C AND C PUMPS AND SUPPLY

ILLINOIS RURAL WATER ASSOCIATION

OBLONG, IL HYDRAULICS TRAINING SESSION | DECEMBER 6, 2022

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A WILO COMPANY

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ENGINEERED PRODUCTS

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PUMPS & SUPPLY
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ENGINEERED SOLUTIONS • QUALITY PRODUCTS • EXCEPTIONAL SERVICE

PRESSURE VS. HEAD | WHAT!?!

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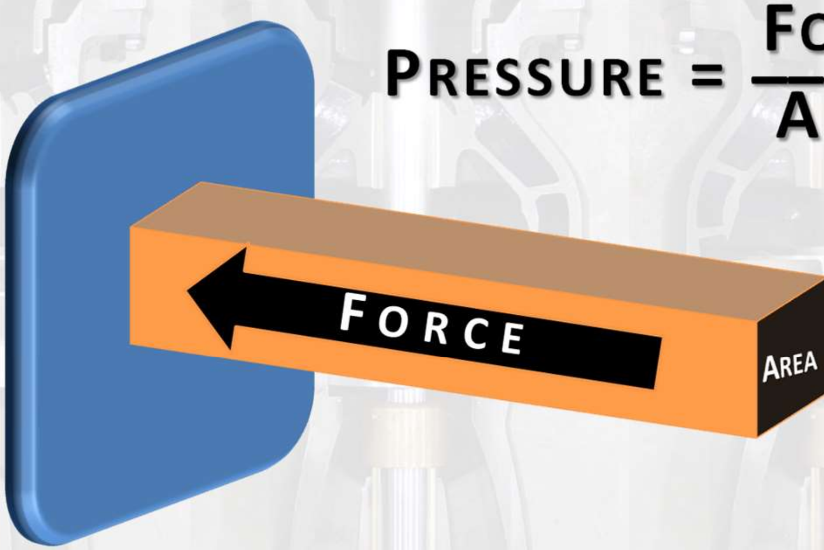
Marion, IL
618-997-2311

PRESSURE HEAD IS AN ALTERNATIVE WAY OF DESCRIBING PRESSURE

INSTEAD OF GIVING UNITS AS FORCE PER UNIT AREA (PSI – POUNDS PER SQUARE INCH)

PRESSURE IS EXPRESSED AS DEPTH IN A LIQUID AT WHICH PRESSURE EQUALS PRESSURE OF INTEREST

WHAT!?!



$$\text{PRESSURE} = \frac{\text{FORCE}}{\text{AREA}} = \frac{\text{POUNDS}}{\text{IN}^2} = \text{PSI}$$

PRESSURE VS. HEAD | WHAT!?!

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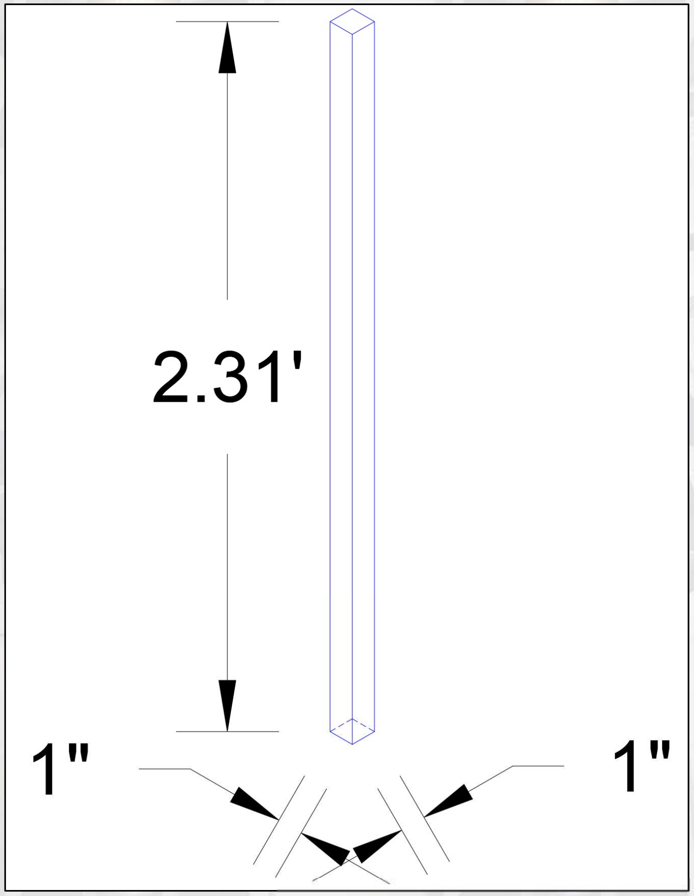
PRESSURE IS EXPRESSED AS DEPTH IN A LIQUID AT WHICH PRESSURE EQUALS PRESSURE OF INTEREST



1. 1 PSI = 2.31’ OF HEAD
2. 1 POUND PER IN^2 = 2.31’
3. SO, 2.31’ OF WATER WEIGHS 1 POUND PER IN^2
4. WATER WEIGHS 8.34 LBS/GAL
5. VOLUME = L X W X H
6. VOLUME = (1/12) X (1/12) X 2.31 = 0.016 FT^3
7. WEIGHT = 0.016 FT^3 X 7.48 GAL/FT^3 X 8.34 LBS/GAL = 1 POUND
8. SO, 1 IN^2 OF WATER 2.31’ TALL WEIGHS 1 POUND
9. 1 PSI = 2.31’ OF WATER

PRESSURE VS. HEAD | WHAT!?!

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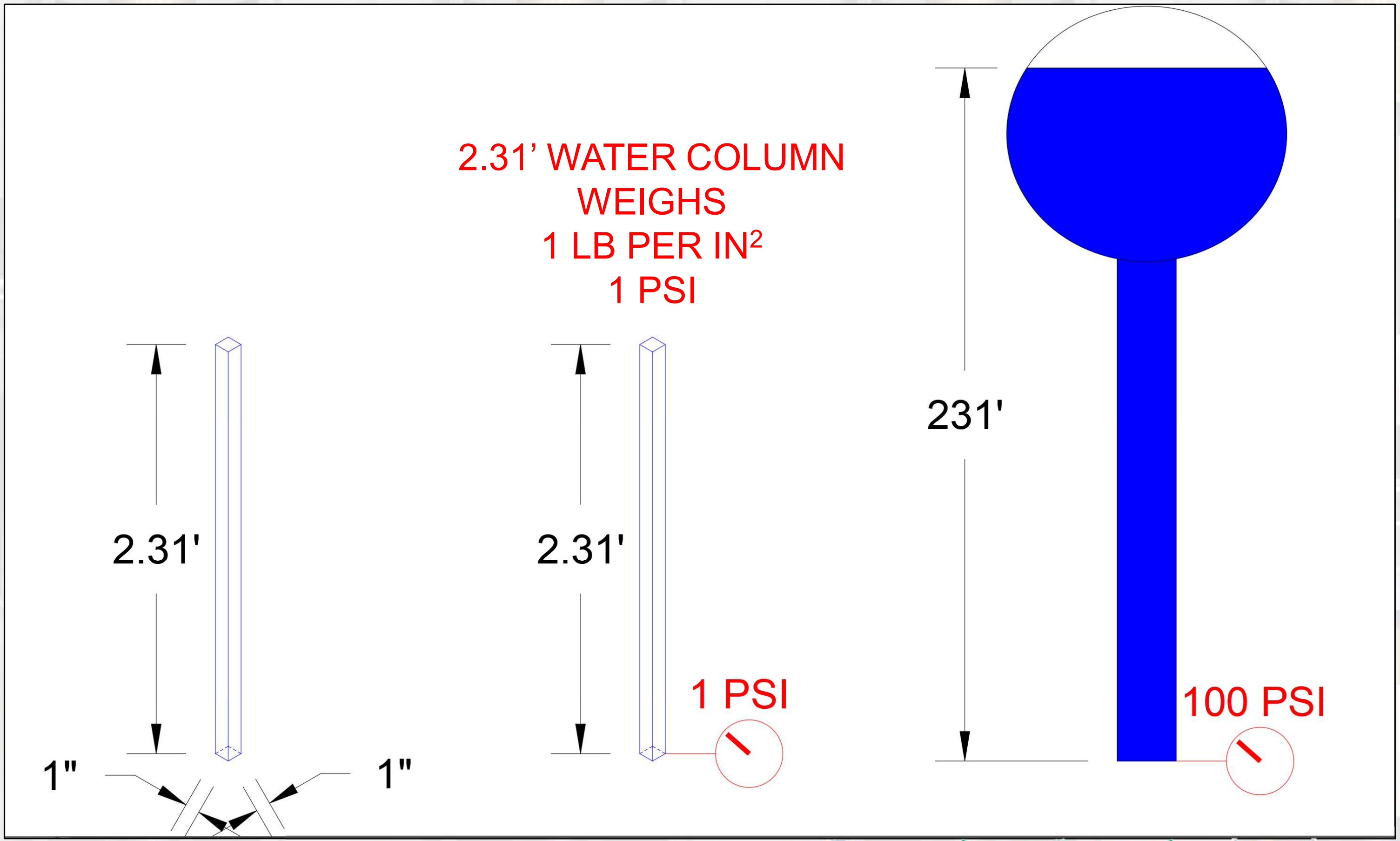

PRESSURE VS. HEAD | WHAT!?!

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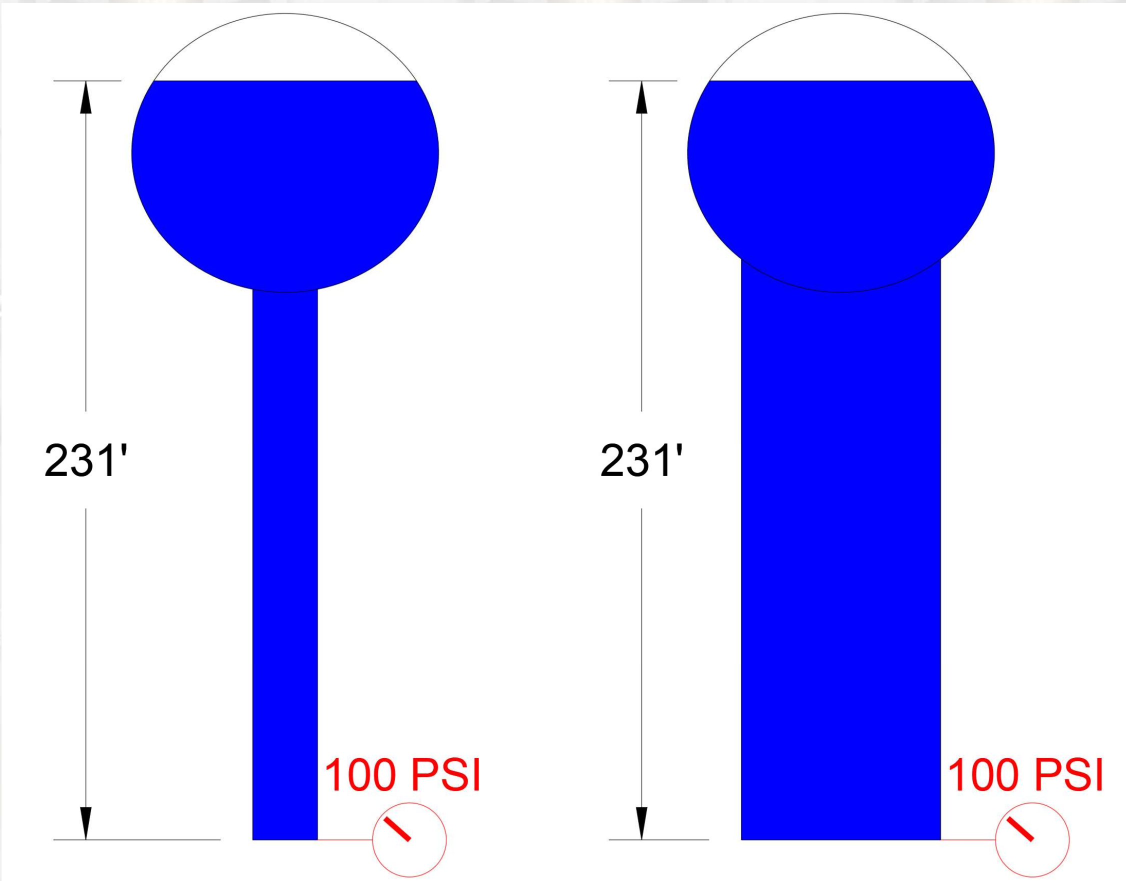

1. 1 PSI = 2.31' OF HEAD
2. IT DOESN'T MATTER PIPE SIZE
3. 2.31' OF WATER WEIGHS 1 POUND PER IN^2
4. WE'RE NOT MEASURING TOTAL WEIGHT
5. WE WANT TO KNOW HOW MUCH WATER HEAD WEIGHS PER IN^2
6. THAT IS 2.31' OF WATER HEAD = 1 PSI
7. IT DOES HAVE TO BE WATER WITH SG = 1.0

WHAT IS 1 ATM (ATMOSPHERE)?

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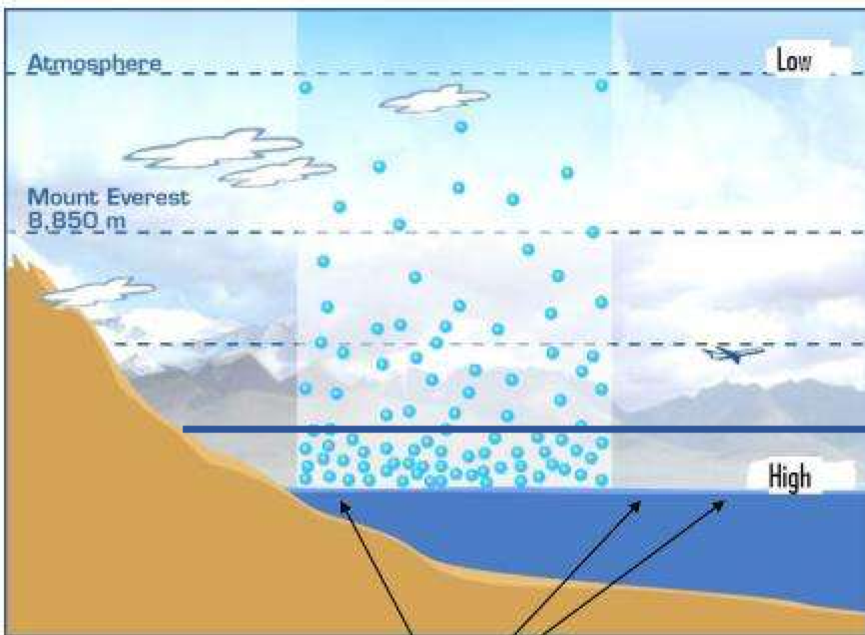
ATMOSPHERIC PRESSURE



HIGHER ALTITUDE | LOWER PRESSURE
(THERE IS LESS AIR ABOVE YOU)

MARION, IL | 520.00 = 14.4 PSI = 33.3’

LOWER ALTITUDE | HIGHER PRESSURE
(THERE IS MORE AIR ON TOP OF YOU)

SEA LEVEL = 1 ATM OF PRESSURE = 14.7 PSI = 33.9’

THE AIR ABOVE US HAS A WEIGHT | AT SEA LEVEL = 14.7 PSI

WHAT IS 1 ATM (ATMOSPHERE)?

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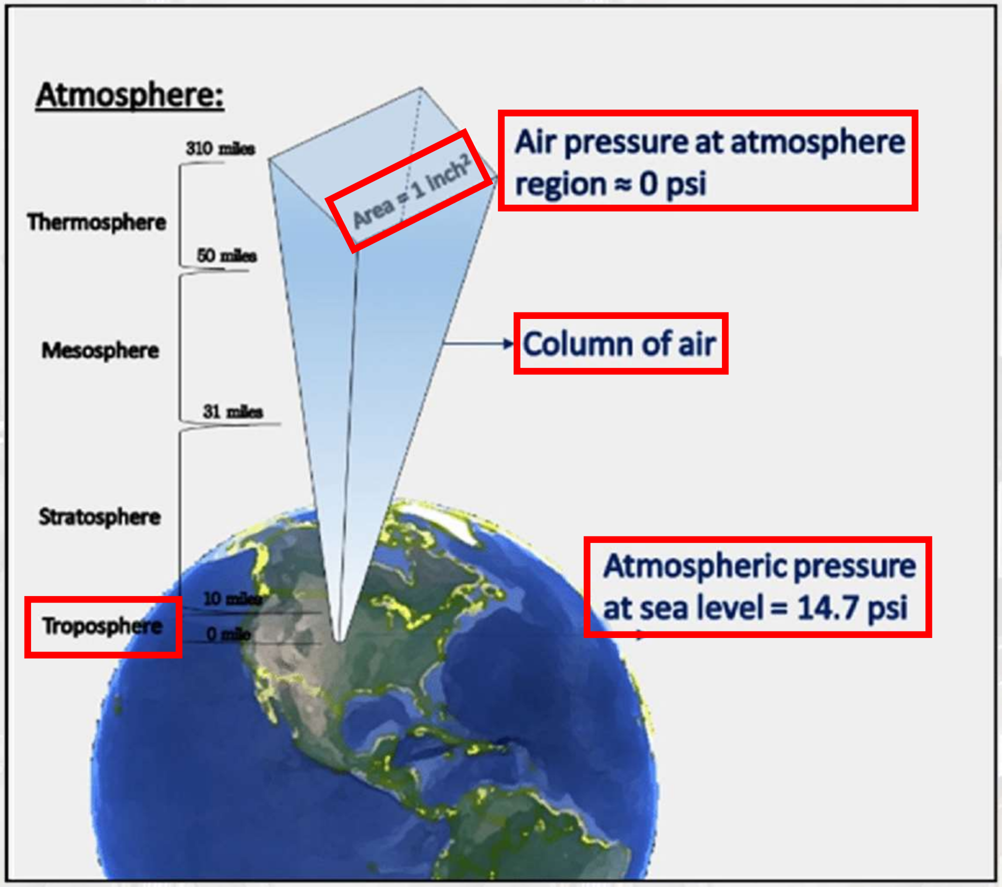
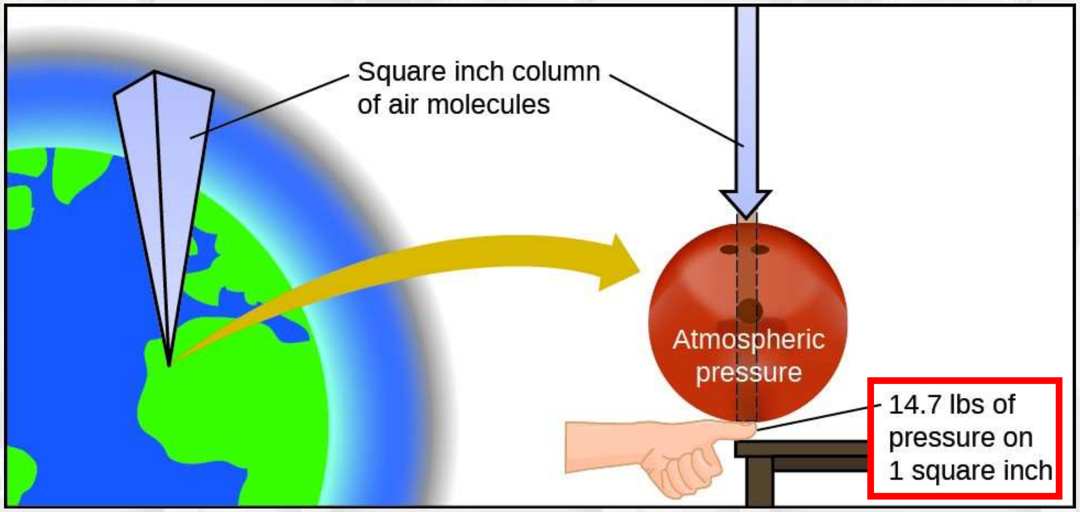
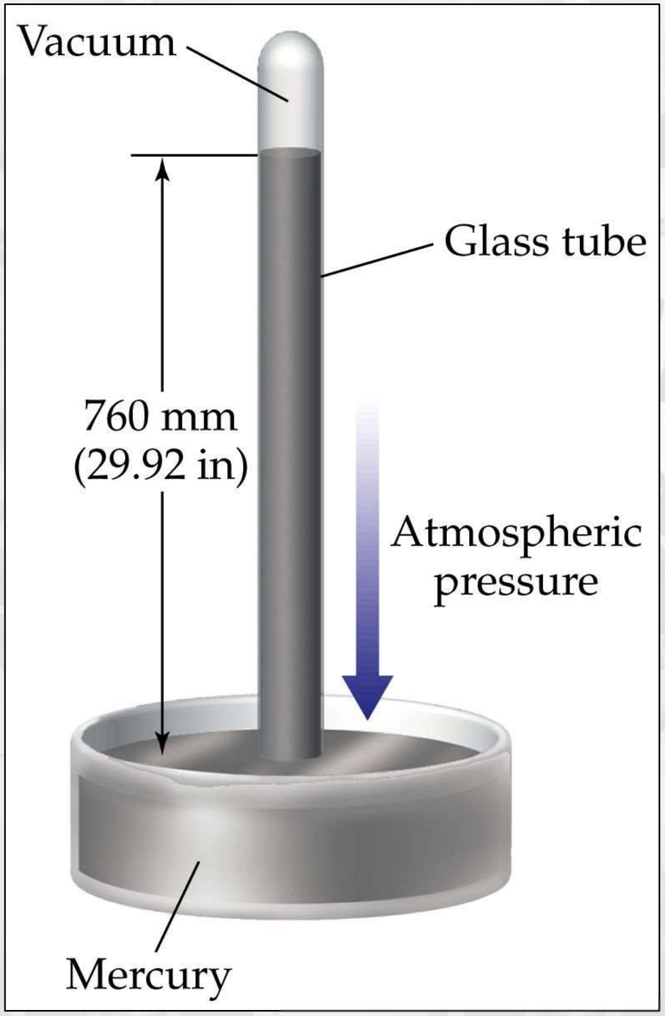




WHY CAN'T WE FEEL ATMOSPHERIC PRESSURE?

1. AT SEA LEVEL, THE ATMOSPHERE IS BEARING DOWN ON US AT 14.7 PSI (BOWLING BALL ON THUMB)
2. WE CAN'T FEEL IT BECAUSE THE AIR IN OUR BODIES EXERTS SAME PRESSURE OUTWARDS:
   - THERE'S NO PRESSURE DIFFERENCE AND NO NEED TO EXERT ANY EFFORT | FISH CAN!

HOW DO WE MEASURE ATMOSPHERIC PRESSURE?



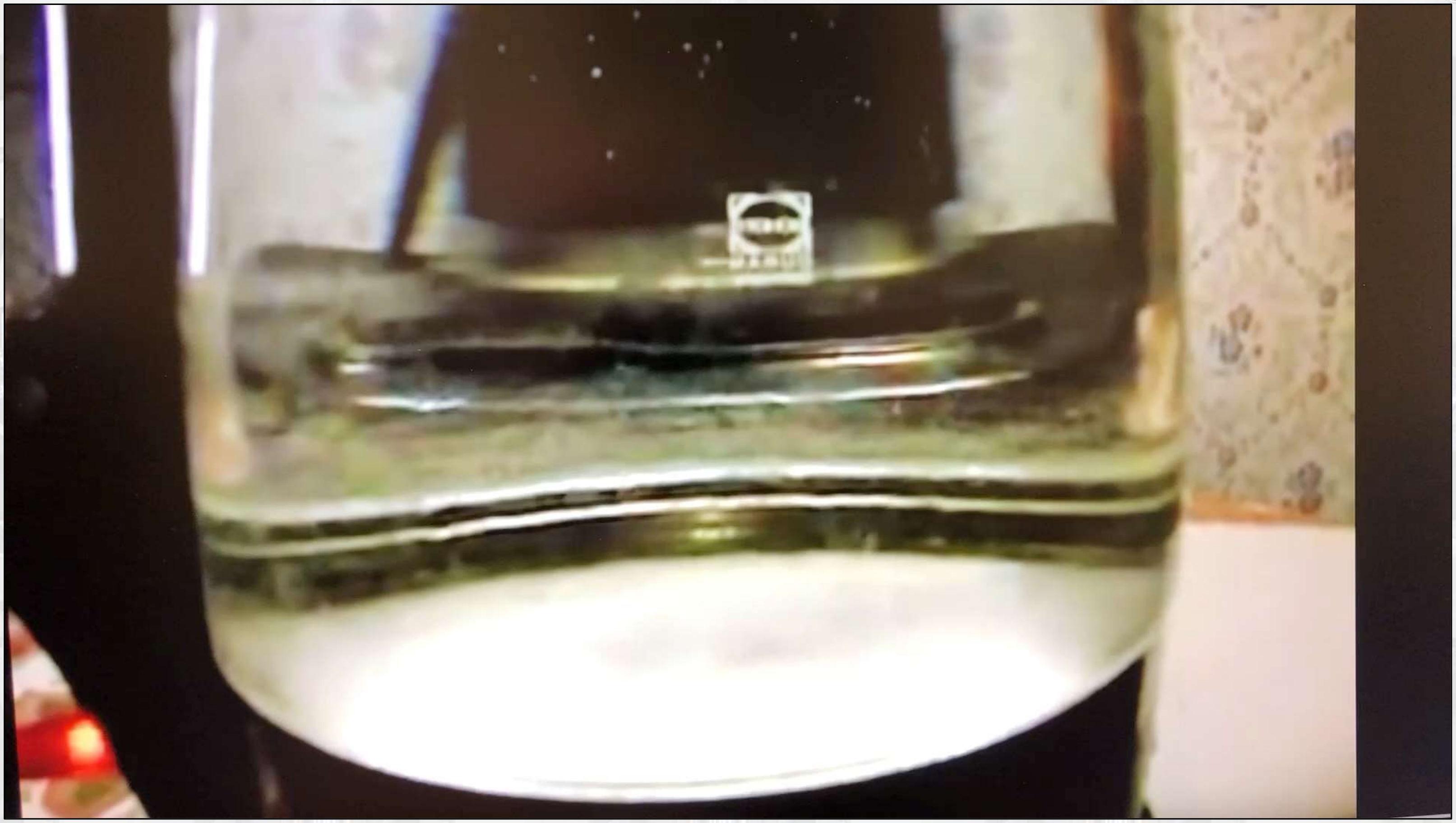
MERCURY BAROMETER

1. FILL GLASS TUBE WITH MERCURY
2. COVER THE OPEN END AND INVERT IN BOWL OF MERCURY
3. IF AIR IS NOT ALLOWED IN, SPACE ABOVE MERCURY IS A VACUUM
4. MERCURY RISES TO LEVEL OF ATMOSPHERIC PRESSURE

MEASUREMENT AT SEA LEVEL

1. 760mm OF MERCURY = 29.92” OF MERCURY
2. 29.92” OF MERCURY X **1.133** = 33.9’ OF WATER = 1 ATM

WATER BOILS AT 212° F, RIGHT?



WATER BOILS AT 212° F, RIGHT?

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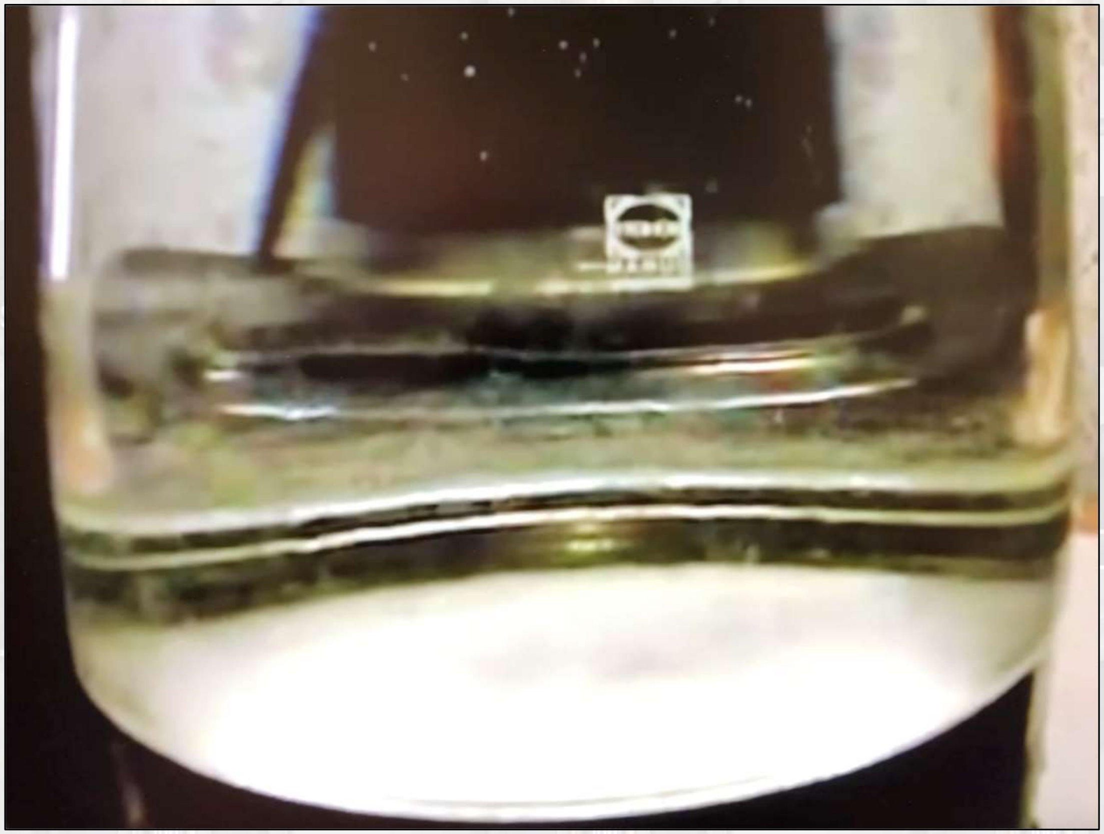

WATER OCCUPIES 100% OF VOLUME

AIR OCCUPIES SIGNIFICANT AMOUNT OF VOLUME

WATER BOILS AT 212°F, RIGHT?

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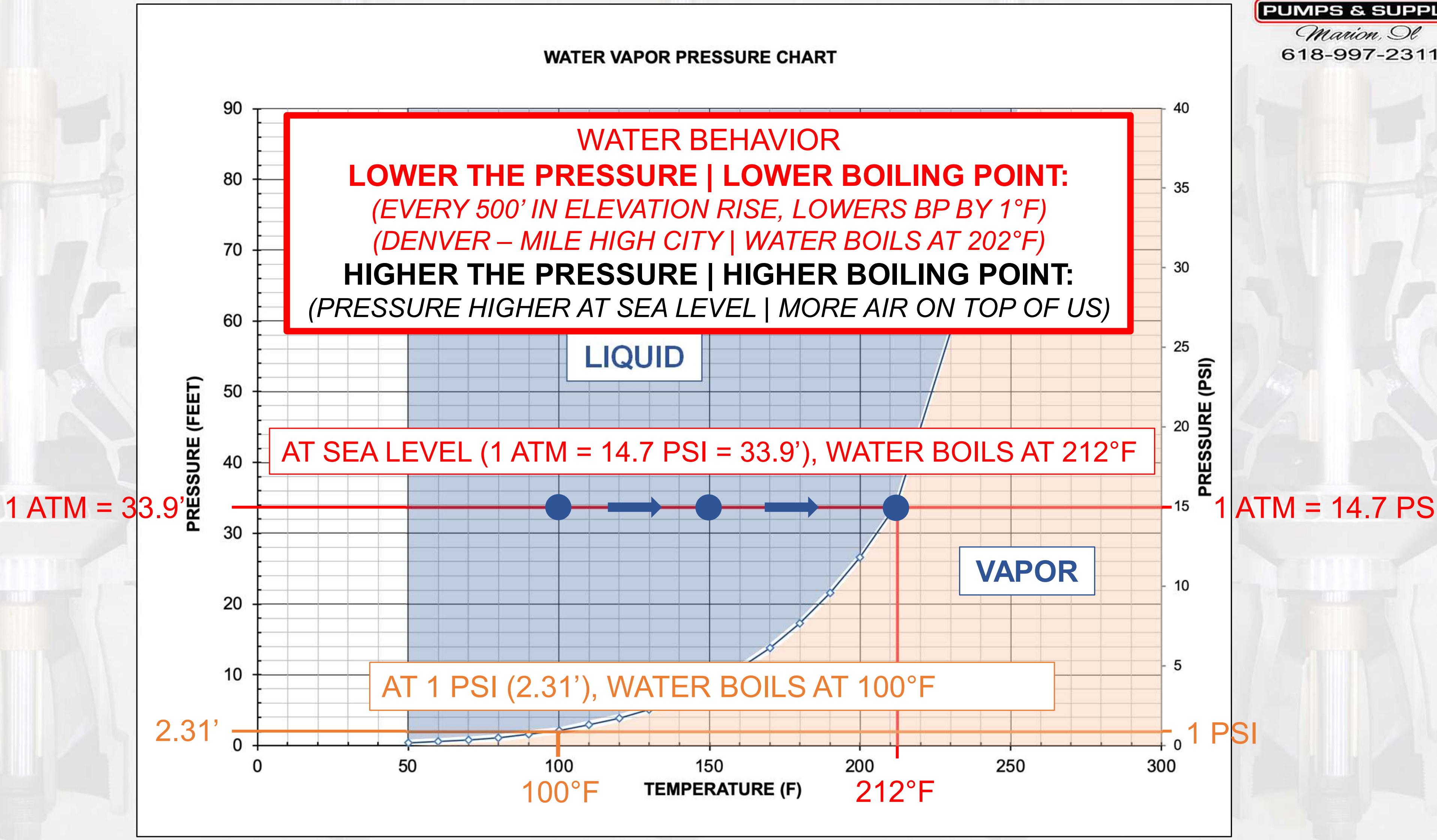

HOW DOES A CENTRIFUGAL PUMP WORK?

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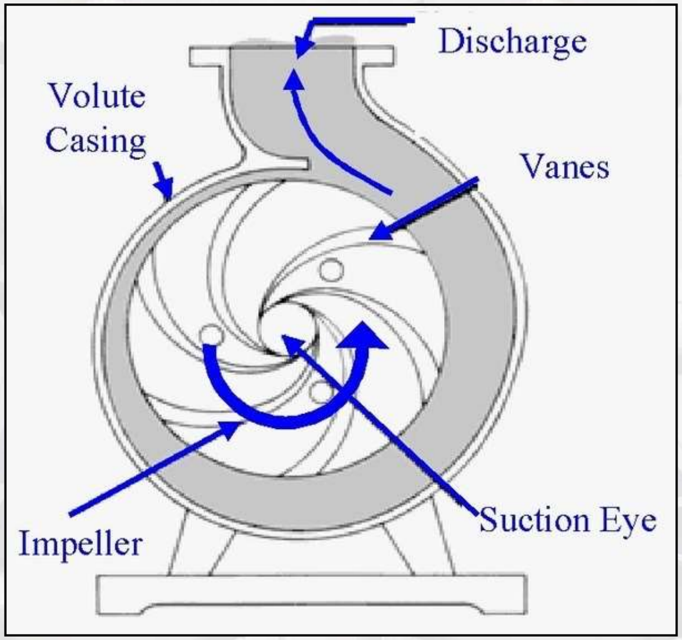
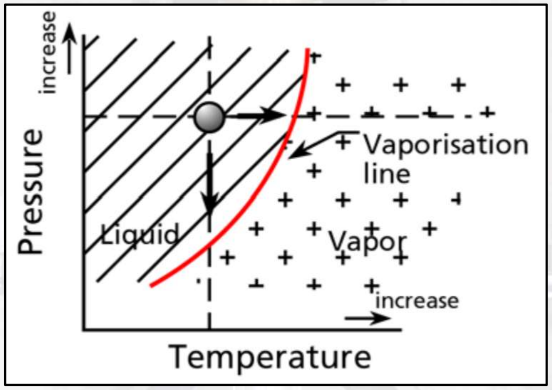
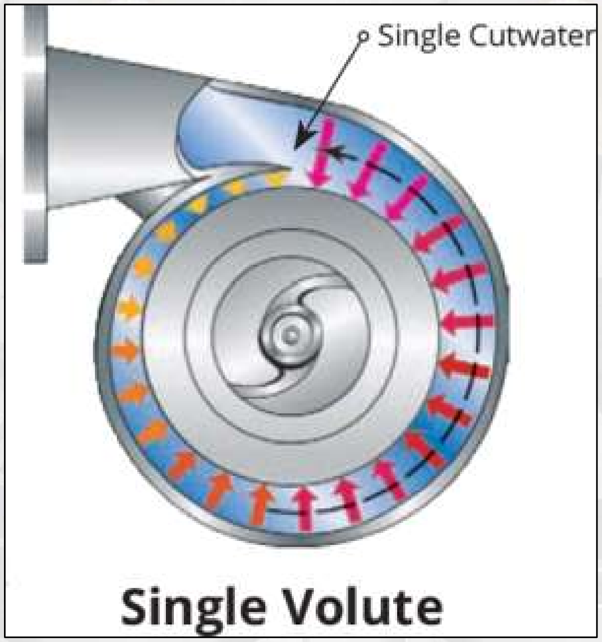




CONSTANT PRESSURE
* VAPORIZATION AT 212º F
DROP PRESSURE:
* VAPORIZATION AT LOWER TEMP.



BERNOULI'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

HOW DOES A CENTRIFUGAL PUMP WORK?

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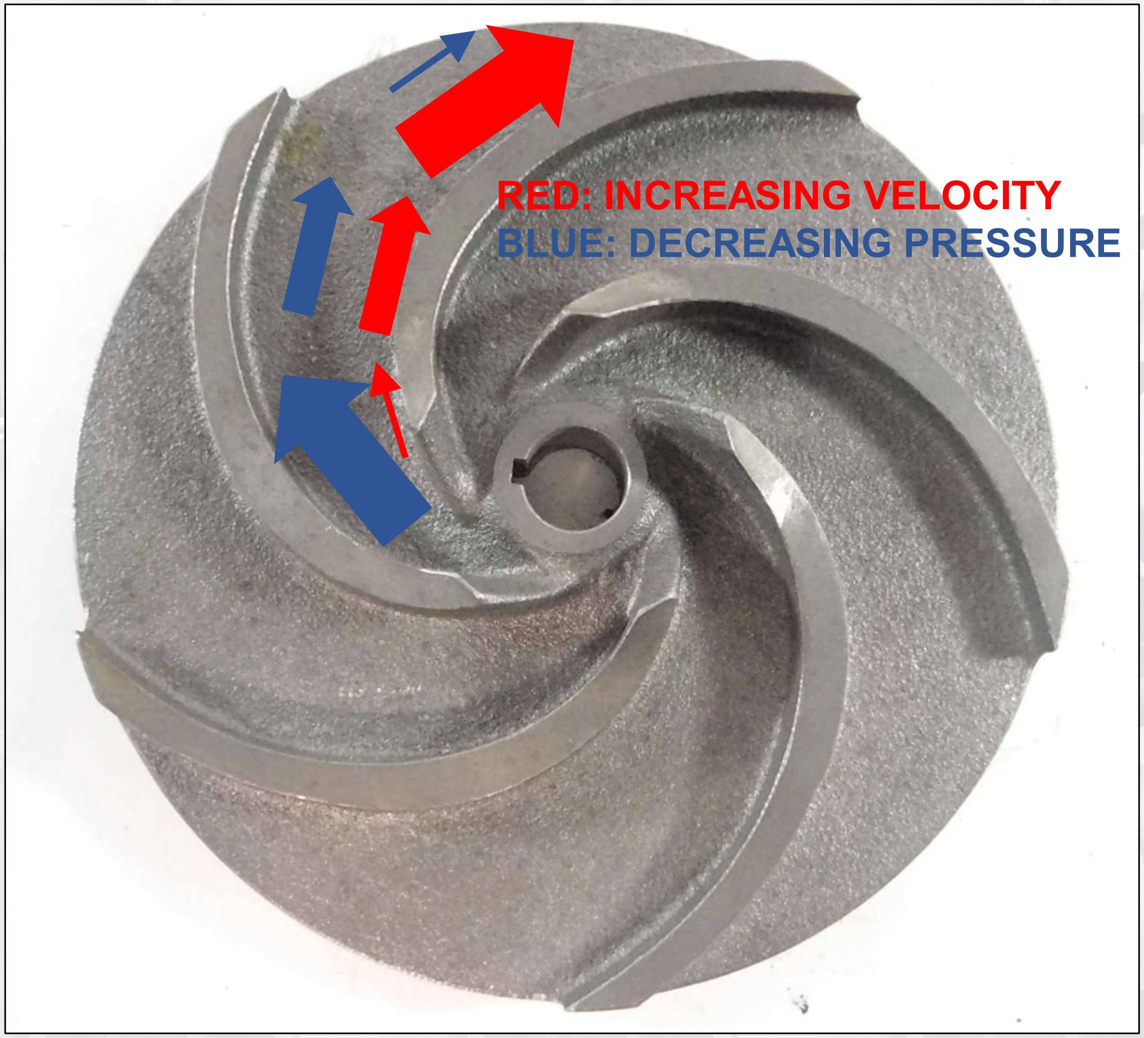
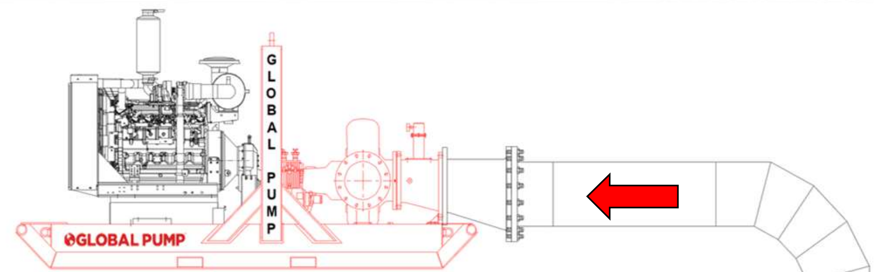
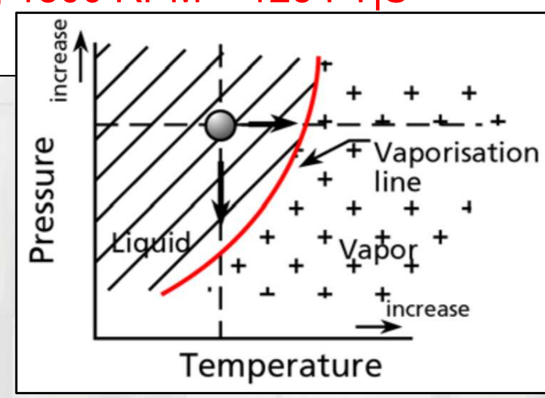




COMMON DESIGN PRACTICE:

- SUCTION VELOCITY: 6 FT|S TO 10 FT|S
- TIP SPEED: 85 FT|S TO 125 FT|S
- TIP SPEED = $\pi D(IN) X\ RPM/720$
- 16”Ø, 1800 RPM = 125 FT|S



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

HOW TO CHANGE HEAD | CHANGE IMPELLER DIAMETER

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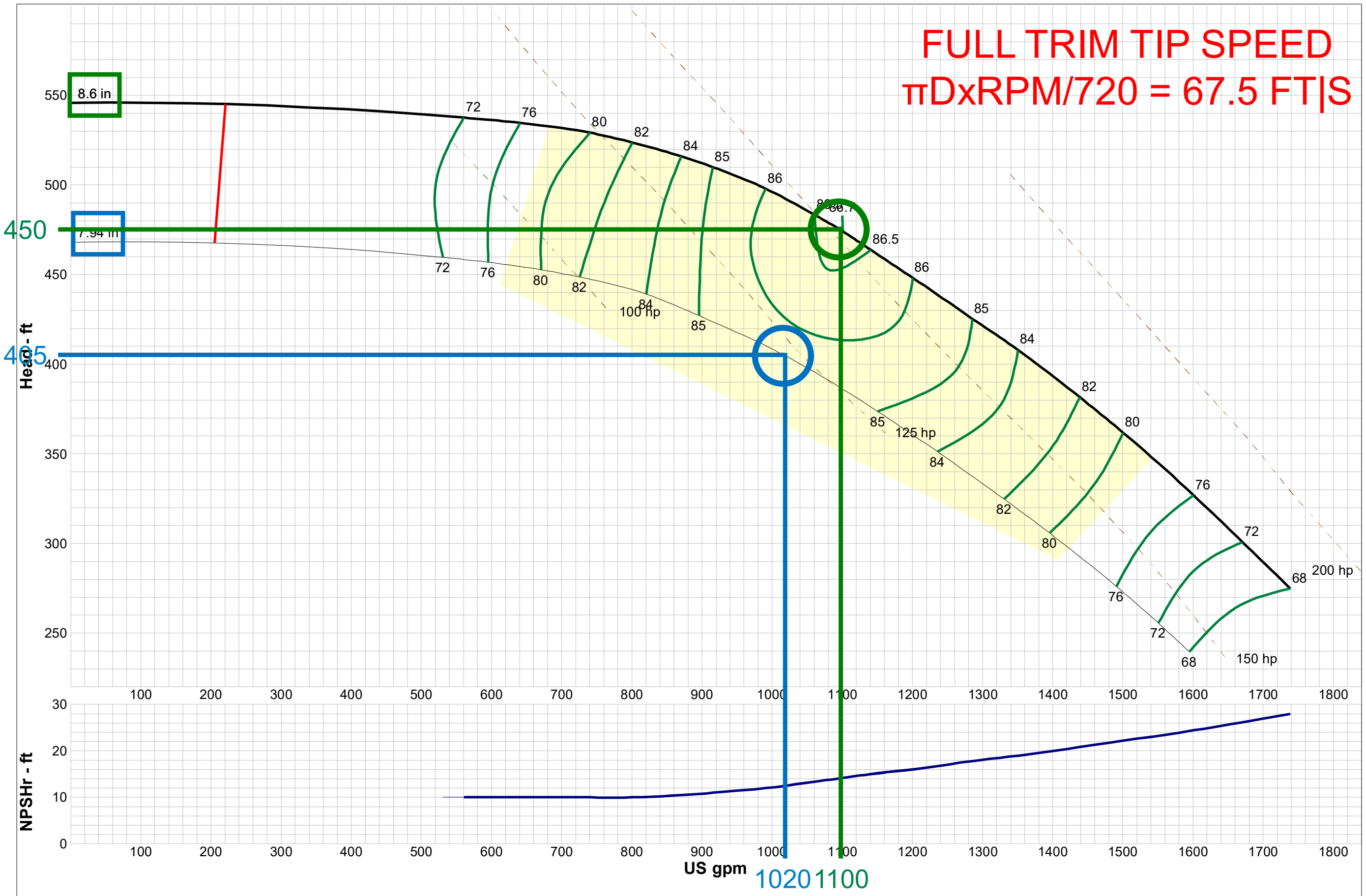

Company: Hydroflo Pumps
Name: Pumps 101 Training
1/15/16

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.

FLOWISE®

HOW TO CHANGE HEAD | CHANGE IMPELLER SPEED

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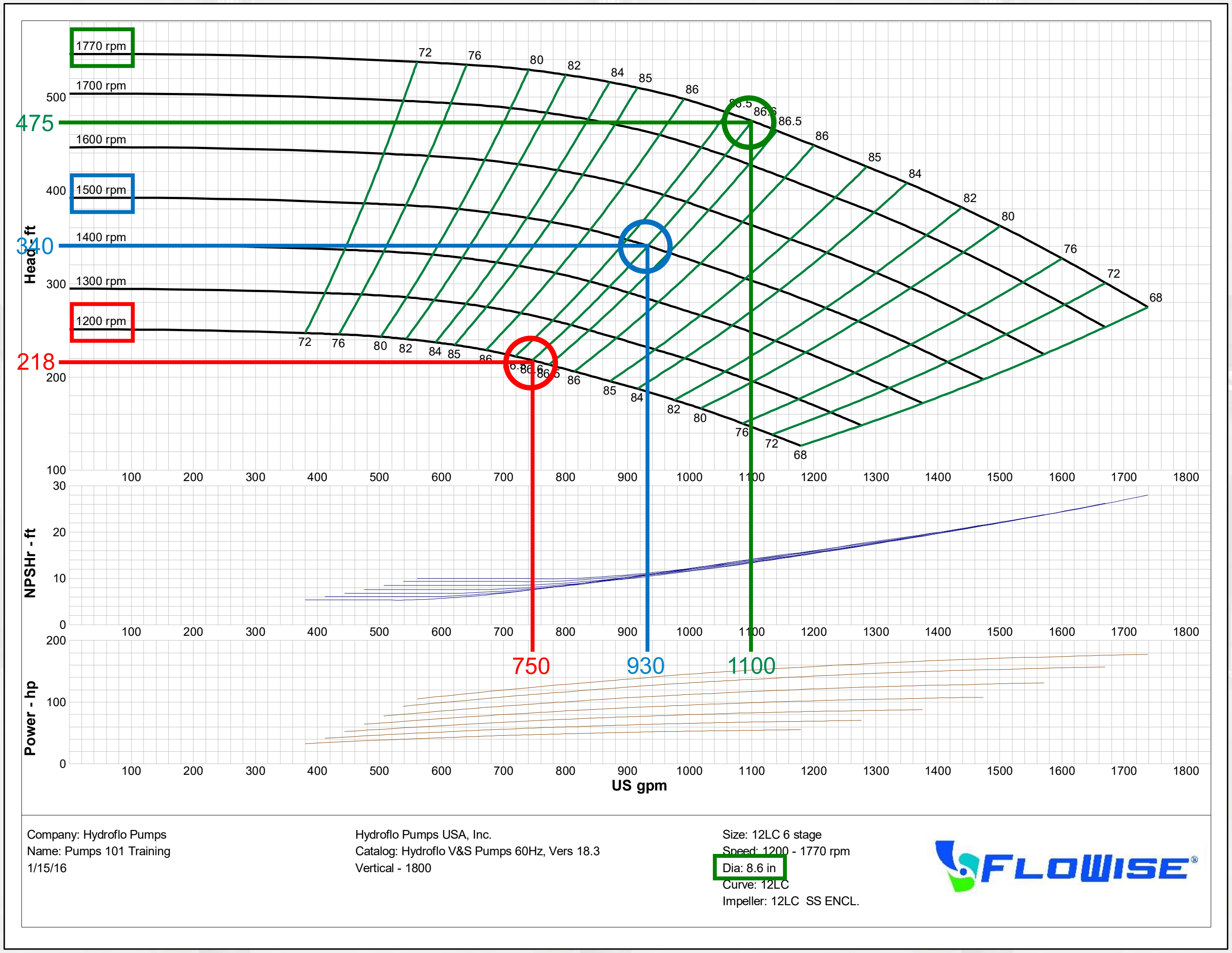

SPEED UP – DROP PRESSURE | OTHER EXAMPLE

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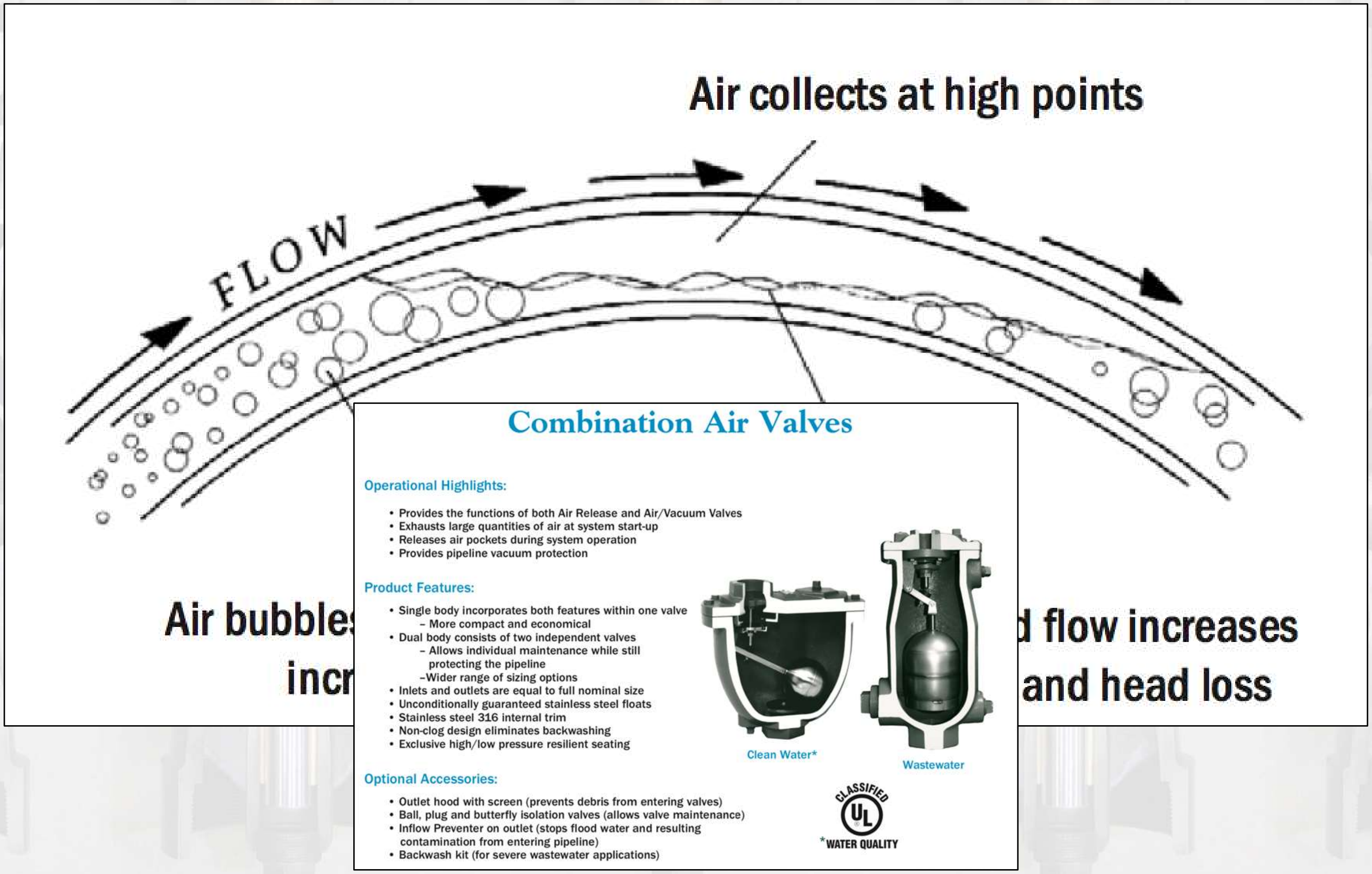

Combination Air Valves

Operational Highlights:

- Provides the functions of both Air Release and Air/Vacuum Valves
- Exhausts large quantities of air at system start-up
- Releases air pockets during system operation
- Provides pipeline vacuum protection

Product Features:

- Single body incorporates both features within one valve
  - More compact and economical
- Dual body consists of two independent valves
  - Allows individual maintenance while still protecting the pipeline
  - Wider range of sizing options
- Inlets and outlets are equal to full nominal size
- Unconditionally guaranteed stainless steel floats
- Stainless steel 316 internal trim
- Non-clog design eliminates backwashing
- Exclusive high/low pressure resilient seating

Optional Accessories:

- Outlet hood with screen (prevents debris from entering valves)
- Ball, plug and butterfly isolation valves (allows valve maintenance)
- Inflow Preventer on outlet (stops flood water and resulting contamination from entering pipeline)
- Backwash kit (for severe wastewater applications)

SPEED UP – DROP PRESSURE | ANOTHER EXAMPLE

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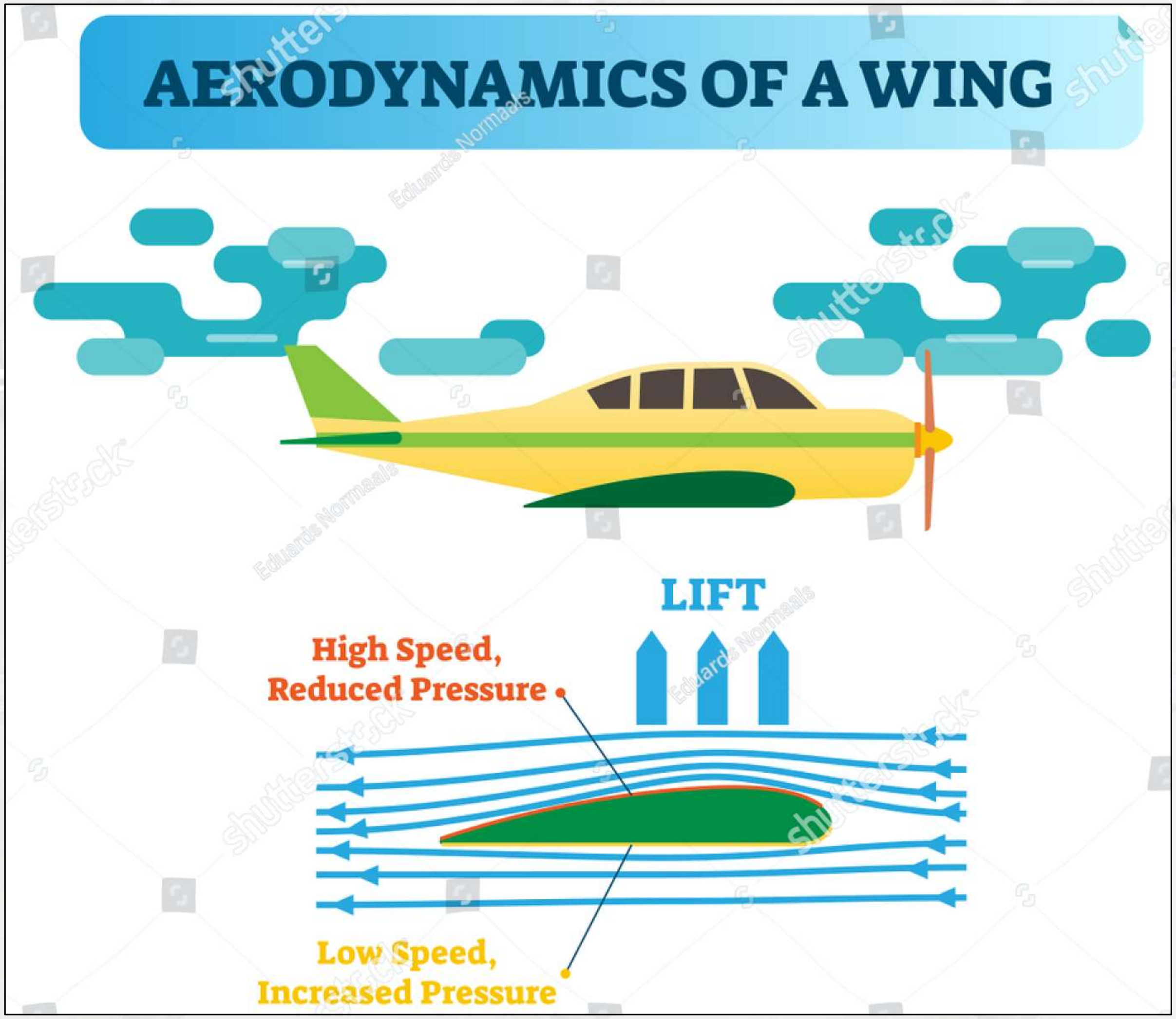

CHECK CURVE SPEED | IS THAT VARIABLE?

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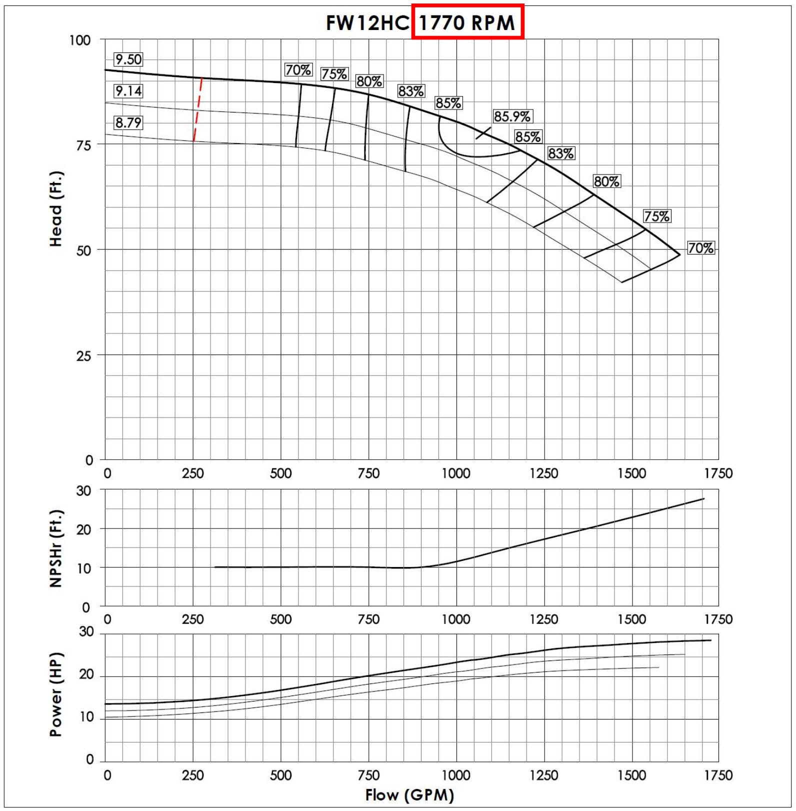
FLOWISE™ **TURBINE PUMP CURVES**

SINGLE STAGE PERFORMANCE	Curve No. FT6412HC0	Updated: Oct. 2017



EFFICIENCY CORRECTION	
1 STG.	-3.0
2 STG.	-2.0
3 STG.	-0.5
4 STG.	0.0

IMPELLER DATA	
TYPE	CLOSED
MAX SPEED	2200 RPM
Ns	2223
KT	7.5 LBS/FT

BOWL ASSEMBLY DATA			
BOWL O.D.	11.50"	SINGLE STG. WT.	290 LBS
STD. LATERAL	1.00"	ADD. STG. WT.	130 LBS
DISCH. SIZE (S)	8"	MIN. SUBMERGENCE	28"
SHAFT DIA.	1-11/16"	MAX WORKING PRES.	340 PSI

Curves represent single stage bowl performance when pumping clear, non-aerated water. Performance is based on laboratory testing of multi-stage pump assembly and reflective of HI and ISO pump testing tolerances and guidelines. Efficiency corrections are required as noted for fewer stages.

HO30P2BLF - 30 HP - WPI - 1775 RPM

Catalog #: HO30P2BLF **Model #:** FG73

HO150P2SLG - 150 HP - WPI - 1780 RPM

Catalog #: HO150P2SLG **Model #:** FE02

HO400V2SLH - 400 HP - WPI - 1785 RPM

Catalog #: HO400V2SLH **Model #:** DP76

READING A PUMP CURVE | DOES IT MATTER WHERE I OPERATE?

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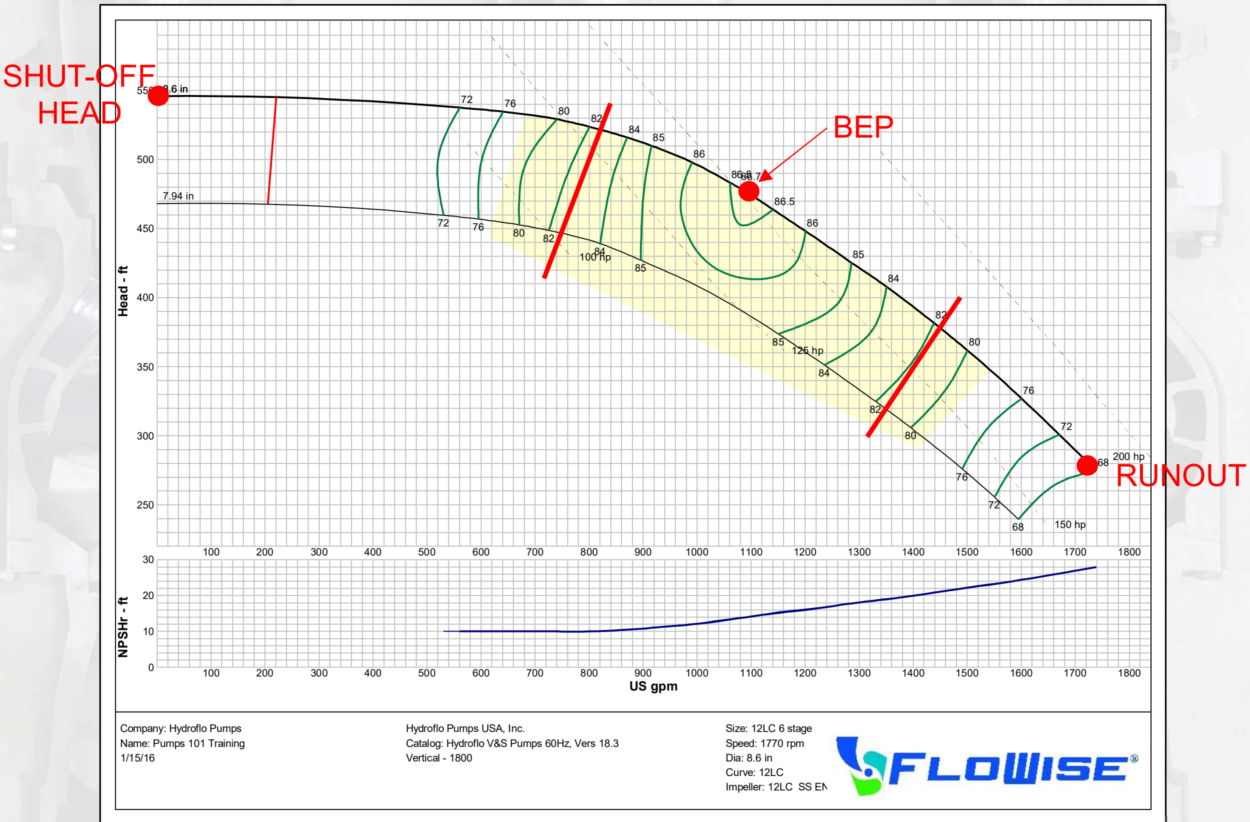
1. FIRST, AND FOREMOST, OPERATE AT OR NEAR BEP

2. LESS SHAFT DEFLECTION – INCREASED RELIABILITY



TYPICALLY OPERATE 30% LEFT OR RIGHT OF BEP

PUMP BECOMES UNSTABLE LEFT OR RIGHT OF BEP

RECIRCULATION | TWO (2) TYPES

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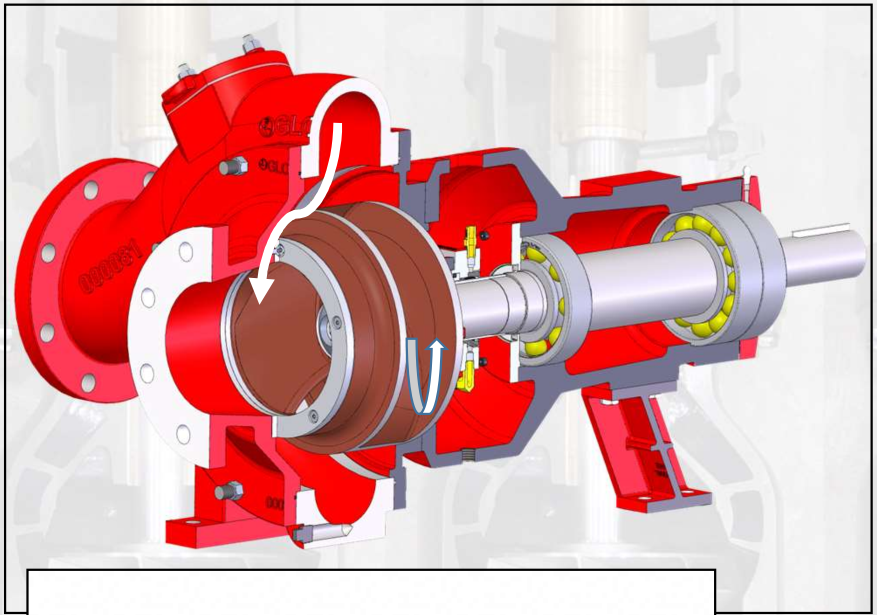

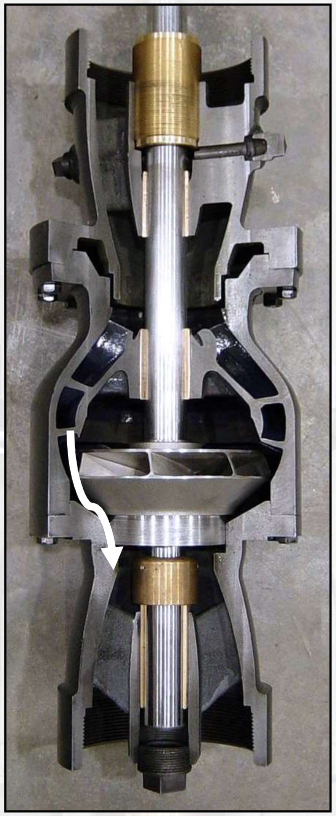

Open Impeller   Closed Impeller

1. RECIRCULATION IS NOT SYMMETRICAL | THIS CAUSES VIBRATION
2. TYPICAL CLEARANCE: 0.020" – 0.025" (CI) | 0.025" – 0.030" (SS) | DIME: 0.053"

BEP OPERATION | INCREASES RELIABILITY

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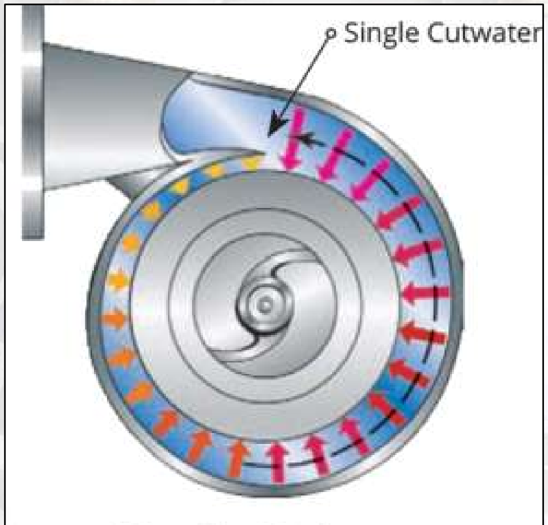
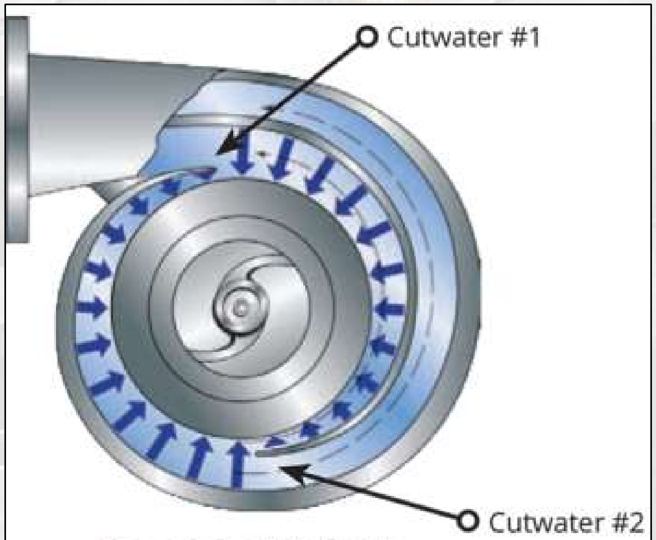
1. WHY DOES THE PUMP BECOME UNSTABLE?

2. THERE IS ALREADY UNEVEN PRESSURE DISTRIBUTION | RECIRCULATION AMPLIFIES IMBALANCE



Single Volute



Double Volute

VERTICAL TURBINE DIFFUSERS

DIFFERENT PUMP DESIGNS | DIFFERENT RELIABILITY

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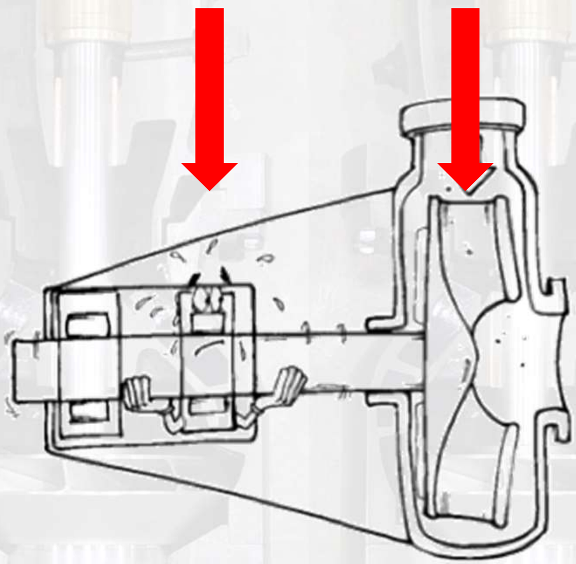
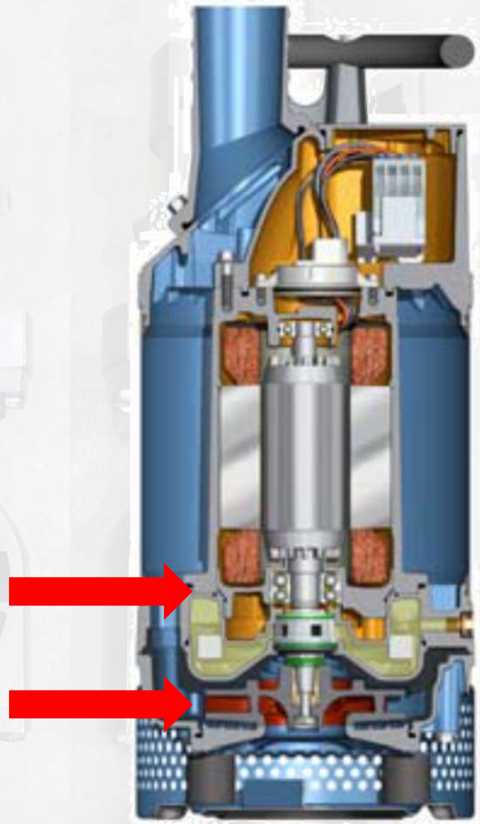


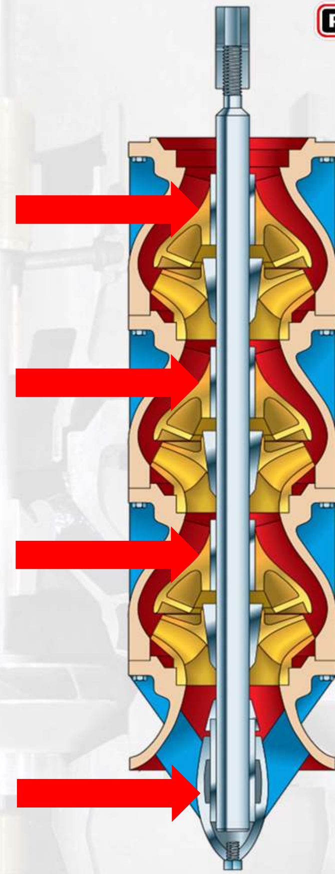
END SUCTION | OVERHUNG

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

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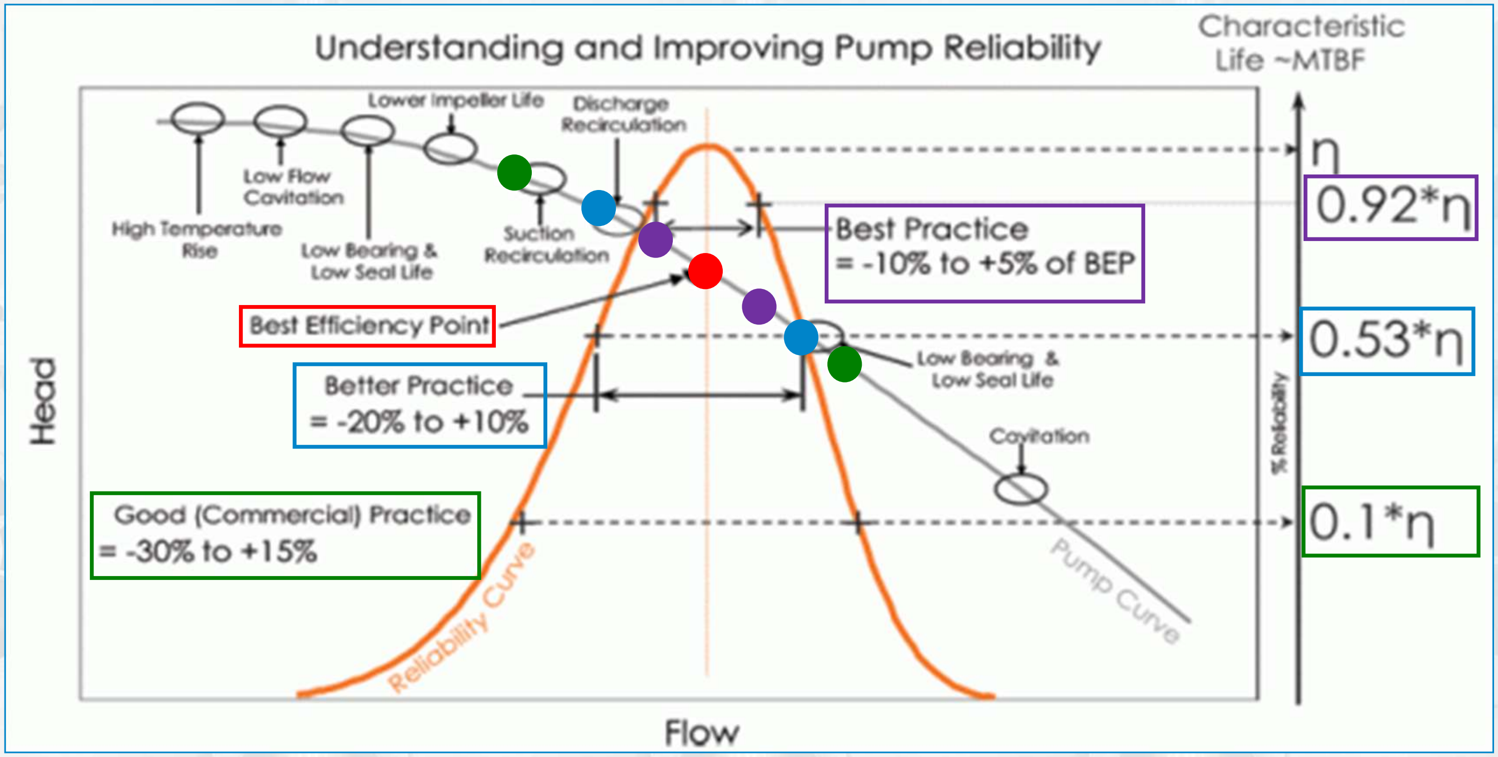
ASSUME η = 10 YEARS



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**

PIPING SYSTEM DESIGN | STATIC HEAD

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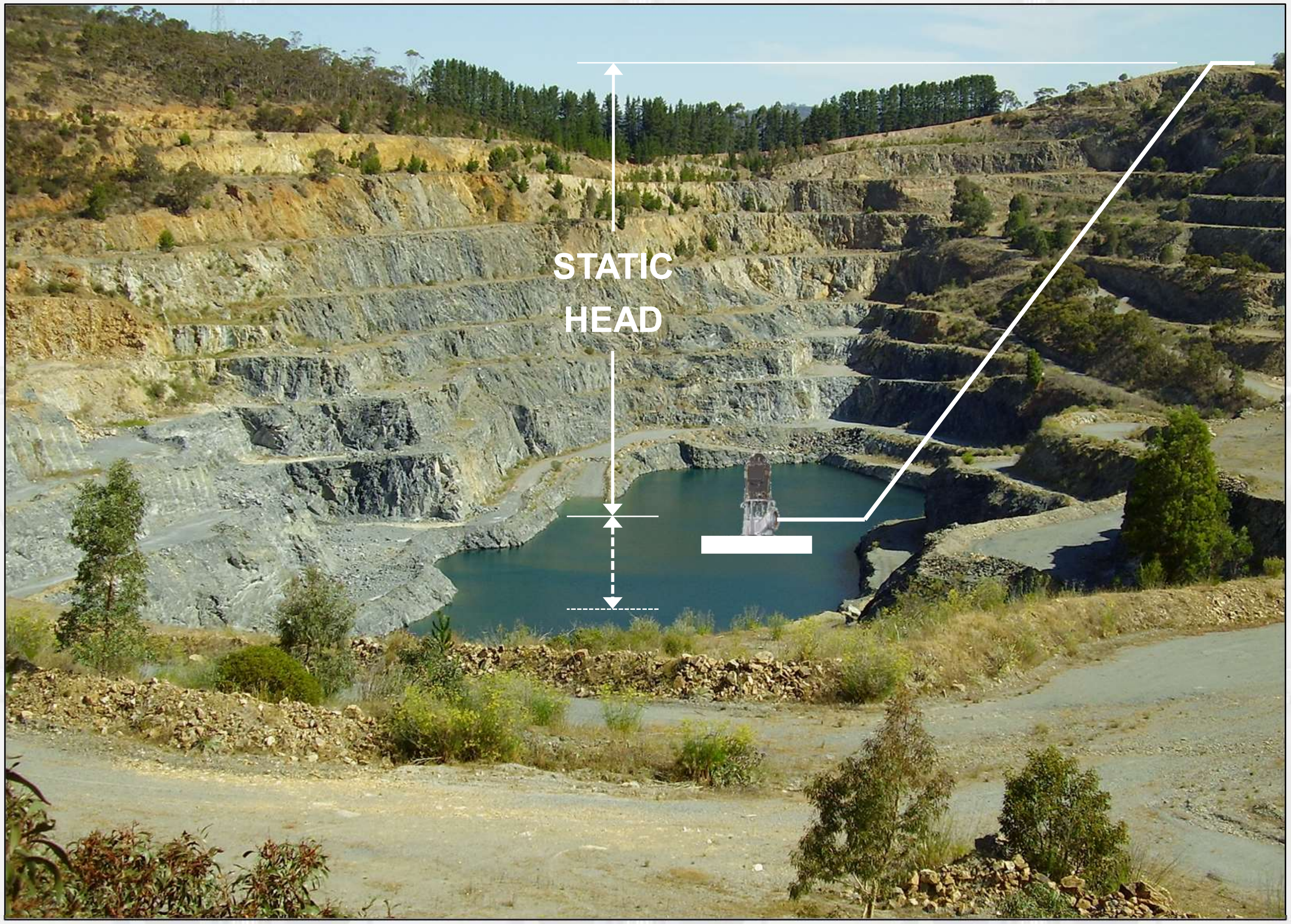

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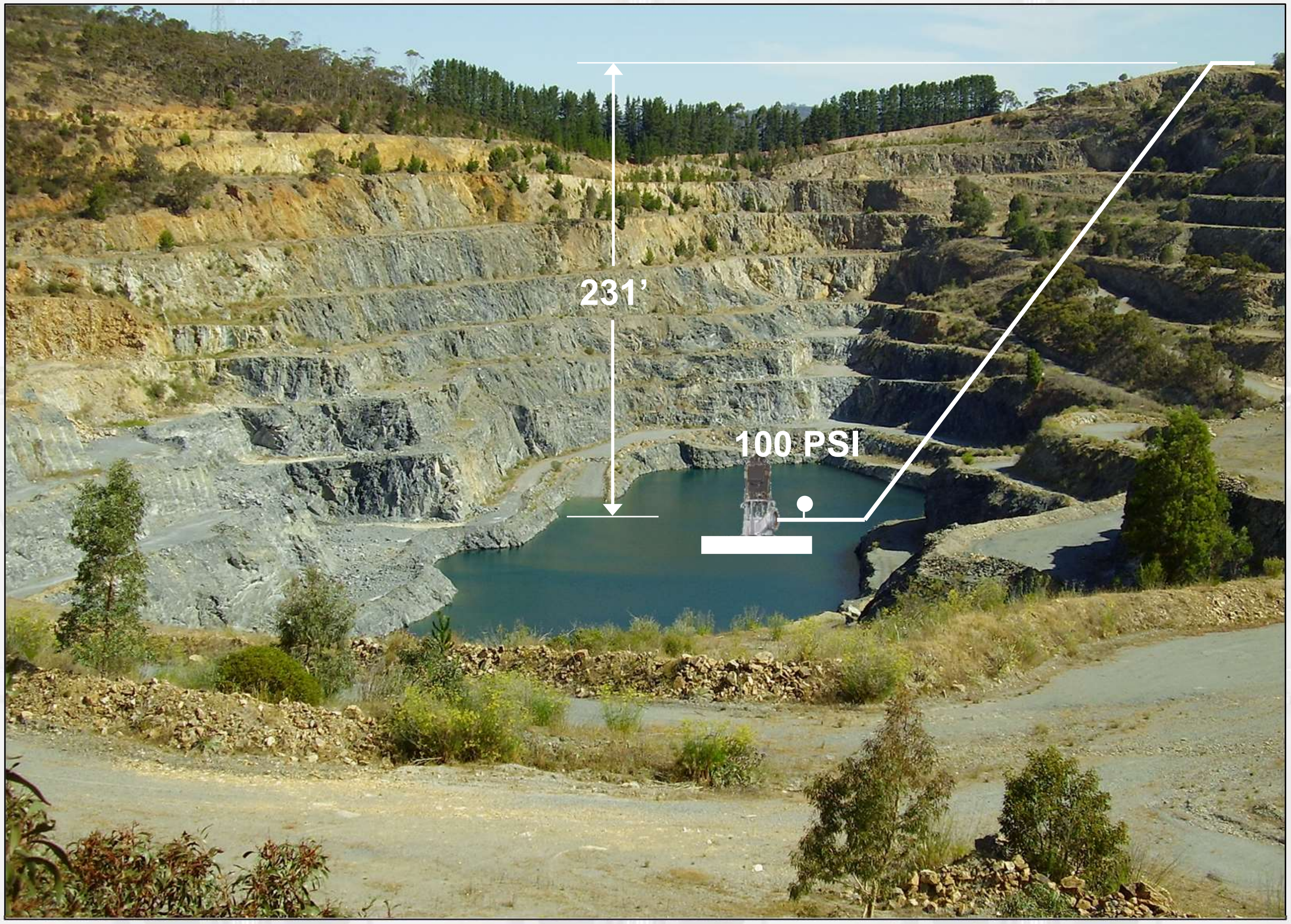
PIPING SYSTEM DESIGN | STATIC HEAD



PIPING SYSTEM DESIGN | CALCULATING THE DUTY POINT

TOTAL DYNAMIC HEAD (TDH)

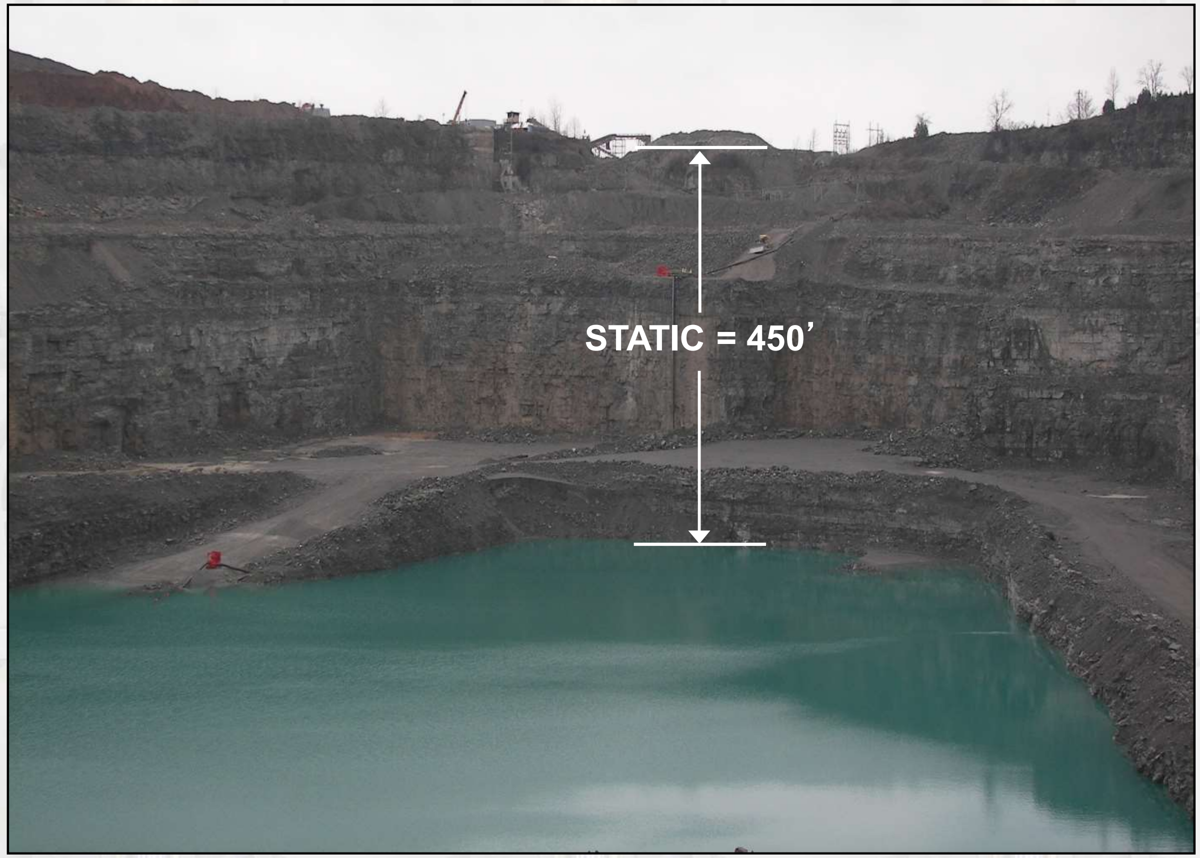
TDH = STATIC + FRICTION

STATIC HEAD – Water Level to Water Level – Static Head Changes as Level Changes.

FRICTION HEAD – Calculated from Following:

- Required Flow Rate.
- Pipe Length.
- Pipe Diameter.
- Pipe Material (Determines Roughness).
- Miscellaneous Fittings.
- Fluid Viscosity.

TDH INCREASES WITH FLOW



HAZEN AND WILLIAMS FORMULA **–** Used to Calculate Friction Loss**:**

Friction Loss – $h_f = 0.002083\ L\ (100/C)^{1.85} \times GPM^{1.85}/d^{4.8655}$

- h_f = Head Loss Due to Friction (ft).
- L = Length of Pipe Including Equivalent Length through Fittings (ft).
- C = Friction Factor for Hazen & Williams.
- GPM = Flow Rate (GPM).
- d = Inside Diameter of Circular Pipe (in) – Beware of DR Ratings.

This Formula is Good for any Liquid Having a Viscosity in the Range of 1.130 Centistokes (Property of Water at 60˚ F).

HAZEN AND WILLIAMS C FACTORS – Relates to Pipe Roughness:

TYPE OF PIPE	RANGE	AVG NEW	COMMON DESIGN
Cement Asbestos	160 – 140	150	140
Cement Lined Iron or Steel		150	140
Welded & Seamless Steel	150 – 80	130	100
Wrought Iron, Cast Iron	150 – 80	130	100
Tar-Coated Cast Iron	145 – 50	130	100
Concrete	152 – 85	120	100
Corrugated Steel		60	60
PVC		140	120
HDPE	150 – 130	150	140

Source: Cameron Hydraulic Data, 18th Edition.

PIPING SYSTEM DESIGN | EQUIVALENT PIPE LENGTH

EQUIVALENT PIPE LENGTH:

Used to Account for Fittings in Piping System.

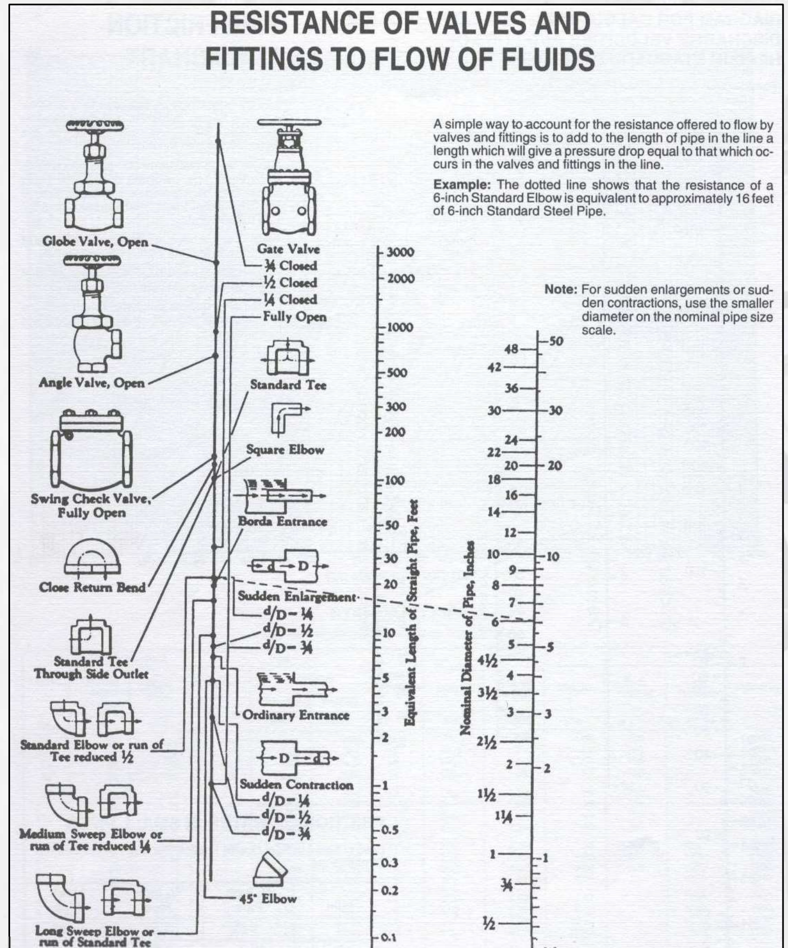
Friction Loss – $h_f = 0.002083\ L\ (100/C)^{1.85} \times GPM^{1.85}/d^{4.8655}$

For Example;

Pipe Length = 500’ – 6” Steel.

Fittings = 4 – 6” Standard 90° Elbows,
1 – 6” Swing Check Valve, and
2 – 6” Gate Valves (Open).

Equivalent Length = 500’ + 4 (17’) + 40’ + 2 (4’)
= 616’



FRICTION LOSS CALCULATOR | SPREADSHEETS ARE YOUR FRIENDS!

PUMPS & SUPPLY

CUSTOMER, 2-1-16

Increment

50

	SUCTION PIPING		DISCHARGE PIPING				
# of Parallel Lines =	1	1	1	1	1	1	1
C=	125	125	145	145	145	145	145
ID=	4.00	4.00	6.00	6.00	6.00	6.00	6.00
L(k)=	0	0	0	0	0	0	0

HDPE ID CHART

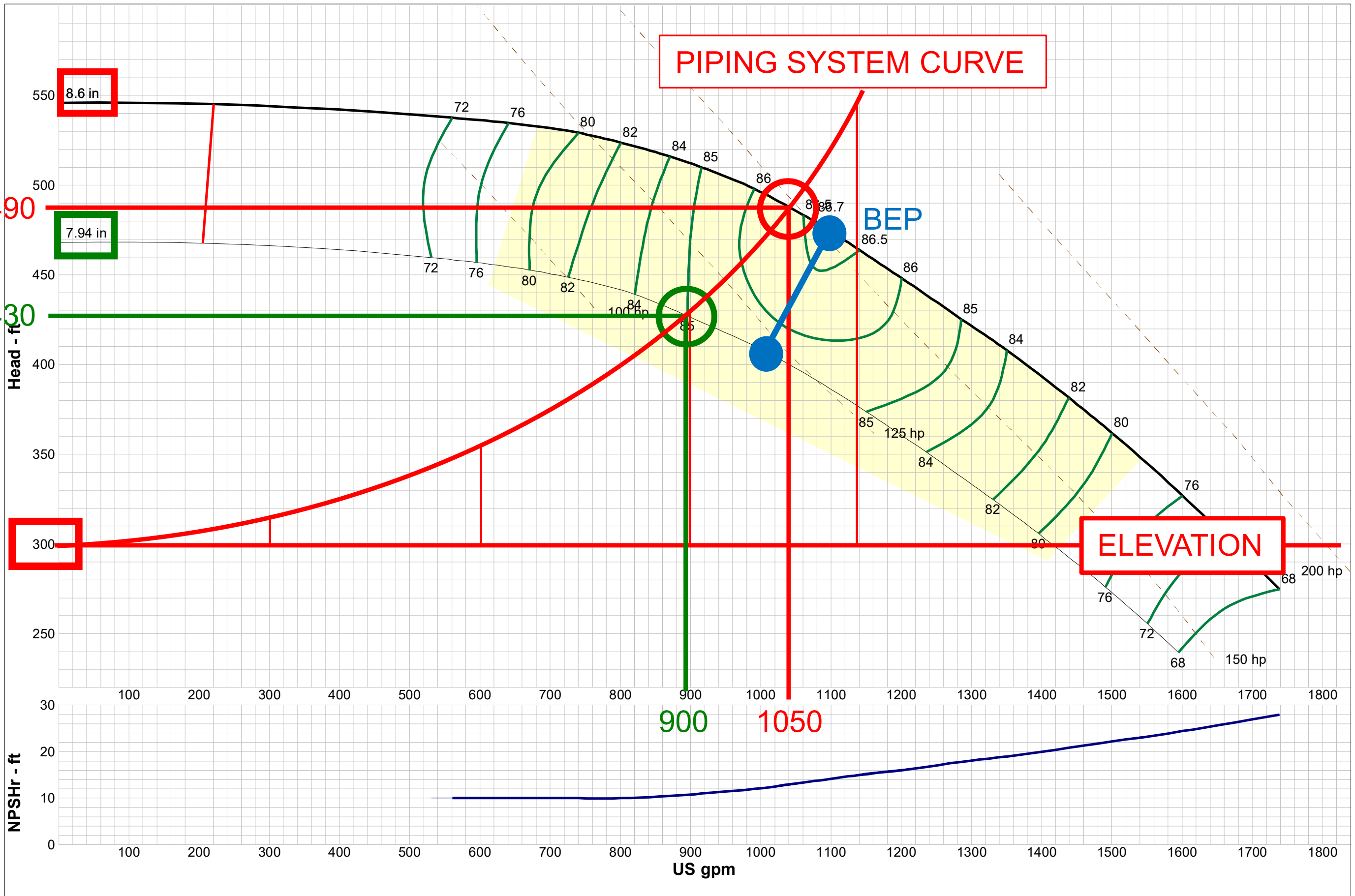
2"	3"	4"	6"	8"	10"	12"	14"	16"	18"	20"	22"	24"	26"	28"	30"	36"	48"	54"
2.375	3.5	4.5	6.625	8.625	10.75	12.75	14	16	18	20	22	24	26	28	30	36	48	54
17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17
2.08	3.06	3.94	5.80	7.55	9.41	11.16	12.25	14.00	15.76	17.51	19.26	21.01	22.76	24.51	26.26	31.51	42.01	47.27

FLOW		TDH START	PSI	HP (INPUT EFFC'Y)	RESID (PSI) 0	DYNAMIC SUCTION	STATIC SUCTION LIFT	DISCHARGE HEAD	SUCTION FRICTION HEAD		DISCHARGE FRICTION HEAD					SUCTION VELOCITY		DISCHARGE VELOCITY					SUCTION VELOCITY HEAD		DISCHARGE VELOCITY HEAD					FLOW
GPM		TDH	PSI	0.000	ft	h_f	h_s	Hsd	h_f	h_f	h_f	h_f	h_f	h_f	h_f	fps	fps	fps	fps	fps	fps	fps	ft	ft	ft	ft	ft	ft	ft	GPM
0	GPM at	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0															0
50	GPM at	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0															50
100	GPM at	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0															100
150	GPM at	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0															150
200	GPM at	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0															200
250	GPM at	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0															250
300	GPM at	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0															300
350	GPM at	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0															350
400	GPM at	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0															400
450	GPM at	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0															450
500	GPM at	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0															500
550	GPM at	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0															550
600	GPM at	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0															600
650	GPM at	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0															650
700	GPM at	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0															700
750	GPM at	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0															750
800	GPM at	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0															800
850	GPM at	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0															850
900	GPM at	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0															900
950	GPM at	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0															950
1,000	GPM at	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0															1,000
1,050	GPM at	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0															1,050
1,100	GPM at	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0															1,100
1,150	GPM at	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0															1,150
1,200	GPM at	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0															1,200
1,250	GPM at	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0															1,250
1,300	GPM at	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0															1,300
1,350	GPM at	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0															1,350
1,400	GPM at	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0															1,400
1,450	GPM at	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0															1,450
1,500	GPM at	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0															1,500

LENGTH (FT)		0	0	0	0	0	0	0
90 Degree Elbow	33							
45 Degree Elbow	15							
Check Valve	80							
Gate Valve (100%)	7							
Butterfly	16							
T-Branch	68							
T-Run	20							
Road Ramp	180							
Screen	50							
Entrance	18							
Exit	30							
Manifold	136							
d/D (1/4) Increase	33							
d/D (1/2) Increase	19							
d/D (3/4) Increase	7							
d/D (1/4) Reduce	16							
d/D (1/2) Reduce	11							
d/D (3/4) Reduce	7							

OPERATING YOUR PUMP ON THE CURVE | VARIABLE TRIM

C and C PUMPS & SUPPLY
Marion, IL
618-997-2311



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

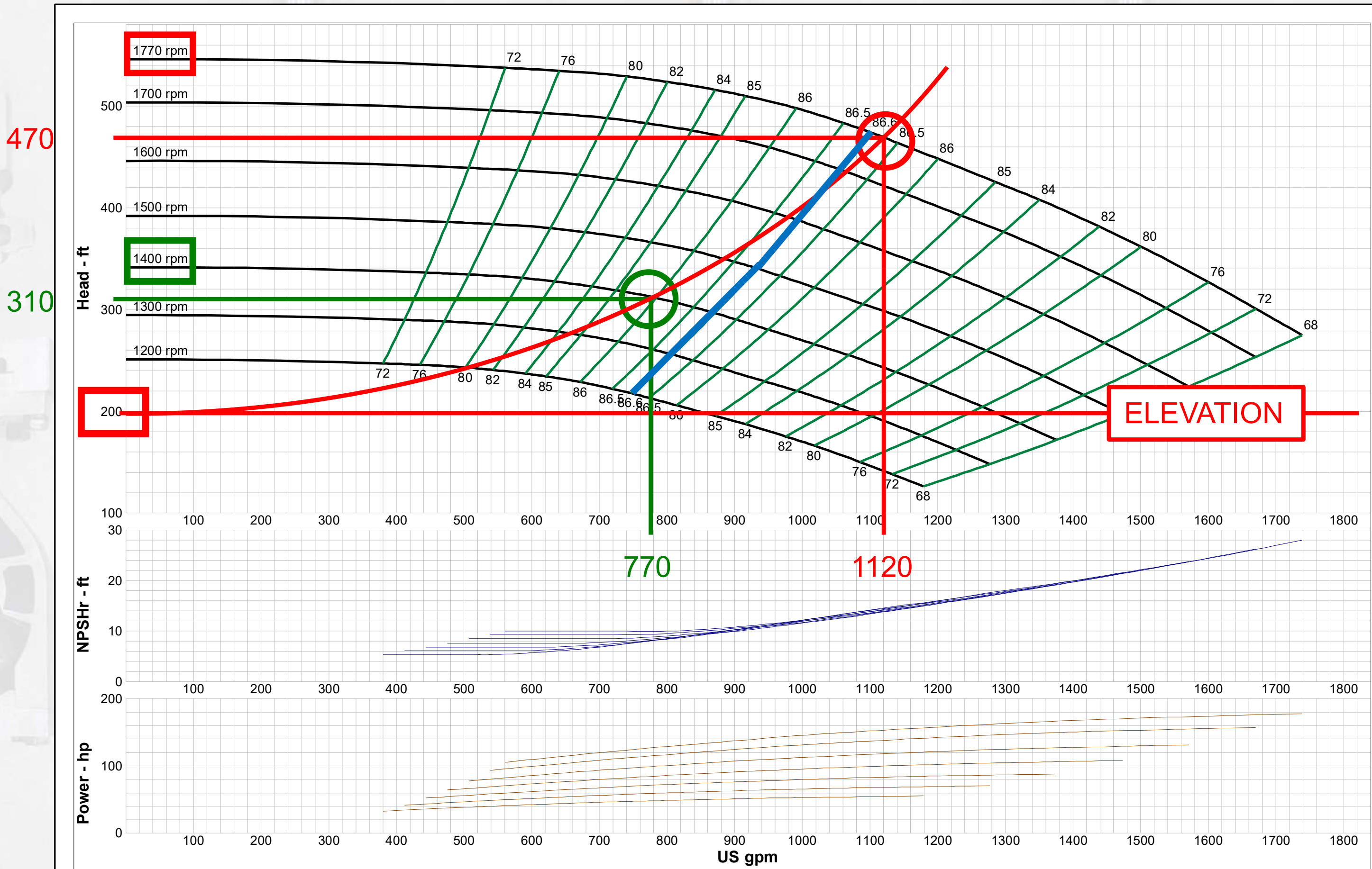
Hydroflo Pumps USA, Inc.
Catalog: Hydroflo V&S Pumps 60Hz, Vers 18.3
Vertical - 1800

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

FLOWISE

OPERATING YOUR PUMP ON THE CURVE | VARIABLE SPEED

C and C PUMPS & SUPPLY
Marion, Il
618-997-2311



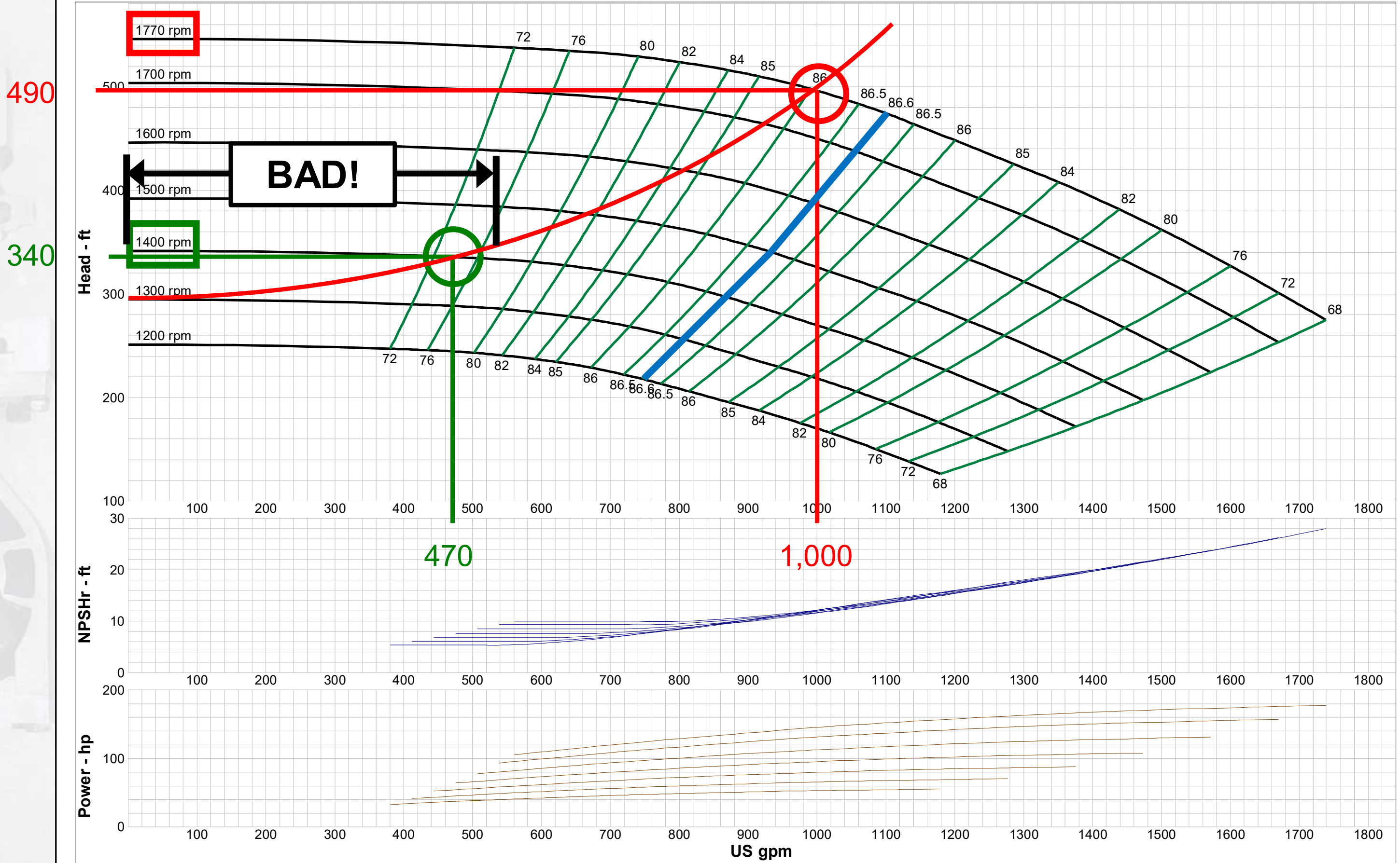
Company: Hydroflo Pumps
Name: Pumps 101 Training
1/15/16

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.

OPERATING YOUR PUMP ON THE CURVE | VARIABLE SPEED PROBLEMS

C and C PUMPS & SUPPLY
Marion, Il
618-997-2311



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Vertical - 1800

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

FLOWISE®

OPERATING YOUR PUMP ON THE CURVE | VARIABLE SPEED PROBLEMS

C AND C PUMPS & SUPPLY
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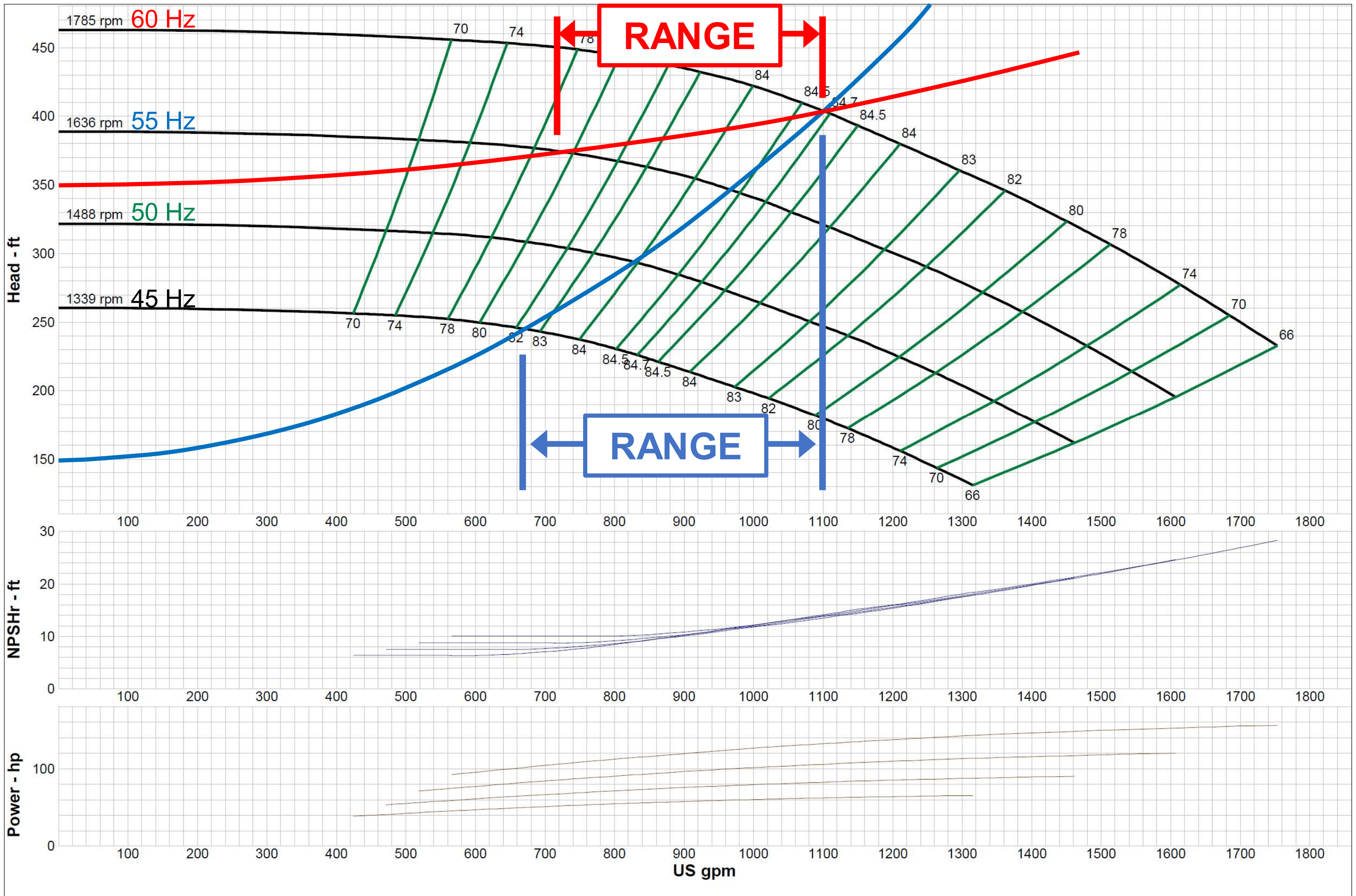
55 HZ SPEED:
55/60 X 1785 =
1636 RPM

50 HZ SPEED:
50/60 X 1785 =
1488 RPM

45 HZ SPEED:
45/60 X 1785 =
1339 RPM



Company: C and C Pumps & Supply, Inc.
Name: Open House 2018
10/24/2018

Hydroflo Pumps USA, Inc.
Catalog: Hydroflo VS Pumps.60, Vers 18.3
Vertical - 1800

Size: 12LC 5 stage
Speed: 1339 - 1785 rpm
Dia: 8.6 in
Curve: 12LC
Impeller: 12LC SS ENCL.

FLOWISE

OPERATING YOUR PUMP ON THE CURVE | FLAT AND STEEP PIPING SYSTEM CURVE

C and C PUMPS & SUPPLY
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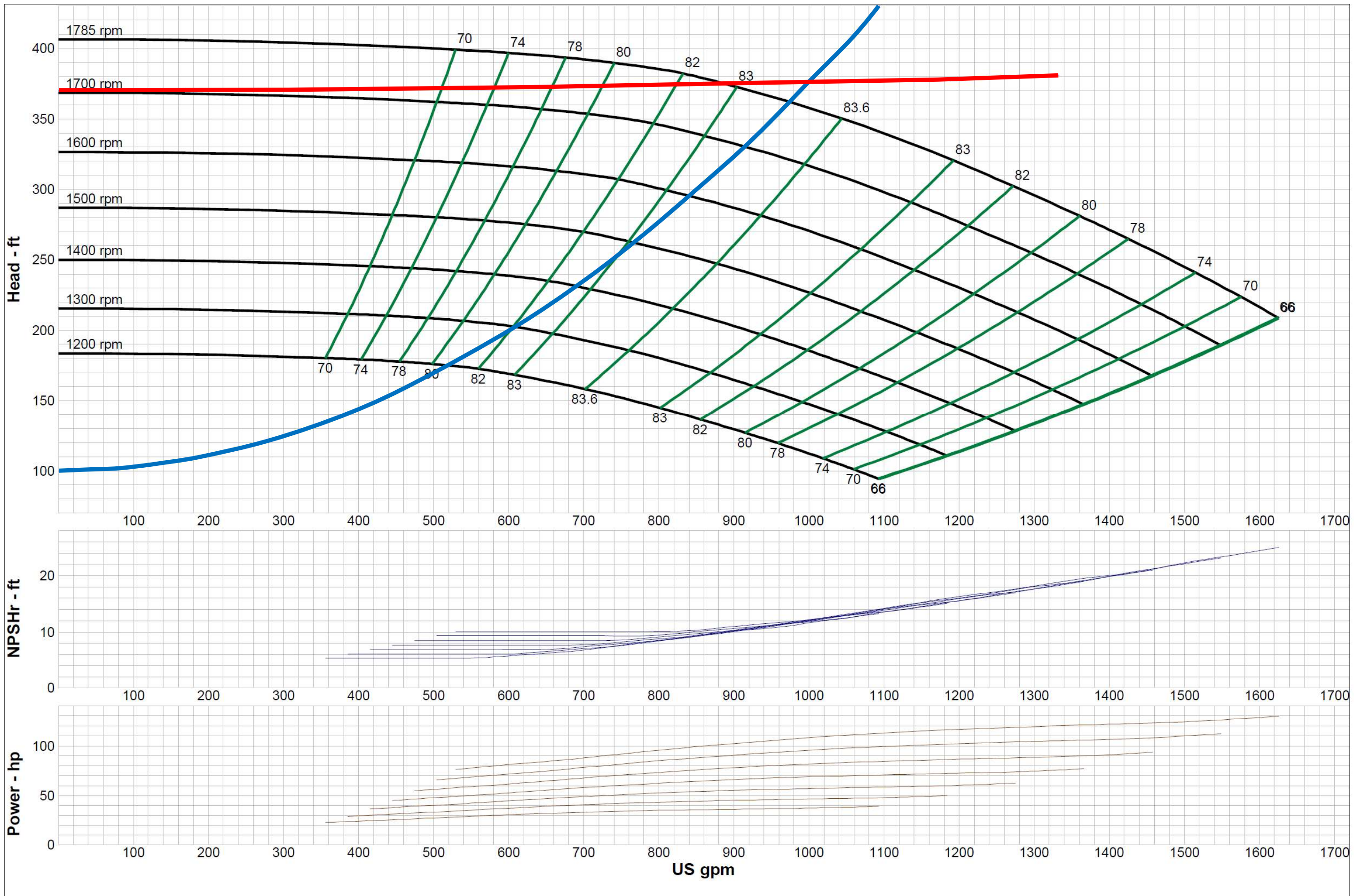
FLAT CURVE
MOSTLY
ELEVATION
MINIMAL
FRICTION

STEEP CURVE
MOSTLY
FRICTION
MINIMAL
ELEVATION



Company: C and C Pumps & Supply, Inc.
Name: Open House 2018
10/25/2018

Hydroflo Pumps USA, Inc.
Catalog: Hydroflo VS Pumps.60, Vers 18.3
Vertical - 1800

Size: 12LC 5 stage
Speed: 1200 - 1785 rpm
Dia: 8.04 in
Curve: 12LC
Impeller: 12LC SS ENCL.

FLOWISE®

OPERATING YOUR PUMP ON THE CURVE | USING VALVE VS. VFD

MPS & SUPPLY
Marion, Il
18-997-2311

Company: C and C Pumps & Supply, Inc.
Name: Open House 2018
Date: 10/25/2018

FLOWISE®

Pump:
Size: 12LC (5 stage)
Type: Vertical
Synch speed: 1800 rpm
Speed: 1785 rpm
Dia: 8.07 in
Curve: 12LC
Impeller: 12LC SS ENCL.
Specific Speeds:
Ns: ---
Nss: ---
Dimensions:
Suction: 8 in
Discharge: 10 in
Vertical Turbine:
Bowl size: 11.8 in
Max lateral: 1 in
Thrust K factor: 7.5 lb/ft

Search Criteria:
Flow: 1000 US gpm
Head: 350 ft

Fluid:
Water
Density: 62.32 lb/ft³
Viscosity: 0.9946 cP
NPSHa: ---
Temperature: 68 °F
Vapor pressure: 0.3391 psi a
Atm pressure: 14.7 psi a

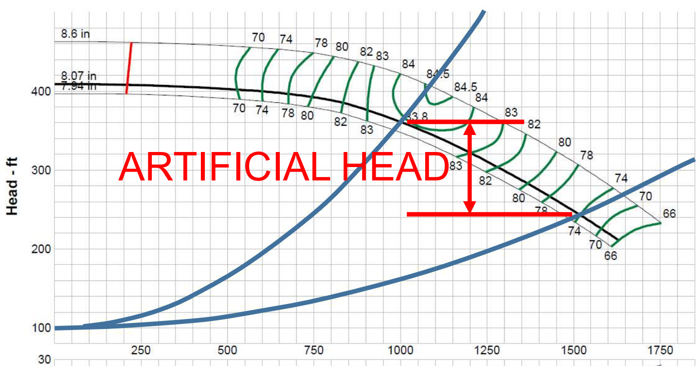
Motor:
Standard: NEMA
Enclosure: WP1
Size: 150 hp
Speed: 1800
Frame: 444T
Sizing criteria: Max Power on Design Curve

Pump Limits:
Temperature: 140 °F
Pressure: 350 psi g
Sphere size: 0.73 in
Power: 350 hp
Eye area: ---

---- Data Point ----
Flow: 1000 US gpm
Head: 360 ft
Eff: 83.5%
Power: 109 hp
NPSHr: 12.3 ft

---- Design Curve ----
Shutoff head: 409 ft
Shutoff dP: 177 psi
Min flow: 209 US gpm
BEP: 83.8% @ 1047 US gpm
NOL power:
131 hp @ 1629 US gpm

-- Max Curve --
Max power:
156 hp @ 1753 US gpm



Perfor...

Flo... US gpm	rpm	ft	%	hp	ft
1200	1785	322	83	118	16.3
1000	1785	360	83.5	109	12.3
800	1785	388	81.3	96.4	10.2
600	1785	400	74	81.8	10.1
400	1785	404	62.9	67.1	10.1

Company: C and C Pumps & Supply, Inc.
Name: Open House 2018
Date: 10/25/2018

FLOWISE®

Pump:
Size: 12LC (5 stage)
Type: Vertical
Synch speed: 1800 rpm
Speed: 1320 rpm
Dia: 8.07 in
Curve: 12LC
Impeller: 12LC SS ENCL.
Specific Speeds:
Ns: ---
Nss: ---
Dimensions:
Suction: 8 in
Discharge: 10 in
Vertical Turbine:
Bowl size: 11.8 in
Max lateral: 1 in
Thrust K factor: 7.5 lb/ft

Search Criteria:
Flow: 1000 US gpm
Head: 350 ft

Fluid:
Water
Density: 62.32 lb/ft³
Viscosity: 0.9946 cP
NPSHa: ---
Temperature: 68 °F
Vapor pressure: 0.3391 psi a
Atm pressure: 14.7 psi a

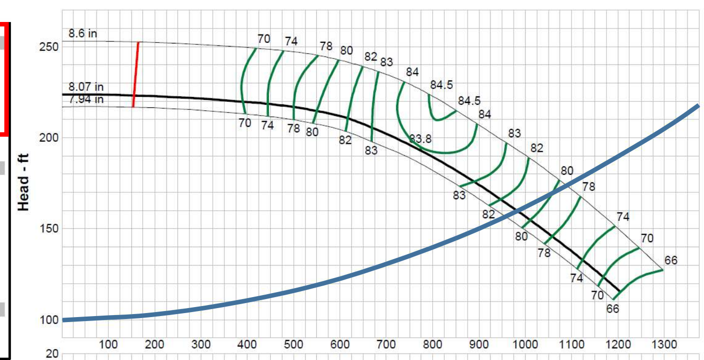
Motor:
Standard: NEMA
Enclosure: WP1
Size: 60 hp
Speed: 1800
Frame: 364T
Sizing criteria: Max Power on Design Curve

Pump Limits:
Temperature: 140 °F
Pressure: 350 psi g
Sphere size: 0.73 in
Power: 350 hp
Eye area: ---

---- Data Point ----
Flow: 1000 US gpm
Head: 157 ft
Eff: 80.3%
Power: 49.2 hp
NPSHr: 11.9 ft

---- Design Curve ----
Shutoff head: 224 ft
Shutoff dP: 96.8 psi
Min flow: 155 US gpm
BEP: 83.8% @ 774 US gpm
NOL power:
53.1 hp @ 1205 US gpm

-- Max Curve --
Max power:
63.2 hp @ 1296 US gpm



US gpm	rpm	ft	%	hp	ft
1200	1320	116	66.6	52.9	15.5
1000	1320	157	80.3	49.2	11.9
800	1320	189	83.6	45.6	8.45
600	1320	212	81.5	39.3	6.27
400	1320	220	70.8	31.3	6.25

HP SAVINGS

VALVE: 109 HP X 0.7457 X 12 HR/DAY X 365 DAY/YR X $0.10/KW-HR = $35,600.00/YR

VFD: 49.2 HP X 0.7457 X 12 HR/DAY X 365 DAY/YR X $0.10/KW-HR = $16,000.00/YR

SAVINGS: $19,600.00/YR (SHORT PAYBACK – SAVINGS FOREVER)

RELIABILITY! IT'S NOT JUST ABOUT COST SAVINGS

NOL | NON-OVERLOADING OVER THE ENTIRE RANGE OF THE CURVE

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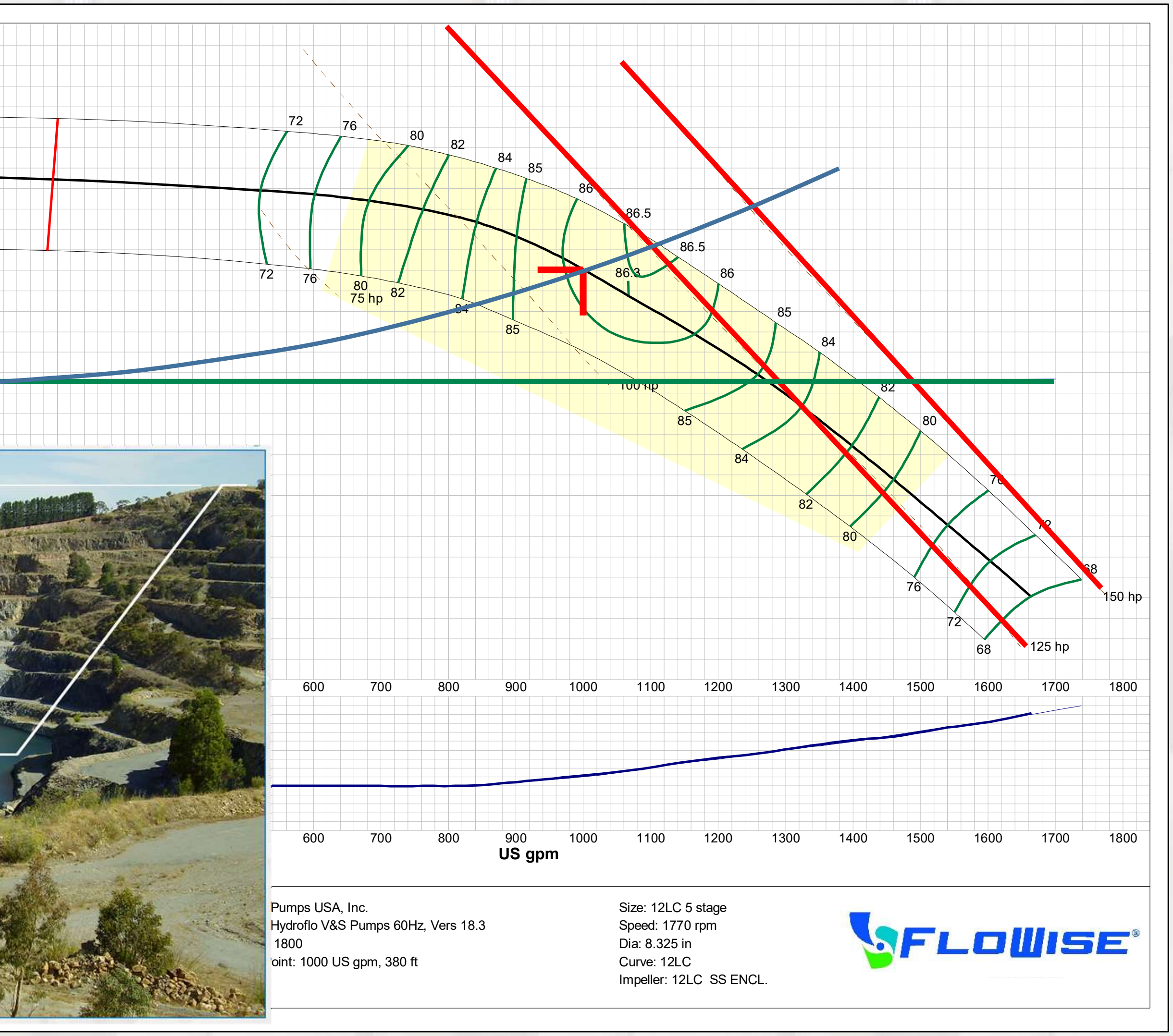

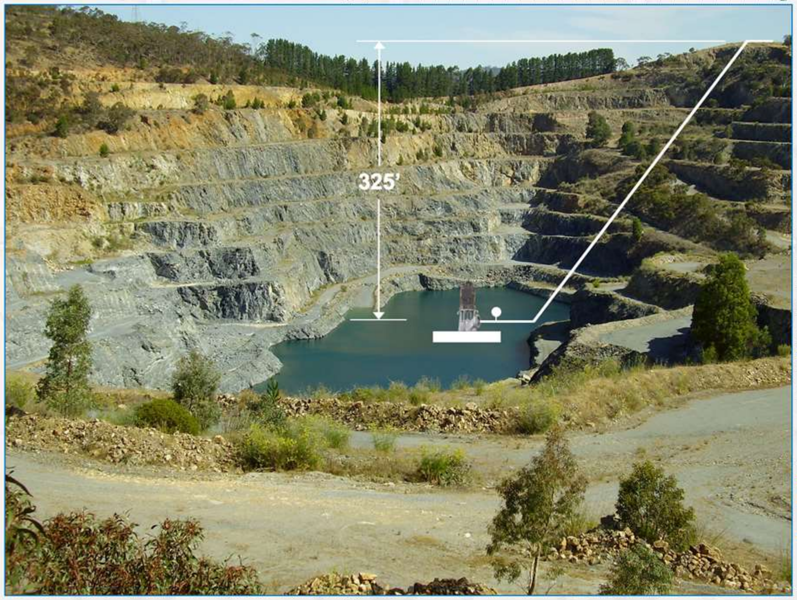

CAVITATION | WHAT IS IT?

Eliminate Cavitation:

- Cavitation Decreases Flow through the Pump.
- Cavitation Drastically Reduces the Life of the Pump (Vibration and Erosion).

What is Cavitation?:

- Accelerating a Fluid to High Velocities Creates a Drop in Pressure (Bernoulli).
- This Drop can Lower the Fluid Pressure to the Fluid's Vapor Pressure or Below.
- 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 Water Jets Impinge onto Surrounding Surfaces.
- The Force of this Impingement Leads to Material Loss, Vibration, Bearing and Seal Wear.
- Over Time, Cavitation Can Create Severe Erosion Problems in Pumps, Valves, Pipes.

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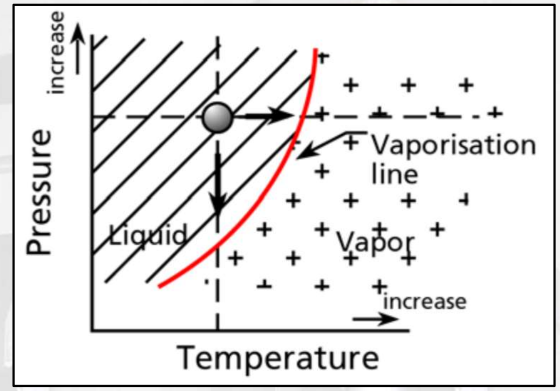
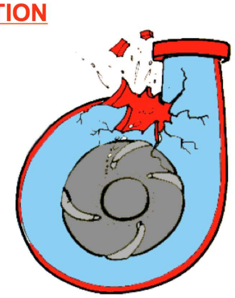


CONSTANT PRESSURE
* WATER BOILS AT 212º F

DROP PRESSURE:
* WATER BOILS AT LOWER TEMP.

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

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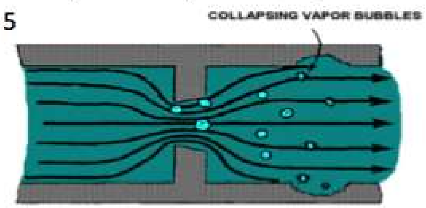
Cavitation

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.

Figure 5



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.

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

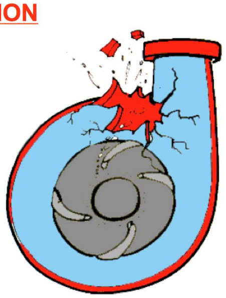
- Lost Efficiency
- Noise and Vibration – Sounds Like Pumping Gravel or Sand
- Increased Wear on Seals, Wear Parts, Bearings, etc…
- Mechanical Damage to Pump !
- A Pump Cavitates Easier at Higher Altitudes.

CAVITATION | IT'S NOT JUST PUMPS

1. Ensure $NPSH_A$ is Greater than $NPSH_R$ by at Least 2':
   - $NPSH_R$ is Determined by Pump Manufacturer:
     - Minimum Pressure Required at Pump Suction to Keep from Cavitating.
     - Increases with Flow and RPM.
   - $NPSH_A = H_A$ +/- $H_Z - H_F - H_{VP}$:
     - H_A = Atmospheric Pressure or Closed Tank or Loop Pressure (33.9' at Sea Level).
     - H_Z = Vertical Distance between the Water Level and the Pump Centerline.
     - H_F = Friction Losses in the Suction Piping.
     - H_{VP} = Liquid Vapor Pressure (~ 0.76' at 68° F).
2. Increase the Vertical Distance from the Water Level to Pump Centerline.
3. Decrease Suction Pipe Losses by Increasing Suction Pipe ID or Reducing Pipe Length.
4. Adjust Liquid Temperature.
5. Adjust Pump Speed.

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.



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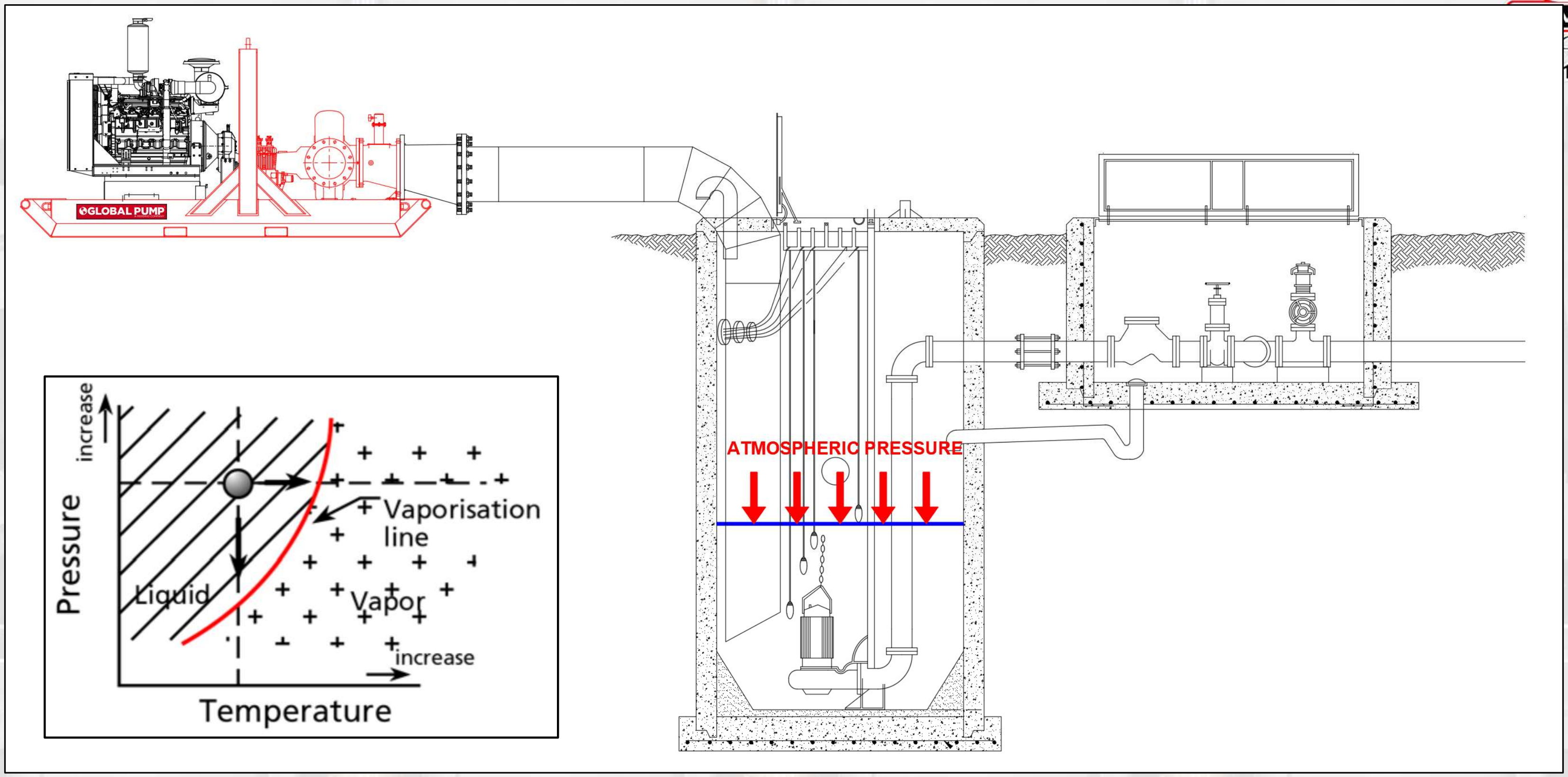
NPSH | HOW IT AFFECTS PUMPS



1. WATER SPEEDS UP AT EYE | LOCALIZED LOW PRESSURE
2. MUST ENSURE ENOUGH PRESSURE SO AIR DOESN'T "FLASH OUT"
3. $NPSH_A$ IS A MEASURE OF PRESSURE AVAILABLE AT EYE
4. $NPSH_A > NPSH_R$ (PERFORMANCE CURVE APPLIES)
5. $NPSH_A < NPSH_R$ (PERFORMANCE DROPS | AIR PRESENT):
   - WALK BACK ON CURVE UNTIL $NPSH_A = NPSH_R$

NPSH$_A$ | HOW TO CALCULATE

18-997-2311

NPSH$_A$ CALCULATION

RED = INPUT

BLUE = CALCULATED

NPSH$_A$ = P$_A$ + Static Head + Surface Pressure Head - Vapor Pressure - Friction Loss			
Atmospheric Pressure:	14.4	33.26	(Assume 500.00 Above Sea Level)
Static Suction Head:	-15.00	-15.00	(Negative for Suction Lift Applications)
Gage Pressure:	0.00	0.00	(Tank or Vessel Pressure)
Vapor Pressure of Liquid:	1.17	1.17	(Water Vapor Pressure at 80 Degrees)
Friction Loss in Suction:	3.00	3.00	(Suction Friction Loss)
	NPSHa:	**14.09**	(NPSHa Must be 2' to 3' Above NPSHr)
	NPSHr:	0.00	(Look at Pump Curve at Duty Point)
NPSHa - NPSHr:		**14.09**	(Must be 2' to 3')

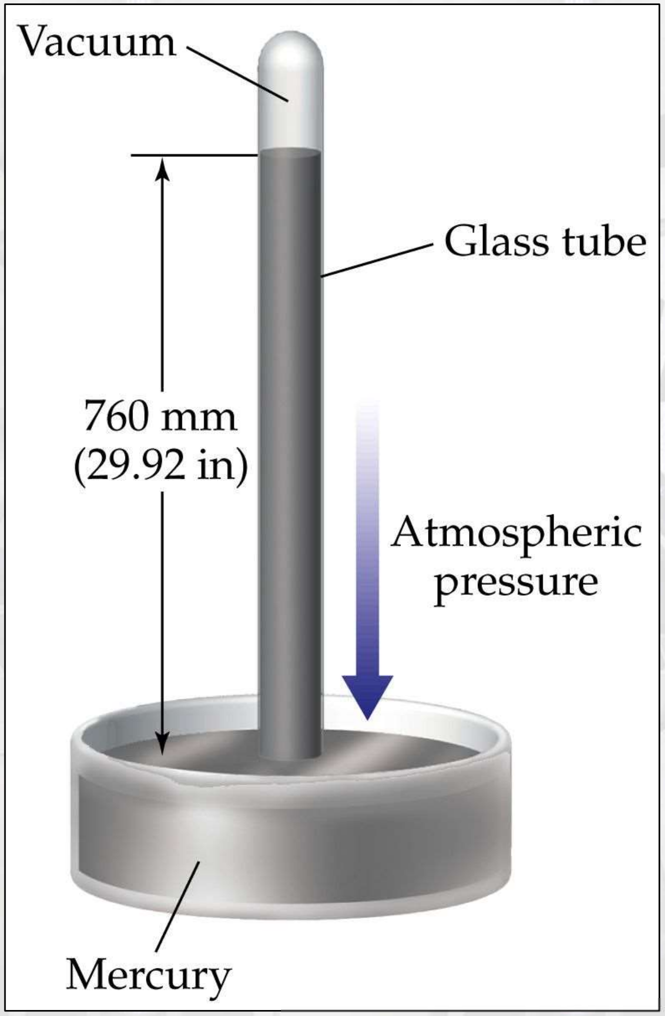
Altitude Above Sea Level		Absolute Barometer		Absolute Atmospheric Pressure		
feet	meters	inches Hg	mm Hg	psia	kg/cm^2	kPa
0[1)]	0	29.9	760	14.7	1.03	101
500	152	29.4	746	14.4	1.01	99.5
1000	305	28.9	733	14.2	0.997	97.7
1500	457	28.3	720	13.9	0.979	96.0
2000	610	27.8	707	13.7	0.961	94.2
2500	762	27.3	694	13.4	0.943	92.5
3000	914	26.8	681	13.2	0.926	90.8
3500	1067	26.3	669	12.9	0.909	89.1
4000	1219	25.8	656	12.7	0.893	87.5
4500	1372	25.4	644	12.5	0.876	85.9
5000	1524	24.9	632	12.2	0.860	84.3
6000	1829	24.0	609	11.8	0.828	81.2
7000	2134	23.1	586	11.3	0.797	78.2
8000	2438	22.2	564	10.9	0.768	75.3
9000	2743	21.4	543	10.5	0.739	72.4
10000	3048	20.6	523	10.1	0.711	69.7
15000	4572	16.9	429	8.29	0.583	57.2
20000	6096	13.8	349	6.75	0.475	46.6
25000	7620	11.1	282	5.45	0.384	37.6
30000	9144	8.89	226	4.36	0.307	30.1
35000	10668	7.04	179	3.46	0.243	23.8
40000	12192	5.52	140	2.71	0.191	18.7
45000	13716	4.28	109	2.10	0.148	14.5
50000	15240	3.27	83	1.61	0.113	11.1

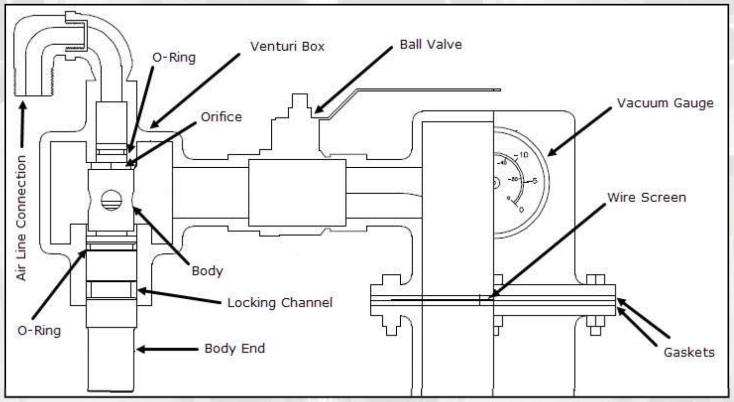
Water Vapor Pressure Chart

Temperature		Vapor Pressure	
F	C	PSI	FT
40	4.4	.1217	.281
50	10	.1781	.4115
60	15.6	.2563	.592
70	21.1	.3631	.815
80	26.7	.5069	1.17
90	32.2	.6982	1.612
100	37.8	.9492	2.191
110	43.3	1.275	2.942
120	48.9	1.692	3.91
130	54.4	2.223	5.145
140	60	2.889	6.675
150	65.6	3.718	8.56
160	71.1	4.741	10.95
170	76.7	5.992	13.84
180	82.2	7.510	17.35
190	87.8	9.339	21.55
200	93.3	11.50	26.65
212	100	14.70	33.96

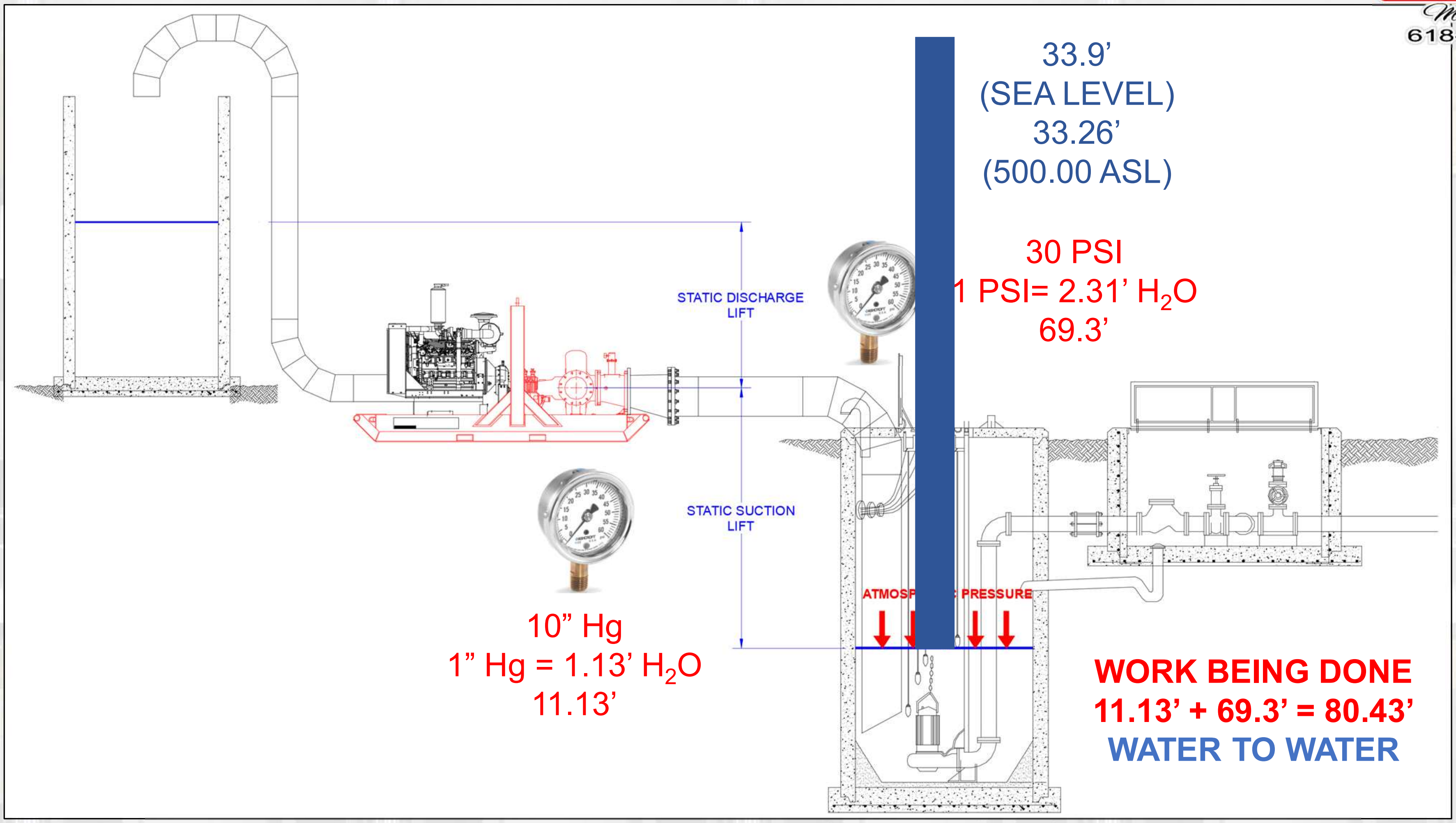
DRY PRIME PUMP | DO OUR PUMPS SUCK?!?

C and C PUMPS & SUPPLY
Marion, Il
618-997-2311



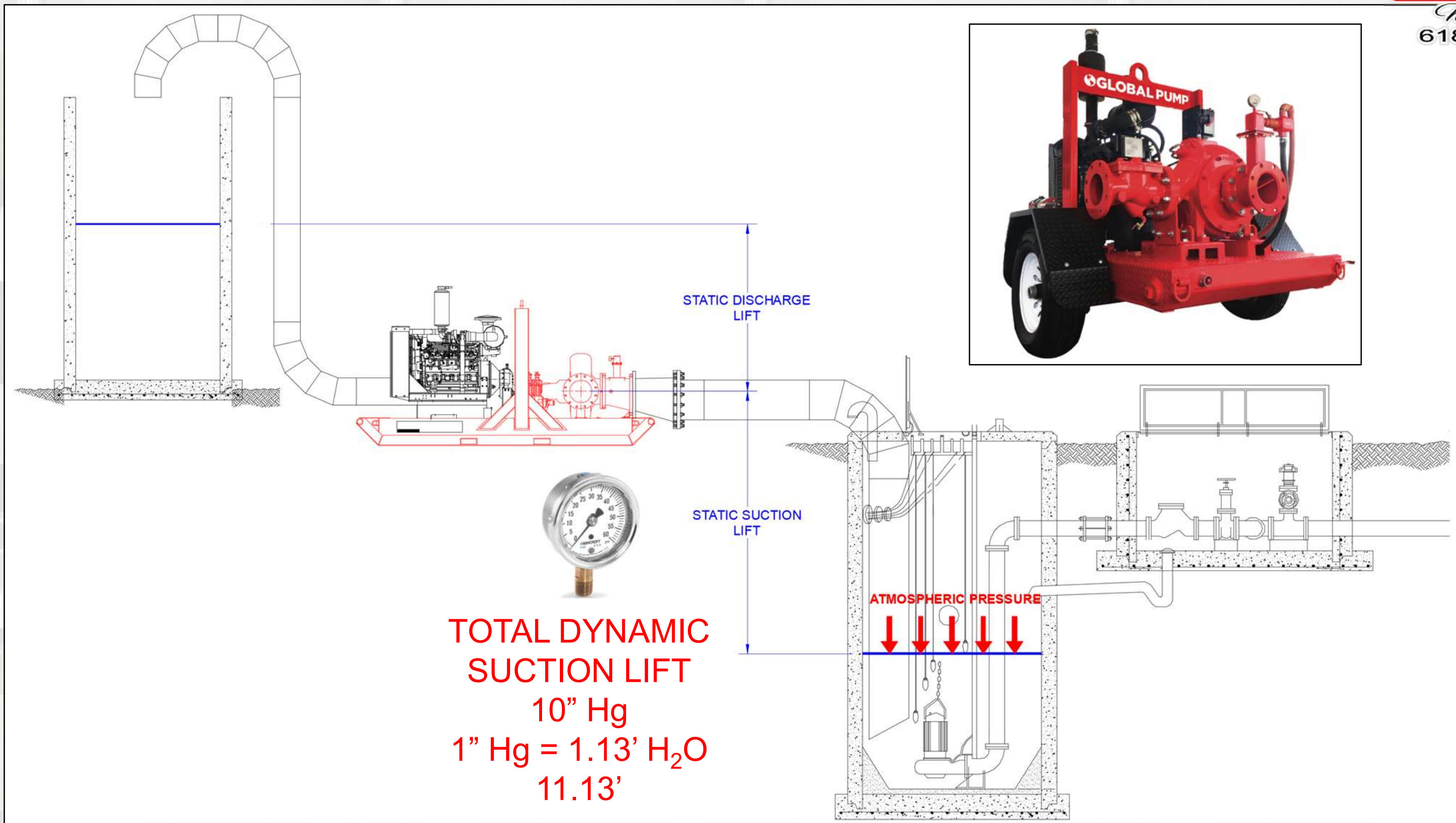


DRY PRIME PUMP | DO OUR PUMPS SUCK?!?



DRY PRIME PUMP | DO OUR PUMPS SUCK?!?

C AND C PUMPS & SUPPLY
Marion, Il
618-997-2311



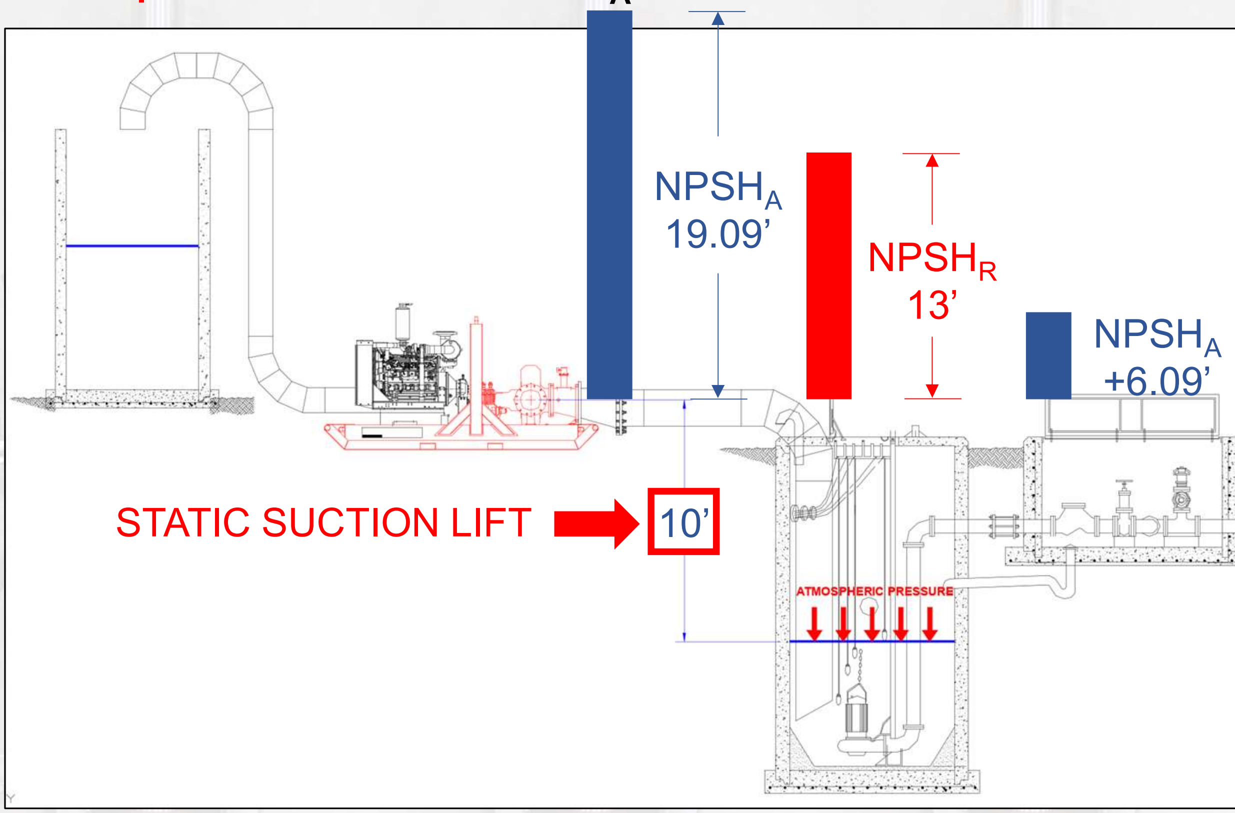
TOTAL DYNAMIC SUCTION LIFT

10” Hg

1” Hg = 1.13’ H_2O

11.13’

NPSH | CALCULATING $NPSH_A$



$NPSH_A$ CALCULATION

RED = INPUT

BLUE = CALCULATED

PUMPS & SUPPLY Marion IL 2013 CELEBRATING 5 YEARS 2018

$NPSH_A = P_A$ + Static Head + Surface Pressure Head - Vapor Pressure - Friction Loss

Atmospheric Pressure:	14.4	33.26	**(500.00 Above Sea Level)**
Static Suction Head:	-10.00	-10.00	(Negative for Suction Lift Applications)
Gage Pressure:	0.00	0.00	(Tank or Vessel Pressure)
Vapor Pressure of Liquid:	1.17	1.17	**(Water Vapor Pressure at 80 Degrees)**
Friction Loss in Suction:	3.00	3.00	(Suction Friction Loss)
	NPSHa:	19.09	(NPSHa Must be 2' to 3' Above NPSHr)
	NPSHr:	0.00	(Look at Pump Curve at Duty Point)
	NPSHa - NPSHr:	19.09	(Must be 2' to 3')

Altitude Above Sea Level		Absolute Barometer		Absolute Atmospheric Pressure		
feet	meters	inches Hg	mm Hg	psia	kg/cm^2	kPa
0[1)]	0	29.9	760	14.7	1.03	101
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20000	6096	13.8	349	6.75	0.475	46.6
25000	7620	11.1	282	5.45	0.384	37.6
30000	9144	8.89	226	4.36	0.307	30.1
35000	10668	7.04	179	3.46	0.243	23.8
40000	12192	5.52	140	2.71	0.191	18.7
45000	13716	4.28	109	2.10	0.148	14.5
50000	15240	3.27	83	1.61	0.113	11.1

Water Vapor Pressure Chart

Temperature		Vapor Pressure	
F	C	PSI	FT
40	4.4	.1217	.281
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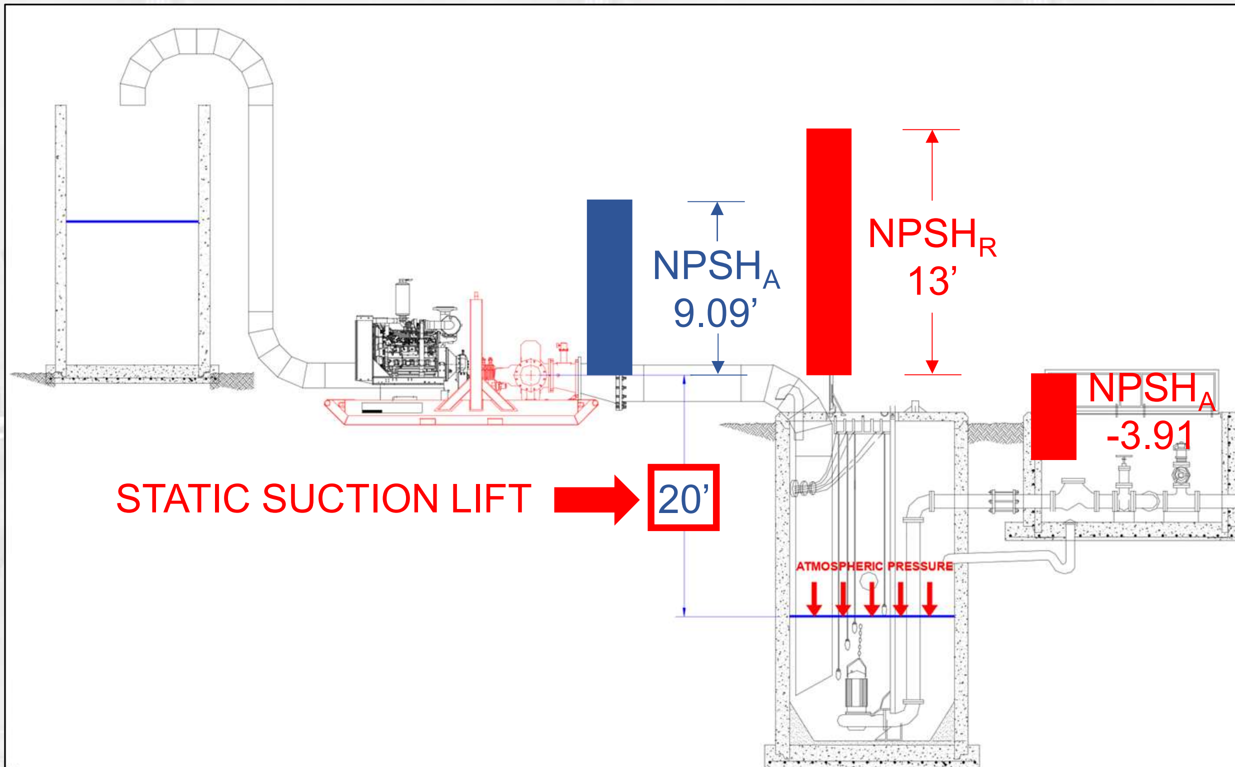
160	71.1	4.741	10.95
170	76.7	5.992	13.84
180	82.2	7.510	17.35
190	87.8	9.339	21.55
200	93.3	11.50	26.65
212	100	14.70	33.96

$NPSH_A = P_A$ +/- STATIC HEAD + SURFACE PRESSURE HEAD – VAPOR PRESSURE – FRICTION LOSS

$NPSH_A$ = 33.26' – 10' + 0 – 1.17' – 3' = **19.09'**

$NPSH_A > NPSH_R$ | CURVE APPLIES (NPSH SURPLUS)

NPSH | CALCULATING $NPSH_A$



C&C PUMPS & SUPPLY Marion, IL 2013 CELEBRATING 5 YEARS 2018

$NPSH_A$ CALCULATION

RED = INPUT

BLUE = CALCULATED

$NPSH_A = P_A$ + Static Head + Surface Pressure Head - Vapor Pressure - Friction Loss

Atmospheric Pressure:	14.4	33.26	**(500.00 Above Sea Level)**
Static Suction Head:	-20.00	-20.00	(Negative for Suction Lift Applications)
Gage Pressure:	0.00	0.00	(Tank or Vessel Pressure)
Vapor Pressure of Liquid:	1.17	1.17	**(Water Vapor Pressure at 80 Degrees)**
Friction Loss in Suction:	3.00	3.00	(Suction Friction Loss)
	NPSHa:	9.09	(NPSHa Must be 2' to 3' Above NPSHr)
	NPSHr:	0.00	(Look at Pump Curve at Duty Point)
	NPSHa - NPSHr:	9.09	(Must be 2' to 3')

Altitude Above Sea Level		Absolute Barometer		Absolute Atmospheric Pressure		
feet	meters	inches Hg	mm Hg	psia	kg/cm^2	kPa
0[1]	0	29.9	760	14.7	1.03	101
500	152	29.4	746	14.4	1.01	99.5
1000	305	28.9	733	[illegible]	0.997	97.7
1500	457	28.3	720	13.9	0.979	96.0
2000	610	27.8	707	13.7	0.961	94.2
2500	762	27.3	694	13.4	0.943	92.5
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7000	2134	23.1	586	11.3	0.797	78.2
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20000	6096	13.8	349	6.75	0.475	46.6
25000	7620	11.1	282	5.45	0.384	37.6
30000	9144	8.89	226	4.36	0.307	30.1
35000	10668	7.04	179	3.46	0.243	23.8
40000	12192	5.52	140	2.71	0.191	18.7
45000	13716	4.28	109	2.10	0.148	14.5
50000	15240	3.27	83	1.61	0.113	11.1

Water Vapor Pressure Chart

Temperature		Vapor Pressure	
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60	15.6	.2563	.592
70	21.1	.3631	.815
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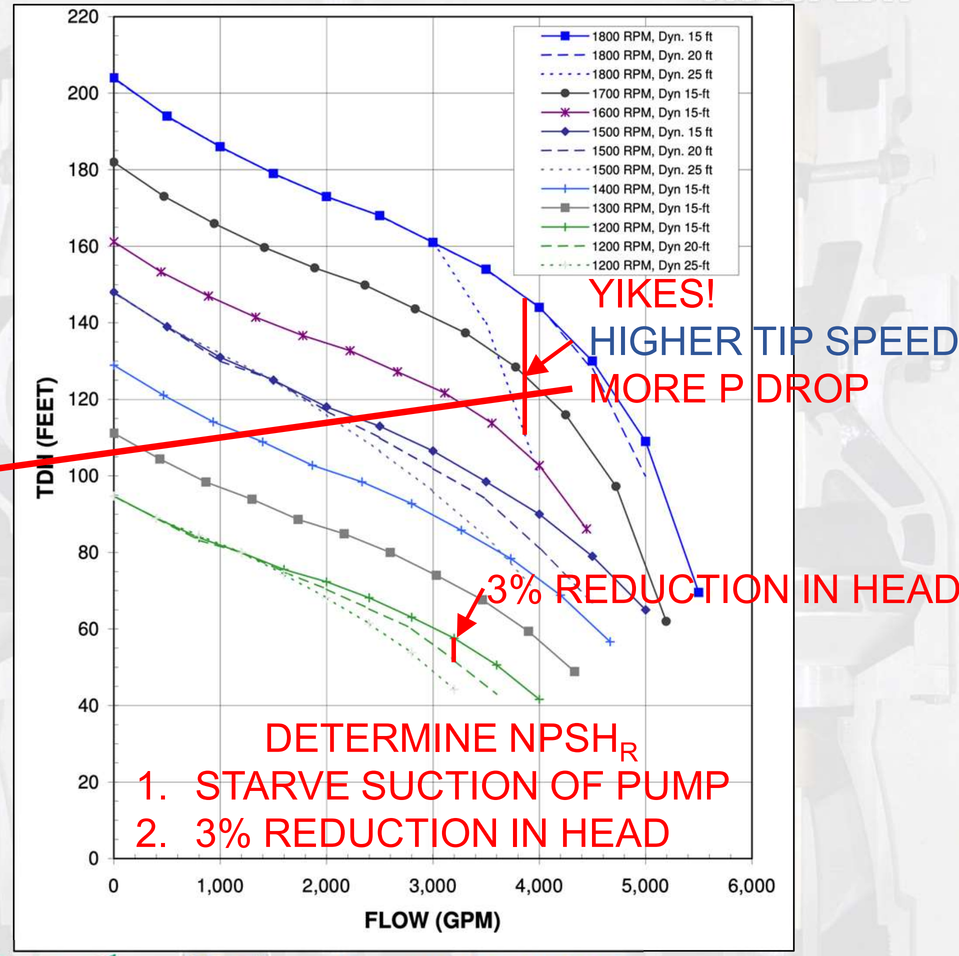
140	60	2.889	6.675
150	65.6	3.718	8.56
160	71.1	4.741	10.95
170	76.7	5.992	13.84
180	82.2	7.510	17.35
190	87.8	9.339	21.55
200	93.3	11.50	26.65
212	100	14.70	33.96

$NPSH_A = P_A$ +/- STATIC HEAD + SURFACE PRESSURE HEAD – VAPOR PRESSURE – FRICTION LOSS

$NPSH_A$ = 33.26' – 20' + 0 – 1.17' – 3' = **9.09'**

$NPSH_A < NPSH_R$ | CURVE DOES NOT APPLY (NPSH DEFICIENT | AIR PRESENT, PERFORMANCE REDUCED)

NPSH | NPSH DEFICIENT OPERATION



NPSH | NPSH DEFICIENT OPERATION

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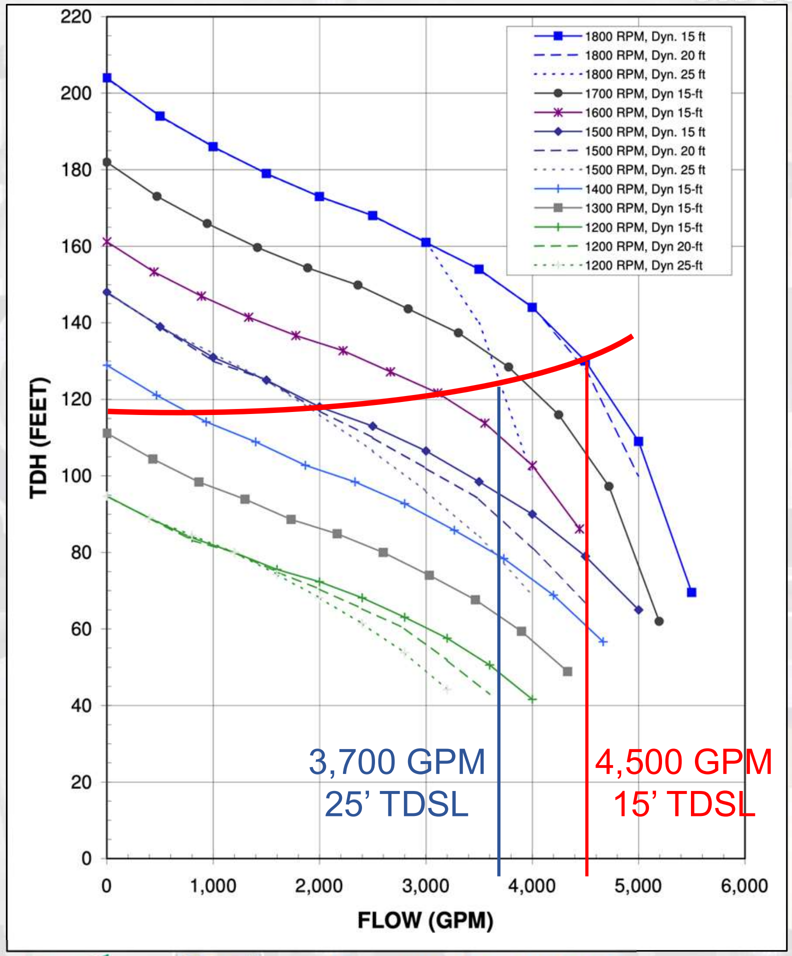
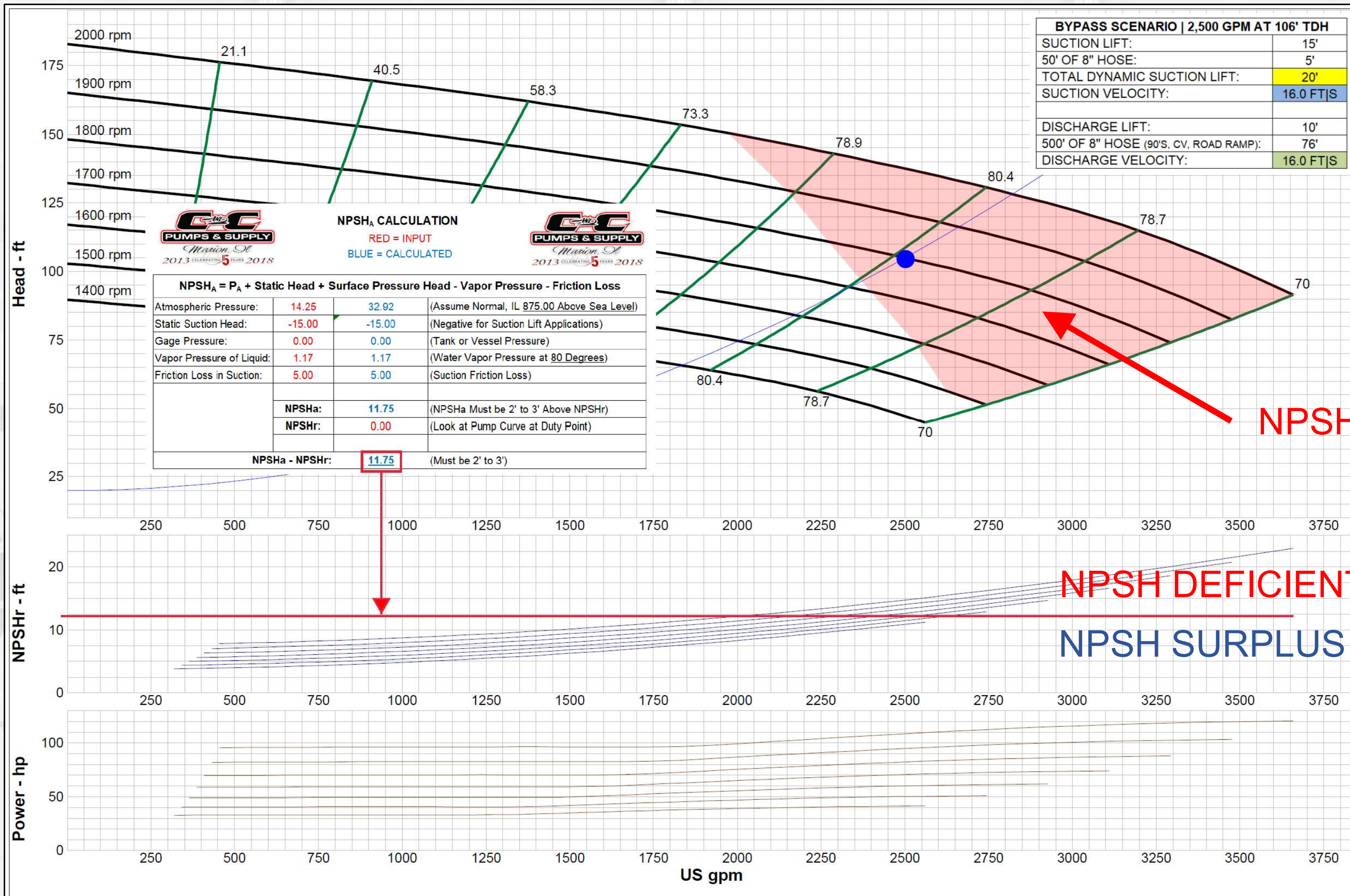


NPSH | HOW IT AFFECTS PUMPS



BYPASS SCENARIO | 2,500 GPM AT 106' TDH	
SUCTION LIFT:	15'
50' OF 8" HOSE:	5'
TOTAL DYNAMIC SUCTION LIFT:	20'
SUCTION VELOCITY:	16.0 FT|S
DISCHARGE LIFT:	10'
500' OF 8" HOSE (90'S, CV, ROAD RAMP):	76'
DISCHARGE VELOCITY:	16.0 FT|S

$NPSH_A = P_A$ + Static Head + Surface Pressure Head - Vapor Pressure - Friction Loss			
Atmospheric Pressure:	14.25	32.92	(Assume Normal, IL 875.00 Above Sea Level)
Static Suction Head:	-15.00	-15.00	(Negative for Suction Lift Applications)
Gage Pressure:	0.00	0.00	(Tank or Vessel Pressure)
Vapor Pressure of Liquid:	1.17	1.17	(Water Vapor Pressure at 80 Degrees)
Friction Loss in Suction:	5.00	5.00	(Suction Friction Loss)
	NPSHa:	11.75	(NPSHa Must be 2' to 3' Above NPSHr)
	NPSHr:	0.00	(Look at Pump Curve at Duty Point)
NPSHa - NPSHr:		11.75	(Must be 2' to 3')

Company: C and C Pumps & Supply, Inc.
Name: Sample Bypass Project
2/13/2019

GLOBAL PUMP
Catalog: Global Pump, Vers 1
TRASH - 1800

Size: 8GST
Speed: 1400 - 2000 rpm
Dia: 12 in
Curve: T500106-2
Impeller: 000142

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

C AND C PUMPS & SUPPLY
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NPSH | HOW IT AFFECTS PUMPS

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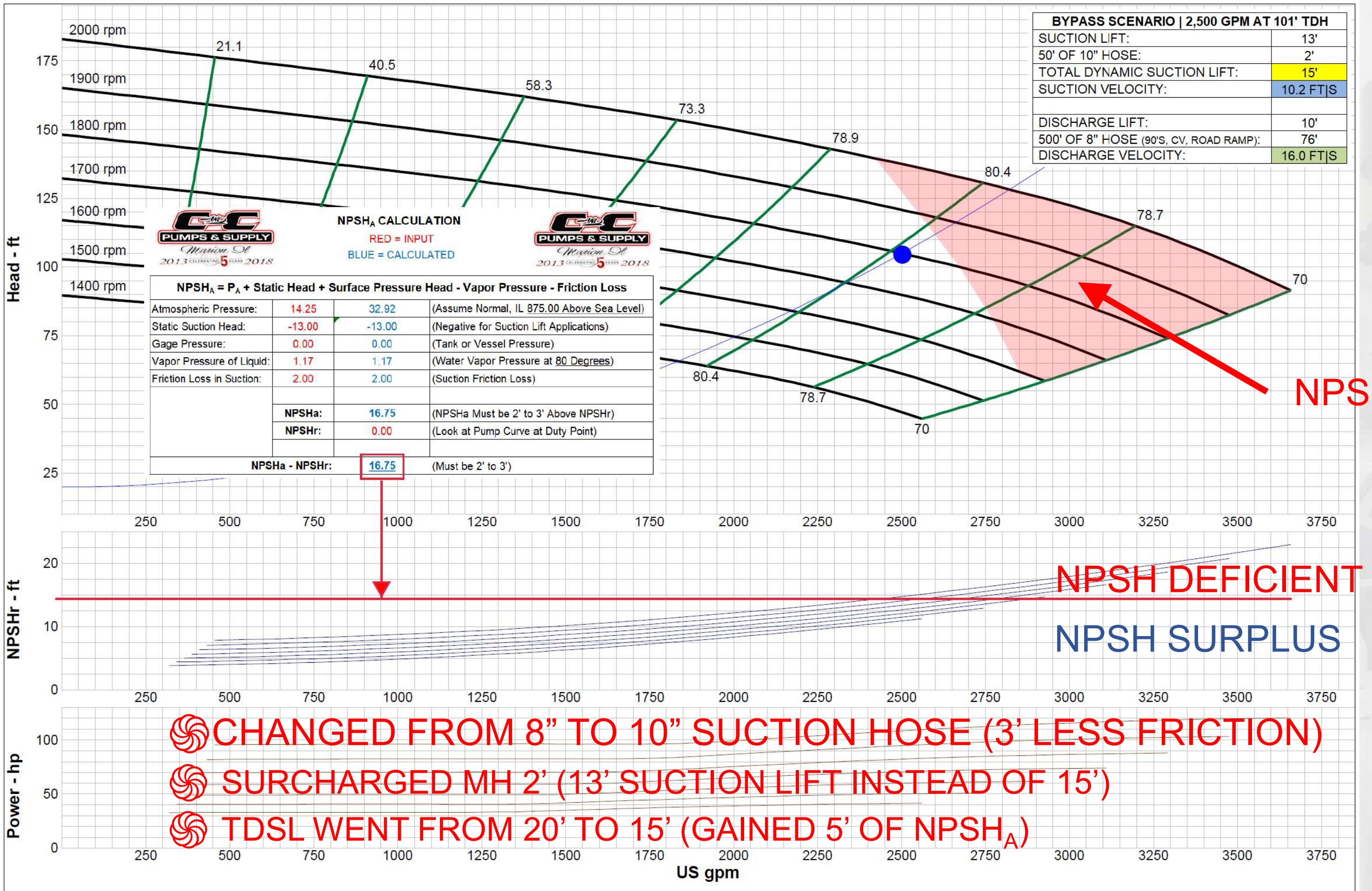
Marion, Il
618-997-2311



Company: C and C Pumps & Supply, Inc.
Name: Sample Bypass Project
2/13/2019

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TRASH - 1800

Size: 8GST
Speed: 1400 - 2000 rpm
Dia: 12 in
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Impeller: 000142

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

PRESSURE GAUGE OFFSET | WHAT ARE YOU TALKING ABOUT, SCOOTER?

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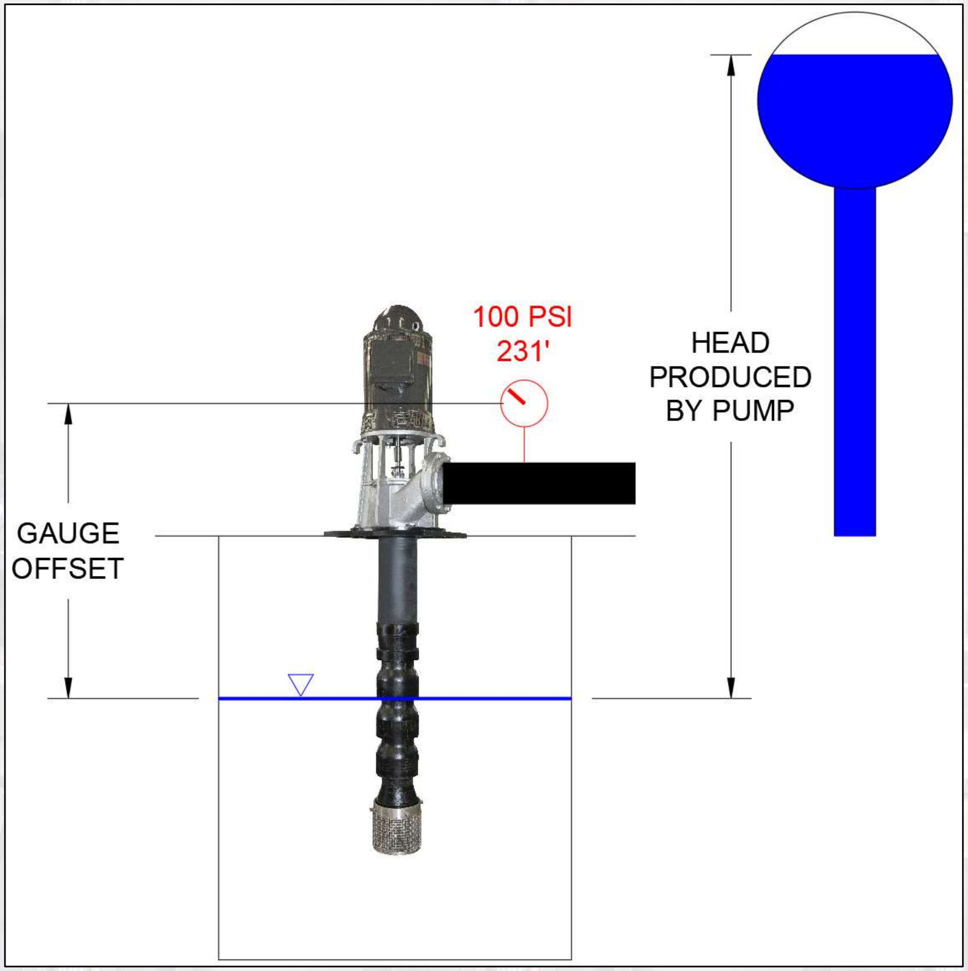
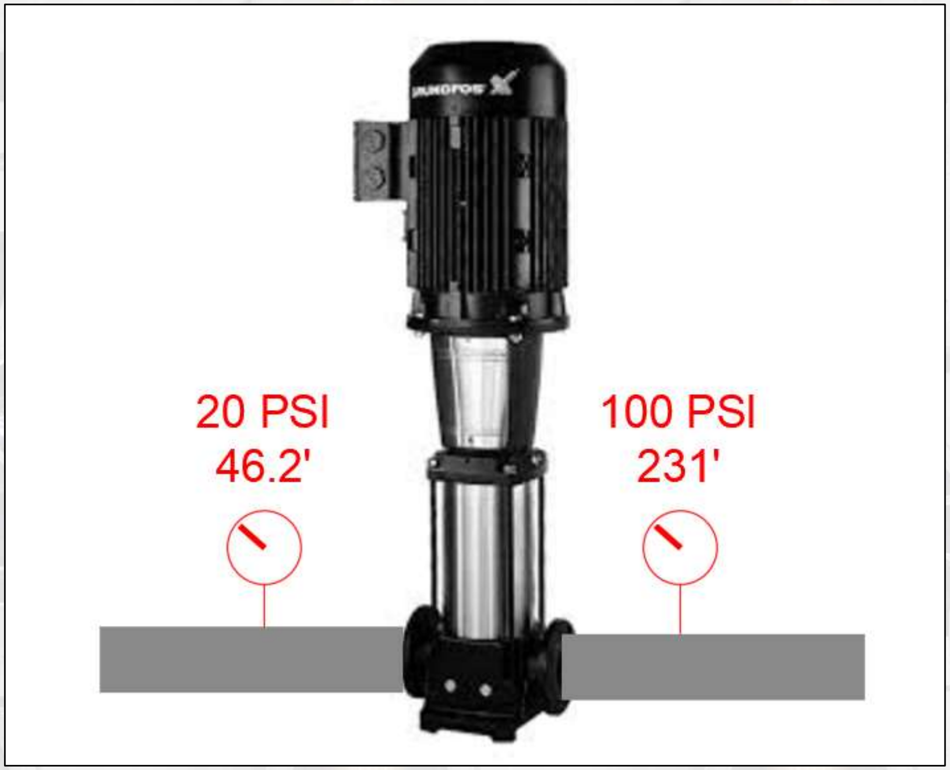
Marion, Il
618-997-2311



ADD OFFSET TO GAUGE READING



SUBTRACT SUCTION FROM DISCHARGE

DISCHARGE PRESSURE TABLE | INCREASE RELIABILITY

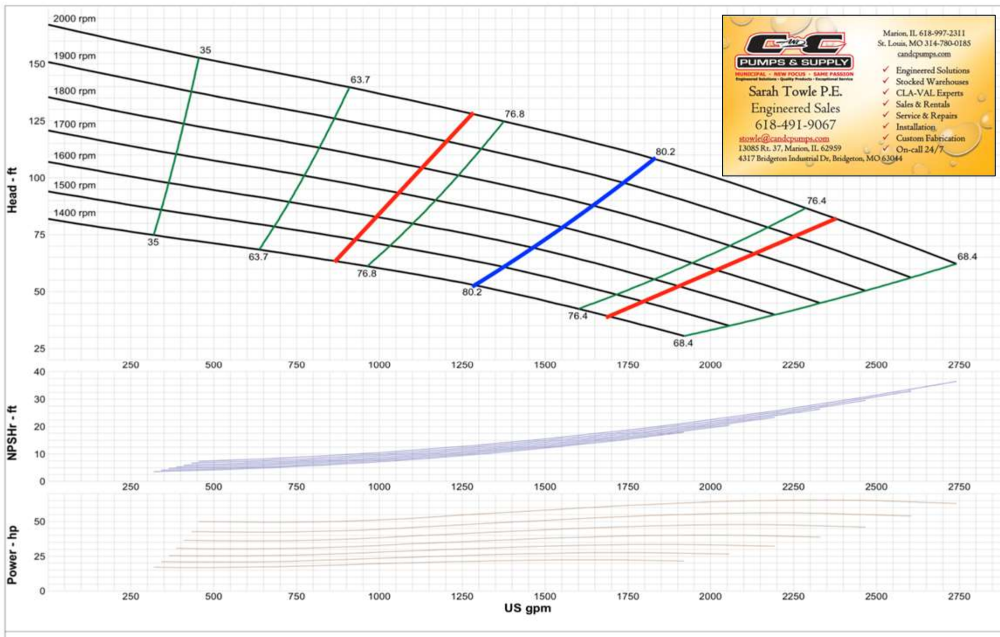
PUMPS & SUPPLY
Marion, IL
618-997-2311

GLOBAL 6GST

DISCHARGE PRESSURE TABLE

The table below is based on a 15' suction lift. Always try to attain the ideal discharge pressure for the speed in which the pump is running. Adjust the engine speed and make sure the discharge pressure is between the minimum and maximum pressures shown below. Please call for operation over 2000 RPM.

SPEED	MINIMUM PRESSURE	IDEAL PRESSURE	MAXIMUM PRESSURE
1400 RPM	10 PSI	16 PSI	21 PSI
1600 RPM	16 PSI	23 PSI	29 PSI
1800 RPM	23 PSI	32 PSI	39 PSI
2000 RPM	29 PSI	41 PSI	49 PSI



Company: C and C Pumps & Supply, Inc.
Name: Discharge Pressure Tables
7/22/2019

GLOBAL PUMP
Catalog: Global Pump, Vers 1
TRASH - 1800

Size: 6GST
Speed: 1400 - 2000 rpm
Dia: 11 in
Curve: T500104-2
Impeller: 000082

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

DISCHARGE PRESSURE TABLE | INCREASE RELIABILITY

PUMPS & SUPPLY
Marion, IL
618-997-2311

GLOBAL 6GST

DISCHARGE PRESSURE TABLE

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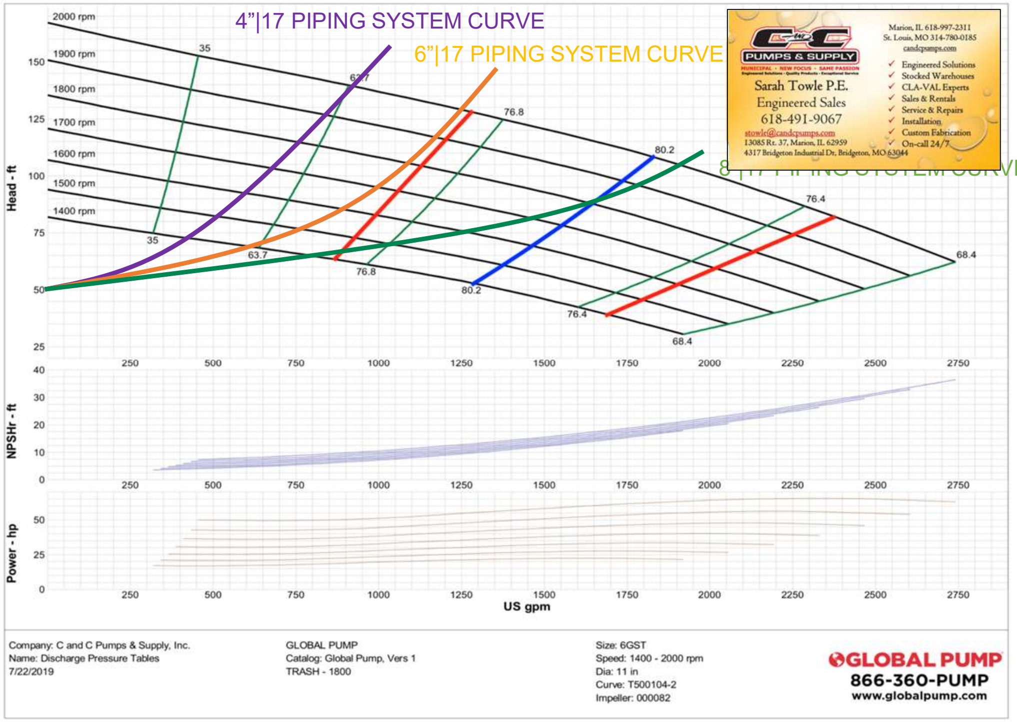
1400 RPM	10 PSI	16 PSI	21 PSI
1600 RPM	16 PSI	23 PSI	29 PSI
1800 RPM	23 PSI	32 PSI	39 PSI
2000 RPM	29 PSI	41 PSI	49 PSI



DISCHARGE PRESSURE TABLE | INCREASE RELIABILITY

618-997-2311

GLOBAL 6GST
DISCHARGE PRESSURE TABLE

The table below is based on a 15' suction lift Always try to attain the ideal discharge pressure for the speed in which the pump is running. Adjust the engine speed and make sure the discharge pressure is between the minimum and maximum pressures shown below. Please call for operation over 2000 RPM.

SPEED	MINIMUM PRESSURE	IDEAL PRESSURE	MAXIMUM PRESSURE
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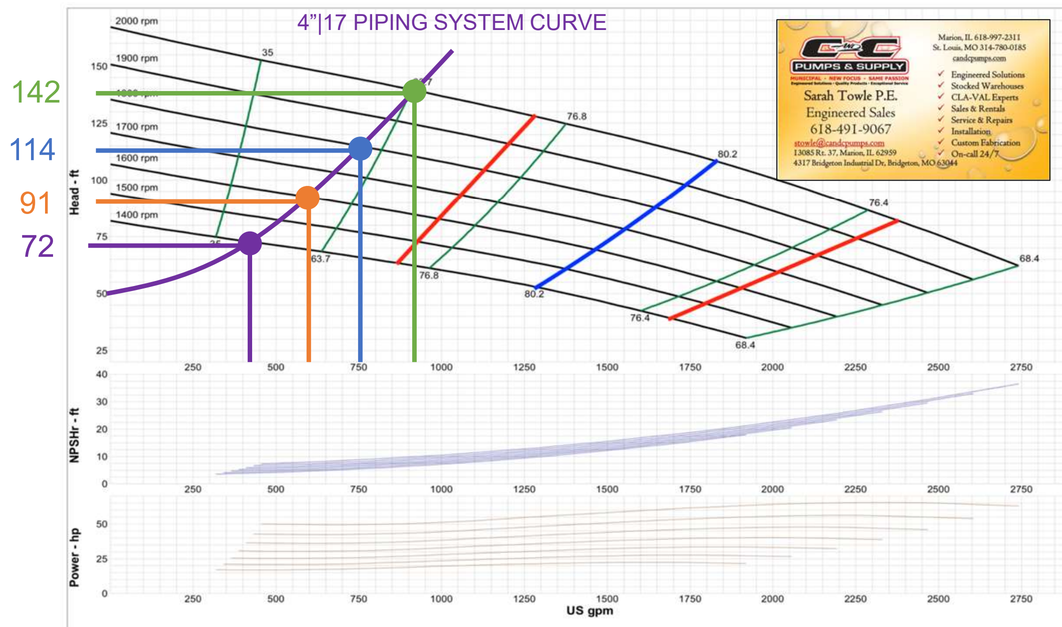


Company: C and C Pumps & Supply, Inc.
Name: Discharge Pressure Tables
7/22/2019

GLOBAL PUMP
Catalog: Global Pump, Vers 1
TRASH - 1800

Size: 6GST
Speed: 1400 - 2000 rpm
Dia: 11 in
Curve: T500104-2
Impeller: 000082

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

4"|17 DISCHARGE PIPING EXAMPLE

RUN AT 1400 RPM:
1. **25 PSI** X 2.31 + 15' = 72'
2. GO TO 1400 RPM IN TABLE
3. DISCHARGE PRESSURE TOO HIGH
4. SPEED PUMP UP

RUN AT 1600 RPM:
1. **33 PSI** X 2.31 + 15' = 91'
2. GO TO 1600 RPM IN TABLE
3. DISCHARGE PRESSURE TOO HIGH
4. SPEED PUMP UP

RUN AT 1800 RPM:
1. **43 PSI** X 2.31 + 15' = 114'
2. GO TO 1800 RPM IN TABLE
3. DISCHARGE PRESSURE TOO HIGH
4. SPEED PUMP UP

RUN AT 2000 RPM:
1. **55 PSI** X 2.31 + 15' = 142'
2. GO TO 2000 RPM IN TABLE
3. DISCHARGE PRESSURE TOO HIGH
4. CALL SARAH AND BRAD!

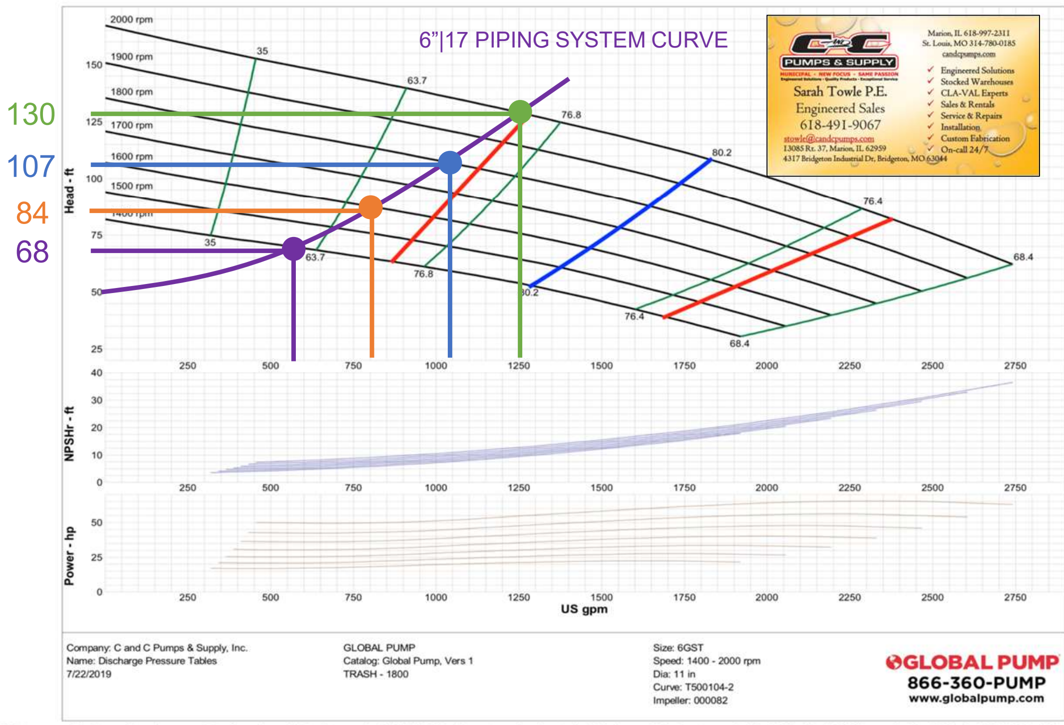
DISCHARGE PRESSURE TABLE | INCREASE RELIABILITY

PUMPS & SUPPLY
Marion, IL
618-997-2311

GLOBAL 6GST
DISCHARGE PRESSURE TABLE

The table below is based on a 15' suction lift Always try to attain the ideal discharge pressure for the speed in which the pump is running. Adjust the engine speed and make sure the discharge pressure is between the minimum and maximum pressures shown below. Please call for operation over 2000 RPM.

SPEED	MINIMUM PRESSURE	IDEAL PRESSURE	MAXIMUM PRESSURE
1400 RPM	10 PSI	16 PSI	21 PSI
1600 RPM	16 PSI	23 PSI	29 PSI
1800 RPM	23 PSI	32 PSI	39 PSI
2000 RPM	29 PSI	41 PSI	49 PSI



6"|17 DISCHARGE PIPING EXAMPLE

RUN AT 1400 RPM:
1. **23 PSI** X 2.31 + 15' = 68'
2. GO TO 1400 RPM IN TABLE
3. DISCHARGE PRESSURE TOO HIGH
4. SPEED PUMP UP

RUN AT 1600 RPM:
1. **30 PSI** X 2.31 + 15' = 84'
2. GO TO 1600 RPM IN TABLE
3. DISCHARGE PRESSURE TOO HIGH
4. SPEED PUMP UP

RUN AT 1800 RPM:
1. **40 PSI** X 2.31 + 15' = 107'
2. GO TO 1800 RPM IN TABLE
3. DISCHARGE PRESSURE TOO HIGH
4. SPEED PUMP UP

RUN AT 2000 RPM:
1. **50 PSI** X 2.31 + 15' = 130'
2. GO TO 2000 RPM IN TABLE
3. DISCHARGE PRESSURE TOO HIGH
4. CALL SARAH AND BRAD!

DISCHARGE PRESSURE TABLE | INCREASE RELIABILITY

C and C PUMPS & SUPPLY Marion, Il 2013 CELEBRATING 5 YEARS 2018

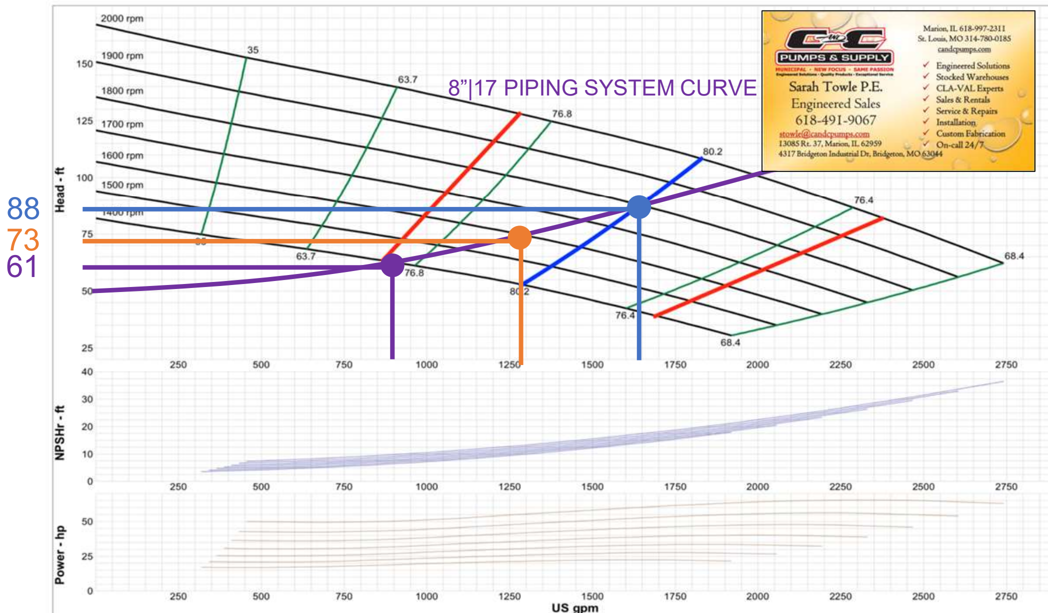
GLOBAL 6GST

DISCHARGE PRESSURE TABLE

C and C PUMPS & SUPPLY Marion, Il 2013 CELEBRATING 5 YEARS 2018

The table below is based on a 15' suction lift. Always try to attain the ideal discharge pressure for the speed in which the pump is running. Adjust the engine speed and make sure the discharge pressure is between the minimum and maximum pressures shown below. Please call for operation over 2000 RPM.

SPEED	MINIMUM PRESSURE	IDEAL PRESSURE	MAXIMUM PRESSURE
1400 RPM	10 PSI	16 PSI	21 PSI
1600 RPM	16 PSI	23 PSI	29 PSI
1800 RPM	23 PSI	32 PSI	39 PSI
2000 RPM	29 PSI	41 PSI	49 PSI



Company: C and C Pumps & Supply, Inc.
Name: Discharge Pressure Tables
7/22/2019

GLOBAL PUMP
Catalog: Global Pump, Vers 1
TRASH - 1800

Size: 6GST
Speed: 1400 - 2000 rpm
Dia: 11 in
Curve: T500104-2
Impeller: 000082

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

C and C Pumps & Supply, Inc. - St. Louis, MO Branch | 4317 Bridgeton Industrial Drive, Bridgeton, MO 63044 | Office: 314.780.0185 | Mobile: 618.694.2039

C and C PUMPS & SUPPLY Marion, Il
618-997-2311

8"|17 DISCHARGE PIPING EXAMPLE

RUN AT 1400 RPM:

1. **20 PSI** X 2.31 + 15' = 61'
2. GO TO 1400 RPM IN TABLE
3. ACCEPTABLE | GET CLOSER
4. SPEED PUMP UP

RUN AT 1600 RPM:

1. **25 PSI** X 2.31 + 15' = 73'
2. GO TO 1600 RPM IN TABLE
3. ACCEPTABLE | ALMOST IDEAL
4. SPEED PUMP UP

RUN AT 1800 RPM:

1. **32 PSI** X 2.31 + 15' = 88'
2. GO TO 1800 RPM IN TABLE
3. GOT IT! | IDEAL PRESSURE
4. GO FISHING!