



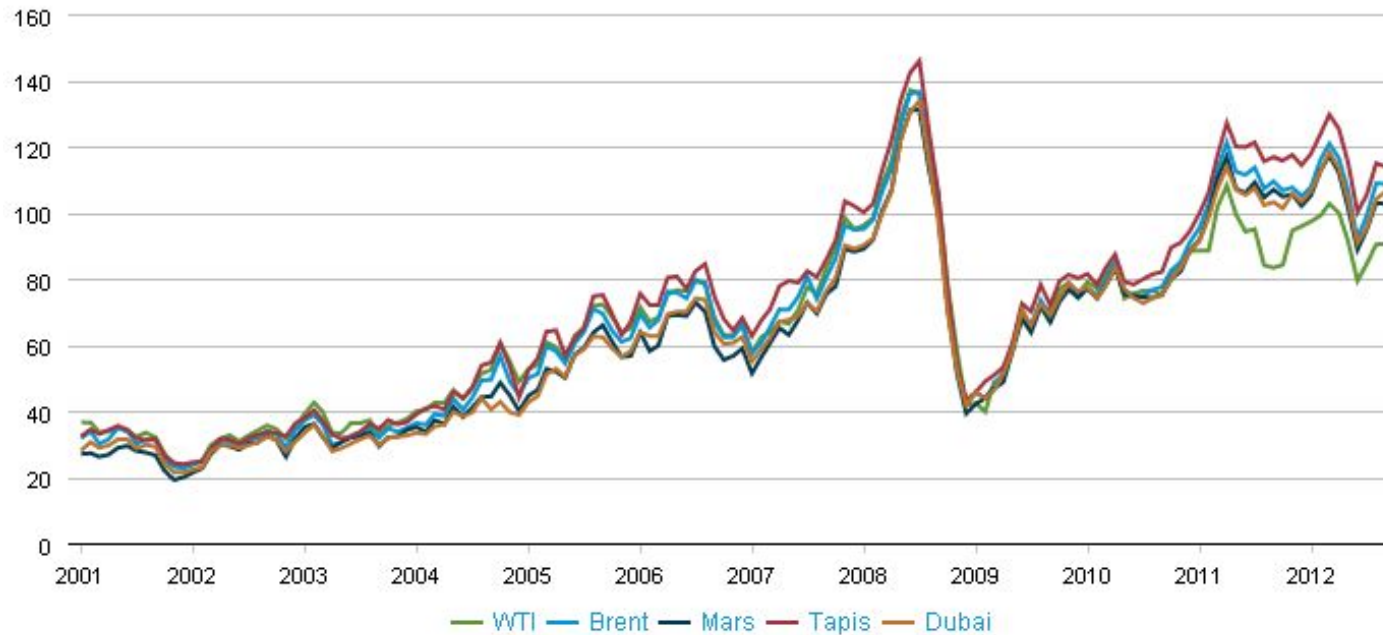
Fuel Saving Solutions

Basel Yousef
Manish Jangir

Fuel Prices Rising

World crude oil prices

dollars per barrel (real 2010 dollars, monthly average)



Sources: Bloomberg , Thomson Reuters . Published by: U.S. Energy Information Administration .
Updated: Monthly | Last Updated: 9/28/2012

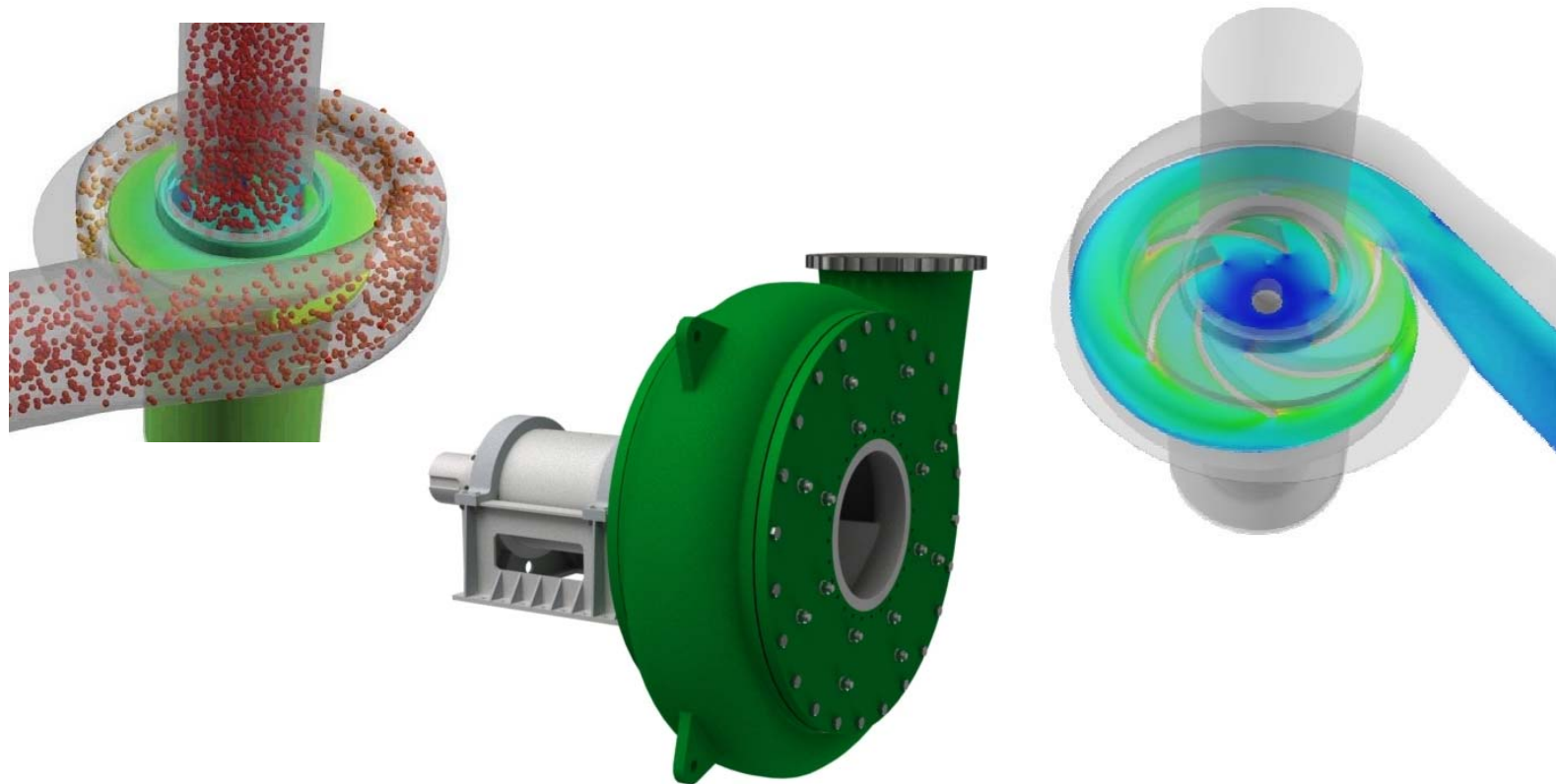
Other industries savings

- Hybrid Drives Systems
- New Energy: Solar, Wind, Wave
- Isolation of heated or cooled spaces
- Use lighter material
- Planning of consumption
- And much more



Recent developments

- **Dredge Pumps** are more efficient



Recent developments

- **Cutter heads improved significantly**



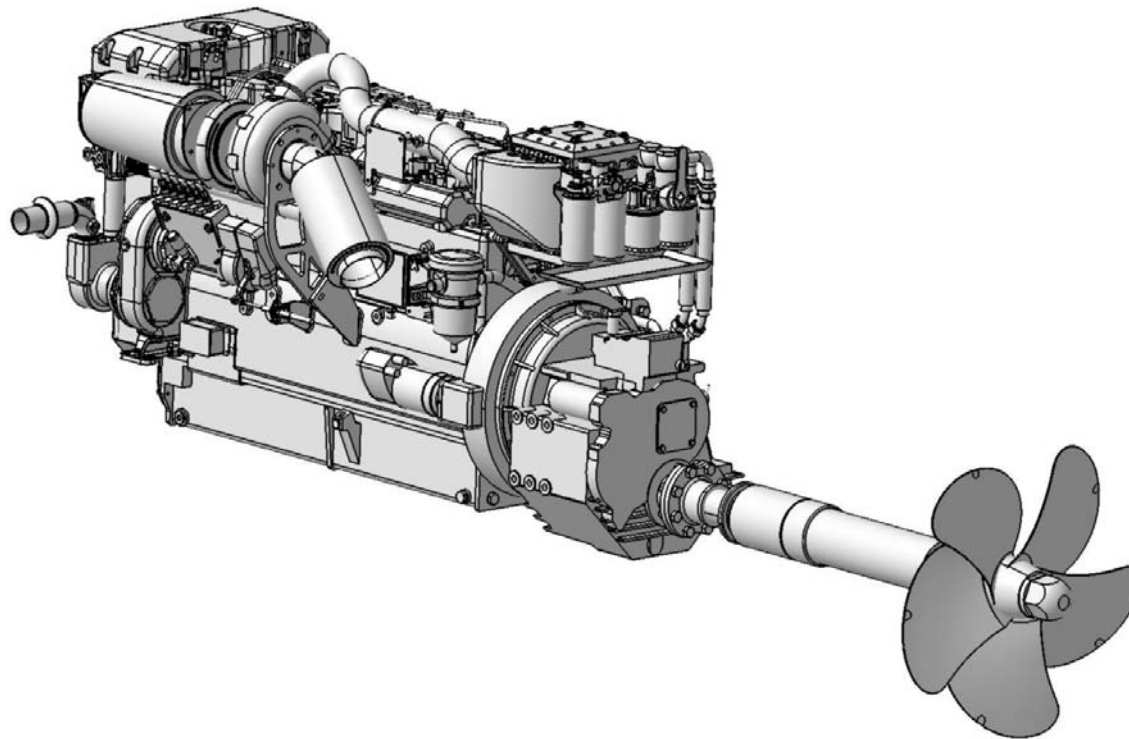
Recent developments

- Drag heads are active machines



Recent developments

- **Drives** are producing more power than ever



But one component remains the same:

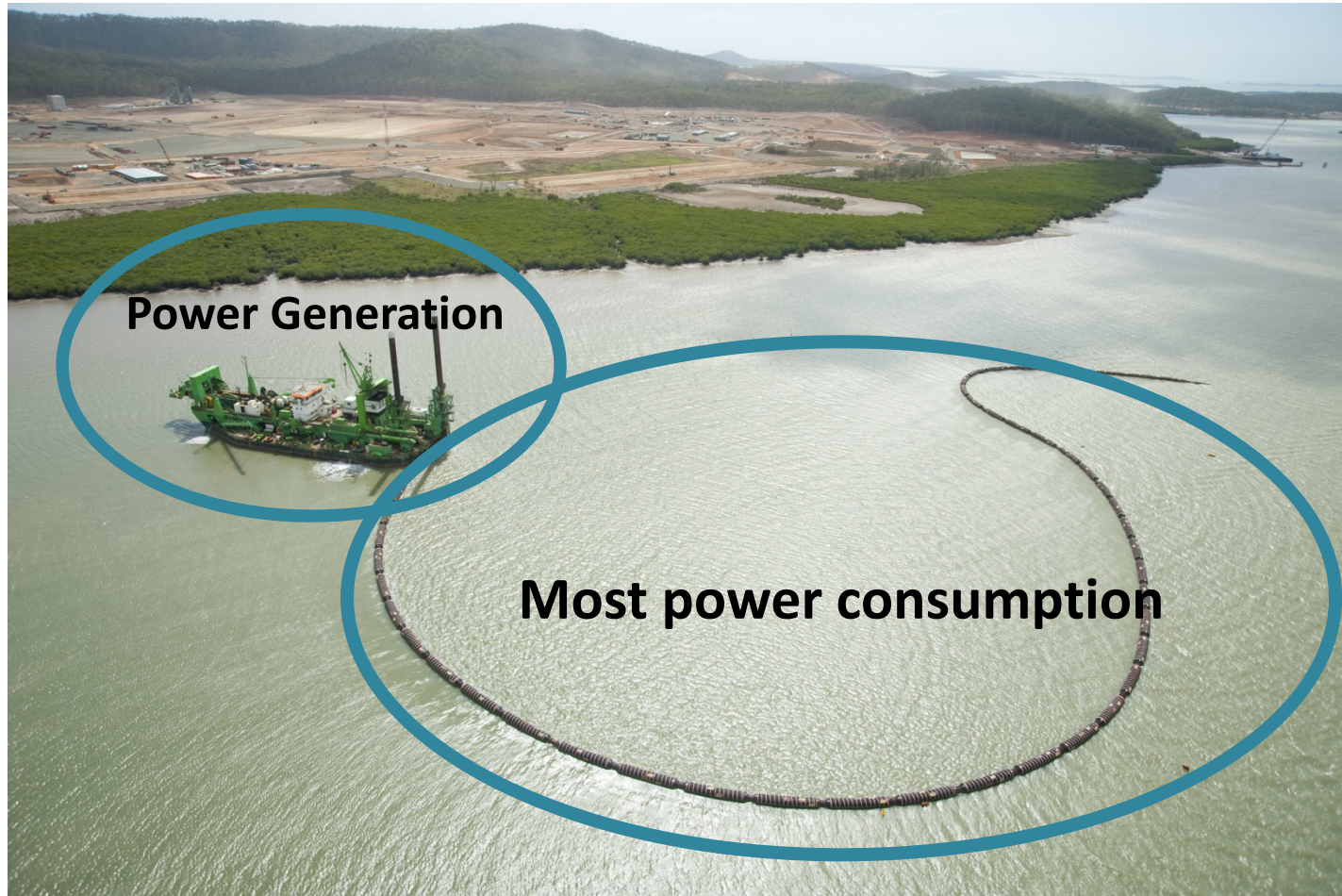
- **Discharge Pipe Coupling (Ball Joint)**



Consumption of discharge pipes

- **Most power** is used to pump mixture
- Discharge pipe **length** increases each year
- **More bends** are added in pipe lines
- This creates a **need of flexible coupling**
- Flexible couplings are **OLD** and **NOT EFFICIENT**

Consumption of discharge pipes

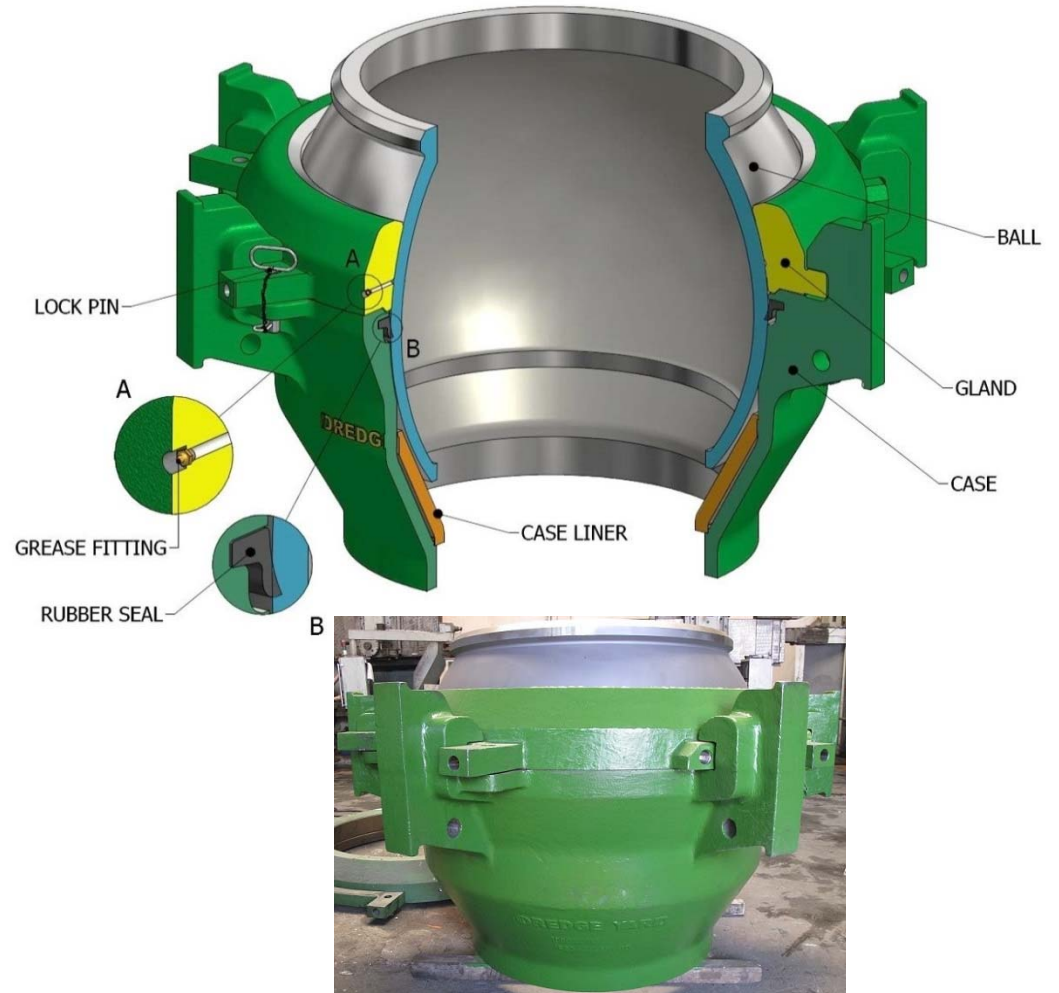
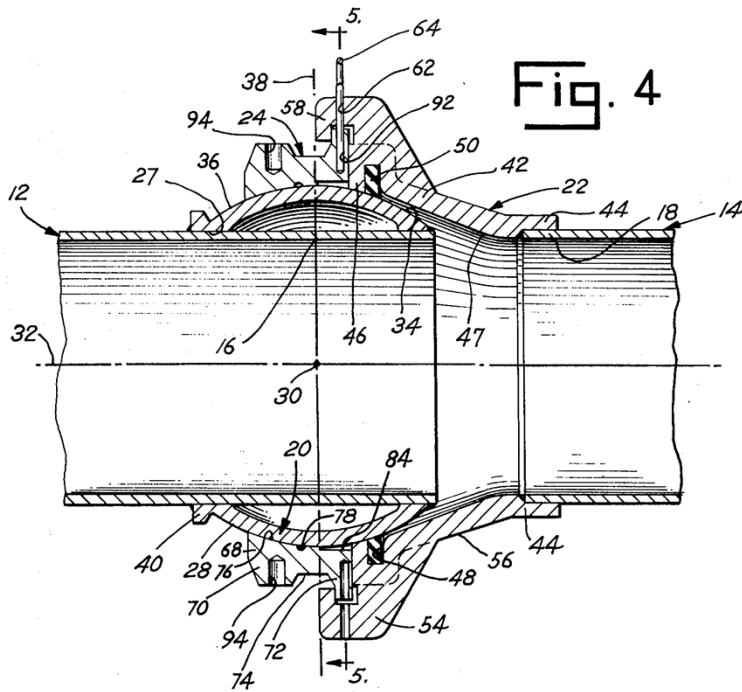


Consumption of discharge pipes

- Estimation of Power Consumption
 - For **CSD 40% - 70%**
 - For **TSHD 30% - 60%**

Current ball joint

U.S. Patent Dec. 7, 1976 Sheet 2 of 2 3,995,889



One of the first types of ball joints

Ball Joints still in Production

Problems with Ball Joints

- **Rust** (Tilting Resistance)
- **More force** to tilt
- **Power consumption**

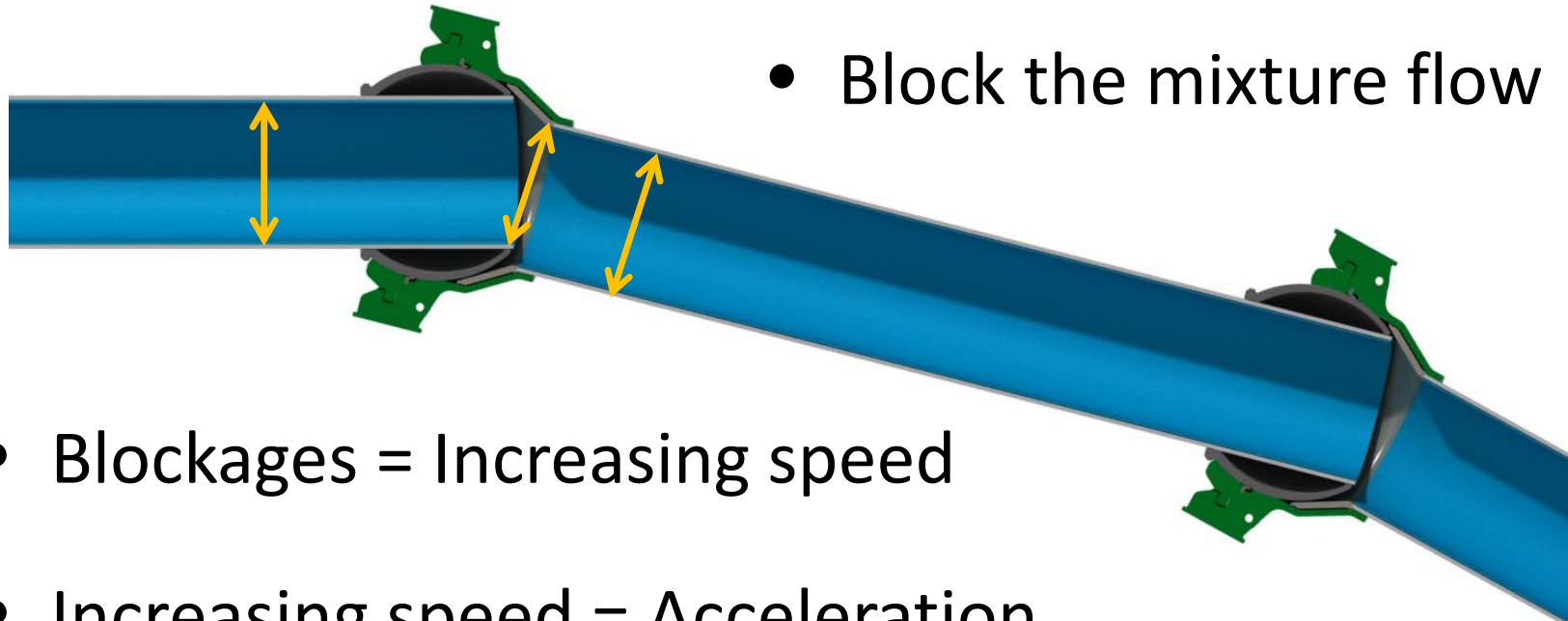


Rust on Ball Joint



No flexibility in pipe connection

Problems with Ball Joints



- Block the mixture flow

- Blockages = Increasing speed
- Increasing speed = Acceleration
- Acceleration = Pressure Drop
- Pressure Drop = More Power

Problems with Ball Joints

- Two major problems:

1. RUST

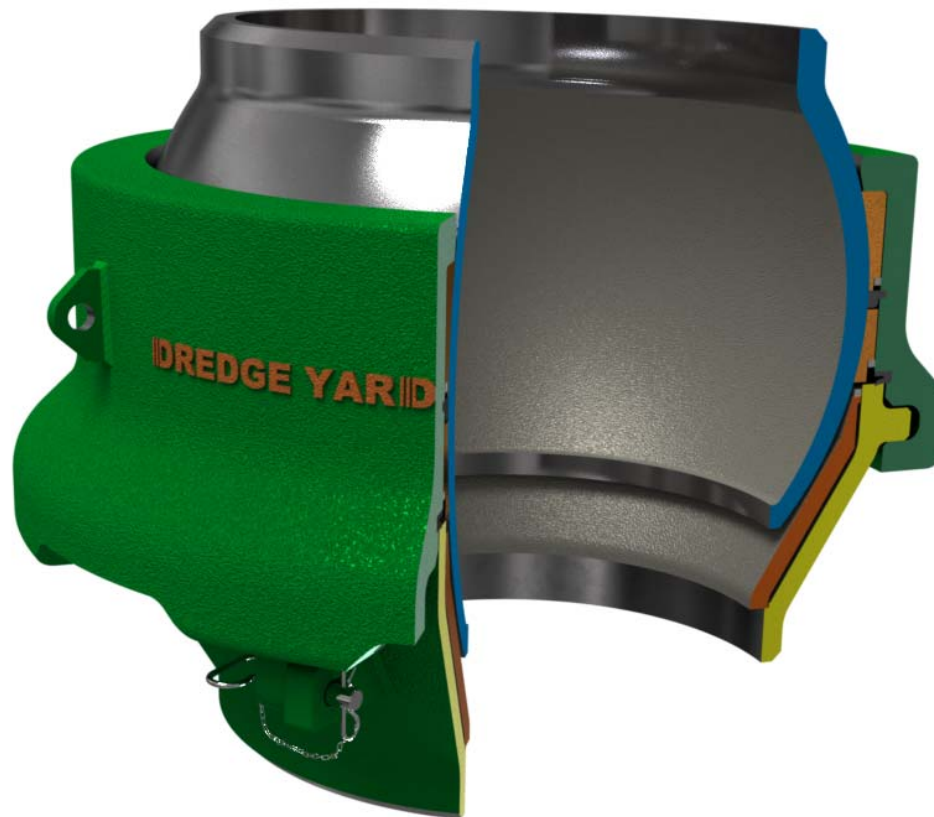


2. BLOCKAGE



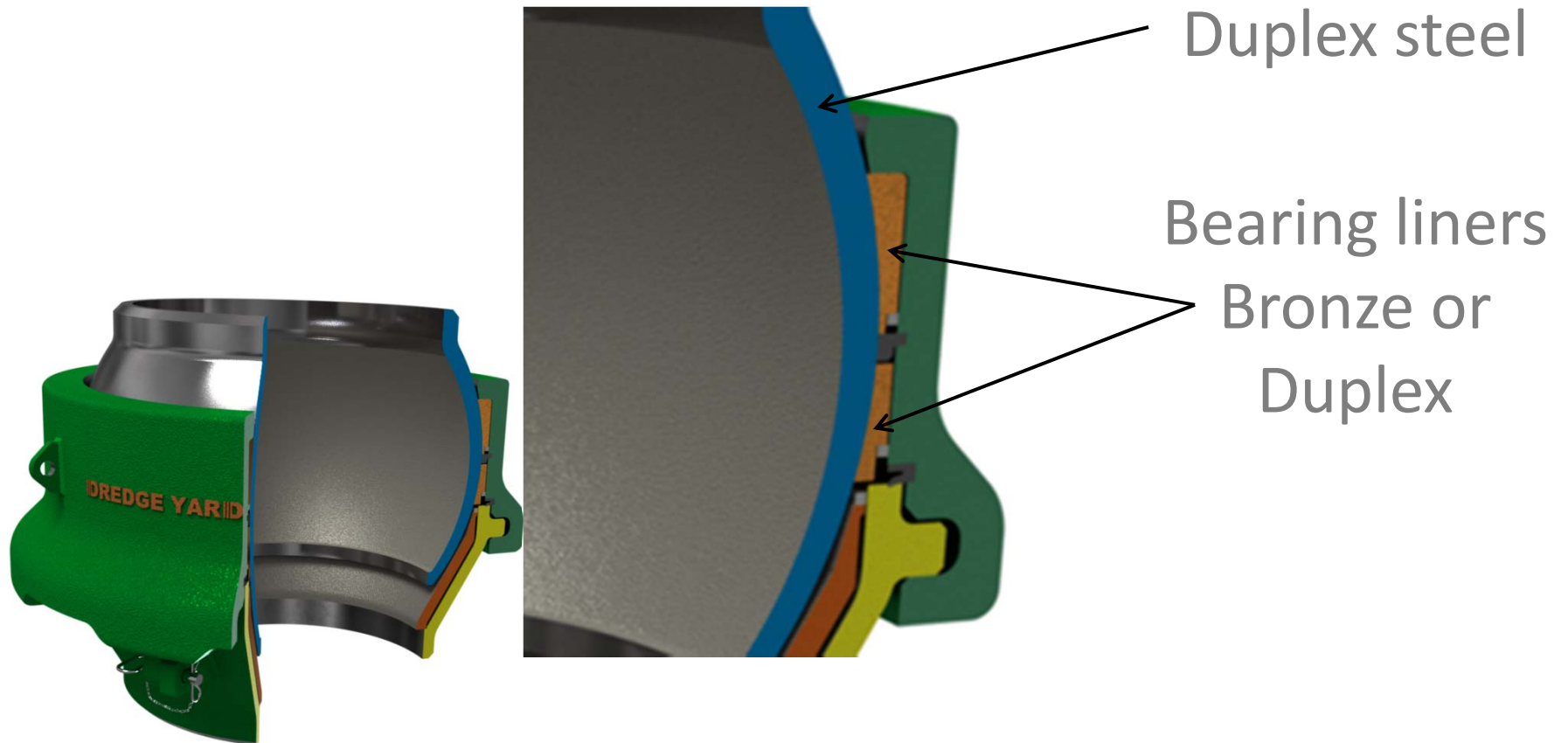
Possible Solutions (Rust)

- Bearing Ball Joint



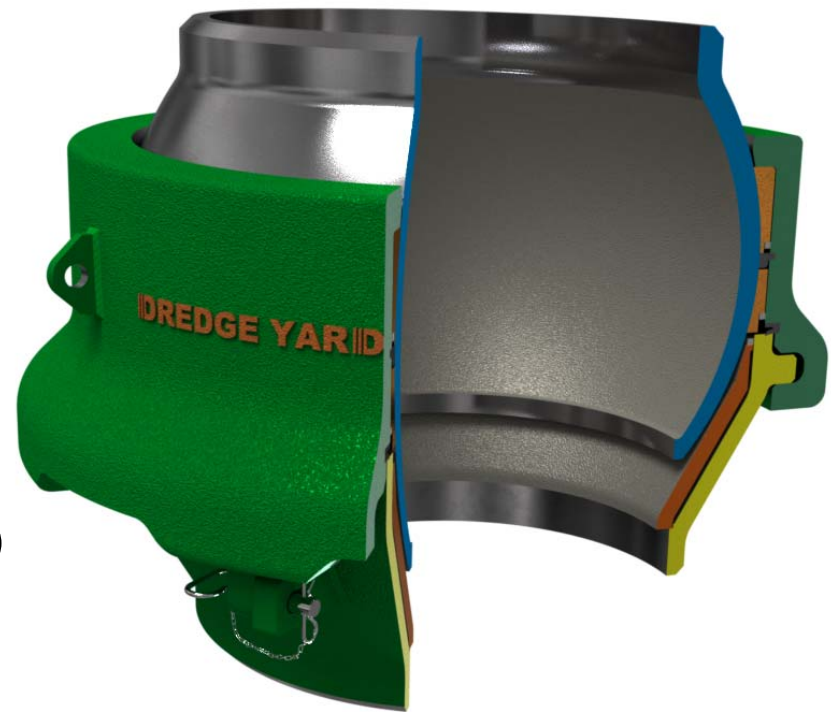
Possible Solutions (Rust)

- Bearing Ball Joint



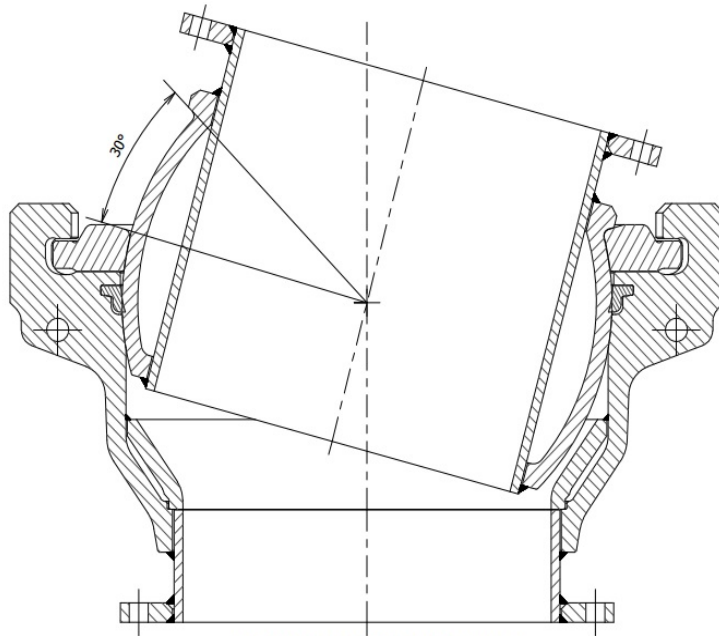
Possible Solutions (Rust)

- **Bearing Ball Joint benefits:**
 - No Grease
 - Flexible
 - Longer life time
 - Replaceable bearings
 - Environment friendly 😊
 - Easy dismantling

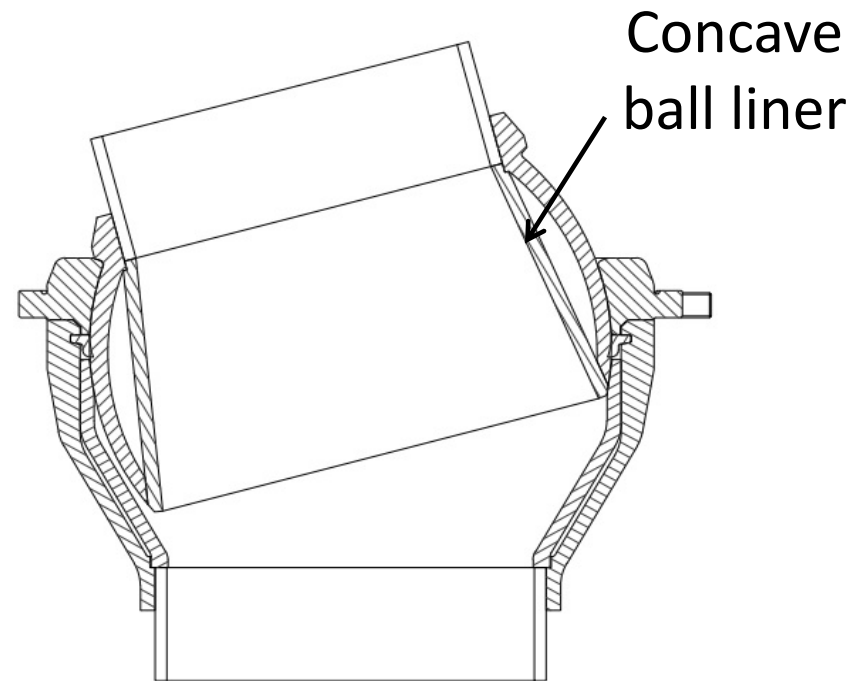


Possible Solutions (Blockage)

- Concave ball liner

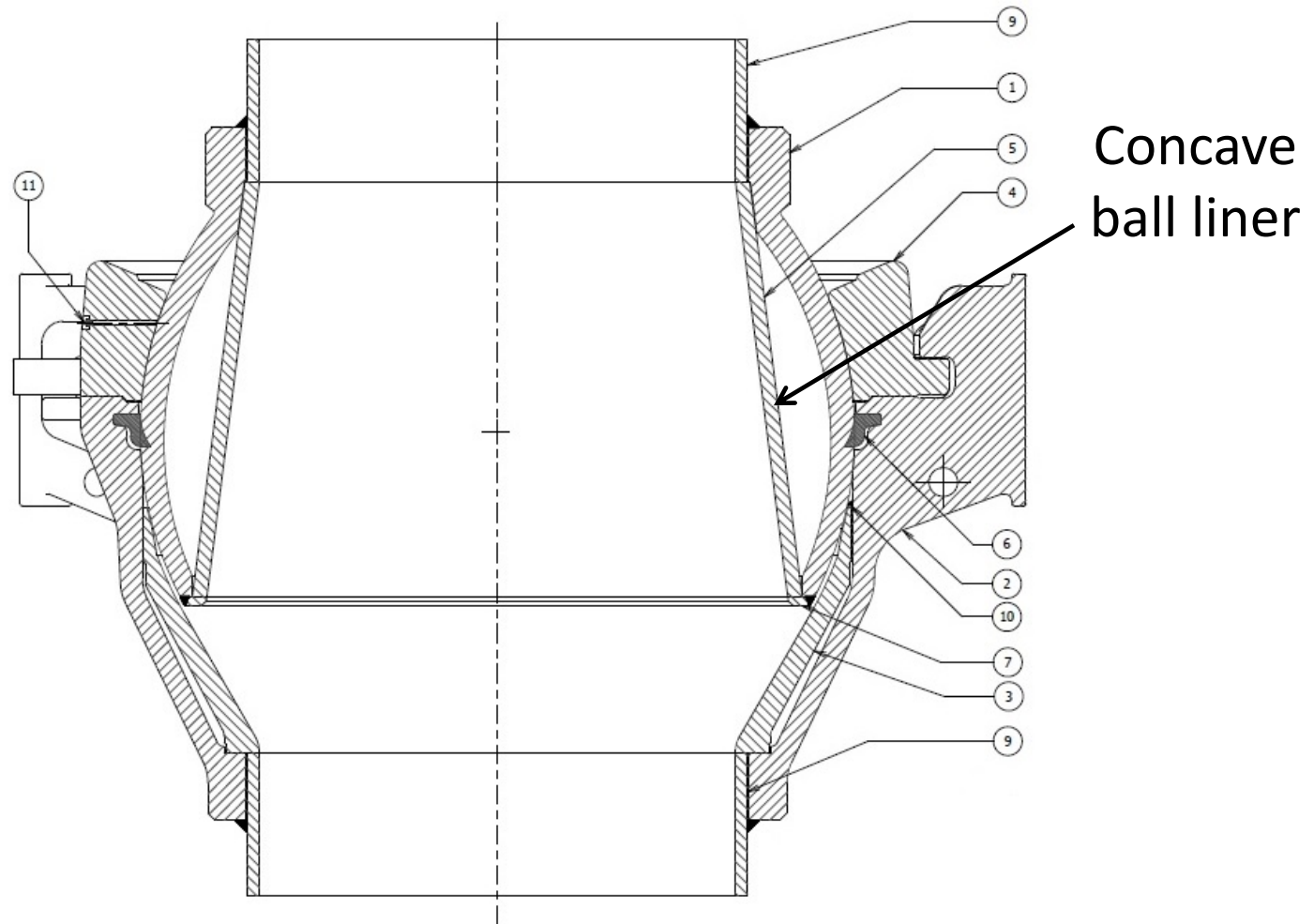


CONVENTIONAL



CONCAVE LINER

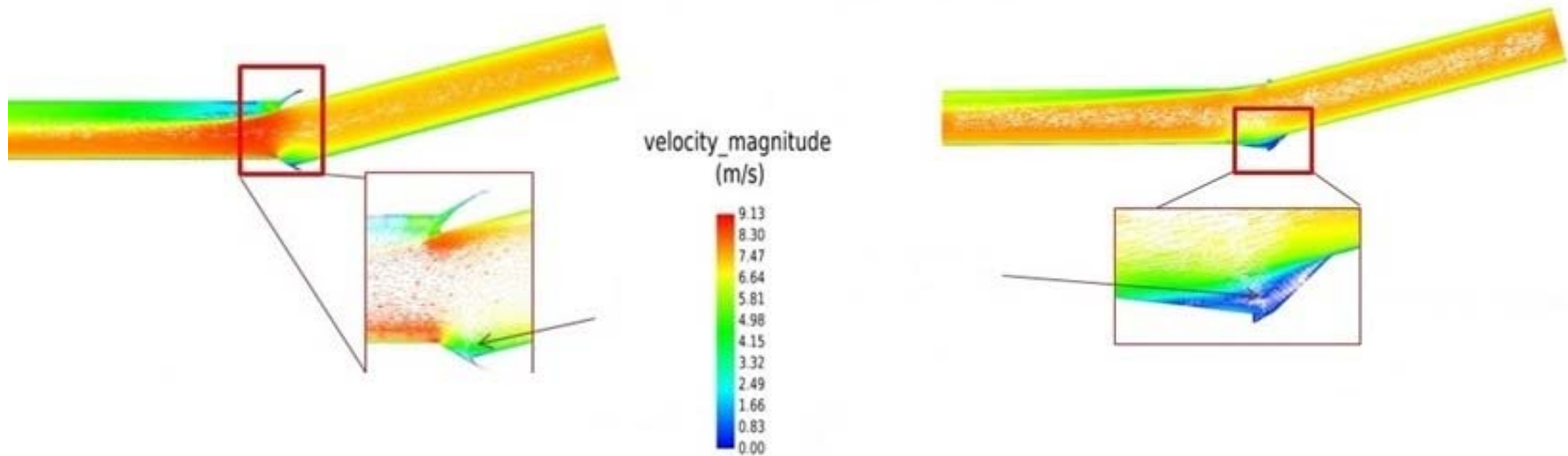
Possible Solutions (Blockage)



Possible Solutions (Blockage)

- Concave ball liner CFD Simulation

MAX TILTED POSITION



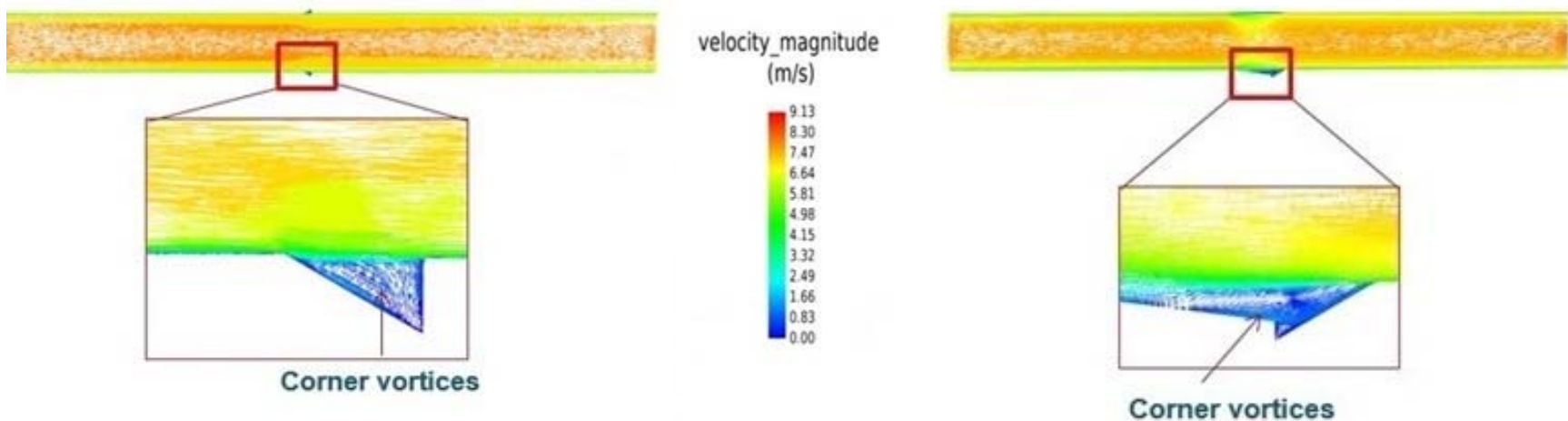
CONVENTIONAL

CONCAVE LINER

Possible Solutions (Blockage)

- Concave ball liner CFD Simulation

SYMMETRICAL POSITION

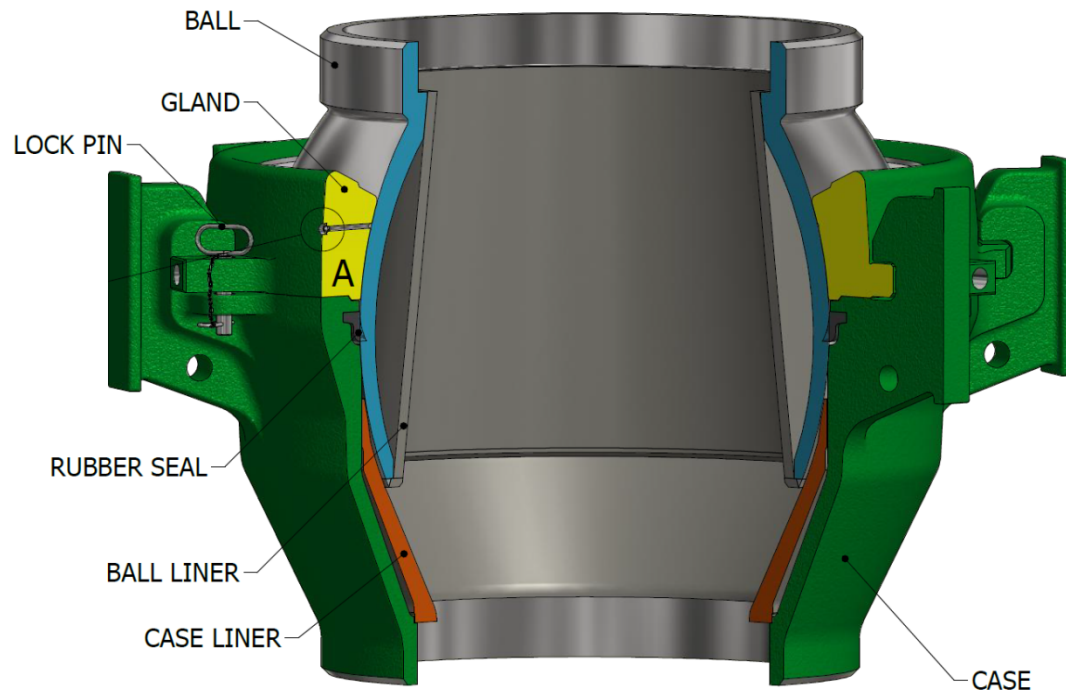


CONVENTIONAL

CONCAVE LINER

Possible Solutions (Blockage)

Benefits:



- Less pressure drop
- Replaceable liner
- Less wear
- Longer life cycle
- Environment friendly



Possible savings

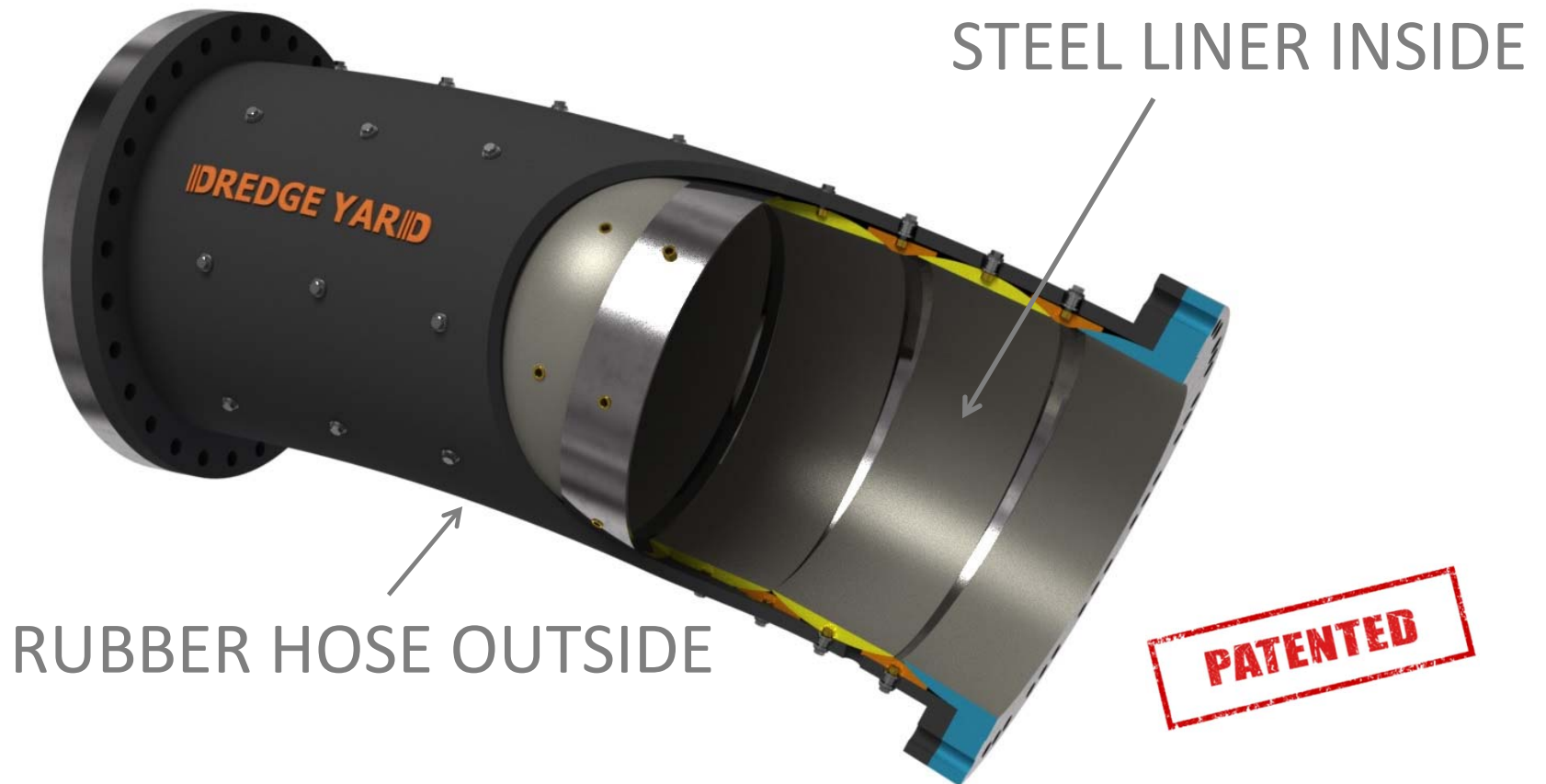
- Pressure drop saving **40-50%**
- According to calculations made with CFD
- In-house and using Simerics and HyperWorks



- **Fuel saving 10-15%** according to total pipe resistance

Possible Solutions (Blockage)

- Spine Hose



Safety

- Many safety issues
- Ball Joints are getting bigger
- Difficult to handle
- Rough environment



Problem of implementation

- Joints bought as price/weight
- Old available stocks
- Workers not aware about the savings
- Trying new technology is time consuming
- The old system is known and proven

Recommendations

- Selection on long term use
- Cost calculation of fuel consumption differences
- Modify existing used stock

THANK YOU

QUESTIONS AND DISCUSSIONS

