

# Hydrostatic Testing & Drying



Doug Crabtree  
Senior Sales Engineer  
T. D. Williamson, Inc.

[doug.crabtree@tdwilliamson.com](mailto:doug.crabtree@tdwilliamson.com)

# Introduction

## Why Test ?

- To establish/MAOP of new pipelines
- Verify structural integrity of a pipeline system
- Code requirements for new pipelines
- Upgrading pipelines to higher MAOP
- Alternative technique to ILI or DA for IMPs

# Primary Testing Activities

- Pipeline Cleaning
- Line Fill
- Pipeline Hydrostatic Testing
- Line Dewater
- Pipeline Dehydration or Drying
- Geometry Pigging

# Pipeline Cleaning

## Why Clean Before Hydrotest ?

- Pre-cleaning existing pipelines, reduces Environmental Risks
- Clean to avoid treatment of Hydrotest water
  - PCB or NORM laden material exists in many pipelines
  - Hydro water can be disposed w/ lower costs
- Avoid pushing debris/contaminants from section to section
- It is very difficult to dry dirty pipelines

# Progressive Pigging

Pigs used in initial runs should be more forgiving in lines that have not been pigged or have unknown characteristics and features. Start with conservative, less aggressive pigs and build confidence through the this process. As you confirm piggability and secure additional pipeline data, transition to more aggressive pigs.

- Example:
- Foam Pig
  - Foam Pig with Bristles
  - Mandrel Pig W/ Cups
  - Mandrel Pig W/ Discs & Brushes
  - Mandrel Pig W/ Aggressive Brushes
  - Gauging Pig

**NOTE: Optional Bypass ports may be added to virtually any pig and can significantly enhance cleaning the cleaning process**

# Typical Pigs Used For Cleaning



RS-7  
Foam



Magnetic  
Cleaning



Power  
Brush™



Vantage® V  
DCDC-BR



PitBoss™



BiDi w/  
Circular  
Brushes



BiDi w/  
Spring  
Brushes

# Typical Water Specs

Determine the suitability of the water sources.

A typical water specification is as follows:

- ✓ Silt            Less than 100 PPM
- ✓ Saline        Less than 2,000 PPM
- ✓ pH Factor Between 6 and 9

*NOTE: The installation of filtration equipment capable of removing 99 percent of all particles to a specified micron diameter (typically 90-micron) is necessary when using water from streams, rivers, lakes*

# Hydrostatic Testing Factors

- Predictability of failure pressure levels for defects located along the longitudinal axis based on the known axial length and maximum depth of the defects.
- Smaller defects will fail as the test pressure is increased.
- As the pressure is increased ductile tearing of existing defects can occur resulting in the growth of defects that may hold the initial pressure, but could fail later with subsequent pressurization.
- Decisions for test segment lengths are made early in the process

# Failure Pressure Curve

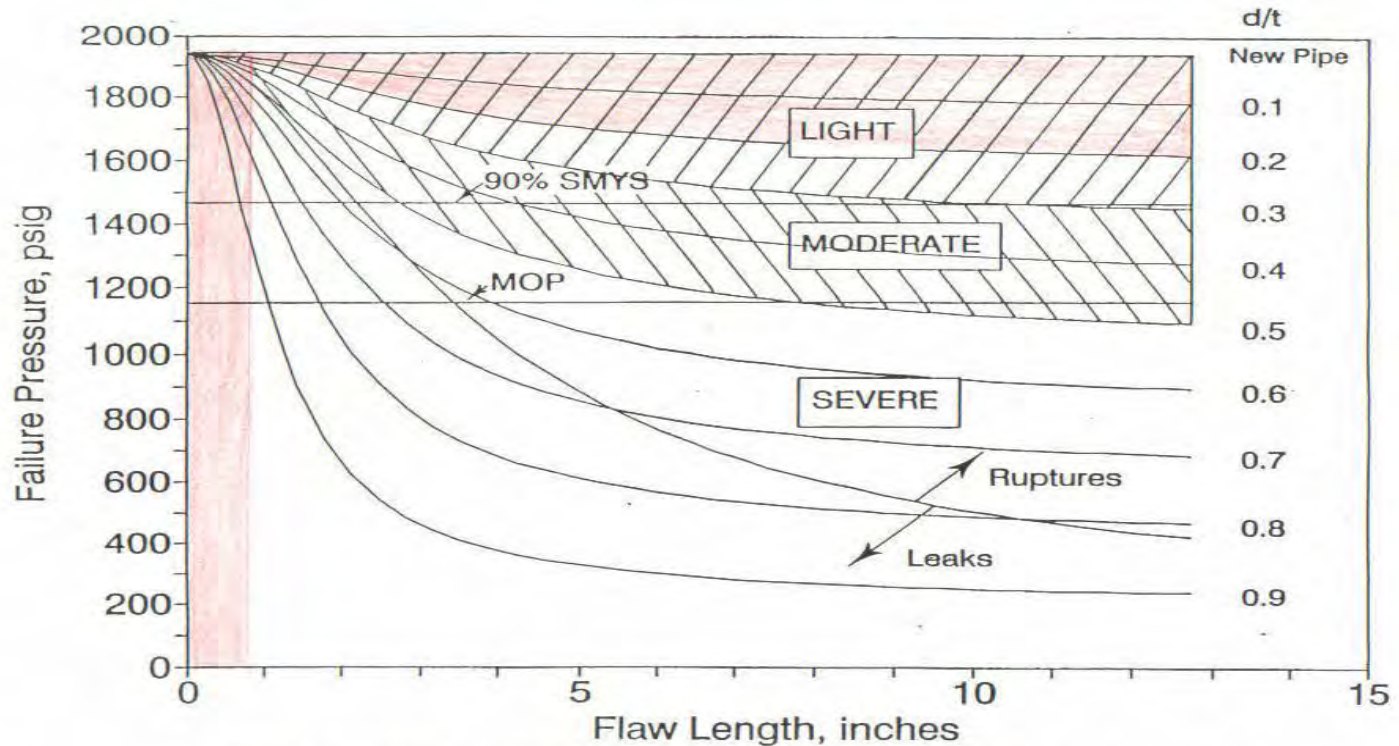
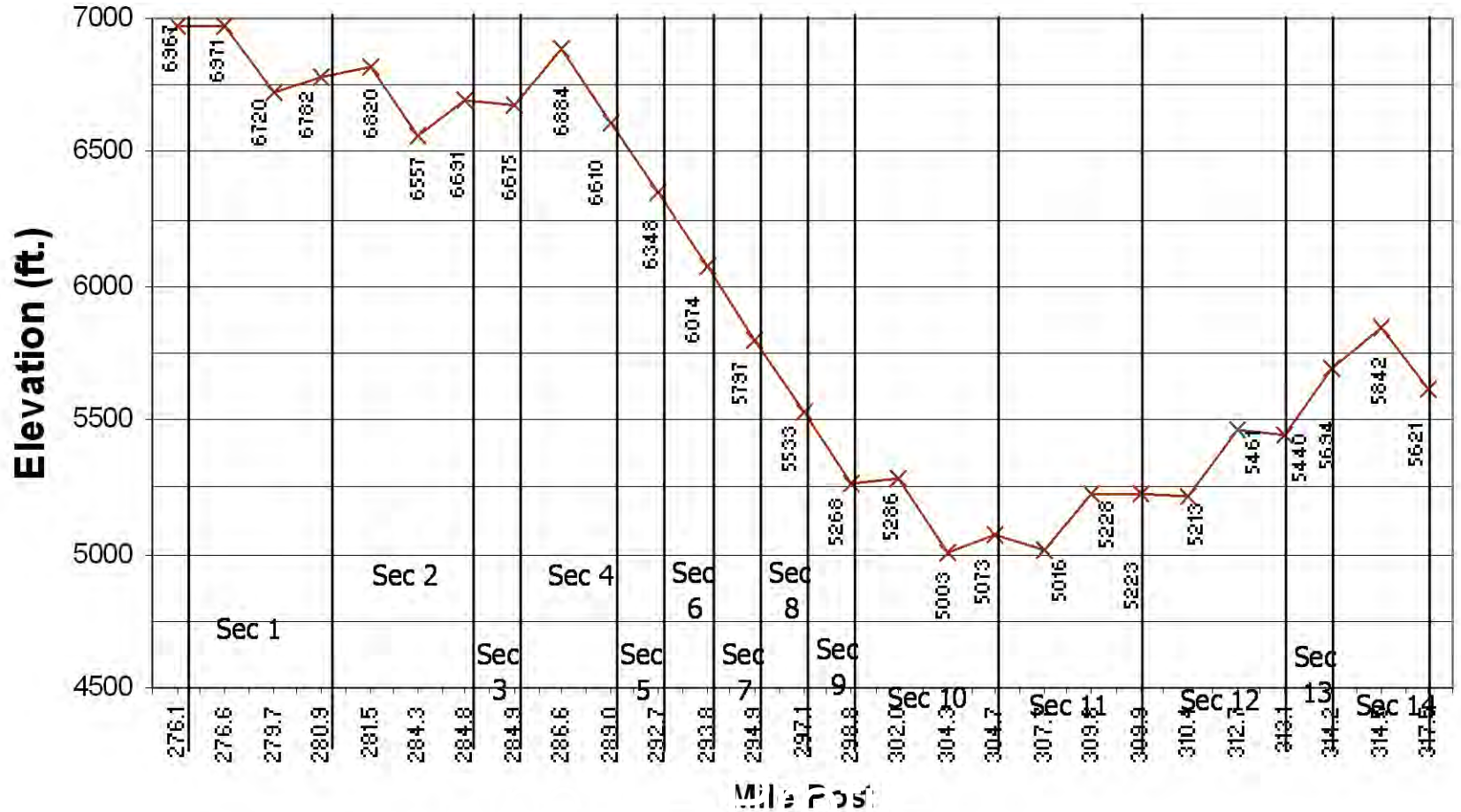


FIGURE 5. SIZES OF FLAWS LOCATED BY IN-LINE INSPECTION (CORROSION) (16 INCH BY 0.250 INCH, X52, BLUNT DEFECTS)

## Sample Elevation Profile



# Key Execution Points

- Fill water should be measured accurately, not only for determining the total fill volume, but to help locate a pig that may stick due to a pipe restriction
- Controlled Pig Velocity is the key to not breaking your water column and introducing air pockets. It is also important to hold back pressure against the fill pig
- Watch temperature to avoid over pressure while testing
- Include head pressure in your calculations for the test
- When the pressure reaches a point of 70% SMYS, the rate of pressurization should not exceed 10 psig per minute
- The volumes of water added or removed to control test pressures should be measured and documented.

# Pigs for Filling & Displacement



RS-7  
Foam



Vantage V  
w/ RealSeal®  
Cups



1C5D X-Pig®



BiDi

Typical pigs used to fill pipelines are the RS-7, Vantage or OptionAllTM 4CC w/ RealSeal cups, X-Pigs and BiDi pigs. Disposal of the water will determine if a BiDi type pig is required. If water has to be returned to the source that it was taken from then BiDi pigs would be the preferred type.

# Testing Options

## Nitrogen Test

*Non Piggable*

*Short Segments & Small Diameters*

*Meter Sets, Reg Stations*

*Better Leak Test*

*Low Pressure/Low Volume*

*Packaged w/ Hydrotest*

*Ancillary Piping Systems*

*Media Cost - Expensive*

## Hydrostatic Test

*High Pressures*

*High Volume*

*Large Projects*

*Large Diameters*

*Long or Multiple Segments*

*Cross Country Mileage*

*Media Cost - Inexpensive*

# Pipeline Performance



10  
al o  
cq

# Hydrostatic Test Tools

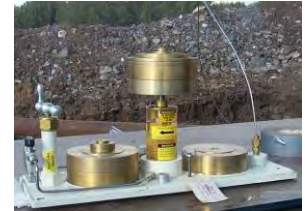


High Pressure Pump



Low Pressure Pump

Dead  
Weights &  
Digital  
Equipment



Temp Recorder



Pressure  
Gauge



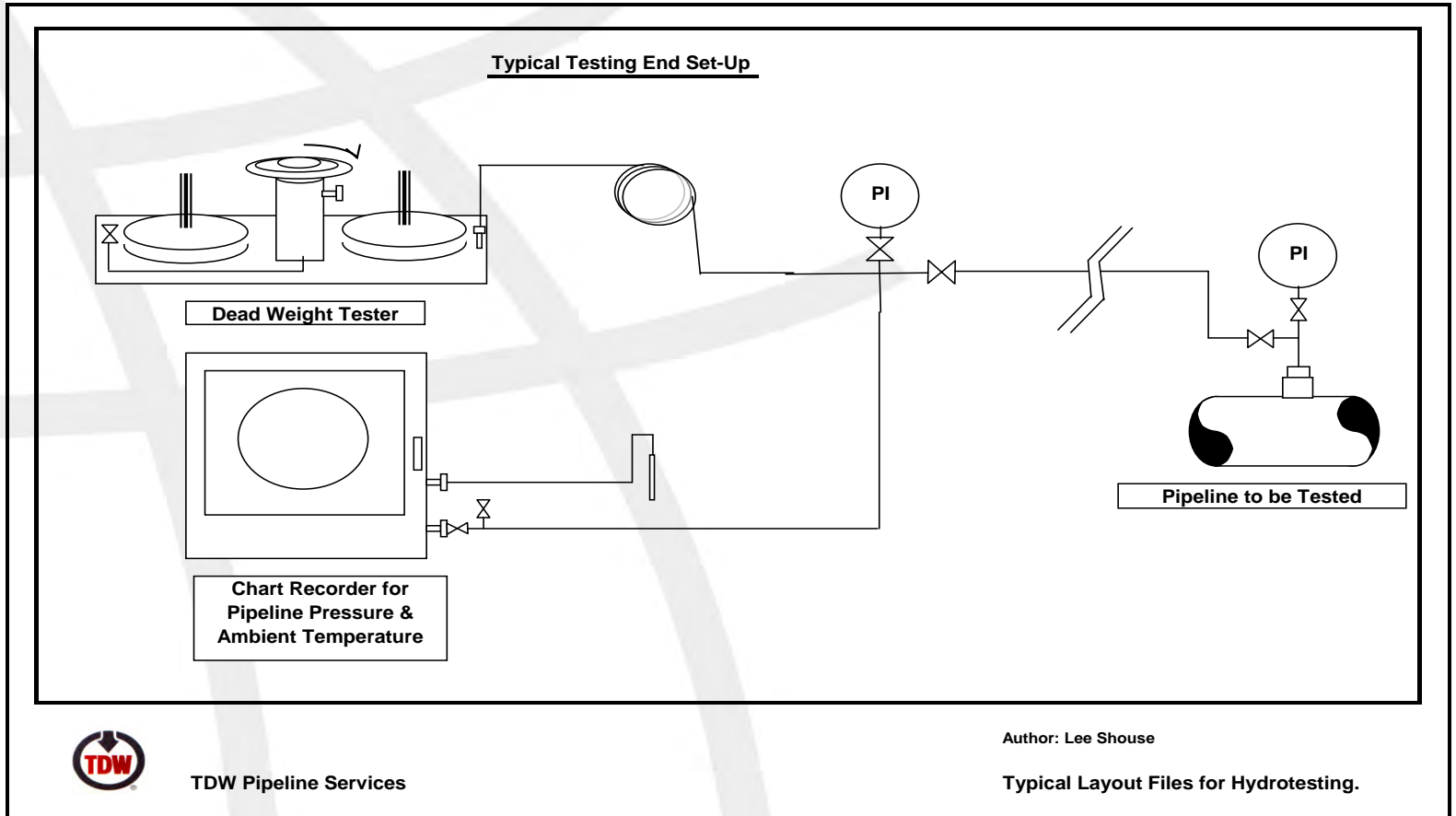
Chart Recorder



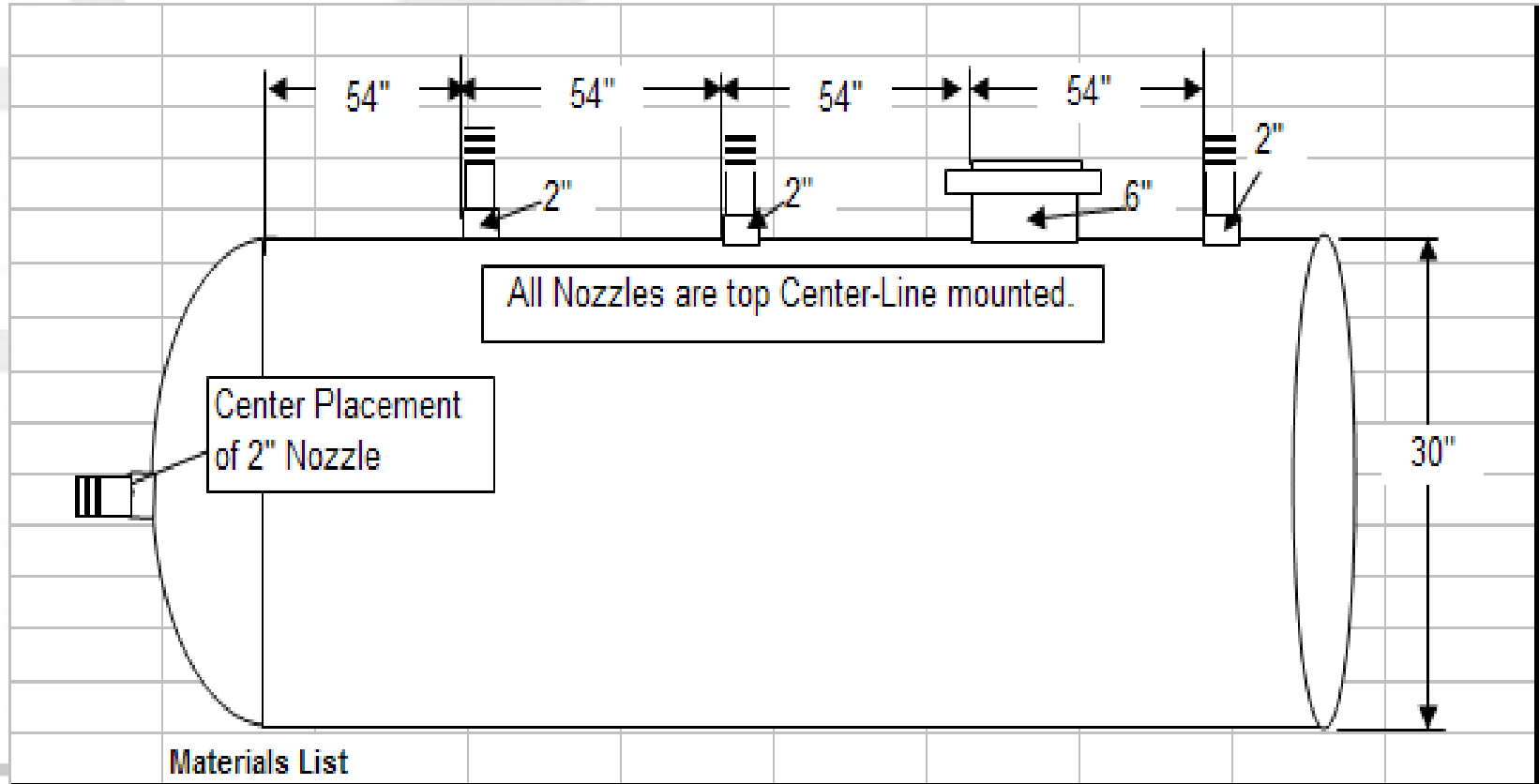
Frac  
Tanks

Other Equipment - Water Meter, Hoses, Dew Point Meters, Light Plants, several hundred feet of temporary pipe for transporting water.

# Hydrostatic Testing - Test End



# Typical Nozzle Configuration For Test Heads





Jump-Over Line Between Two Test Sections

# Ruptured Pipe Section During Testing





Failure During Hydro-Test

# Repairs

- If the pipeline segment fails under test pressure, the rupture must be located and repaired, water must be pumped back into the pipeline to displace air pockets, and the pipeline must be re-pressurized

# Hydrostatic Testing Costs

The costs include the costs to isolate the line for testing, purging product from the line, filling the line with water, gathering the test data, finding and repairing any pipe failures, purging the water from the line, drying the line, re-packing the line with product, and returning the line to service

# Pigs for Filling & Displacement



RS-7  
Foam



Vantage V  
w/ RealSeal®  
Cups



1C5D X-Pig®



BiDi

Typical pigs used to fill pipelines are the RS-7, Vantage or OptionAll™ 4CC w/ RealSeal cups, X-Pigs and BiDi pigs. Disposal of the water will determine if a BiDi type pig is required. If water has to be returned to the source that it was taken from then BiDi pigs would be the preferred type.

# Pipeline Drying Methods

- Methanol Slugs
- Dehydration with Dry Air
- Dehydration with Nitrogen
- Vacuum Drying
- Pigging Only (dewater and foam)

# Air Compressors & Dryers



# Liquid Nitrogen Delivery



# Dewatering/Drying Tools

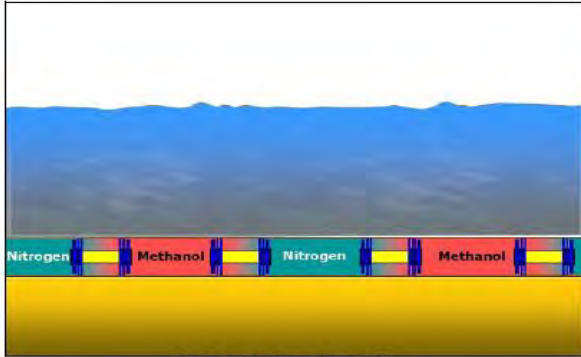


Fig. 7 – Methanol Swabbing

Batch Methanol Slugs



Compressors & Dehydrators



Nitrogen (Tankers or Membrane)

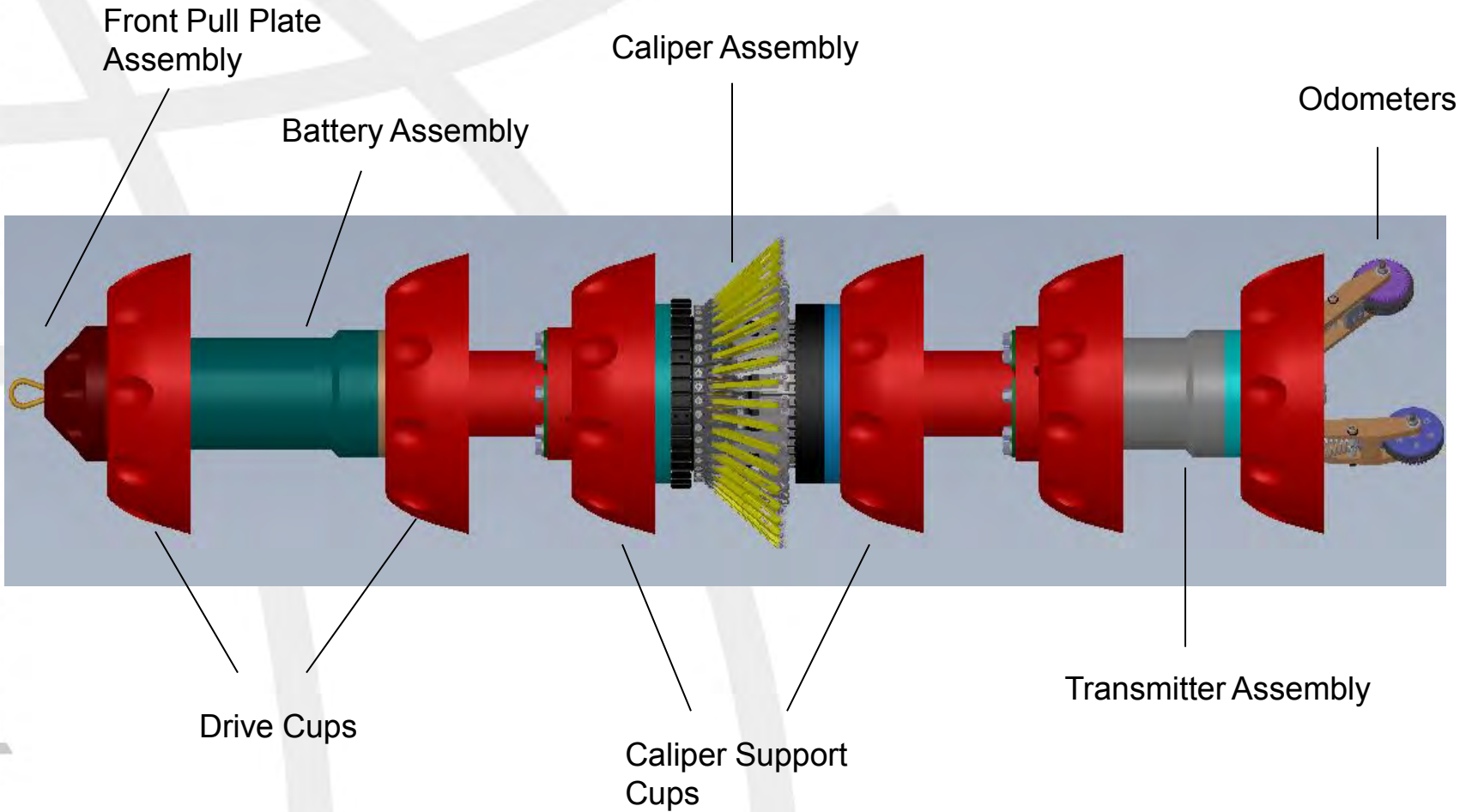


Pipeline Drying

# An Example of Pipe Yielding



# Pipeline Performance



# Why Run A Gauging Pig Before the Smart Tool?

Running a gauging pig is the most expedient, if it comes out with no damage, and economical way to verify the pipeline is laid without serious dents, buckles and/or other obstructions.

Slotted aluminum gauging plates of between 90% to 95% of the pipe's inside diameter are typically used and are mounted between the pig's seals to be protected from any damage other than that caused by a reduction in diameter.



**Questions?**