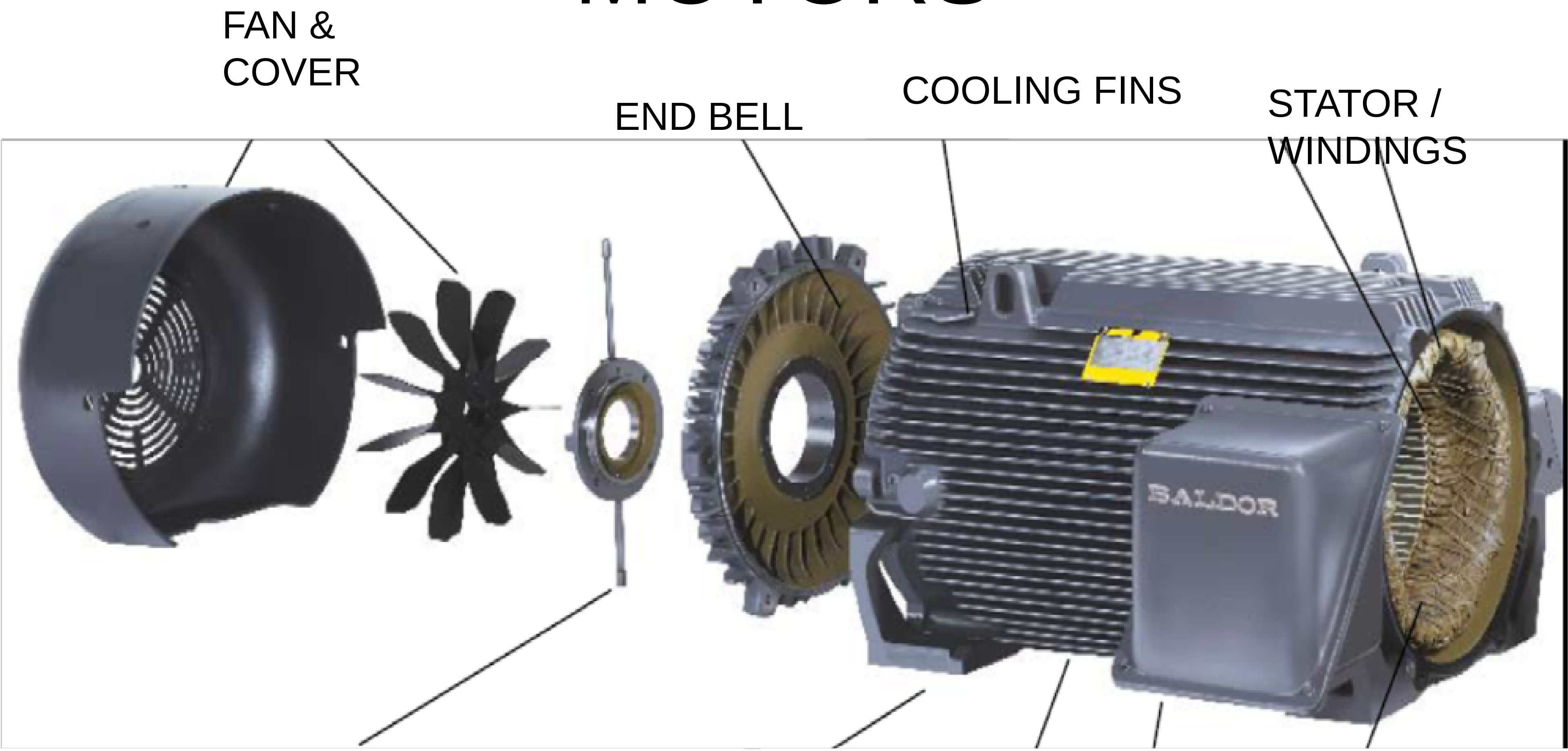
LEFT UNCHECKED AIR LOCKING CAN LEAD TO PUMP AND SEAL FAILURE FROM TEMPERATURE OR DRY-RUN.

REMEMBER THAT THE FLUID BEING PUMPED IS ALSO THE PRODUCT LUBRICATING AND COOLING THE EQUIPMENT AND IT'S COMPONENTS.

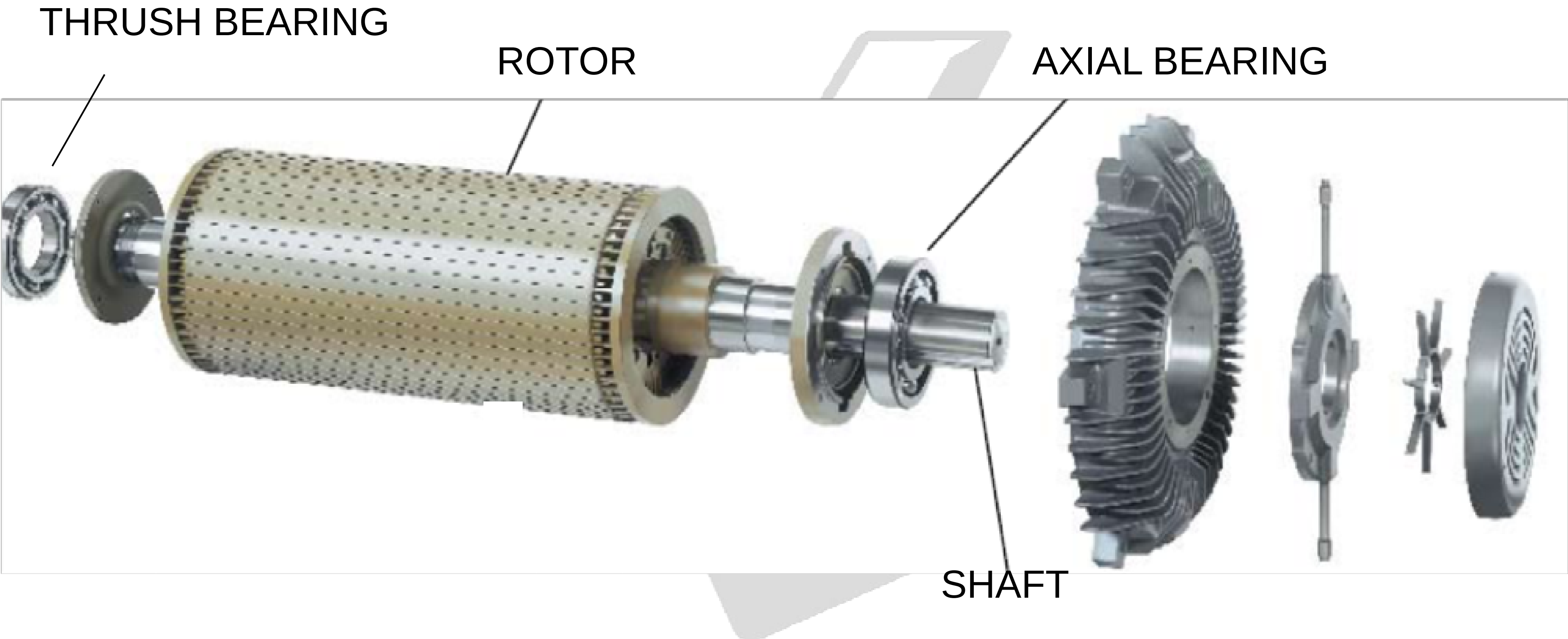
LOSS OF PRIME

- LOSS OF PRIME HAPPENS WHEN WATER RUNS OUT OF THE PUMP VOLUTE & IMPELLER; USUALLY IN A SUCTION LIFT APPLICATION.
- CAUSES ARE FAILED CHECK OF FOOT VALVE, AIR LEAKS IN SUCTION LINE.

MOTORS



MOTORS



ELECTRIC MOTORS

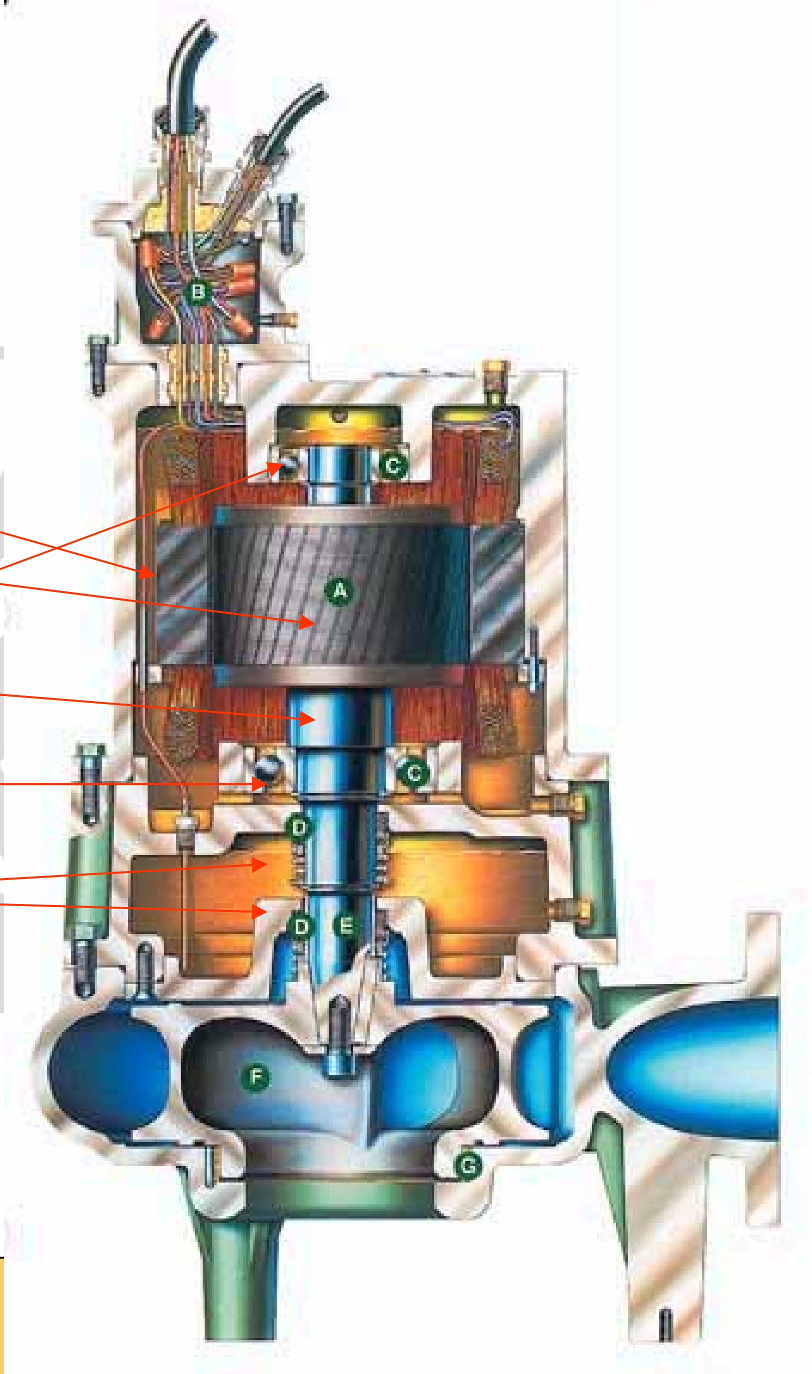
STATOR

ROTOR

SHAFT

BEARINGS

DUAL MECHANICAL SEAL



Motor
Loading, Failure & Lifetime

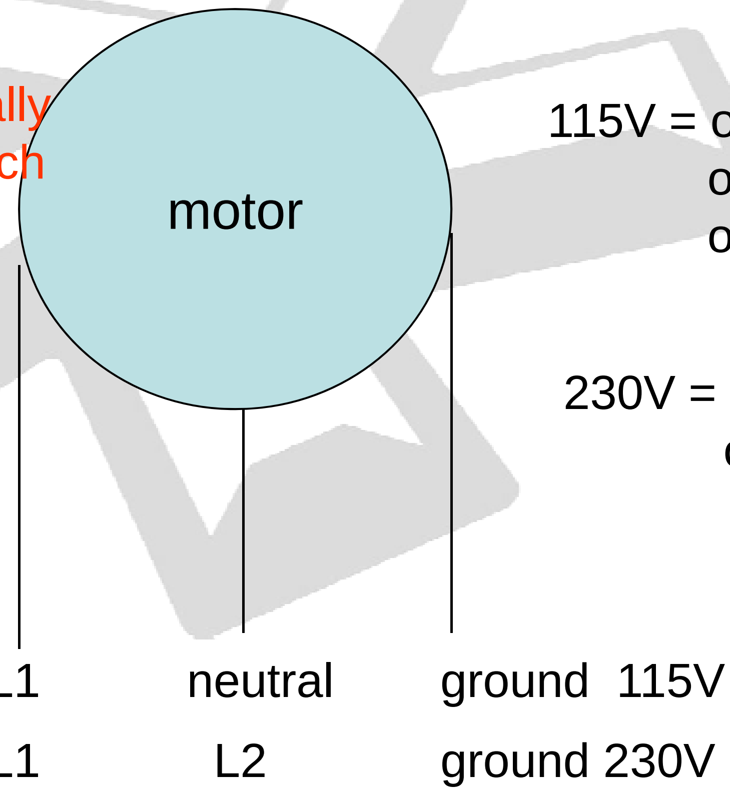
The temperature of the windings are primarily dependent on the current (amp) draw through them and the ability of the motor to dissipate the heat generated to the ambient environment.

The higher the temperature the shorter the motor life.

ELECTRIC MOTORS

- SINGLE PHASE : 115 OR 230 VOLT AC

A single phase motor usually requires starting circuit which also ensures correct rotation.



115V = one hot leg
one common leg
one ground leg

230V = two hot legs
one ground leg

Motor
Loading, Failure & Lifetime

- The voltage supplied to the motor terminals have a significant impact on the motor life.

- A rating of $\pm$ 10% is standard on motors
  - **115V (Range 103 to 127 VAC)**
  - **230V (Range 207 to 253 VAC)**

Submersible Motor Loading, Failure & Lifetime

- As voltage raise, current (amps) draw drops.

  However, above a certain voltage, destructive arching and insulation deterioration can occur.

- As voltage drops, current (amps) raises.

  Means more amps / heat to dissipated.

Submersible Motor Loading, Failure & Lifetime

Three phase motors

- Single phasing
- Voltage Unbalance

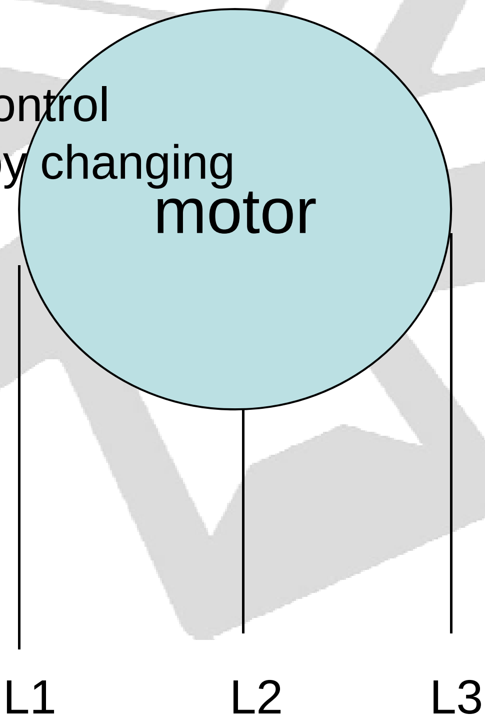
Both of these can result in one leg carrying a higher current causing motor to run hotter, shortening life.

ELECTRIC MOTORS

- THREE PHASE : 208 / 230 / 460 VOLT AC

Requires external starter control
Rotation can be reversed by changing any two leads

All three legs are hot



Incorrect Direction of Rotation

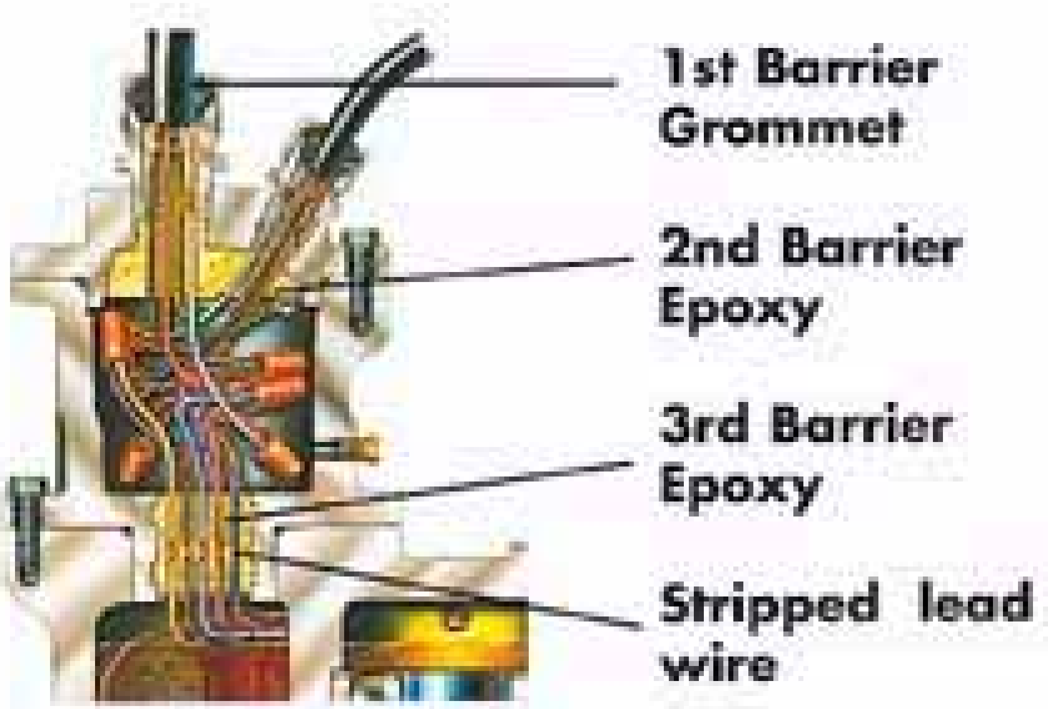
>As a practical matter, applies to 3 Phase motors only (Some 1 phase motors)

>Reduced flow and head

>Noise

>Inability to reach shutoff head

MOTOR LEAD SEALING



Three barriers ensure a dry motor for long-term, reliable operation.

System Components
Electrical

Additional Protective Devises:

- Circuit Breakers or Fused Disconnect Switch
- Run-Dry Protection
- Over Voltage Protection
- Under Voltage Protection
- Over Temperature Protection
- Phase Unbalance (three phase)
- Loss of Phase (three phase)

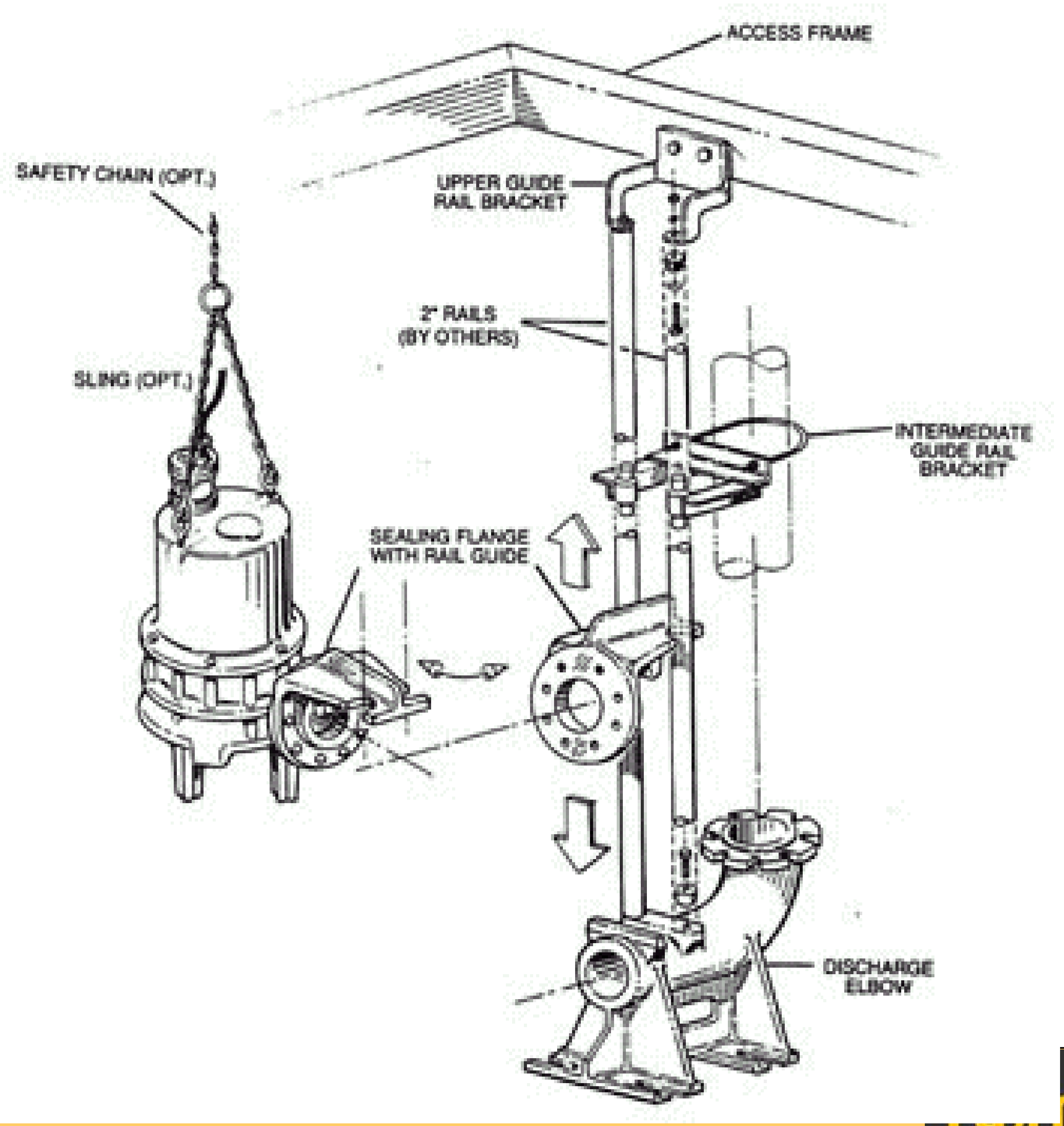
COMPONENTS ID
LIFT STATIONS

FIBERGLASS BASINS

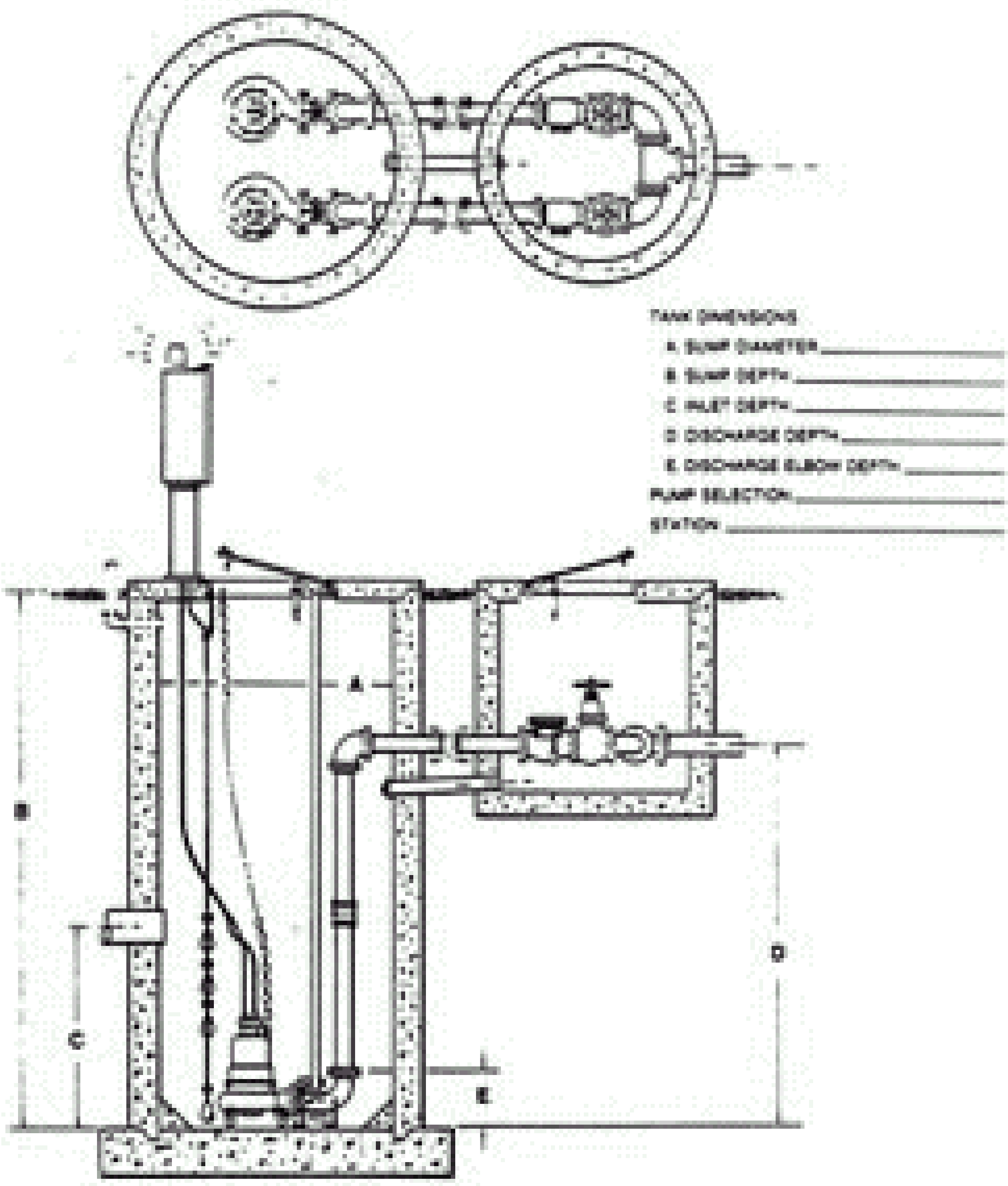
TP PUMP™

EST. 1940 KNOWLEDGE FOR SOLUTIONS.

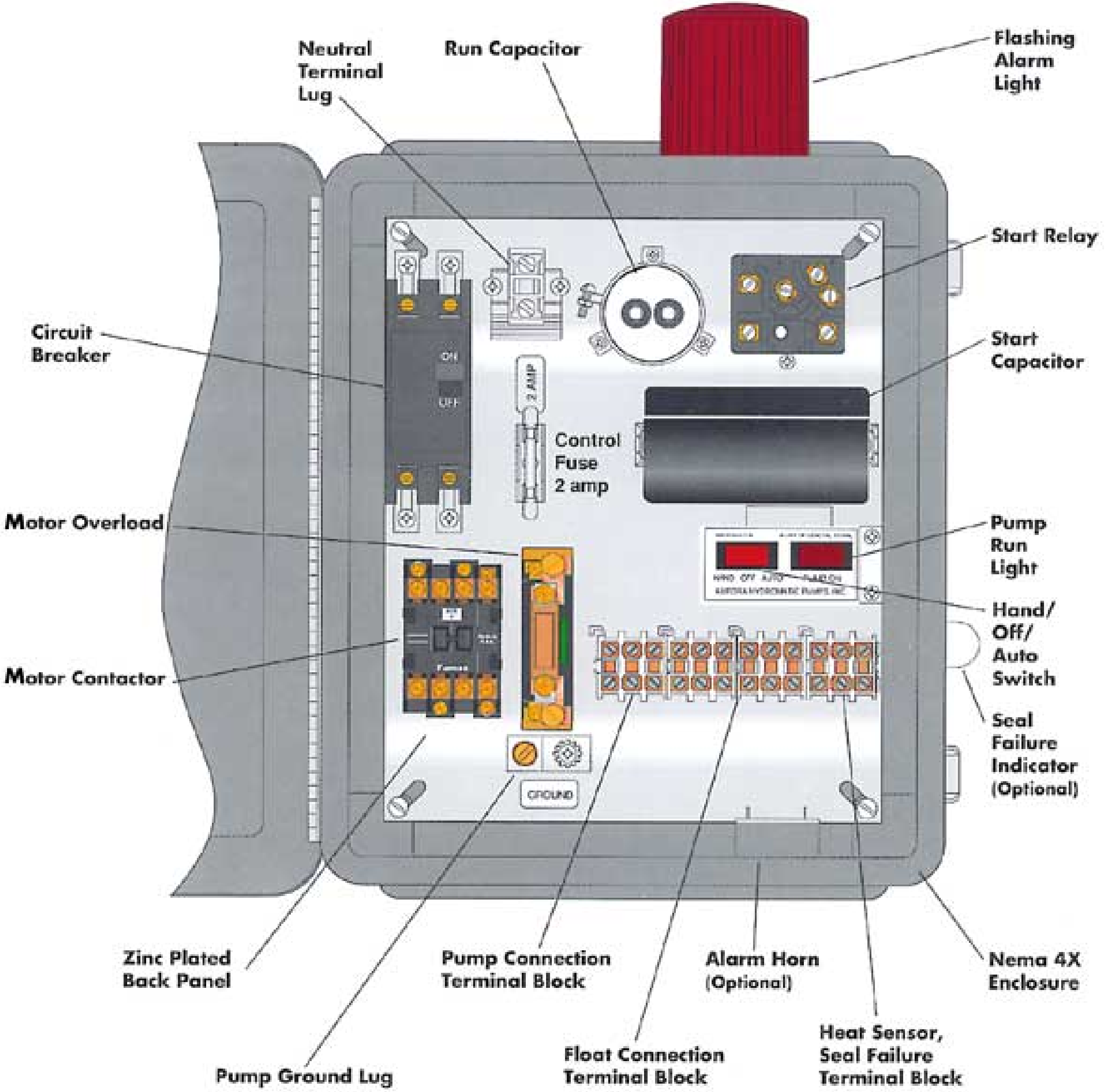
MTM


ACCESS FRAME
SAFETY CHAIN (OPT.)
UPPER GUIDE
RAIL BRACKET
2" RAILS
(BY OTHERS)
SLING (OPT.)
INTERMEDIATE
GUIDE RAIL
BRACKET
SEALING FLANGE
WITH RAIL GUIDE
DISCHARGE
ELBOW

Duplex MTM


TANK DIMENSIONS
A. SUMP DIAMETER
B. SUMP DEPTH
C. INLET DEPTH
D. DISCHARGE DEPTH
E. DISCHARGE ELBOW DEPTH
PUMP SELECTION
STATION
A
B
C
D
E

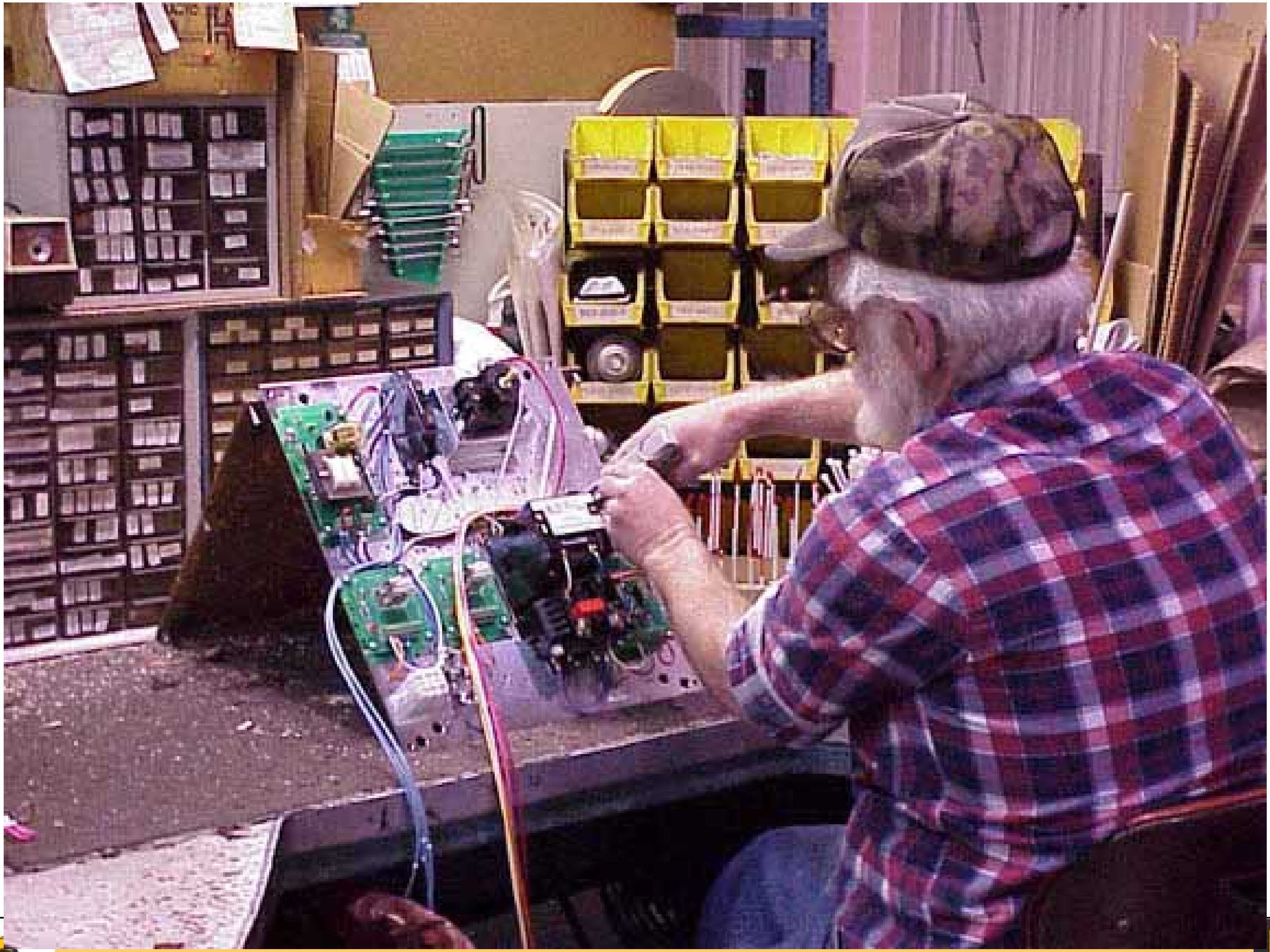
SPC-Panel



HYDROMATIC
Pentair Pump Group

1940 KNOWLEDGE FOR SOLUTIONS.

Virtual Tour Panels



TP PUMP™

EST. 1940 KNOWLEDGE FOR SOLUTIONS.

Virtual Tour Panels

TP PUMP™

EST. 1940 KNOWLEDGE FOR SOLUTIONS.

Virtual Tour Panels

Virtual Tour Panels

HYDROMATIC®

3900/8300

Mercury Switch Level Switch

c UL us LISTED

HYDROMATIC®
Pentair Pump Group

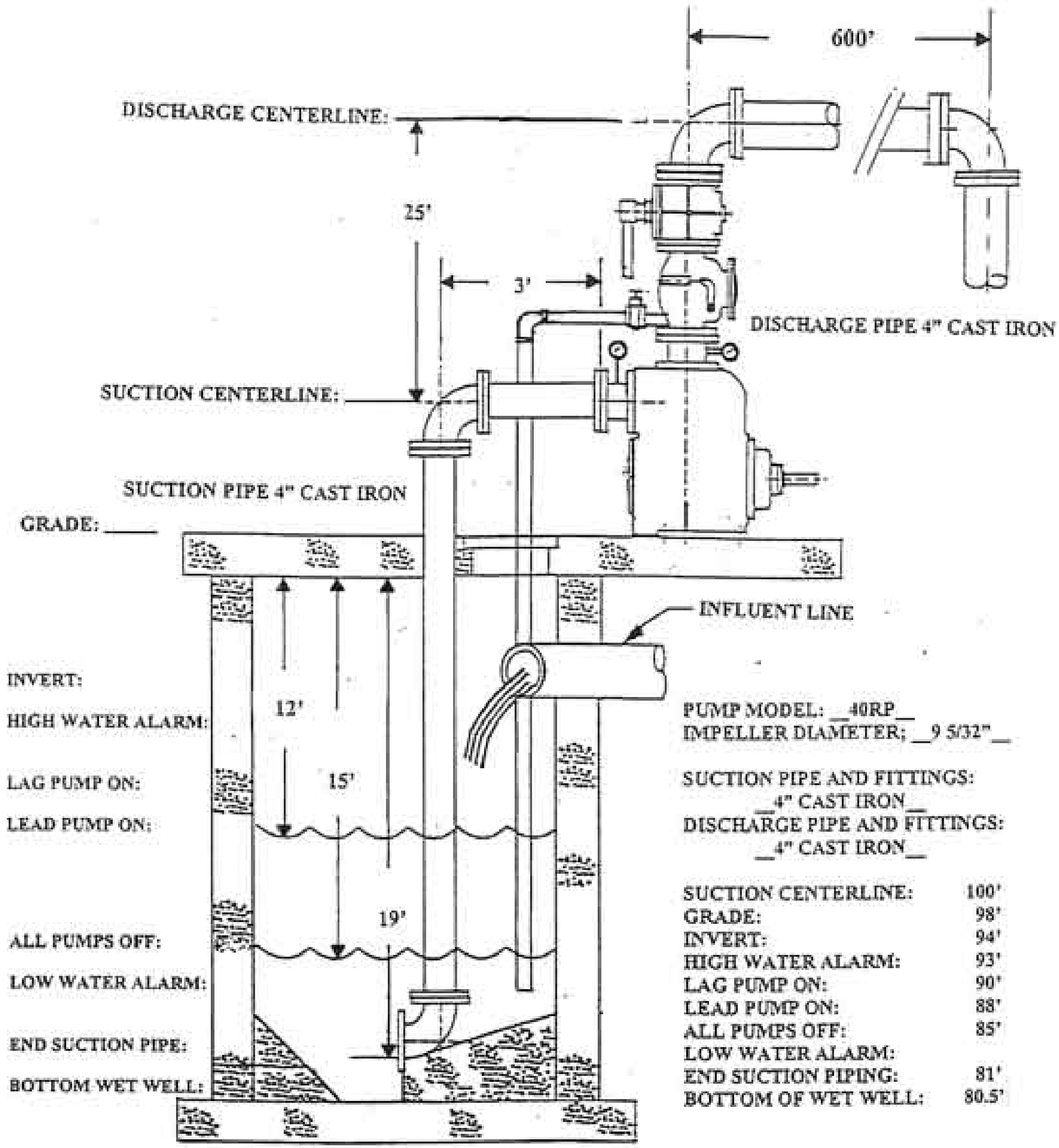
TP PUMP™

EST. 1940 KNOWLEDGE FOR SOLUTIONS.

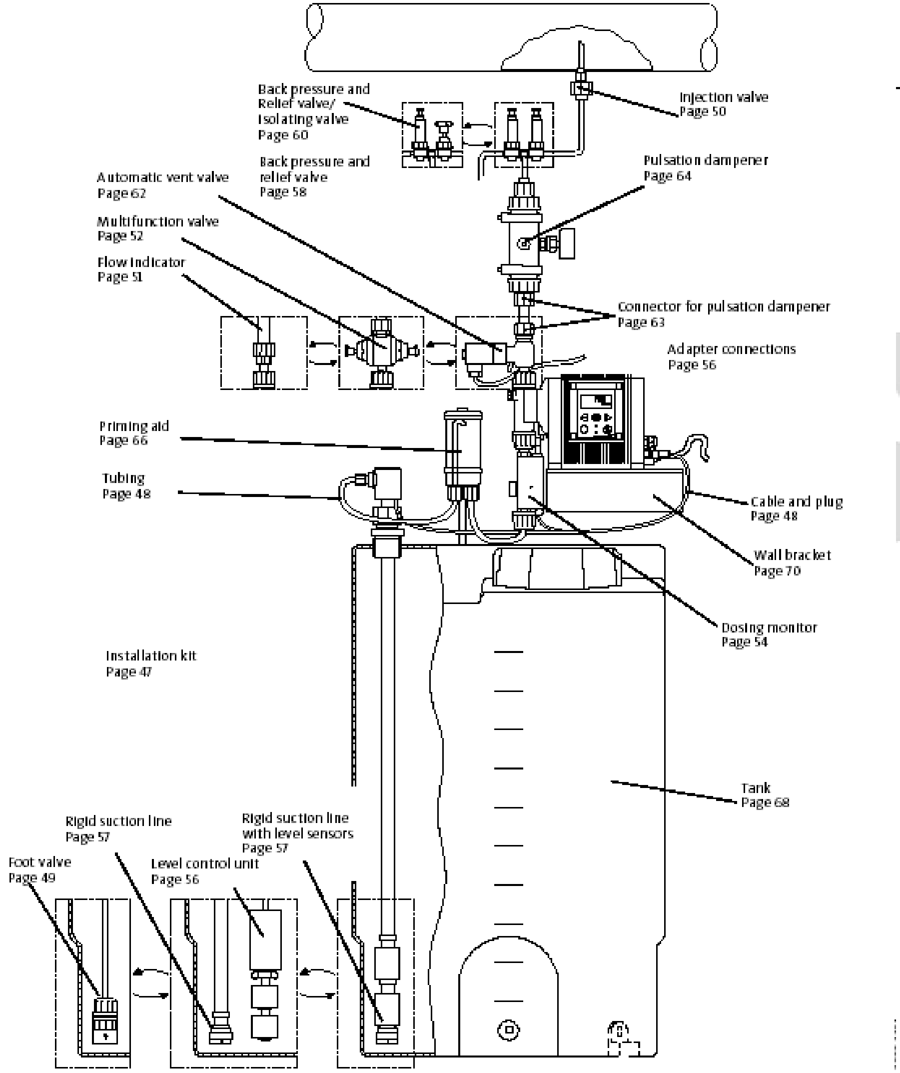
END

DATE: ____ / ____ / ___ LOCATION: ANYWHERE U. S. A.

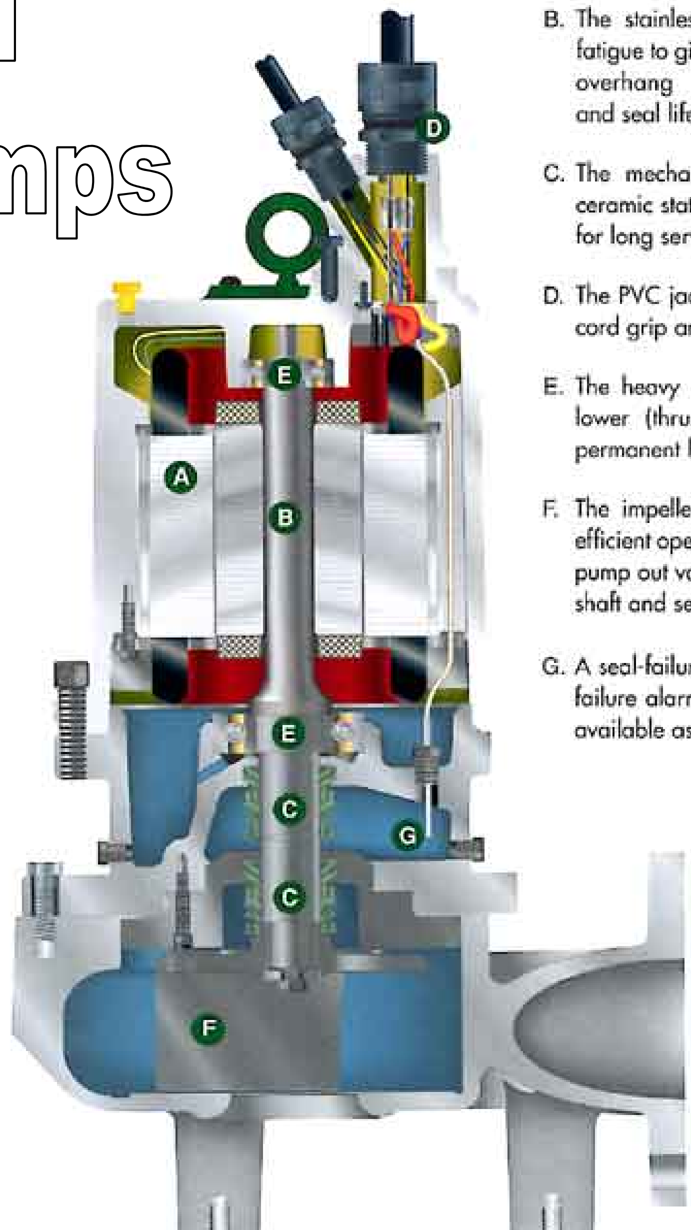
JOB NAME: ZYX INC. GPM: 260 @ TDH: 62'



Typical Metering System



Dual Seal Sewage Pumps



Model: S3SD

A. The fully enclosed oil-filled motor efficiently dissipates heat and locks out moisture so you receive reliable pumping service.

B. The stainless steel shaft eliminates corrosion and fatigue to give longer pump life. The minimum shaft overhang decreases deflection and increases and seal life.

C. The mechanical dual seal is constructed with a ceramic stationary face and a carbon rotating face for long service life.

D. The PVC jacketed power cord is sealed by both the cord grip and additionally by the epoxy barrier.

E. The heavy duty ball bearings, upper (radial) and lower (thrust), are submerged in oil to provide permanent lubrication and insure long service life.

F. The impeller is a two vane semi-open design for efficient operation without clogging. The impeller has pump out vanes to prevent material build up around shaft and seal.

G. A seal-failure sensor probe (for connection to a seal failure alarm) is standard on three-phase units and available as a option on single phase models.

TP PUMP™

Virtual Tour - Non-Clogs

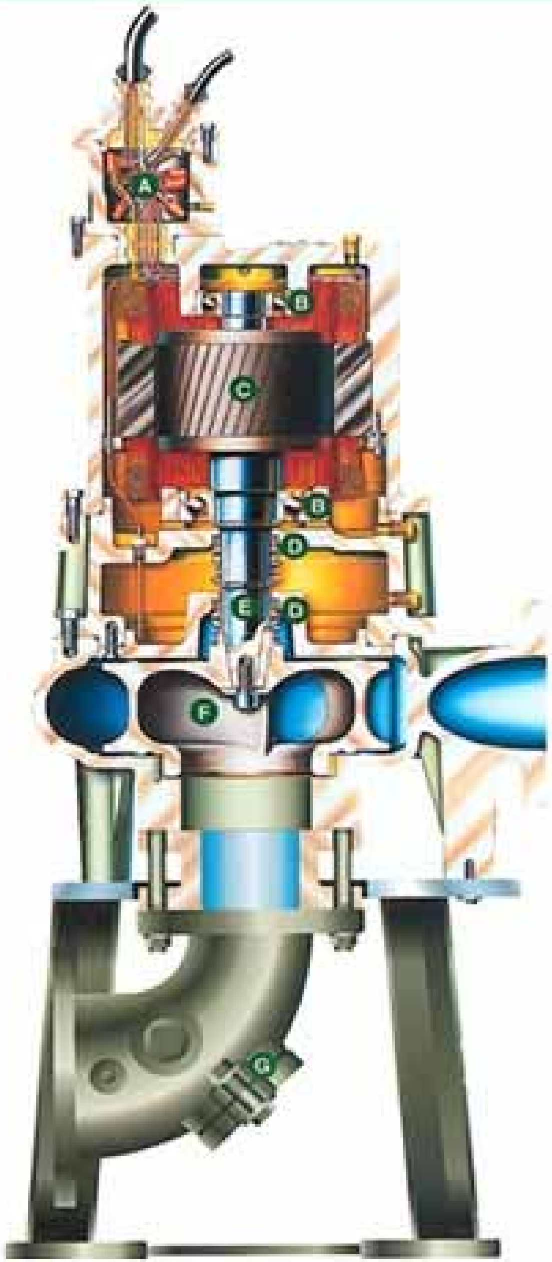
TP PUMP™

EST. 1940 KNOWLEDGE FOR SOLUTIONS.

Virtual Tour - Non-Clogs

Virtual Tour - Non-Clogs

BENEFITS



A. Connection Box
Two epoxy barriers and a compression fitting prevent water contamination of the motor area assuring long term reliable operation. Additionally, epoxy encapsulation and stripped leads positively eliminate "wicking" from the cable.

B. Bearings
Heavy-duty ball bearings, upper (radial) and lower (thrust), are submerged in oil to provide permanent lubrication and ensure long service life.

C. Motor
Hydromatic uses "Class H" Insulation for long life. Three phase pumps are suitable for use with VFD drives. Oil filled motor efficiently dissipates heat and locks out damaging moisture so you receive reliable pumping service.

D. Seals
Dual seal system operates in an oil chamber to provide long pump service life.

E. Shaft
The stainless steel shaft eliminates corrosion and fatigue to give longer pump life. The minimum shaft overhang decreases deflection and increases bearing and seal life.

F. Impeller
Two vane non-clog impellers provide the most energy efficient design. Pump-out vanes on the top shroud prevent the build up of materials in the seal area and extend the life of the thrust bearing by significantly reducing axial thrust.

G. Clean-Out
The pump is provided with a clean-out type cast iron suction elbow which is bolted directly to the pump suction flange. A clean-out hole is provided with a removable cover of the largest possible size.


GRUNDFOS