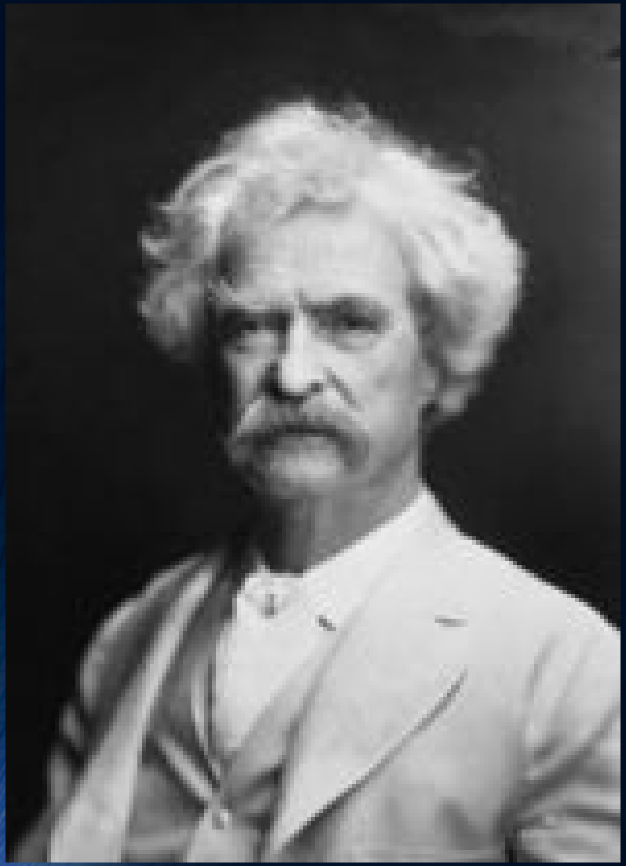
Protect the Heart of the Irrigation System-The Pump

C J PHENE II
PRESIDENT
EPIPHENE, INC



“What gets us into trouble is not what we don't know. It's what we know for sure that just ain't so.”

— **Mark Twain**

Outline

- Downhole Pumps - Sand Protection
- Self-Cleaning Suction Screens
- Strainers
- Flow Control Solutions

Car Analogy

- Fuel Filter
- Oil Filter
- Air Filter
- Fuel Injection Nozzles

Downhole Pumps – Why Sand Protection?

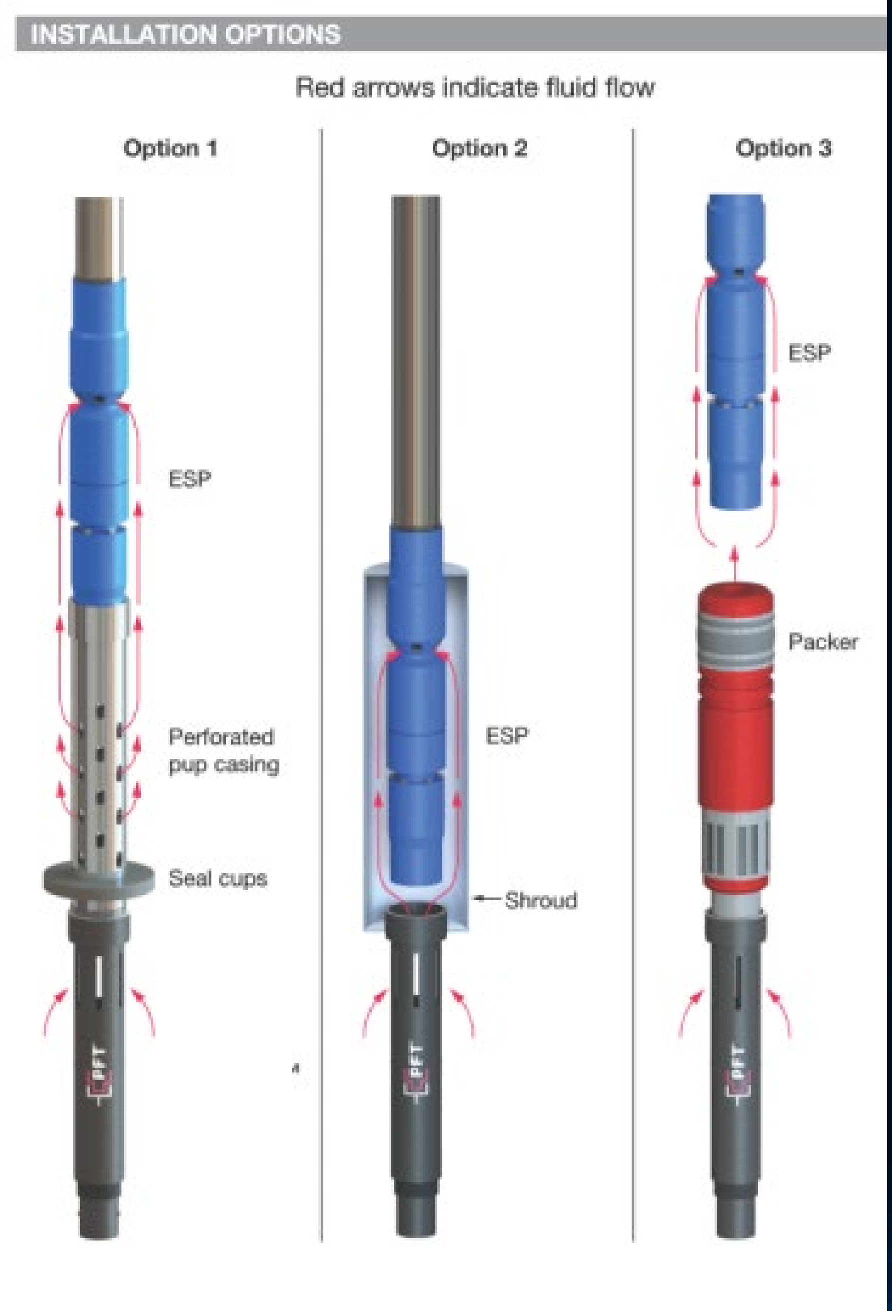
- Declining well water levels
- Decreased well production
- Silt and Sand intrusion
- Damage to bowls and impellers

<u>MAIN BENEFITS</u>

INCREASES LIFE OF PUMP UP TO <u>FIVE</u> TIMES

MAINTAINS FLOW AND HEAD FOR LONGER

Downhole Pumps – Solutions for Submersibles



Downhole Pumps – Solutions for Turbines

Downhole Pumps – Solutions for both Submersible and Turbine

- Important Factors to consider:
  - Casing Inside Diameter
  - Water Level
  - Pump level
  - Depth to bottom of well

- Typical Requirements to consider:
  - Correct Connections & Approach
  - Does the pump have minimum head requirement to operate the downhole separator?
  - Does it change during season?
  - Does it have minimum of 30 ft to bottom?

Why Self-Cleaning Suction Screens?

- Protect Centrifugal or Close Coupled Turbines from
  - debris,
  - aquatic beasties,
  - and algae

What Are Self-Cleaning Suction Screens?

- Centrifugal
- Close Coupled Turbines
- Video Example

Self-Cleaning Suction – Solutions for both Submersible and Turbine

- Important Factors :
  - Flow Rates
  - Debris Expected
  - Inlet Velocities
  - Protecting Screen Collapsing & Pump From Cavitating
  - Drive Type

- Typical Requirements:
  - Always Oversize
  - Algae, Fish & Frogs, other debris
  - Maximum Inlet velocity .4 fps
  - Vacuum Gauge with Switch
  - Diesel or Electric

Why Strainers?

- Protects the Pump
- But also protects downstream components
  - Check Valves
  - Control Valves
  - Filters
- Bottomline:
  - Safety Screen
  - **Rather clean a strainer than chase down issues in downstream components**

Types of Strainers

Y STRAINERS

BASKET STRAINERS

Design Consideration

Y STRAINERS

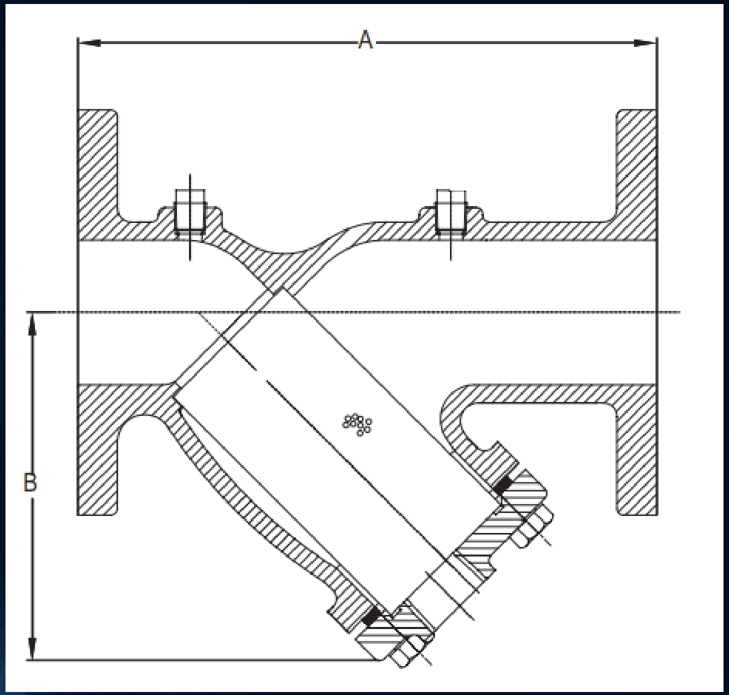
- More Flexible Installation
- Flushable
- More turbulence
- Higher Friction Loss

BASKET STRAINERS

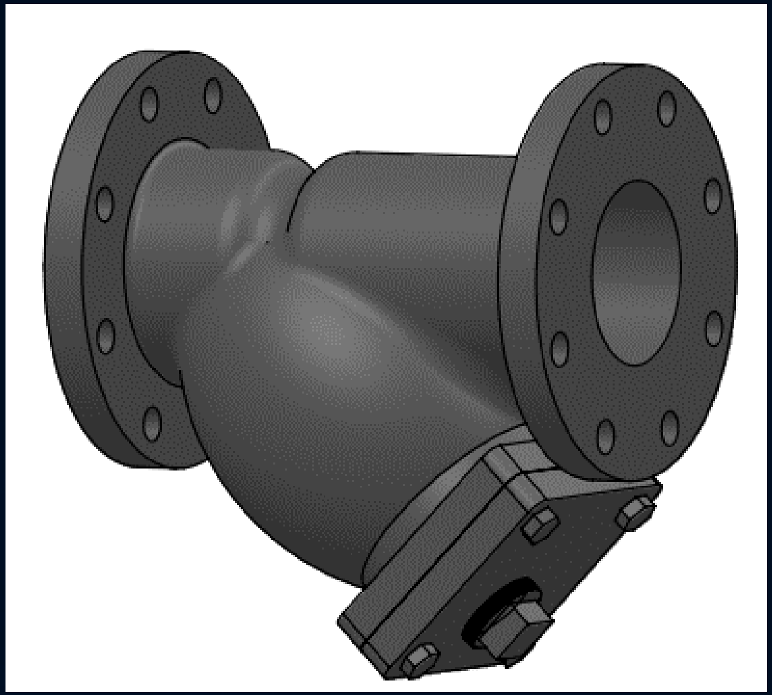
- Only installed one way
- Not Flushable
- Less turbulence
- Lower Friction Loss

Types of Strainers

Y STRAINER

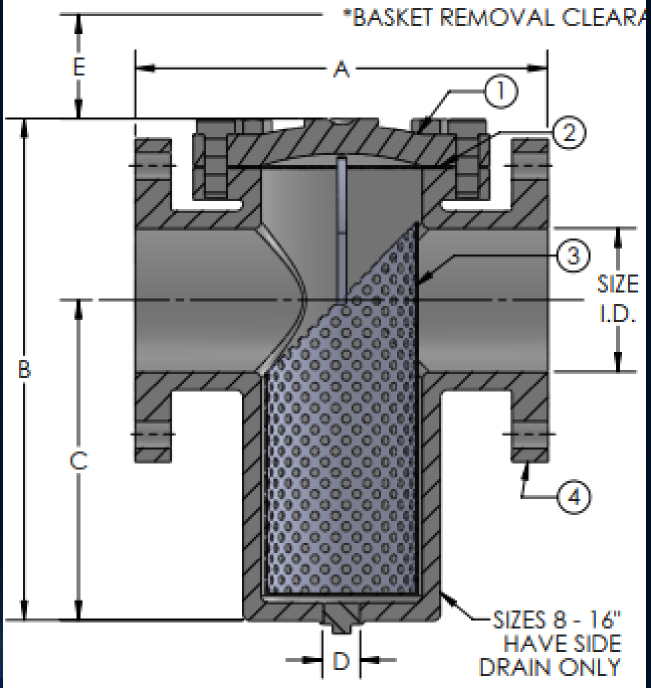


Y STRAINER



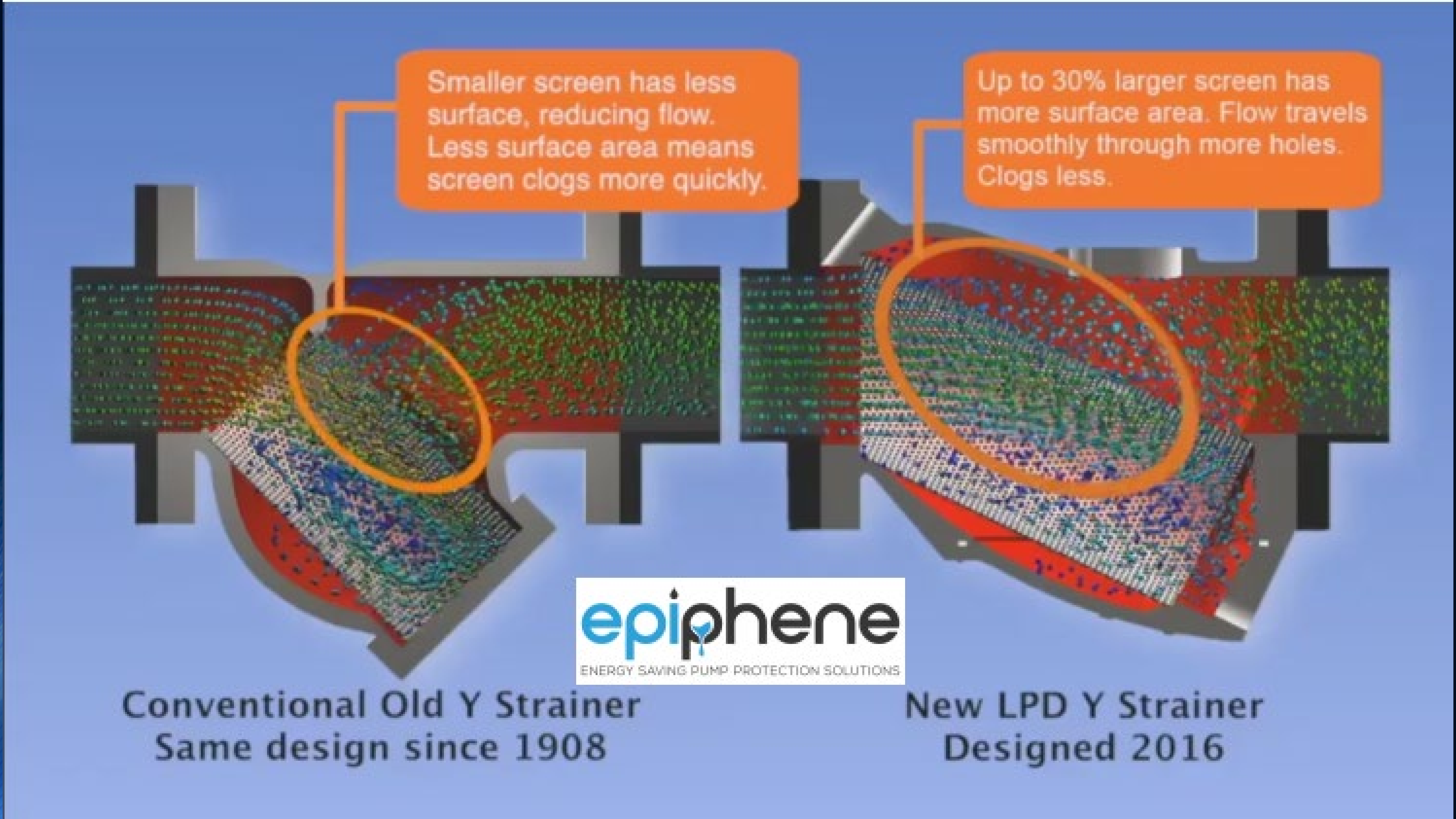
Types of Strainers

BASKET STRAINER

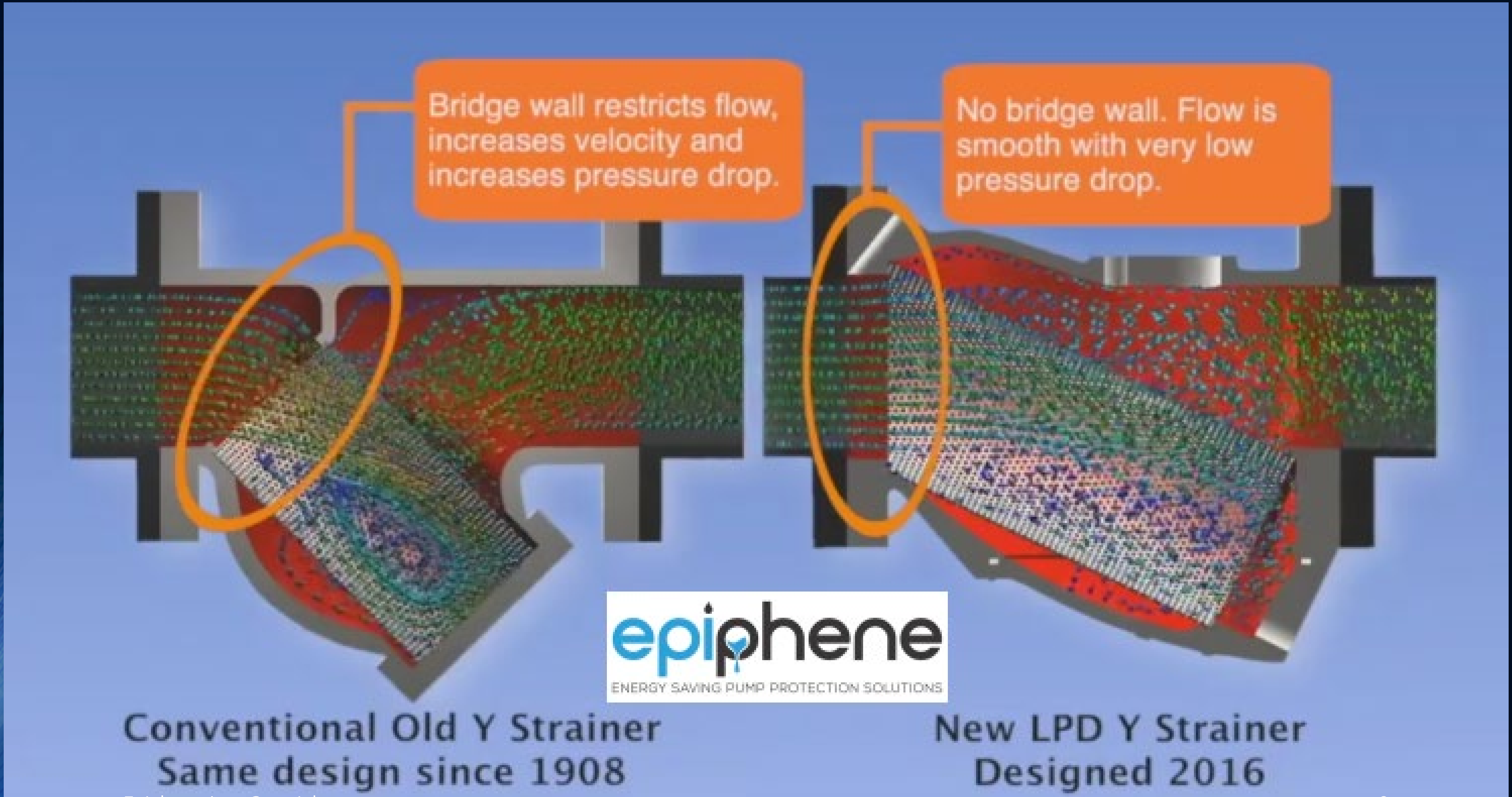


BASKET STRAINER

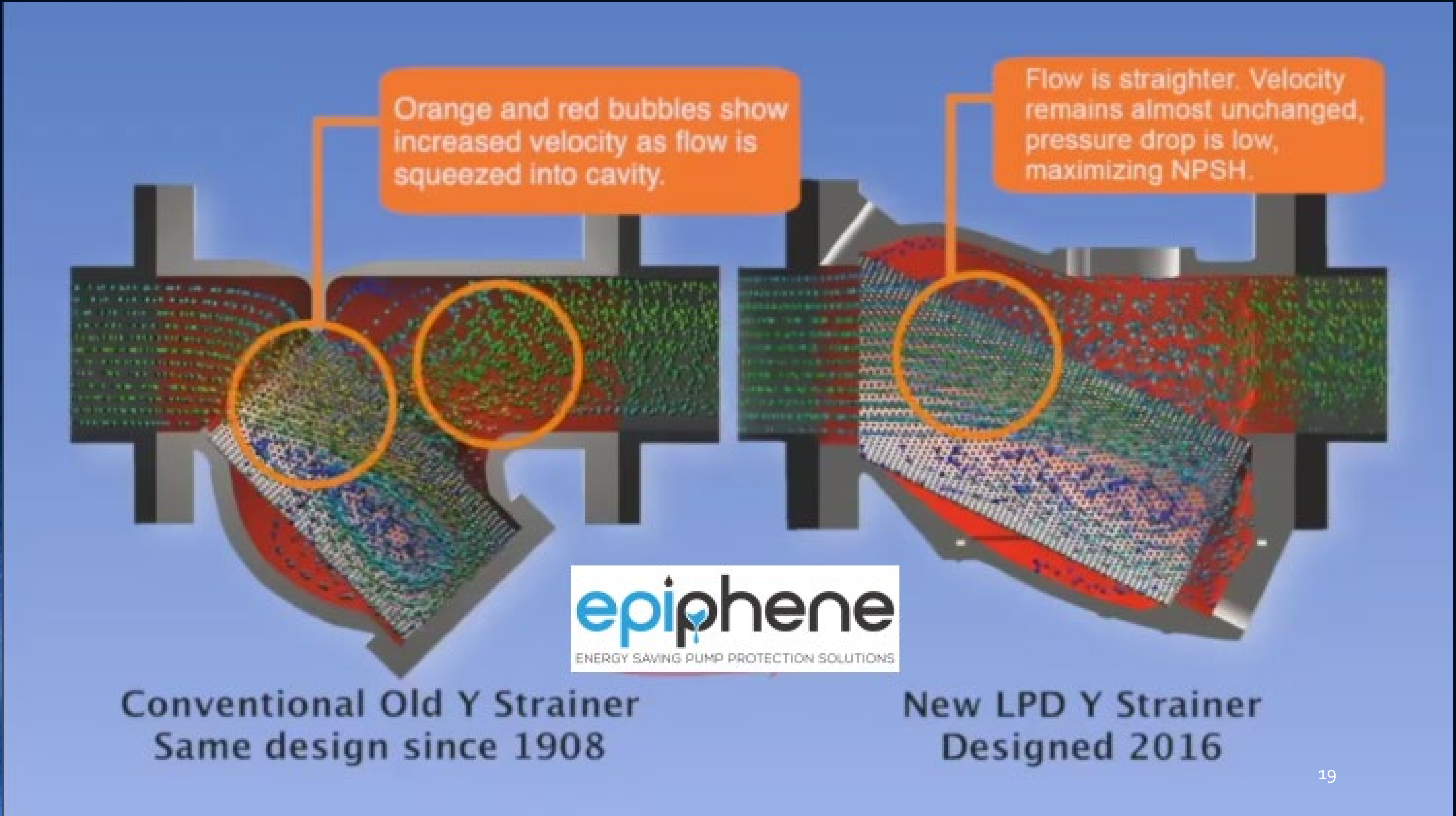
Strainer - “Saving Energy”



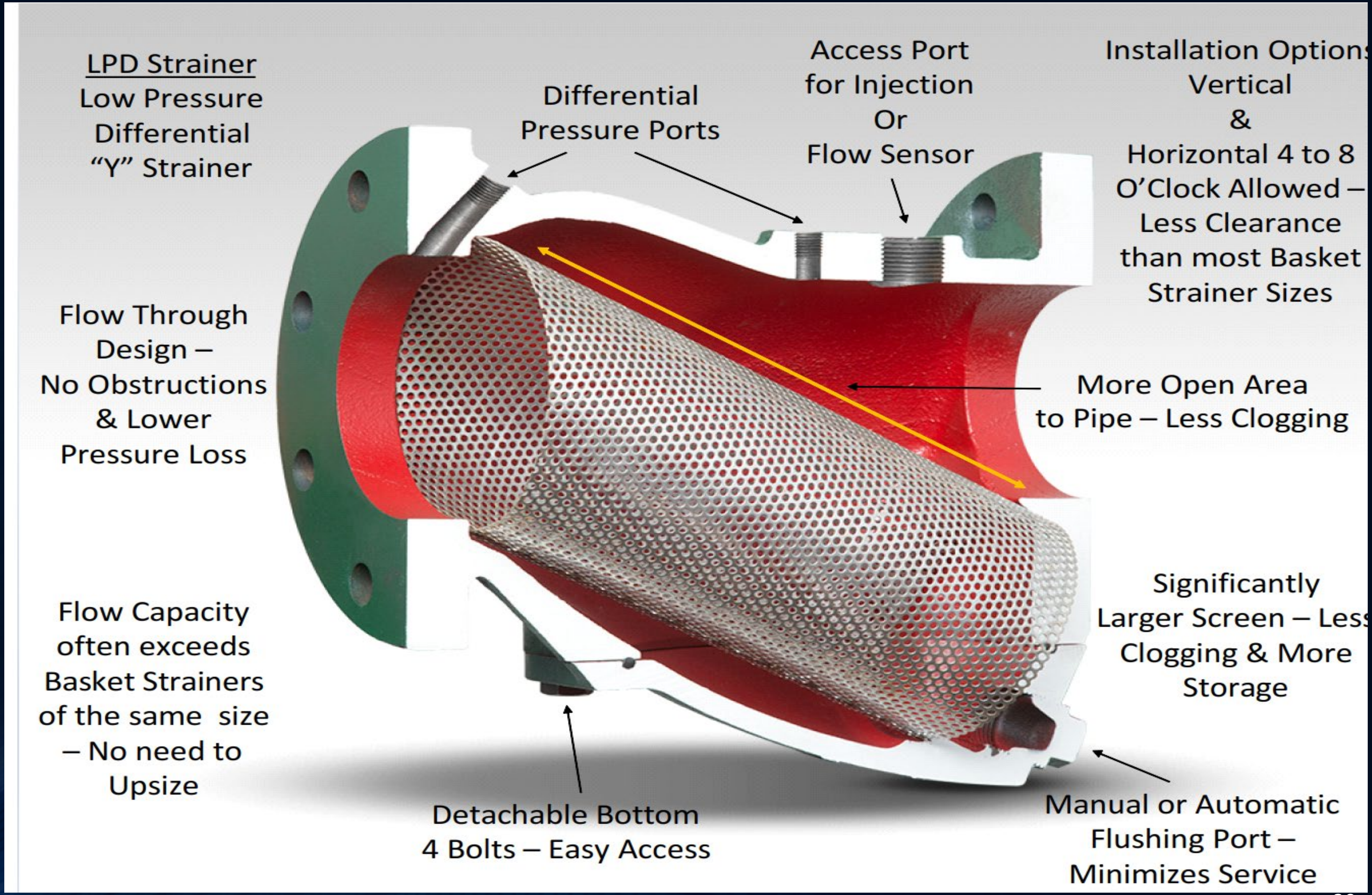
Strainer - "Saving Energy"



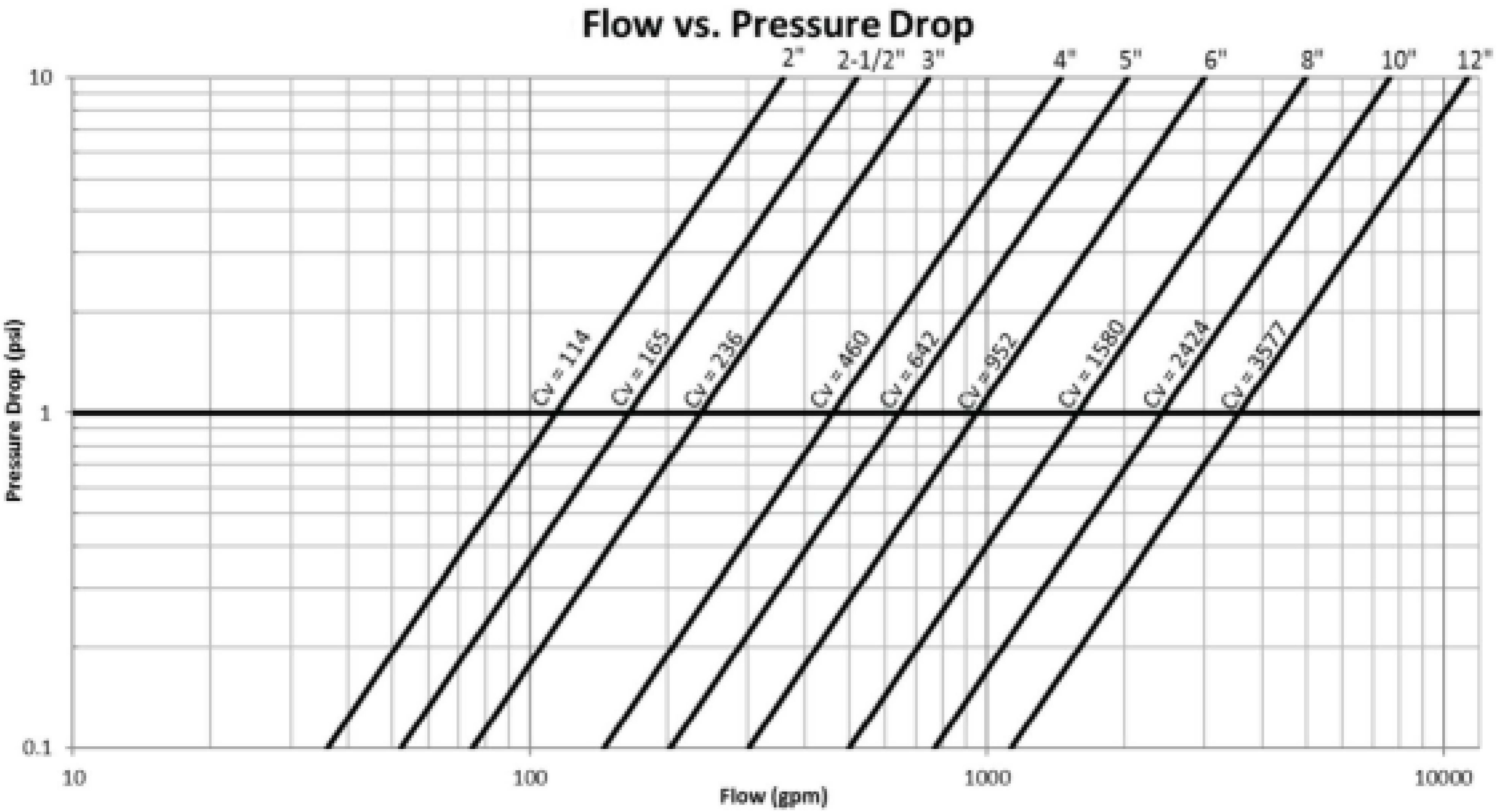
Strainer - “Saving Energy”



Strainer - "Saving Energy"

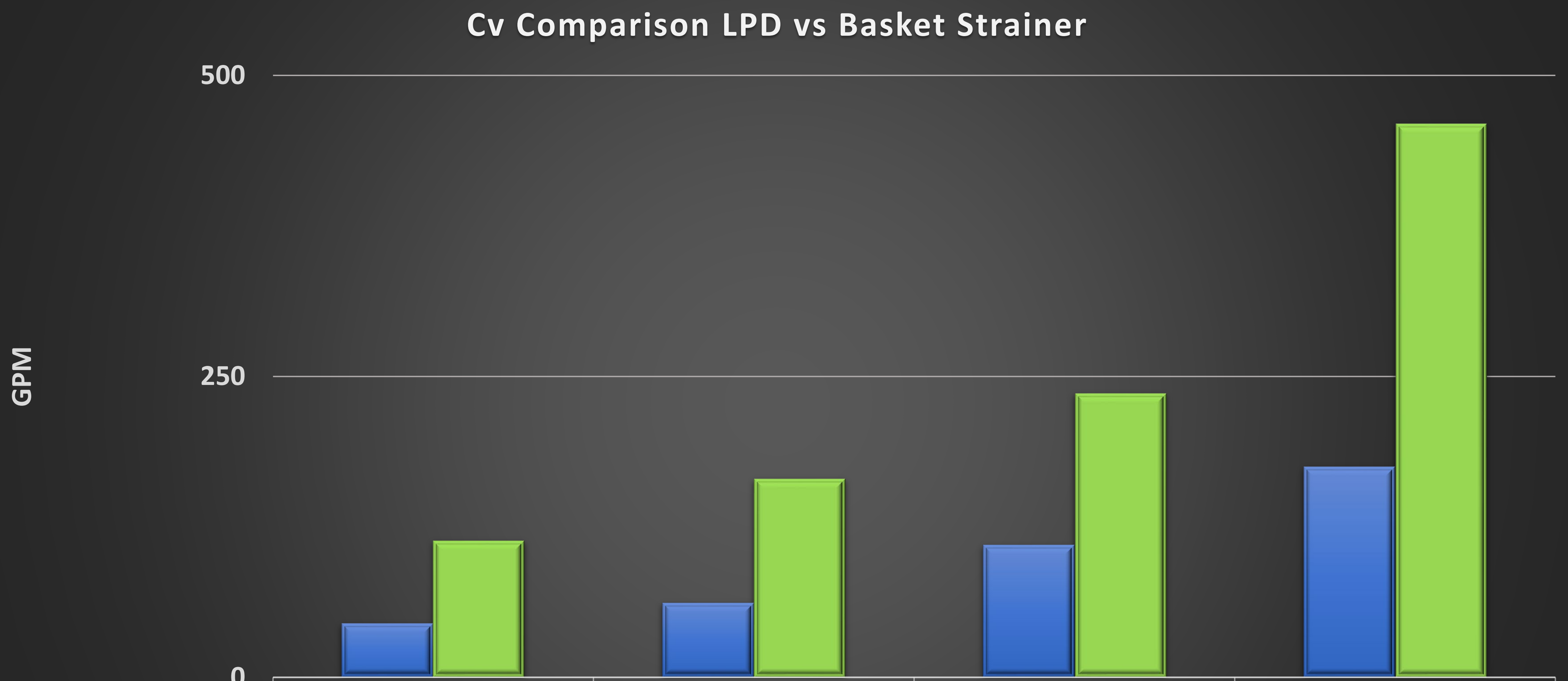


Strainer – Design Flows



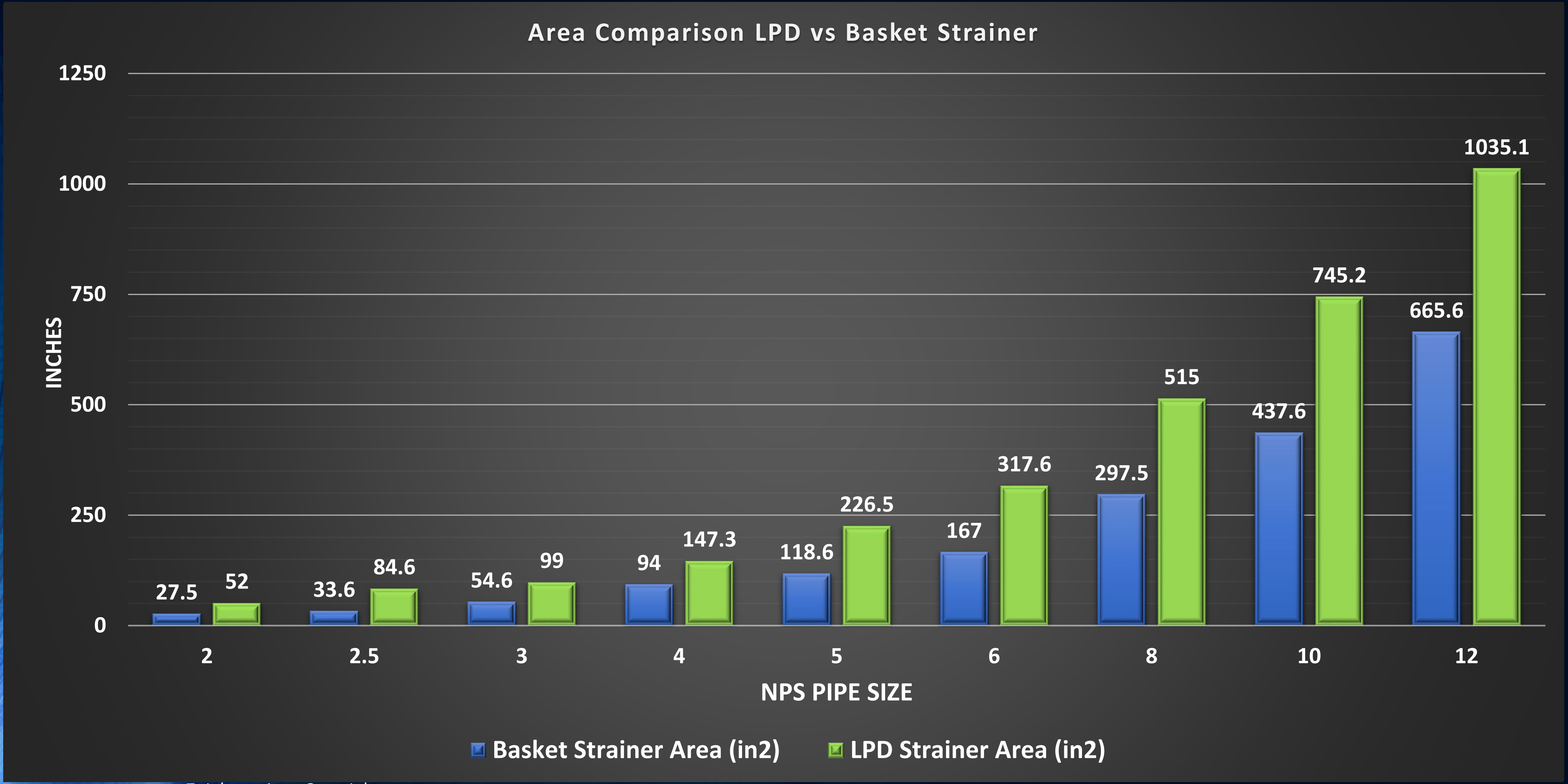
Size	Cv
2	113.8
2.5	165.1
3	236.1
4	460
5	641.9
6	952
8	1579.5
10	2423.5
12	3576.5

Strainer – Design Flow Comparison

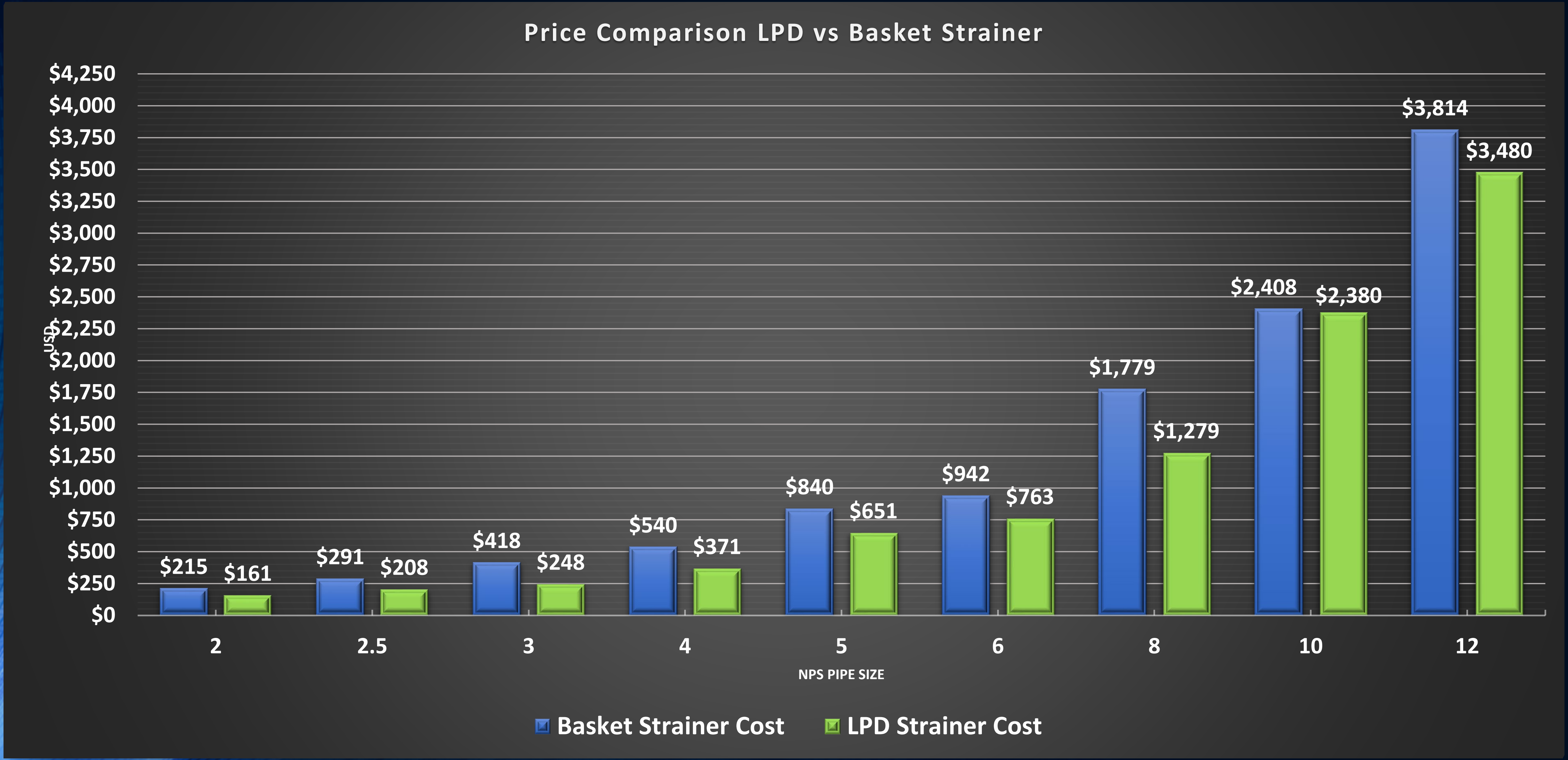


	2	2.5	3	4
Cv Basket Strainer	45	62	110	175
Cv LPD	113.8	165.1	236.1	460

Strainer – Design Flow Comparison



Strainer – Economic Comparison



Strainer - “Saving Energy”

LPD Y Strainer Energy Savings Calculator

Enter your pipe size: 8 in.

Enter your flow rate: 1255.22 GPM

or 8.05 FPS

Enter your pump efficiency ? 0.7 %

Enter your motor efficiency ? 0.9 %

Hours of operation / year ? 8760 hours

Your cost per kWh ? 0.17 $

How much debris ?

Two (2) $1 bills = 32.05 sq. in.

To help visualize the amount of debris, we use a size equivalent to a US $1 bill: 16.0254 sq. in. (103.39 sq. cm.)

Here's how they compare

	Old Y Strainer	LPD Y Strainer
Cv*	920	1580
Pressure drop (psi)	2	0.7
Screen area (sq. in.)	387	515
% of clogged area	8.3	6.2
HP required	2.31	0.77
kW required	1.73	0.57
Total kWh	15120.26	5023.71
Annual electricity cost	$ 2,570.44	$ 854.03

An LPD Y Strainer saves $1,716.41 per year

** Cv is the number of U.S. gallons/minute of 60 degF water that will flow through a strainer with 1 psi pressure drop across the strainer.*

Show Me the Math

Why Flow Control Solutions?

- Minimizes Turbulence
- Minimized Friction Loss
- Improves Asset Life
  - Pump
  - Motor
  - Control Valves
  - Check Valves
  - Pressure Sensors
  - Flow Meters
- Pump & Devices Operate at Design

Why Flexible Connector Solutions?

- Minimizes Vibration
- Mitigates Thermal Expansion Issues
- Easier Connections In the Field
- Strain Relief
- Offers some seismic protection

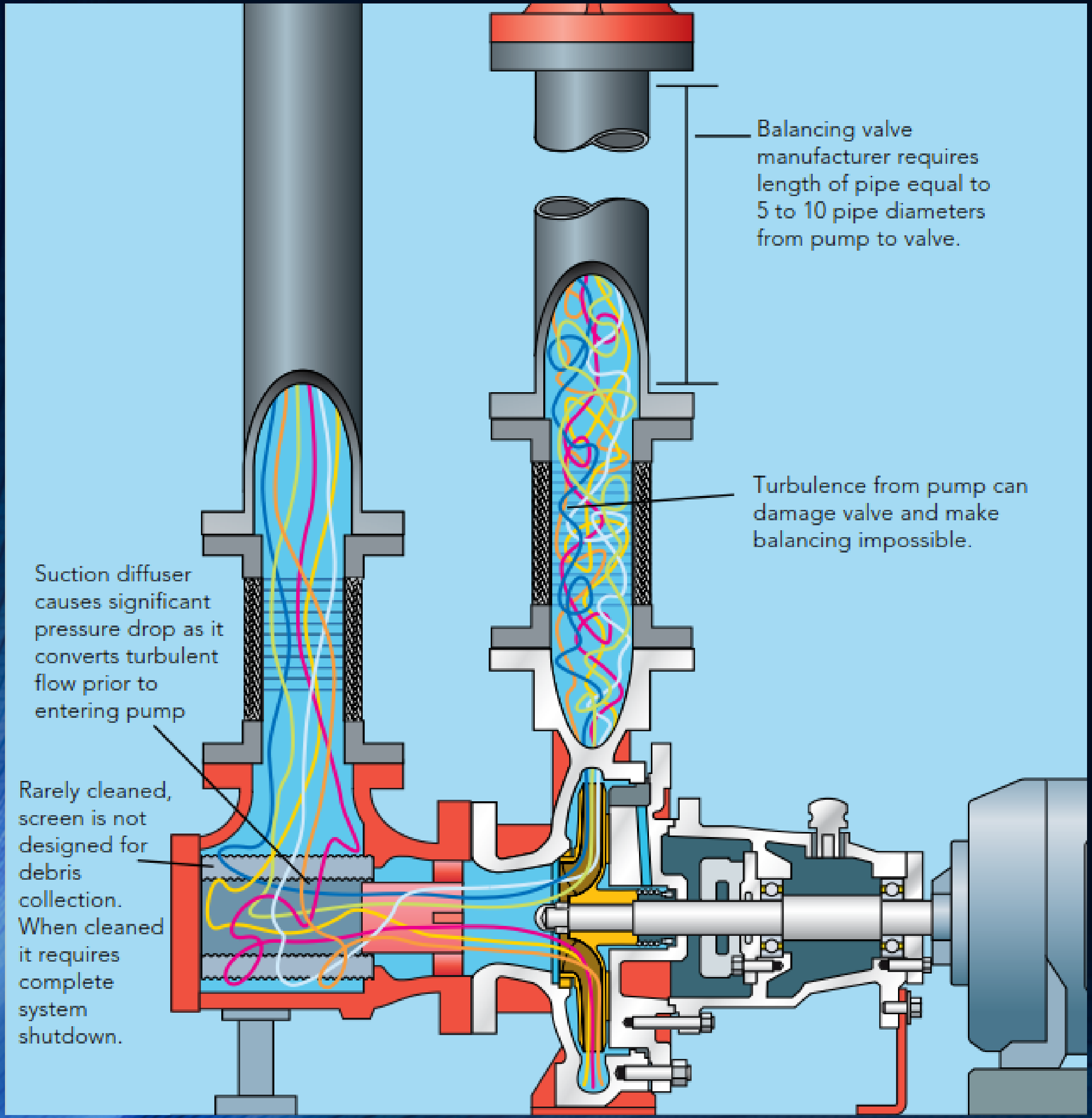
STRAINER & FLOW CONDITIONING
REMOVING TURBULENCE

- SUCTION DIFFUSER

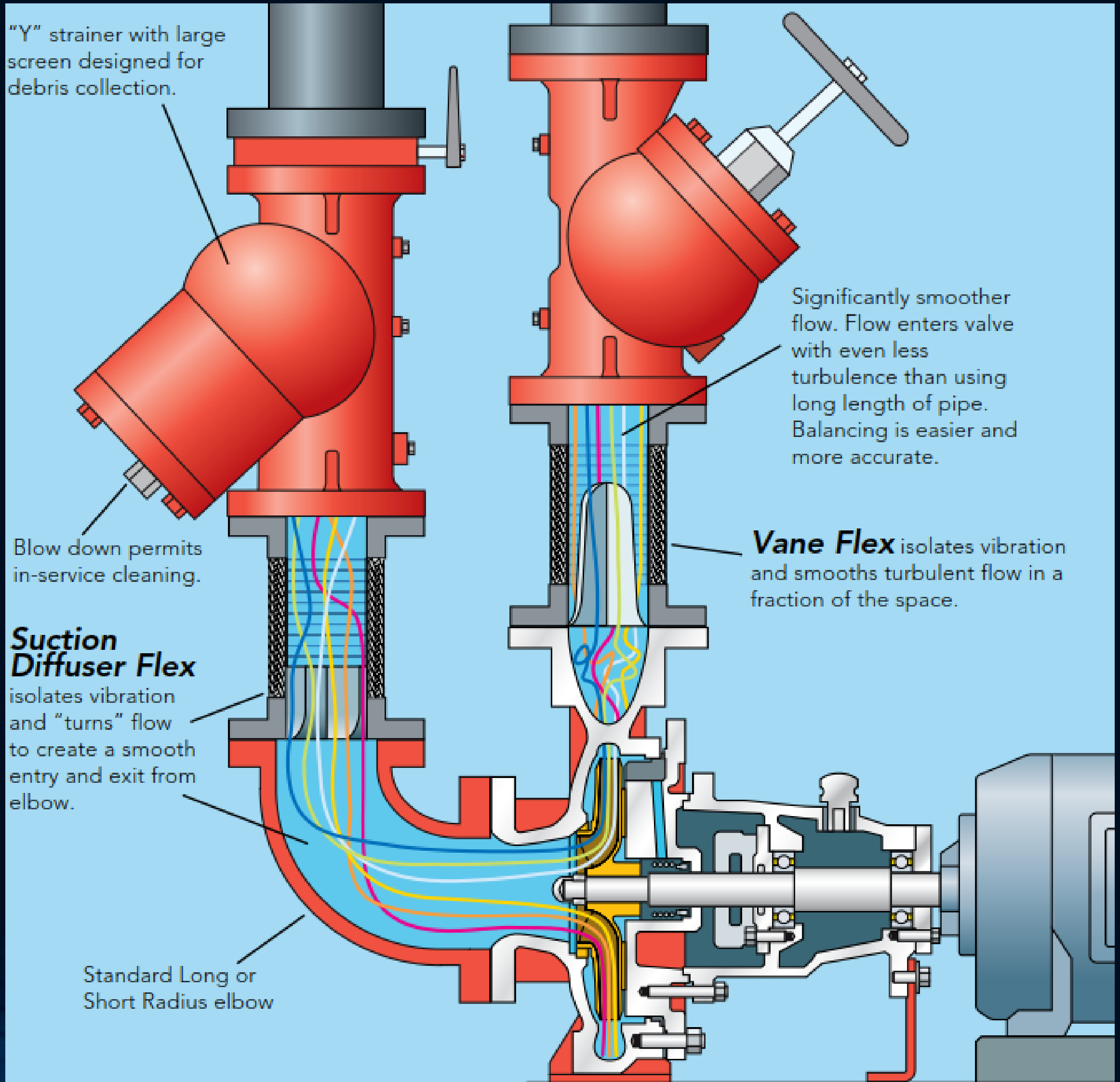
- FLOW CONDITIONER

Flow Conditioning
"Saving Energy & Assets"

BEFORE

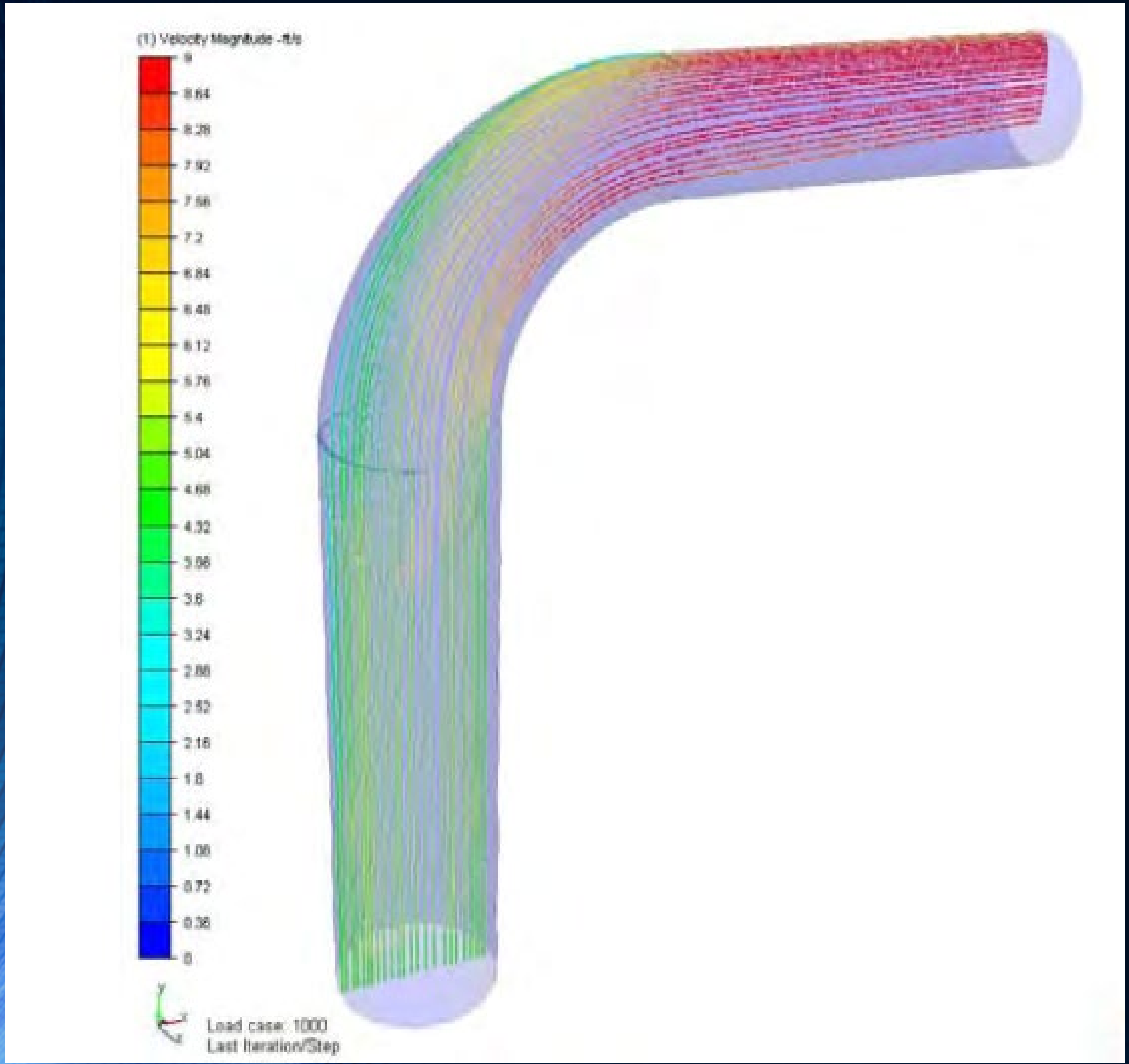


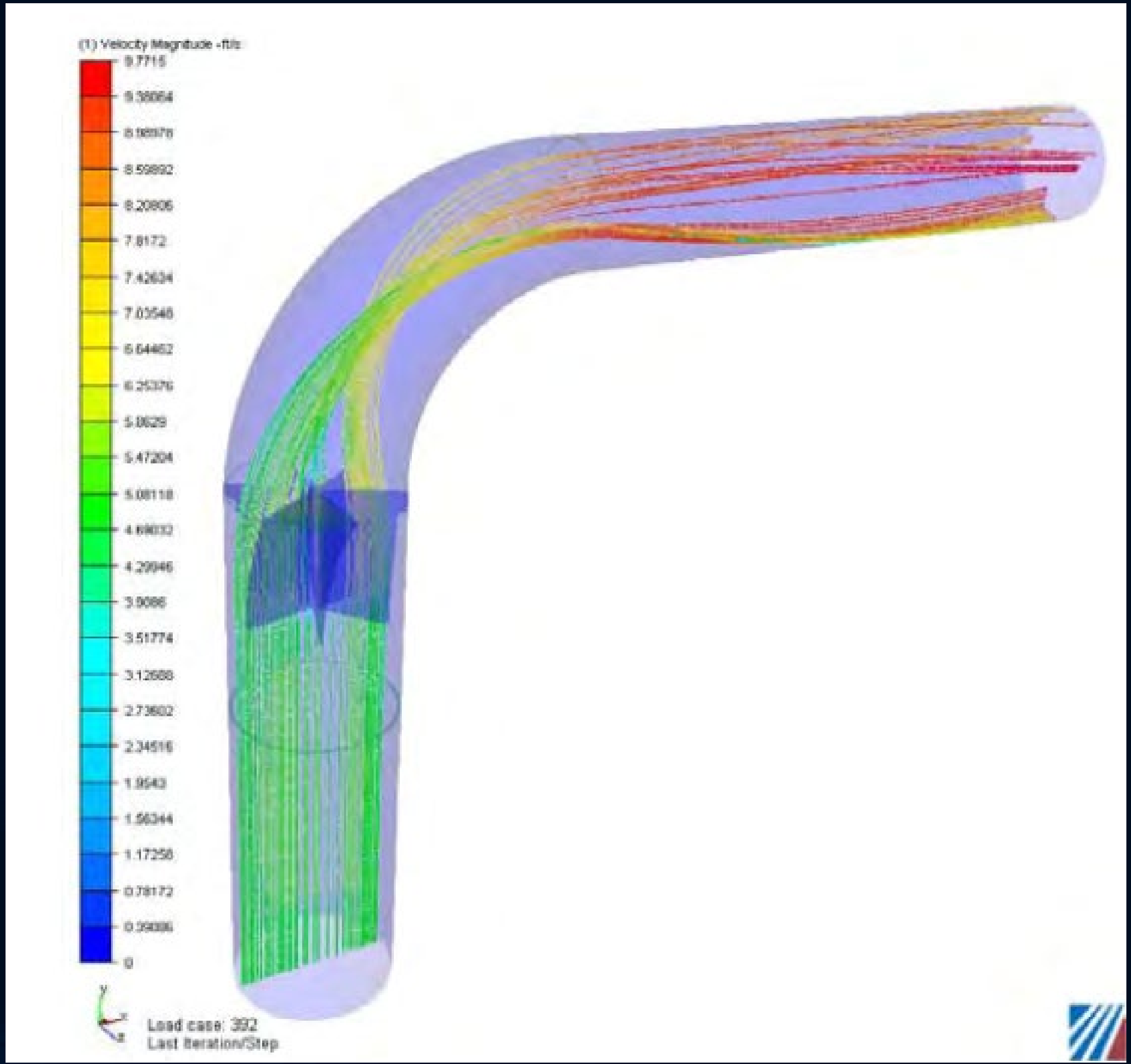
AFTER



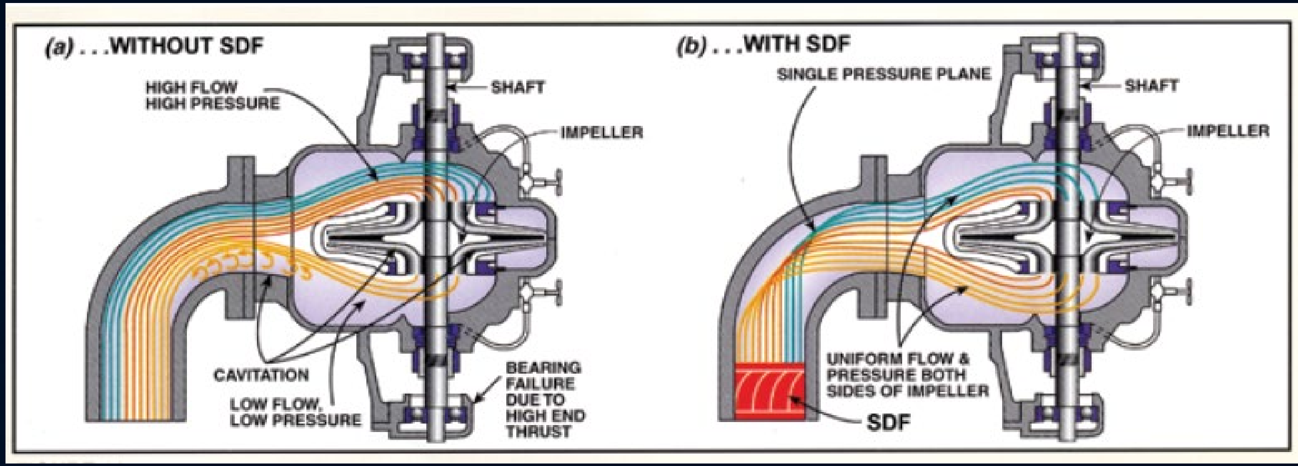
BEFORE ELBOW FLOW CONDITIONING
REMOVING TURBULENCE

SUCTION DIFFUSER – 2" THRU 16"


(1) Velocity Magnitude -ft/s
9
8.64
8.28
7.92
7.56
7.2
6.84
6.48
6.12
5.76
5.4
5.04
4.68
4.32
3.96
3.6
3.24
2.88
2.52
2.16
1.8
1.44
1.08
0.72
0.36
0
Load case: 1000
Last Iteration/Step


(1) Velocity Magnitude -ft/s
9.7715
0
Load case: 392
Last Iteration/Step

Flow Conditioning



4.5% Flow Increase

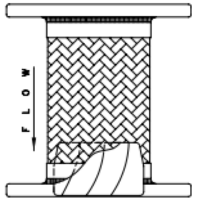
7% HP Reduction

8.6% Discharge Head Increase

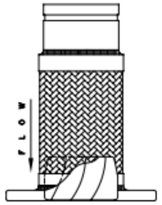
Flow Conditioning

Standard Suction Diffuser Flex Configurations

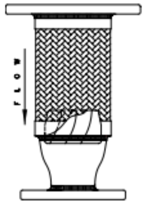
Long Radius Elbow



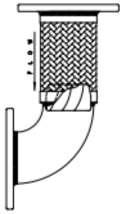
Suction Diffuser Flex with 150# plate flanges for connecting to a long radius elbow



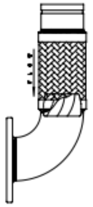
Suction Diffuser Flex with 150# plate flange x groove end for connecting to a long radius elbow



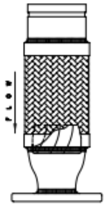
Suction Diffuser Flex with 150# plate flanges with concentric reducer for connecting to a long radius elbow



Suction Diffuser Flex with 150# plate flanges with long radius 90° elbow

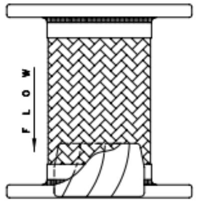


Suction Diffuser Flex with 150# plate flange x groove end with long radius 90° elbow

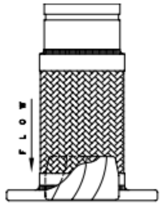


Suction Diffuser Flex with 150# plate flange x groove end with concentric reduc-er for connecting to a long radius elbow

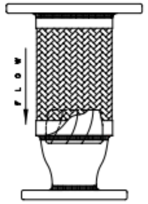
Short Radius Elbow



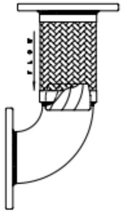
Suction Diffuser Flex with 150# plate flanges for connecting to a short radius elbow



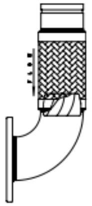
Suction Diffuser Flex with 150# plate flange x groove end for connecting to a short radius elbow



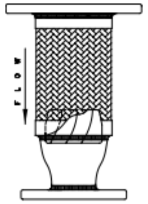
Suction Diffuser Flex with 150# plate flange with concentric reducer for connecting to a short radius elbow



Suction Diffuser Flex with 150# plate flanges with short radius 90° elbow

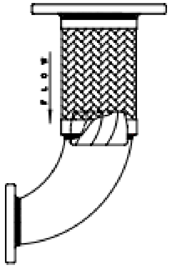


Suction Diffuser Flex with 150# plate flange x groove end with short radius 90° elbow

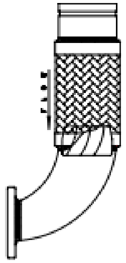


Suction Diffuser Flex with 150# plate flange x groove end with concentric reducer for connecting to a short radius elbow

90° Reducing Elbow

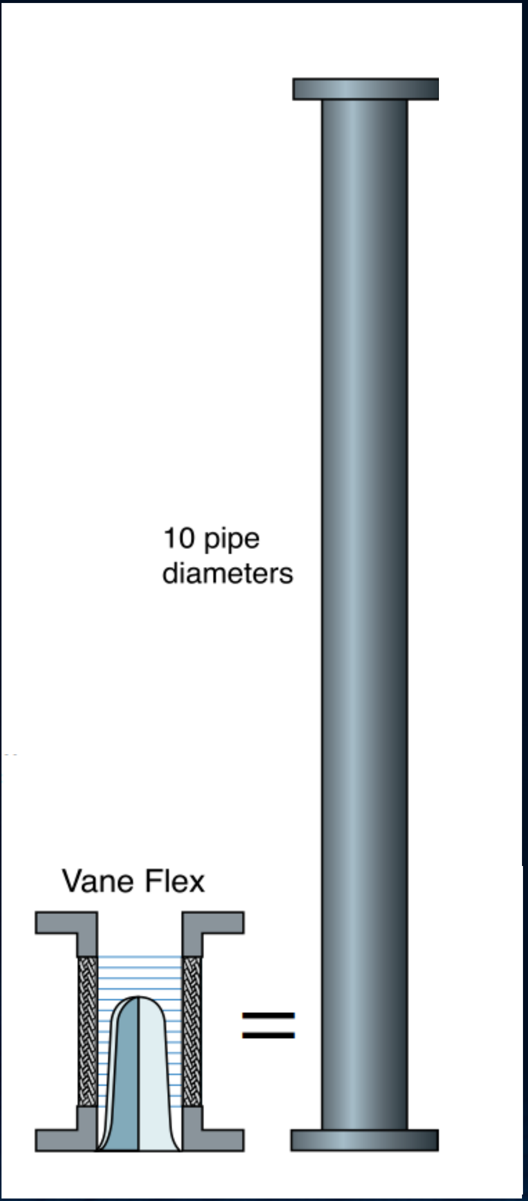


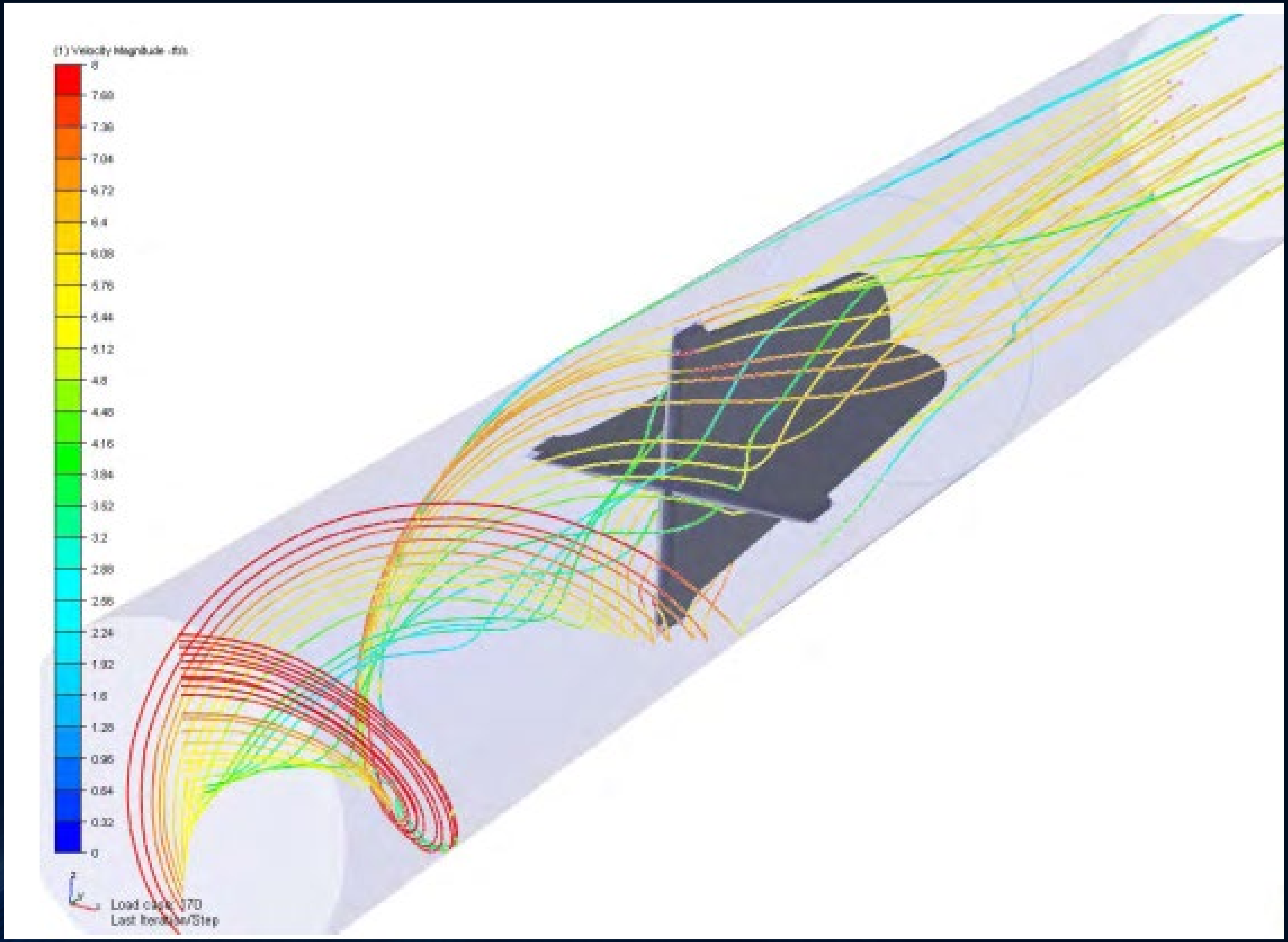
Suction Diffuser Flex with 150# plate flange with 90° reducing elbow



Suction Diffuser Flex with 150# plate flange x groove end with 90° reducing elbow

Flow Conditioning




(1) Velocity Magnitude - ft/s
8
7.68
7.36
7.04
6.72
6.4
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5.76
5.44
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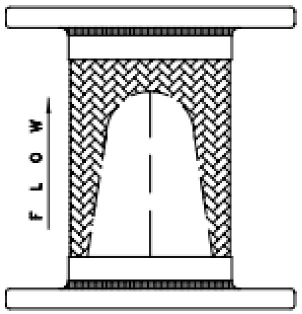
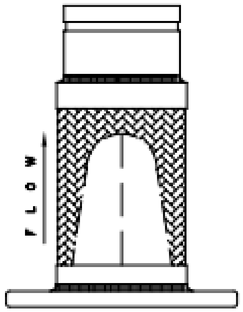
4.8
4.48
4.16
3.84
3.52
3.2
2.88
2.56
2.24
1.92
1.6
1.28
0.96
0.64
0.32
0

Flow Conditioning

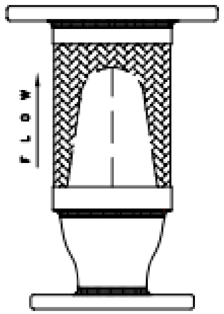
Standard Vane Flex Configurations



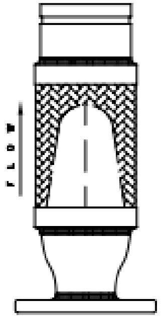
Vane Flex with 150# plate flanges



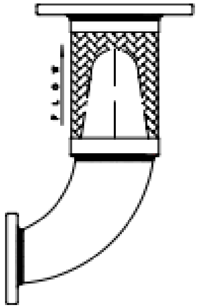
Vane Flex with 150# plate flange x grooved



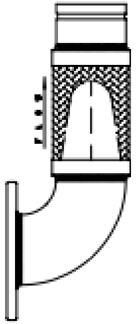
Vane Flex with 150# plate flanges with concentric reducer



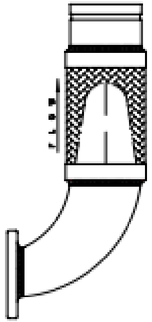
Vane Flex with 150# plate flange x grooved with con-centric reducer



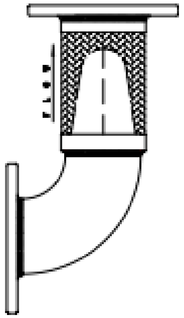
Vane Flex with 150# plate flanges with 90° reducing elbow



Vane Flex with 150# plate flange x groove with 90° elbow



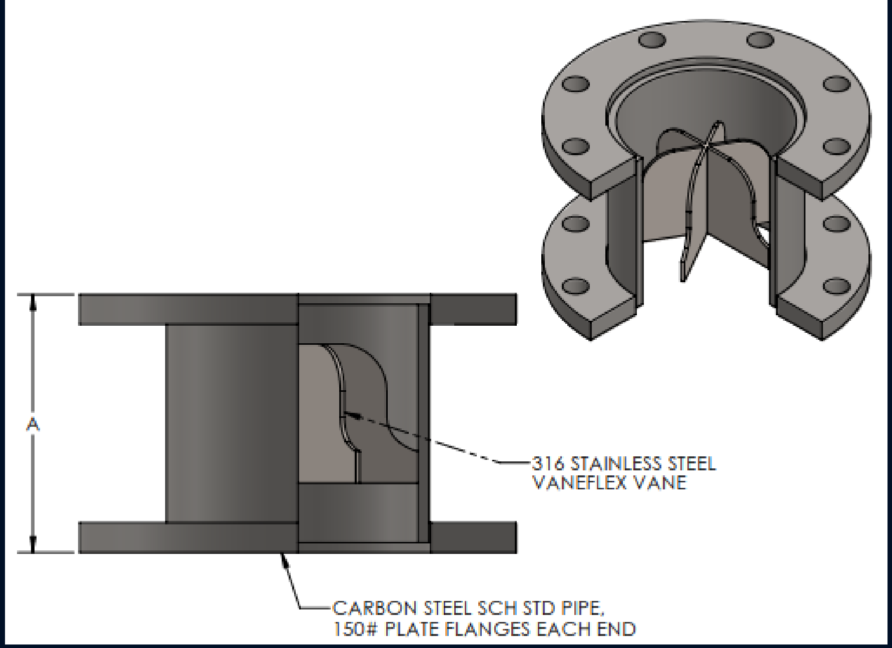
Vane Flex with 150# plate flange x groove with 90° reducing elbow

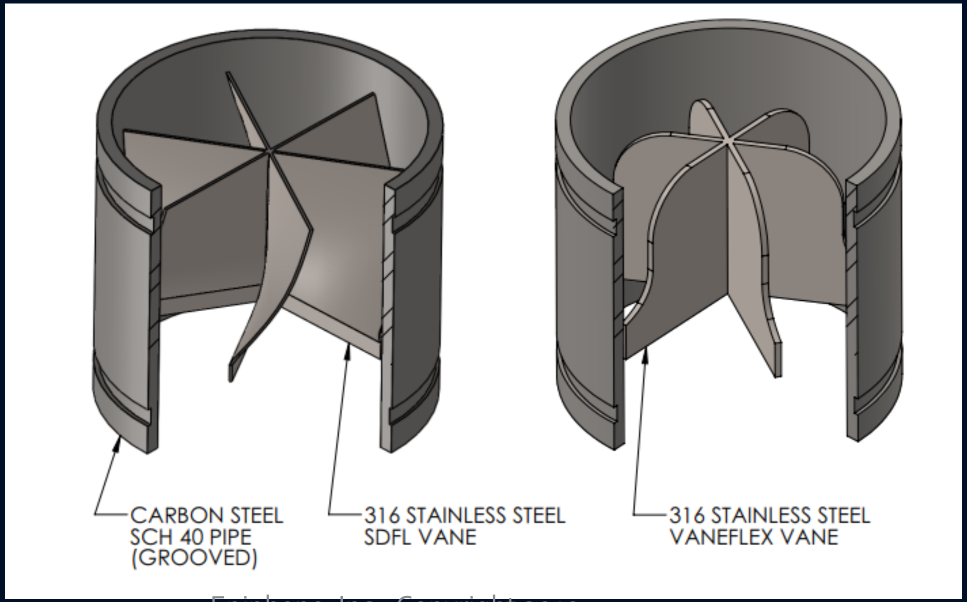


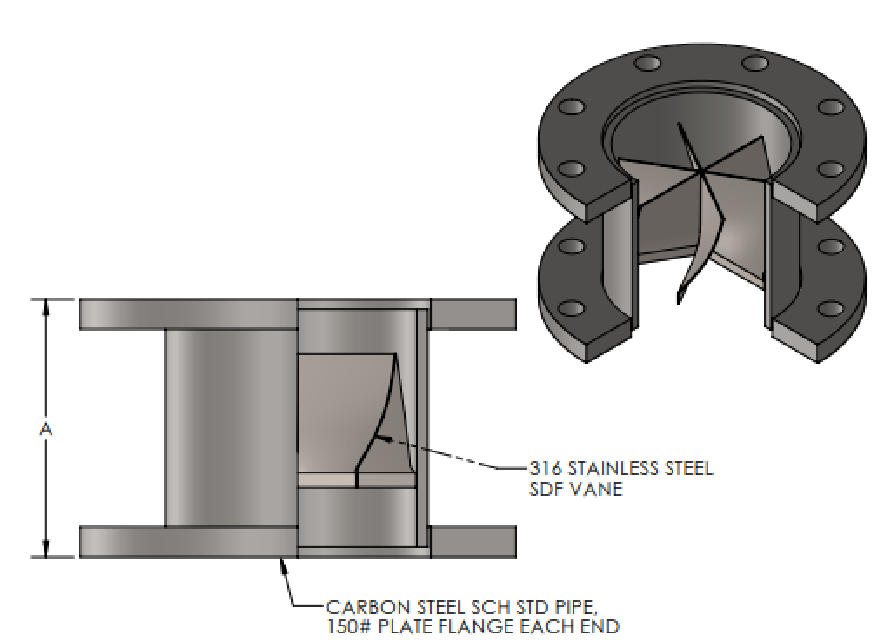
Vane Flex with 150# plate flange with 90° elbow

Flow Conditioning Rigid Configurations

2" thru 12"







Summary

- Design of Pump Station Impacts System Performance
- Minimization of Turbulence
- Minimization of Friction Loss
- Increased Design Flexibility
- Increased Reliability
- Improved Asset Life
- New Tools exist to address issues
- Economically Viable with Quick Paybacks