

Pumping Station Design: Not The Same Ball Game

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What has Changed?

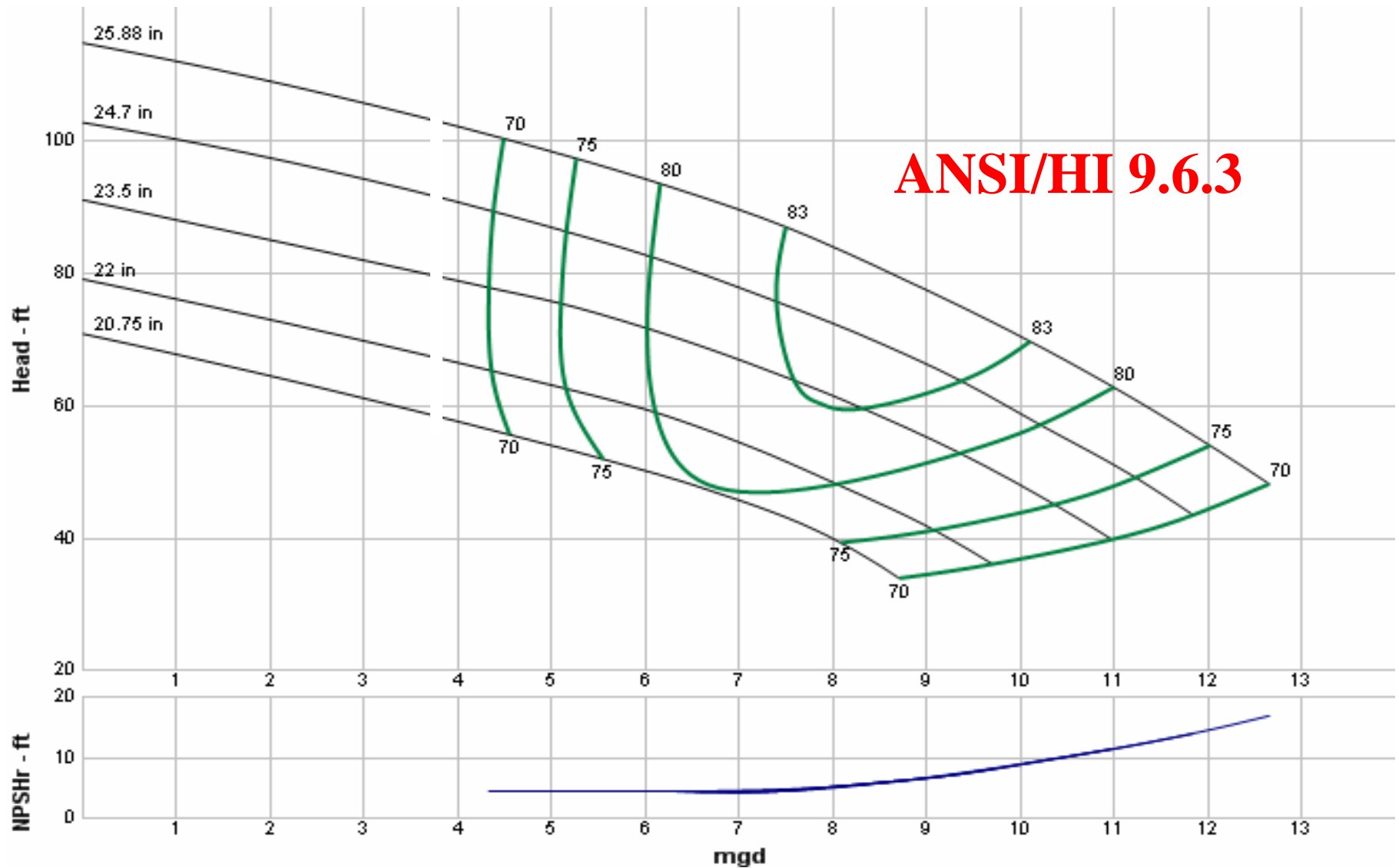
- Hydraulic Institute Standards
- Evolving pump designs
- A clearer understanding of what happens when pumps are operated off-BEP
- Greater transparency on the part of pump manufacturers
- A more comprehensive understanding of cavitation in its various forms
- More definitive design standards for pump intakes and installation requirements
- In other words.....

CAVEAT EMPTOR

What is Needed in Design?

- Improved and more complete definition of operating conditions
- More attention to specification requirements to eliminate marginal pump selections
- Strengthened requirements for mechanical and hydraulic design
- Greater attention to installation details to conform to equipment physical, hydraulic and mechanical limitations

Typical Manufacturer's Curve – before



What is a POR?

Preferred Operating Region

As defined in ANSI/HI 9.6.3

For most pump designs, this region defines the portion of the machine's head/capacity curve where service life *will be optimized*

Preferred Operating Region

- For Specific Speeds ≥ 4500 :
 - **70 percent to 120 percent of BEP Flow**
- For Specific Speeds > 4500
 - **80 percent to 115 percent of BEP Flow**

What is an AOR?

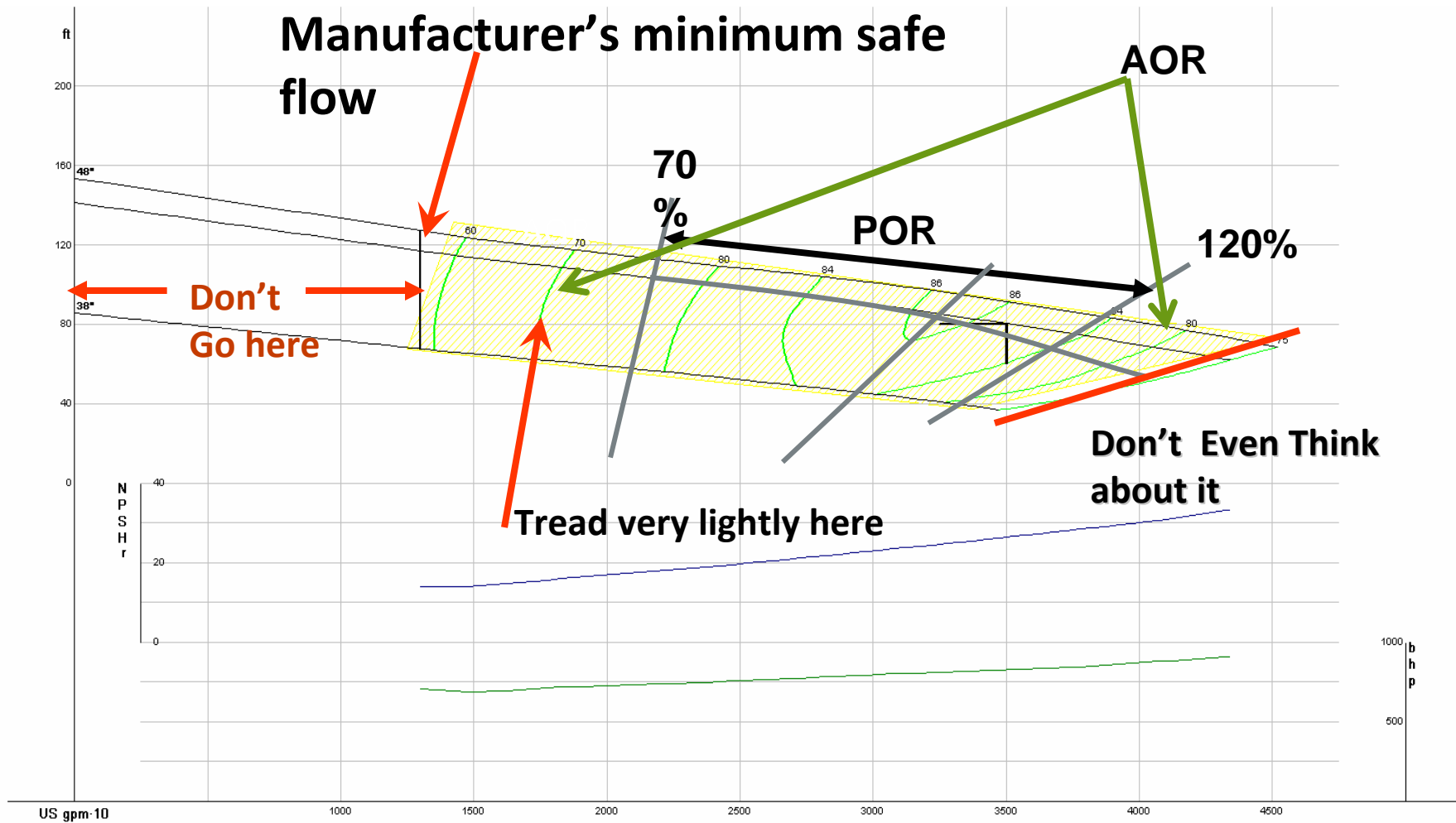
Allowable Operating Region

As defined by ANSI/HI 9.6.3

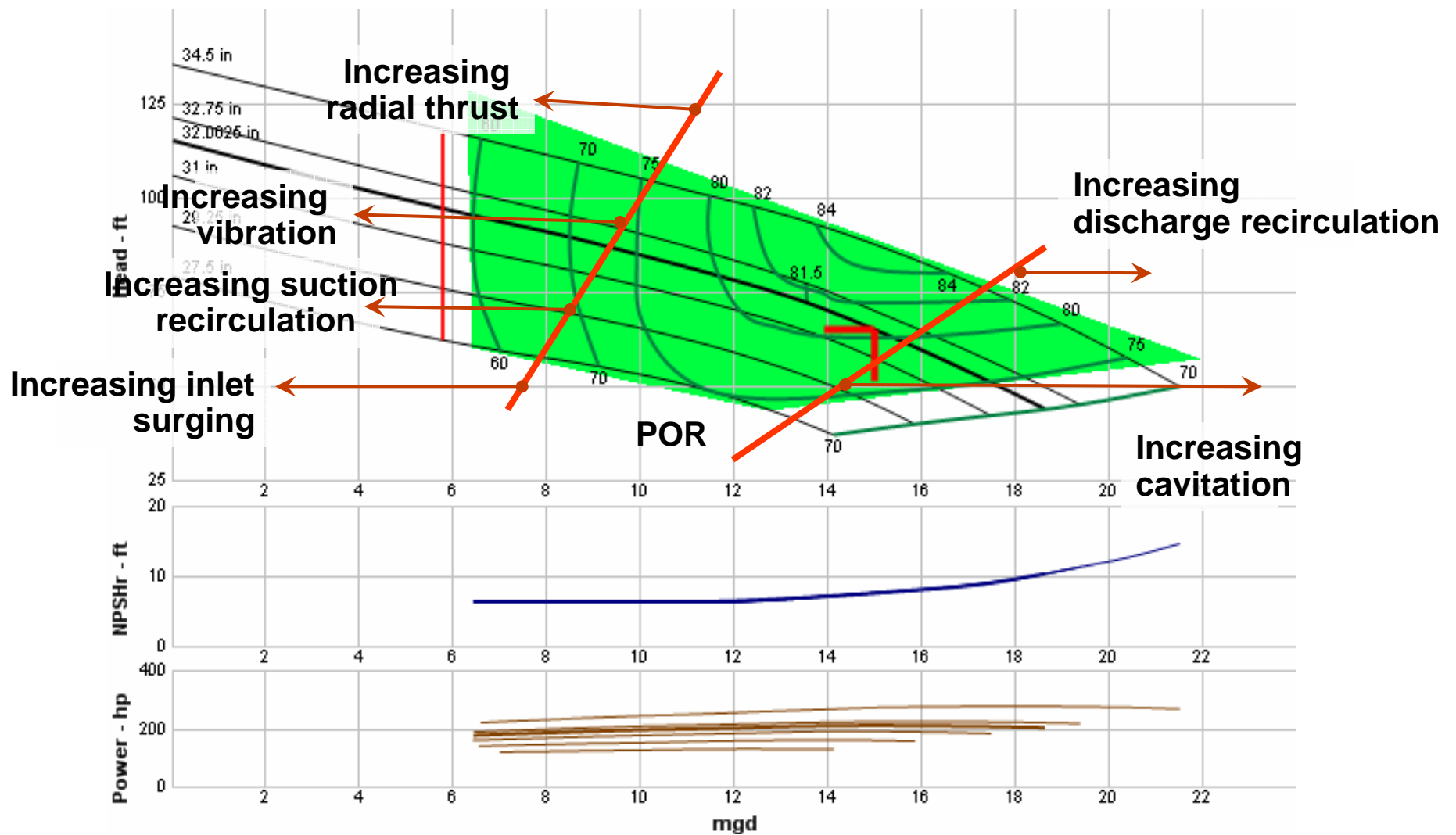
The region on the machine's head/capacity curve where continued or frequent operation will likely result in diminished service life and poor operation

Established by the pump manufacturer

How a Pump Works – II



Bad Things Begin to Happen in the AOR.....



ANSI/HI 9.6.6

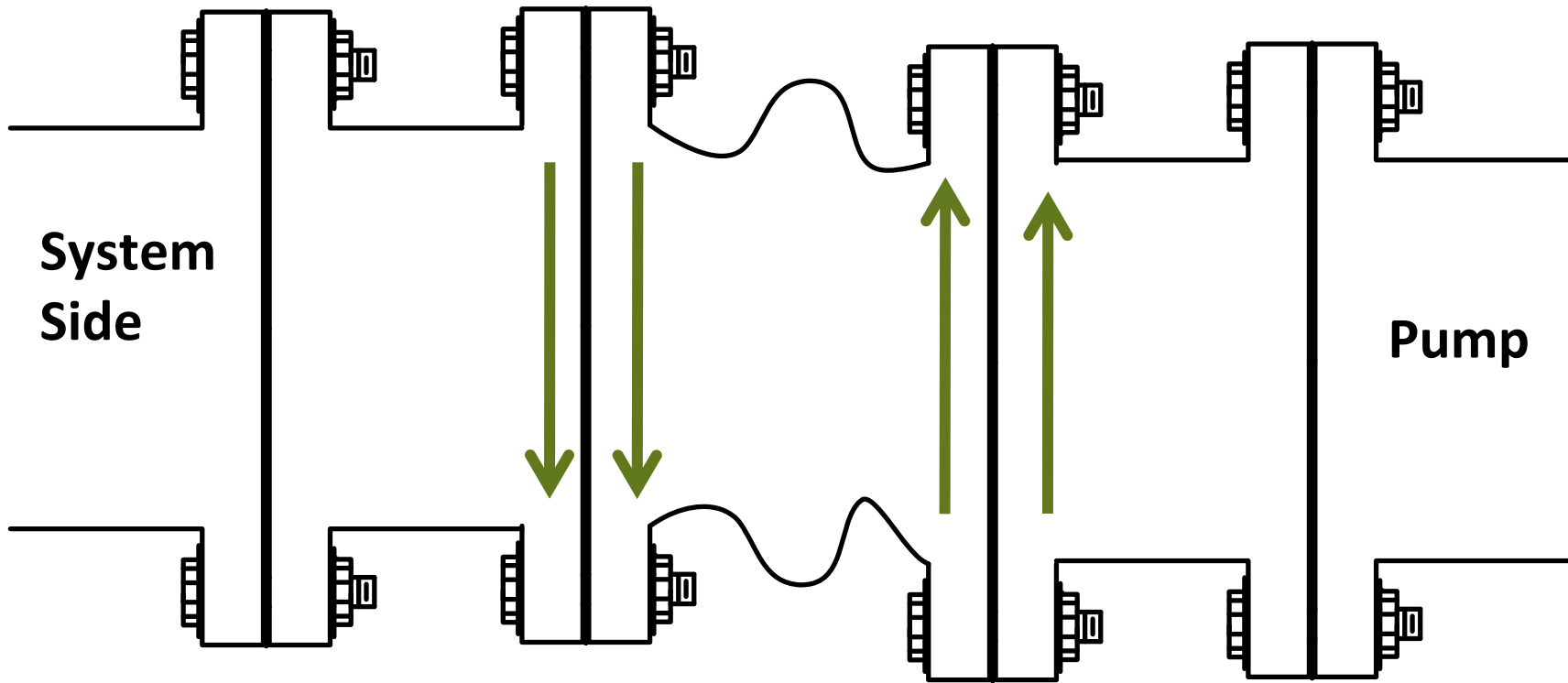
Piping Requirements

Basic Necessities

- Eliminate stress and strain at equipment connections
- Carry unbalanced hydraulic thrust to the structure
- Support valves, but NEVER anchor at a valve
- Minimum 5 pipe diameters straight run after last flow disturbing fitting and pump

- ***Avoid stress risers at all pipe supports and anchors***
- ***All valves and appurtenances MUST be accessible for maintenance, removal/replacement***

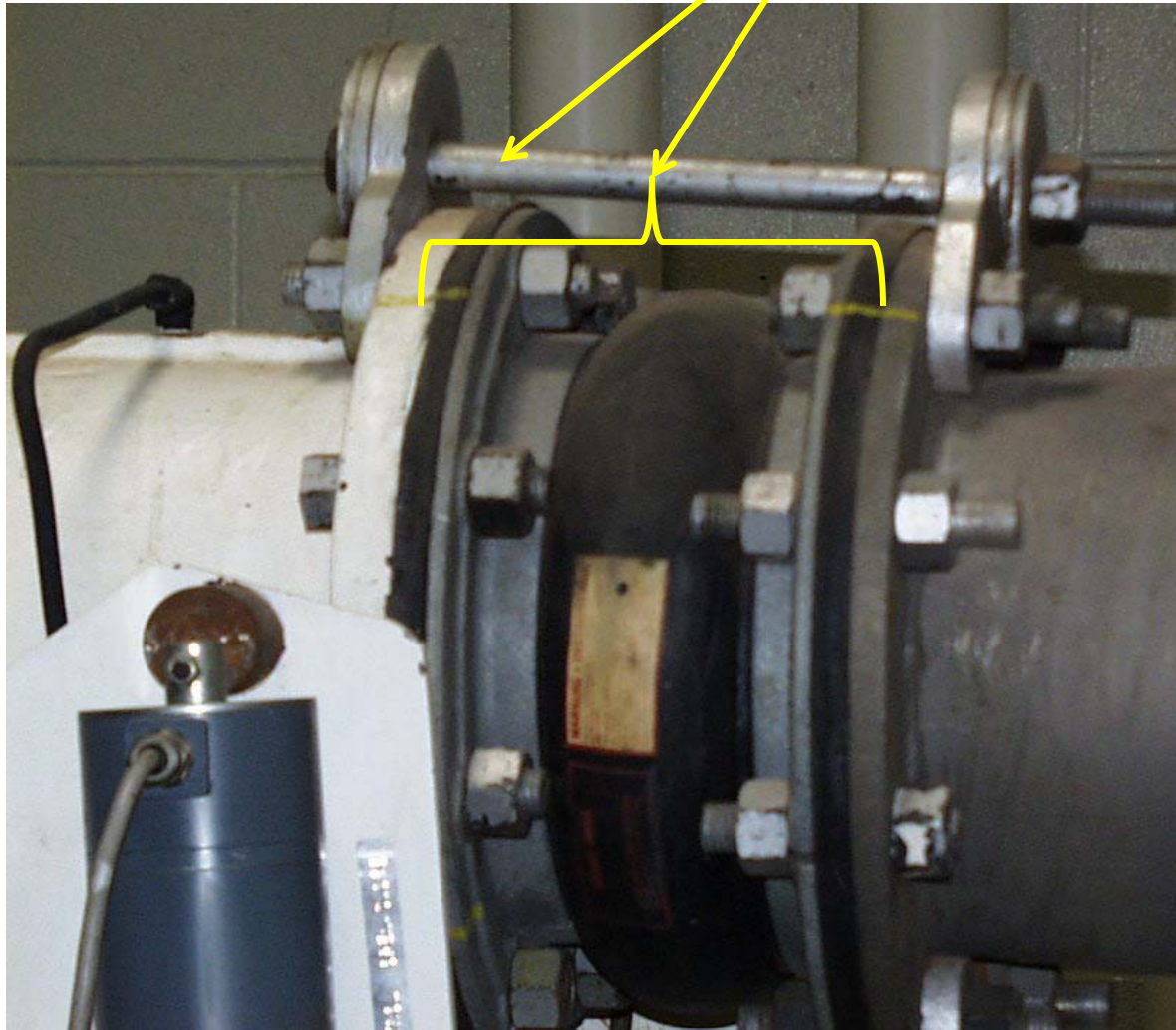
Poor Alignment Results in Unacceptable Forces



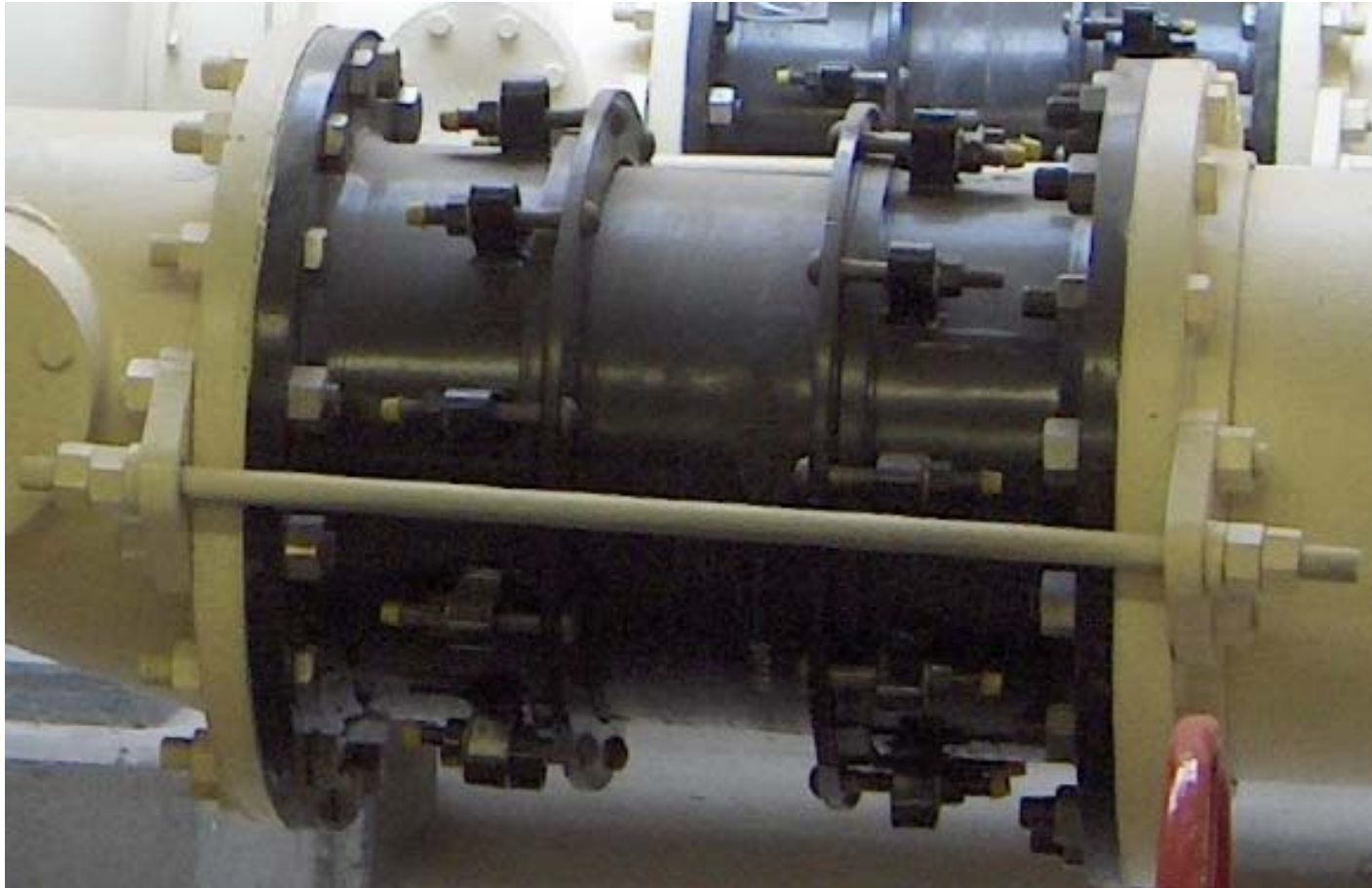
A single flexible coupling will not solve the problem

Misalignment

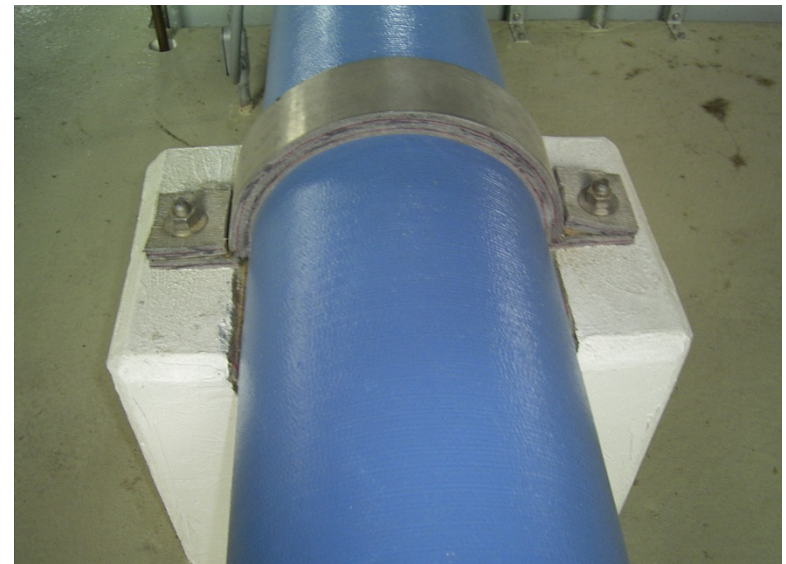
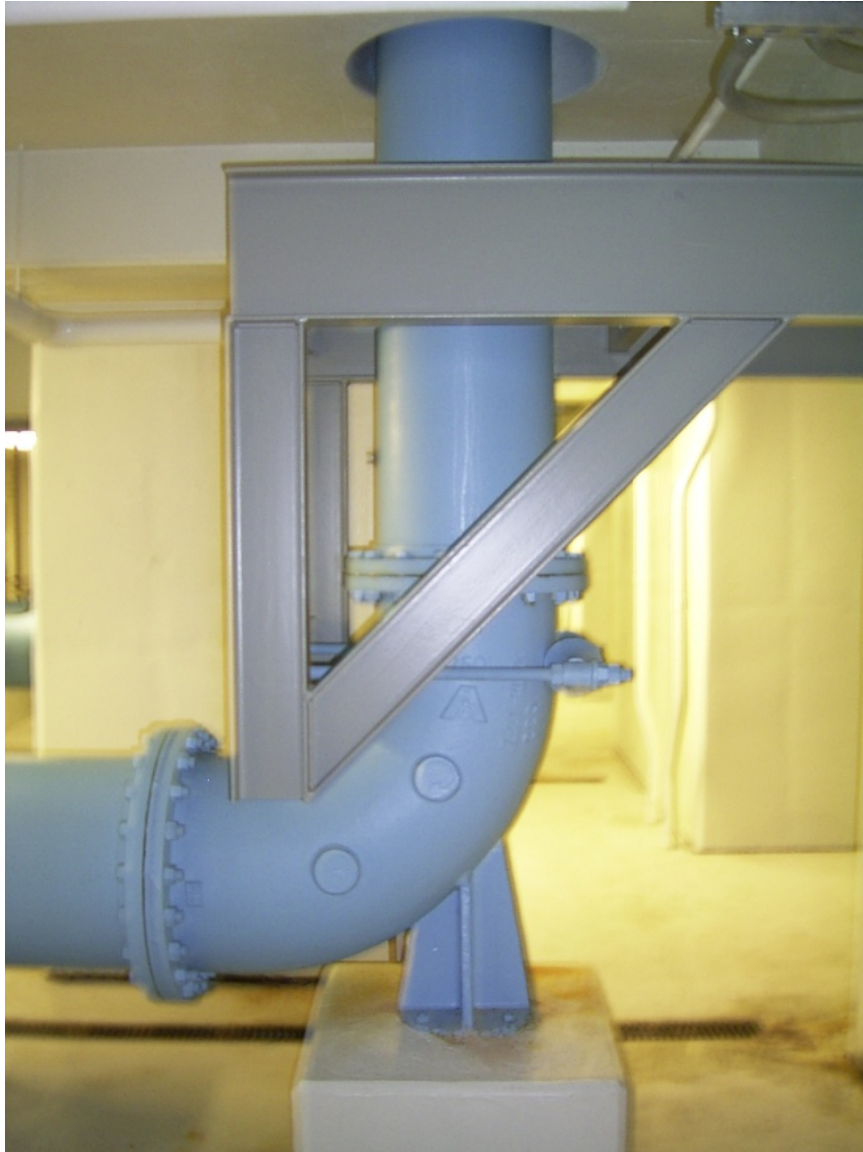
angular and parallel



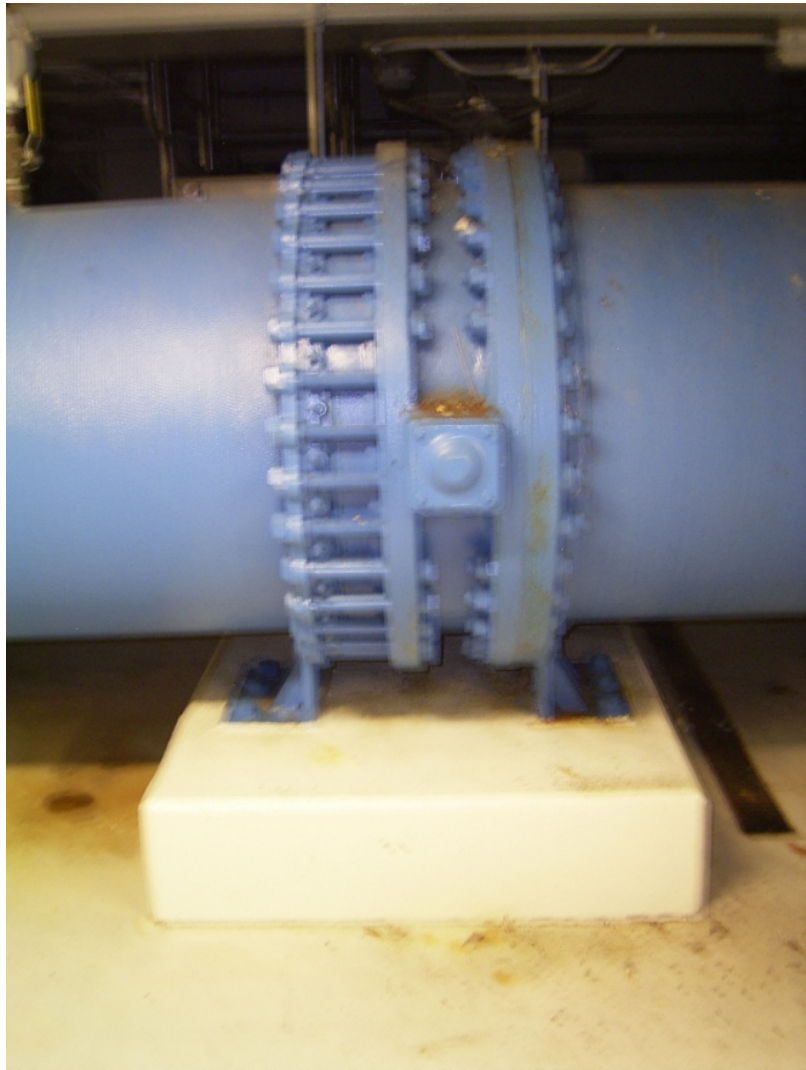
Equipment Connection Fitting



Station Pipe Supports



Station Valve Supports



ANSI/HI 9.8 Pump Intakes

More Often than Not

IT IS...**THE INTAKE,**
STUPID!

Features of a Good Pump Intake

- The pumped fluid must approach **THE PUMP OR PUMP INTAKE** symmetrically
- No high energy currents
- Minimal entrained air
- Sufficient NPSH margin
- Intake level must be high enough to prime the pump
- Sufficient submergence to avoid vortex development

ANSI/HI 9.8

Pump Intake Design

- All Types of Intakes
- Establishes Geometry and Physical Relationships
- Clear and Solids-Bearing Liquids
- Physical Model Tests Required
 - Large Pumps and Stations
 - Designs That Do Not Conform to Standard

Discuss?

That's All Folks!

THANK YOU