Hobas Pipe USA
Mike Bussio

Agenda
HOBAS Pipe USA, Inc.

- ✓Introduction to Hobas Pipe USA
- ✓Product Overview
- ✓Features & Benefits
- ✓Pipe Capabilities & Applications
- ✓Installation Options
- ✓Case Histories Direct Bury & Trenchless
- ✓Pipe Manufacturing & Testing
- ✓Pipe, Couplings, Fittings, Manholes
- ✓Repair & Maintenance
- ✓Pressure Pipes – Our New Frontier
- ✓Questions & Answers

Hobas Pipe USA , Houston TX
More Than a Pipe Manufacturer

- “How Can I Be of Assistance?
- Engineering
- Field Services
- Sales
- Support from cradle to grave

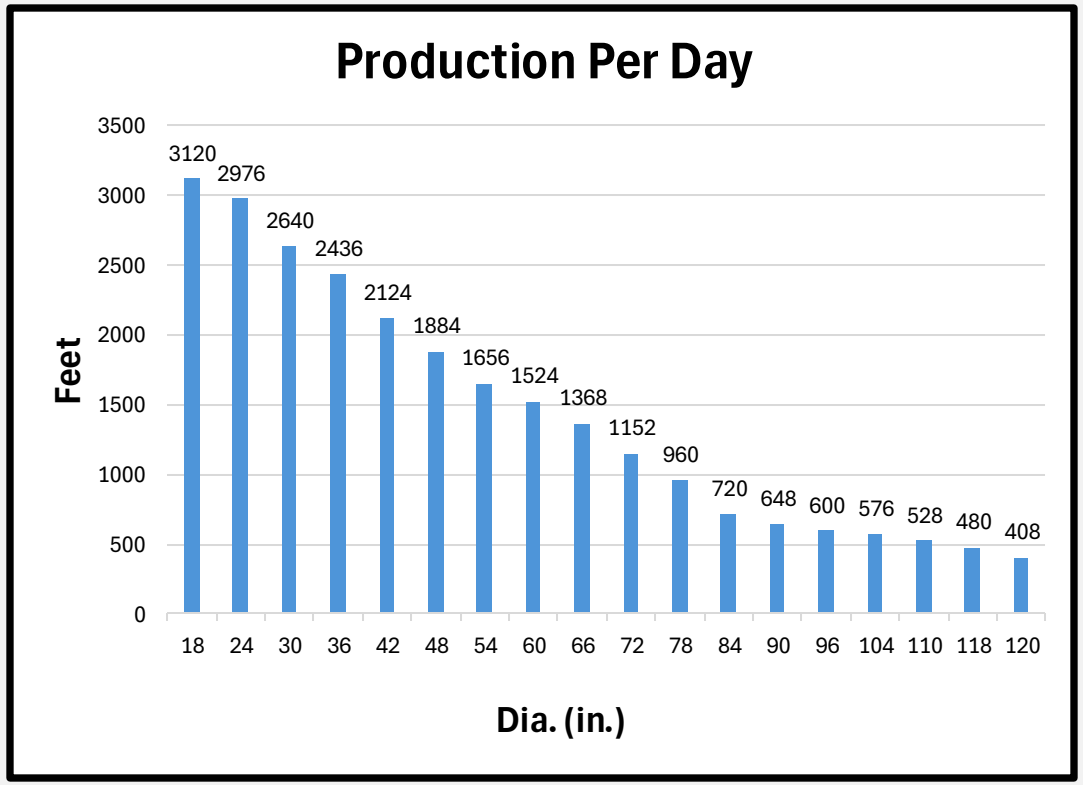
Hobas Pipe USA , Houston TX
More Than a Pipe Manufacturer

- Approx 20 Million LF Installed since 1987.
- Adding 1 Million LF every 18 months
- Market has known us as a “gravity pipe” but have had pressure offerings entire time
- Manufacturing investment in tens of millions to service pressure market

Manufacturing Facilities Overview
Houston, Texas-Since 1987

- Total Acreage: 40 acres
- Total Square Feet Under Roof: 201,196
- Sizes produced from 12”-126” diameter in various pipe stiffness and pressure classes up to 450 psi

Product	Manufacturing
Gravity	4 Feeders 9 Molds
Pressure	2 Filament Winder
Non-Circular	1 Filament Winder 2 Mold Bays
Manhole/Fittings	Water Jet Saw for Precision Cutting



FRPMP – *Fiberglass Reinforced Polymer Mortar Pipe*

- ✓Pipe 18” to 126” Diameter
- ✓Couplings
- ✓ Fittings
- ✓Non-Circular Pipe

Product Overview

Description	Gravity Pipe	Pressure Pipe	Jacking Pipe	Slip Lining & Tunnel Carrier Pipe	Non-Circular Pipe
					
Applications	• Sewers • Storm Water Systems • Industrial Piping • Utility Corridors • Fresh & Salt Water Outfalls • WWTP Piping	• Potable & Raw Water • Sewer Force Mains • Penstocks • Irrigation • Industrial Effluents • Cooling Water	• Sewers • Storm Water Systems • Industrial Piping • Utility Corridors • Fresh & Salt Water Outfalls • WWTP Piping	• Sewers • Storm Water Systems • Industrial Piping • Utility Corridors • Fresh & Salt Water Outfalls • WWTP Piping	• Sanitary Sewer • Storm Sewer
Pipe Diameter	12”-126”	12”-118”	18”-126	18”-126”	18”-118”
Pipe Length	Up to 40’	Up to 40’	Up to 20’	Up to 20’	Up to 10’
Design Basis	Flexible	Flexible	Flexible	Flexible	Flexible

Applications for HOBAS Pipe

- ✓Gravity Sanitary Sewers
- ✓WWTP Piping and Odor Control
- ✓Pressure Water Systems
- ✓Potable Water
- ✓Force Mains
- ✓Large Diameter Storm Sewers
- ✓Irrigation
- ✓Protective Casing
- ✓Raw Water Transmission
- ✓And MUCH more …..

Service Conditions and Capabilities of HOBAS

- ✓Operating Pressures up to 450 psi
- ✓Temperatures up to 180 degrees F
- ✓Can be buried Deep or Shallow - Depths Over 65 Feet
- ✓Hobas Pipes can handle Full Vacuum
- ✓High Live Loads
- ✓High Tonnage Jacking Capacity and Slip Line Distances

Pipe Specifications – ASTM / AWWA Standards

AWWA C950	Fiberglass Pressure Pipe (Potable)
ASTM D3517	Fiberglass Pressure Pipe (Non Potable Water)
NSF 61	Drinking Water System Components
AWWA M45	Fiberglass Pipe Design Manual
ASTM D3754	Sewer Force Main
ASTM D3262	Fiberglass Sewer Pipe
ISO 9001	Quality Management Systems
ISO 14001	Environmental Management

Why our customers choose Hobas Pipe

Features

- **Corrosion resistant**
- Computer-controlled consistent
- Engineered Product
- Lightweight
- Hi Stiffness
- Constant OD
- Versatile Installation Options
- High performance FWC Coupling

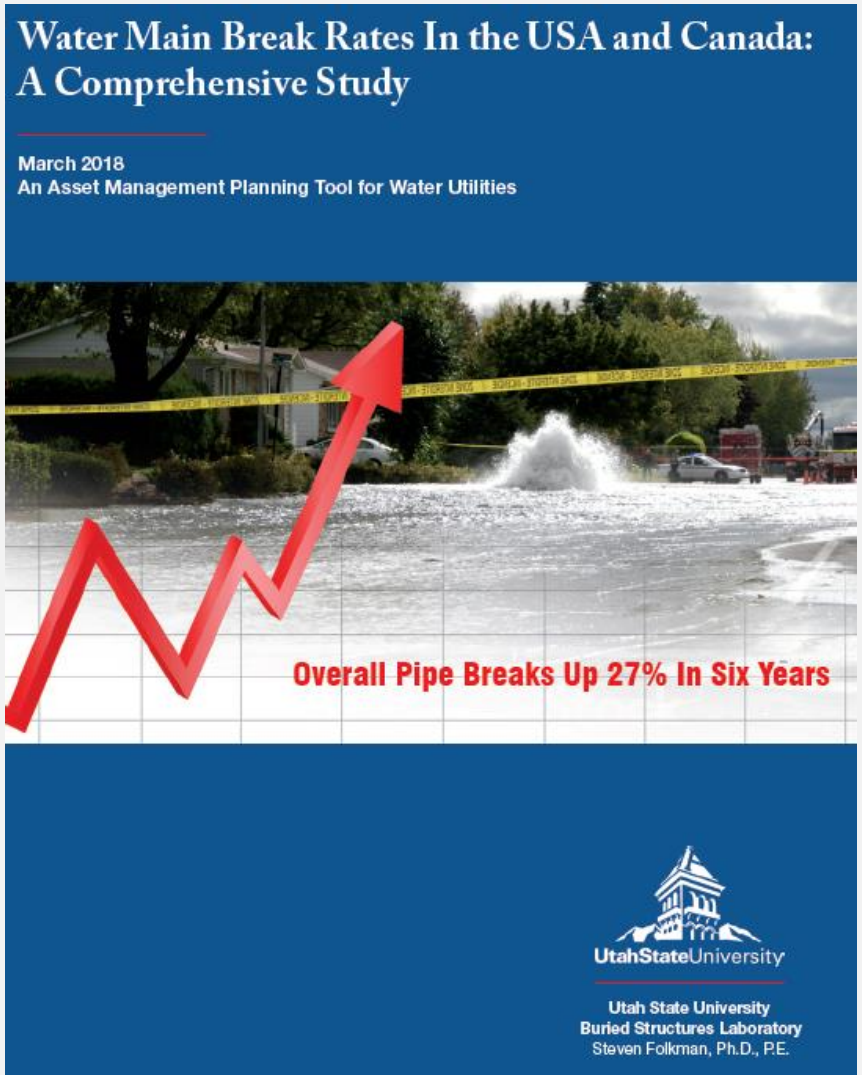
Benefits

- Reliable performance
- Fast assembly easy to field cut
- **Leak-free**
- **Excellent long-term hydraulics, n = 0.009 & C-155**
- Excellent Abrasion Resistance
- No need for cathodic protection or coatings
- Safely Burried deep or shallow
- **Long maintenance-free life 150 Year Design Life**

NORCAL HOBAS PROJECTS

- SFPUC
- MODESTO
- SACRAMENTO
- EBMUD

Pressure Pipe for Water Utilities: Major Findings

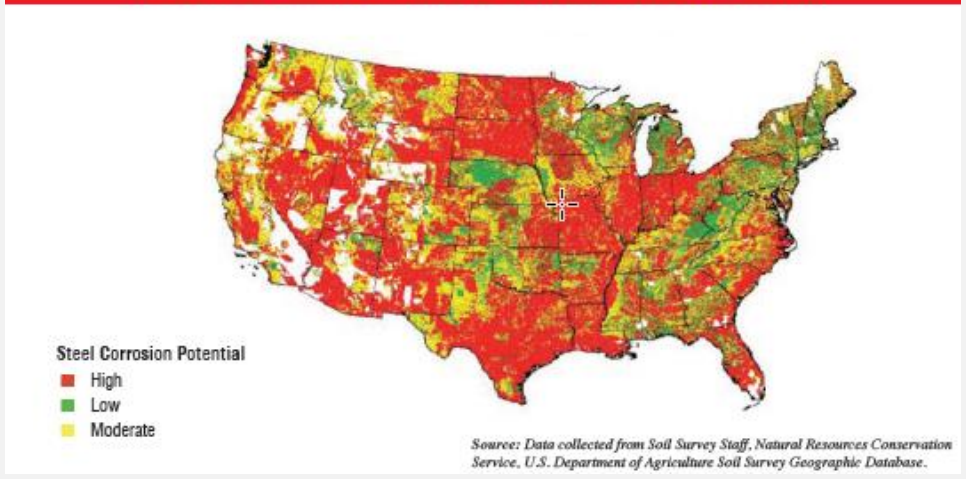


1. 200,000 Miles of Pipe Conditioned and Operation Surveyed
2. Break Rates Have Increased 27% in the Past Six Years
3. Soil-side corrosion is a Major Cause of Water Main Breaks
4. Estimated Average Water Loss to Leakage is 10%

TABLE 6: TYPICAL CORROSION PREVENTION METHODS

Rank	Corrosion Prevention Methods
1	Polywrap
2	Anodes or cathodic protection
3	V-bio polywrap
4	Impressed current
5	Dielectric coatings

FIGURE 30: US CORROSIVE SOILS MAP (CONUS POTENTIAL FOR STEEL CORROSION)



City of Phoenix Pressure Pipe –North Gateway Force Main

27,000’- 24” / 110 PSI Hobas Twin Force Main

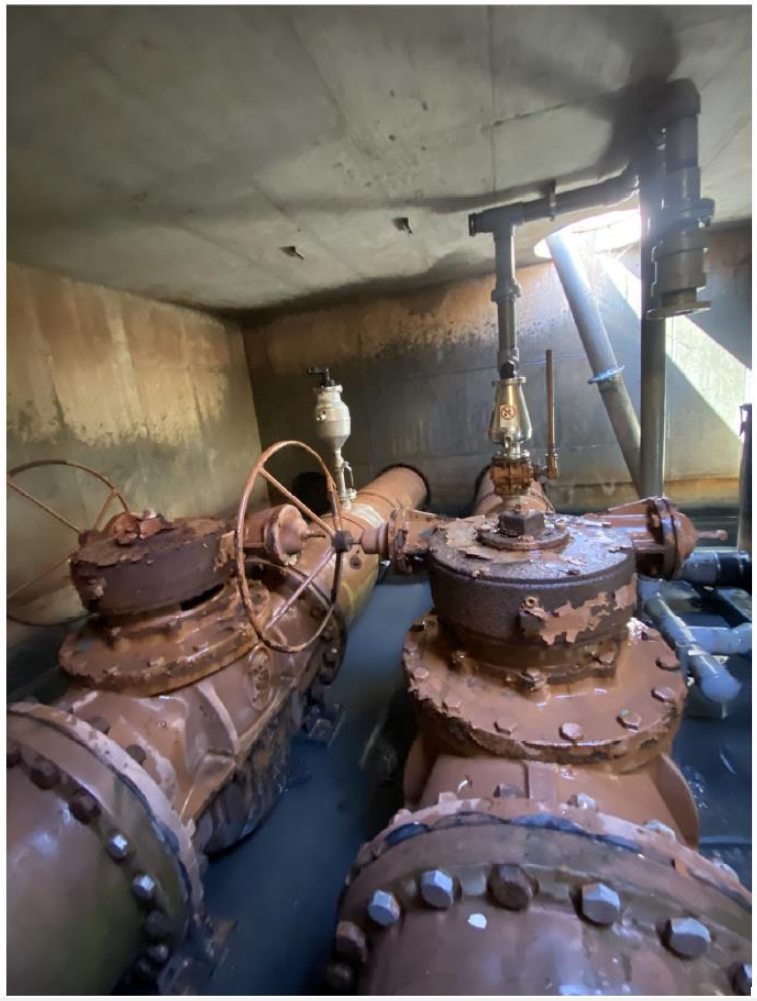
On-Site Verified Pressure Test – City of Phoenix 150 PSI

Axial Concrete Thrust Restraint

North Gateway Force Main

North Gateway Vault **2023** – 20 Years Later!

FRPMP Corrosion Resistant



Installations Suited to HOBAS Pipes

- ✓Direct Bury
- ✓Microtunneling & Jacking
- ✓Sliplining

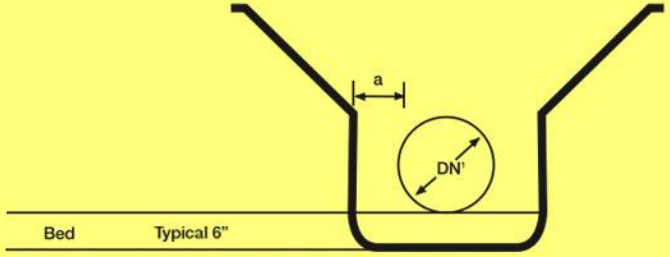
- ✓ Above Ground
- ✓ Tunnel Carrier
- ✓ Casing Pipe

Direct Buried

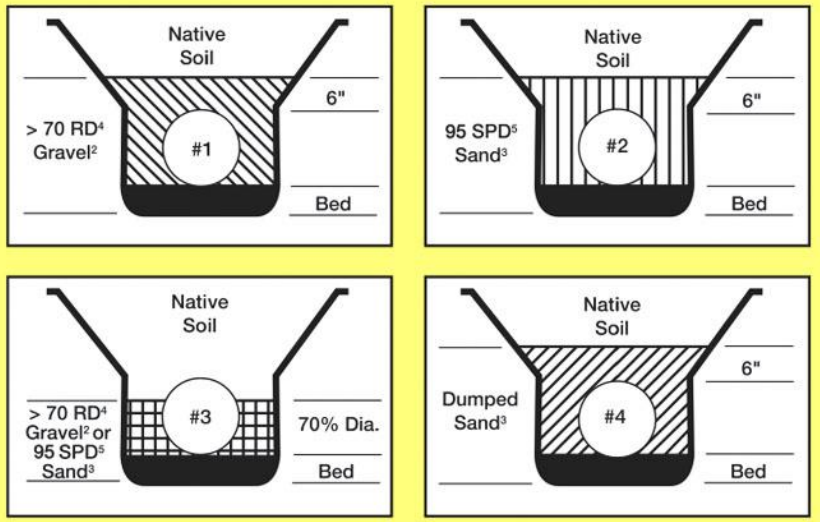
- 6X lighter than competition
- Smaller equipment
- Less carbon emissions
- Cover depths > 50-ft.
- Easy to Field Cut
- High Strength/High Stiffness
- Leak Free Couplings
- Joints go together fast
- Easy to Repair

Direct Bury Embedment Conditions

DN (in.)	Typical Min. a (in.)	
	SPT[2] ≤ 8	SPT[2] > 8
18 to 20	6	4
24 to 33	9	6
36 to 48	12	8
51 to 72	18	12
78 to 126	24	16



[1] DN is nominal diameter
[2] Standard Penetration Test Blows/ft. per ASTM D1586



[2] Gravel is defined in section 14, paragraph A3
[3] Sand is defined in section 14, paragraph A3
[4] RD is relative density per ASTM D4253
[5] SPD is standard proctor density per ASTM D698

PAR 1232 – Metro Water Recovery/HDR/ Garney

Project Scope

- 35,000 feet of 36”
- 32,000 feet of 48”
- 14,000 feet of 54”
- 9,000 feet of 60”
- Hobas Largest Open Cut Project !

PAR 1232 – Second Creek – A LOT of PIPE!

Hobas Field Service Support – Preconstruction Training

- Joint Assembly & Testing
- Backfill and Bedding
- Pipe Deflection Measurement
- Field Cutting
- Fitting Assembly
- Cleaning & Water Jetting
- Pipe Repair Procedures
- Closure Coupling Assembly

Hobas Field Service Team

Pipe Stiffness Selection is a function of native soil characteristics, trench construction, cover depth, embedment conditions & haunching

NATIVE SOIL [2,5]	COVER DEPTH[1] (ft.)	EMBEDMENT CONDITION[3] 1	2	3	4
Rock Stiff to V. Hard Cohesive Compact to V. Dense Granular (Blows/ft.[4] > 8)	10 & <	SN[6] 36			SN[6]72
	10 to 15				
	15 to 20			SN[6] 46	
	20 to 25		SN[6] 46		
	25 to 30	SN[6] 46			
	30 to 40		SN[6] 72	ALTERNATE INSTALLATION[7]	
	40 to 50				
Medium Cohesive Loose Granular (Blows/ft.[4] 4 to 8)	10 & <	SN[6] 36			SN[6] 72
	10 to 15		SN[6] 46	SN[6] 46	
	15 to 20	SN[6] 46			
	20 to 25		SN[6] 72	ALTERNATE INSTALLATION[7]	
	25 to 30				
Soft Cohesive Very Loose Granular (Blows/ft.[4] 2 to 4)	10 & <	SN[6] 36 to 46		SN[6] 72	
	10 to 15	SN[6] 72			
	15 to 20			ALTERNATE INSTALLATION[7]	
	over 20				

[1] Assuming minimum trench width per Figure 11 page 39.
[2] Blow counts should be representative of weakest condition
[3] Defined in Figure 13 page 40. If a cement stabilized sand pipe zone surround is utilized, use column 1 in the highest soils category.
[4] Standard penetration test per ASTM D1586
[5] For v. soft or v.v. loose soils with blow counts less than 2 use alternate installation per section 14, ¶A8.
[6] SN is nominal stiffness in psi.
[7] Alternate installation per section 14, ¶A8.

FIGURE 1 - Pipe Stiffness Selection for Standard Installations[1]

High Street Outfall & 40th Ave - City and County of Denver / UPRR

Micro tunneled Twin 96” Hobas Jacking Pipes

FRPMP Carrier Pipes Inside Steel Casing

Sliplining Rehabilitation

- Improved flow capacity (increased hydraulics Manning's .009)
- Live Flow – No Bypass required $$$
- Long pushes (fewer pits) $
- Hobas *“Stand Alone”* High Strength Pipe
- Easy to grout with higher safety factors
- Elastomeric gasket push together joints
- Smaller pits
- Faster assembly
- Hobas Offers “Odd” Sizes for Slipline 28”,33”,41”, 45”,51”,57”,63”,69”

FRPMP Slipline Rehabilitation – Live Flow, Long Pushes, High Strength Hobas

Oshkosh Wisconsin - 1998

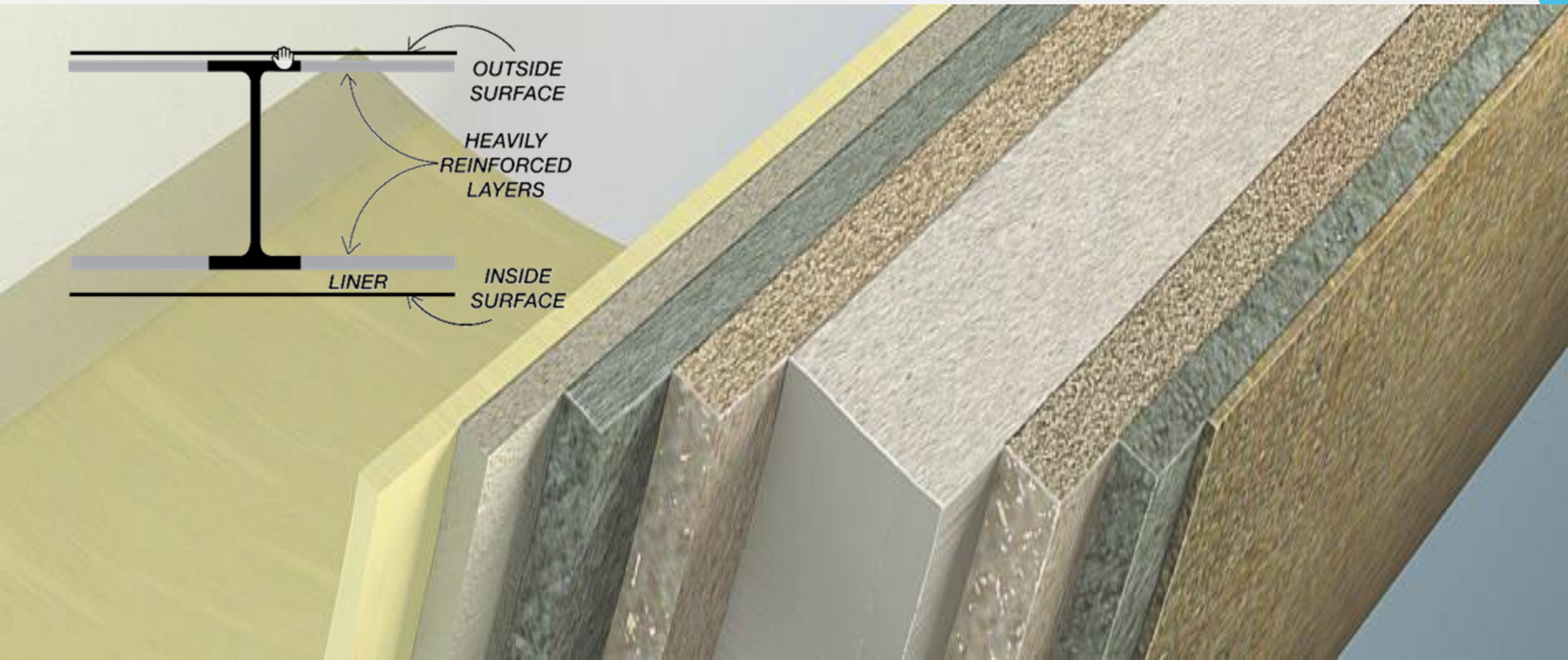
- First Slipline project
- Contractor was a CIPP licensee
- Chose Slipline over CIPP
- No By-Pass Pumping Costs
- Pushed 3,000 Feet from one pit!

Typical Live Flow Sliplining (96” EBMUD)

FRPMP Raw Material Composition

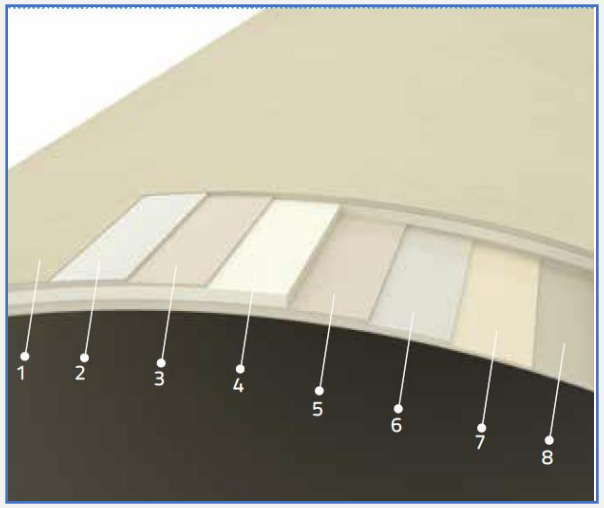
- High quality, commercial grade fibers
  - Glass Fibers for CC
    - 1“ & 2“ chopped
  - Glass Fibers for FW
    - Continous + chopped + veil (non-structural)
- Thermosetting resin
  - Polyester
  - Vinylester
- Precisely graded sand
- Other Additives

Wall Construction (I-beam principle)



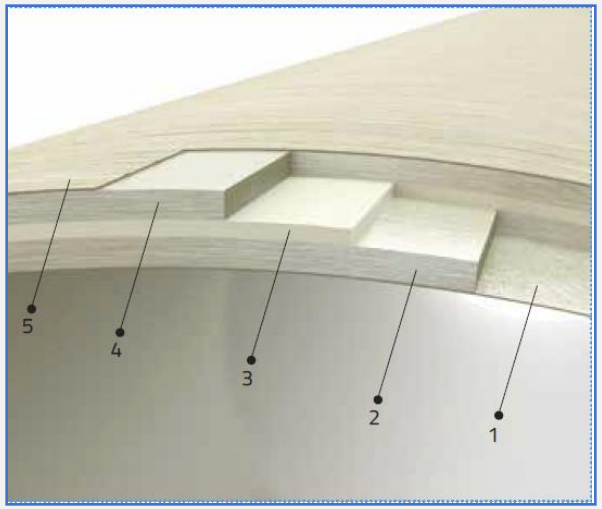
Manufacturing – Pipe Wall Construction

Centrifugal Cast (CC)



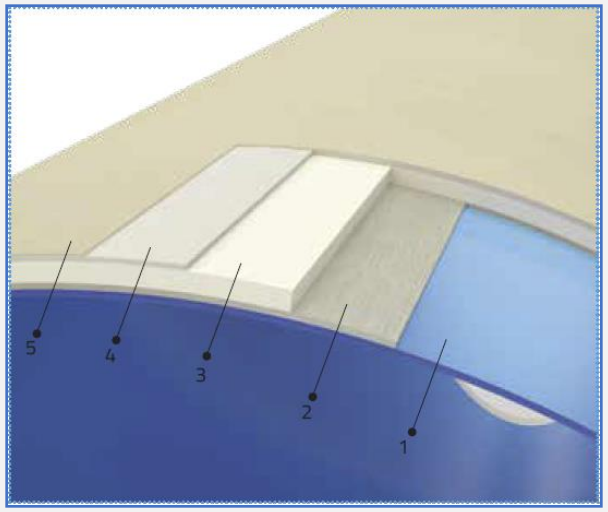
1 External protective layer
2 Outer structural layer
3 Transition layer
4 Core layer
5 Transition layer
6 Inner structural layer
7 Barrier layer
8 Inner liner layer

Filament Wound (FW)



1 Inner liner layer
2 Inner structural layer
3 Core layer
4 Outer structural layer
5 Exterior Surface

Non-Circular (NC)



1 Inner liner layer
2 Inner structural layer
3 Core layer
4 Outer structural layer
5 Exterior surface

Fiberglass Pipe Manufacturing

(Centrifugally Cast Method –ASTM D3262 Type 1, Liner 2, Grade 3

Centrifugal Casting Method

Centrifugal Casting – Houston Texas

FW Manufacturing Process – Pressure Pipe

Features:

- Continuous Winding Process Does Not STOP
- Pipes can be cut to any length
- Up to 40-ft Lengths
- High Pressure up to 450 PSI
- Ability to supply large water projects

FW - Filament Wound FRPMP

In Line Hydro Pressure Tester

Hobas Pipes
Engineered and Designed to Meet the Project Requirements

- Project by project manufacturing and engineering
- Engineered with Options: **Stiffness, Pressure, Pipe Length, and Couplings**
- Hobas Pipe USA is the ONLY American Based Manufacturer of FRPMP offering both Centrifugally Cast and Filament Wound Fiberglass Pipes.

Testing Standards & QC

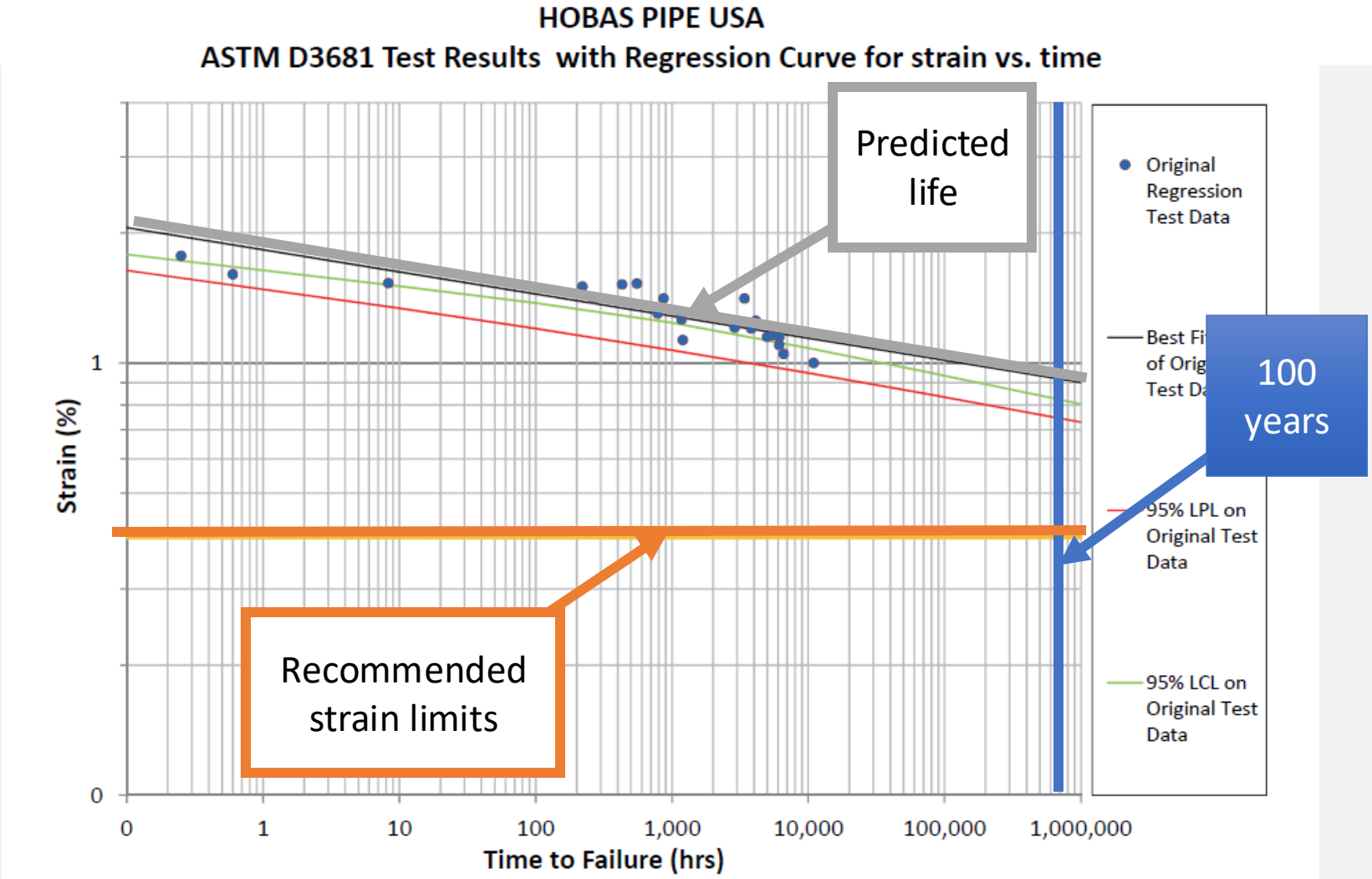
- **ASTM D3681 Long-term Strain Corrosion Test**
  - The only pipe with an actual test standard
  - Can demonstrate 100+ year service life
- **ASTM D2992 Long-term Pressure Regression**

  HDB Basis Determination
- **ASTM D2412 Pipe Stiffness Test**
  - Flexible Pipe Design
  - Resilient

Long-term Performance

- Extended pressure and ring bending tests continue for a minumum of 10,000 hours
- Safe operating limits are established by following appropriate standards

Strain-Corrosion Testing



Strain Corrosion Test Results (H_2SO_4 per ASTM D3262-96)

log (time) = -24.81 log (% strain) + 6.45

Deflection	Life, years
2%	72 Quintillion
3%	3.1 Quadrillion
4%	2.4 Trillion
5%	9.6 Billion
6%	100 Million
7%	2.3 Million
8%	82 Thousand
9%	4.4 Thousand
10%	320

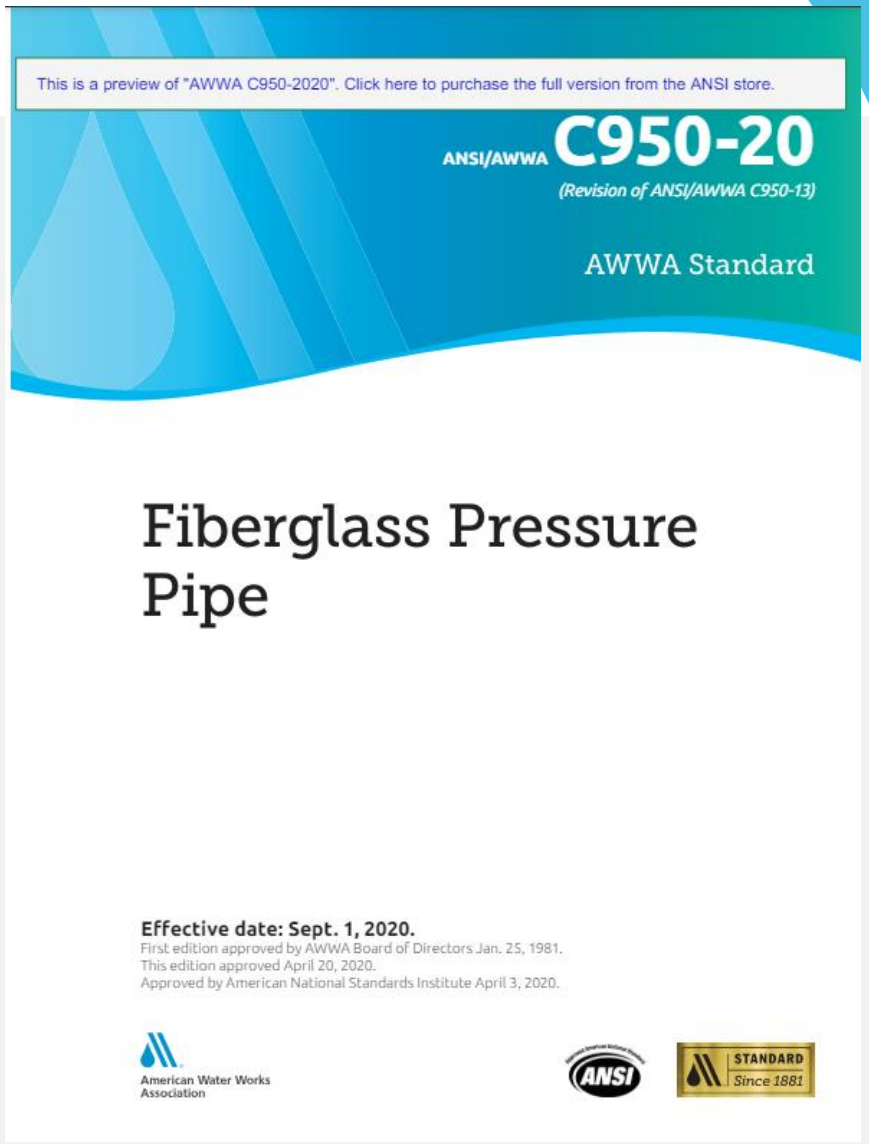
Related Standards

- ASTM D3262 Fiberglass Gravity Sewer Pipe
- ASTM D3754 Sewer Force Mains & Industrial
- AWWA C950 Potable Water Pressure Mains
- ASTM D3517 Raw Water Pressure
- AWWA M45 Fiberglass Pipe Design Manual
- NSF 61 Drinking Water System Components
- ASTM D4161 Fiberglass Pipe Joint Using Flexible Elastomeric Seals

AWWA C950 Standard

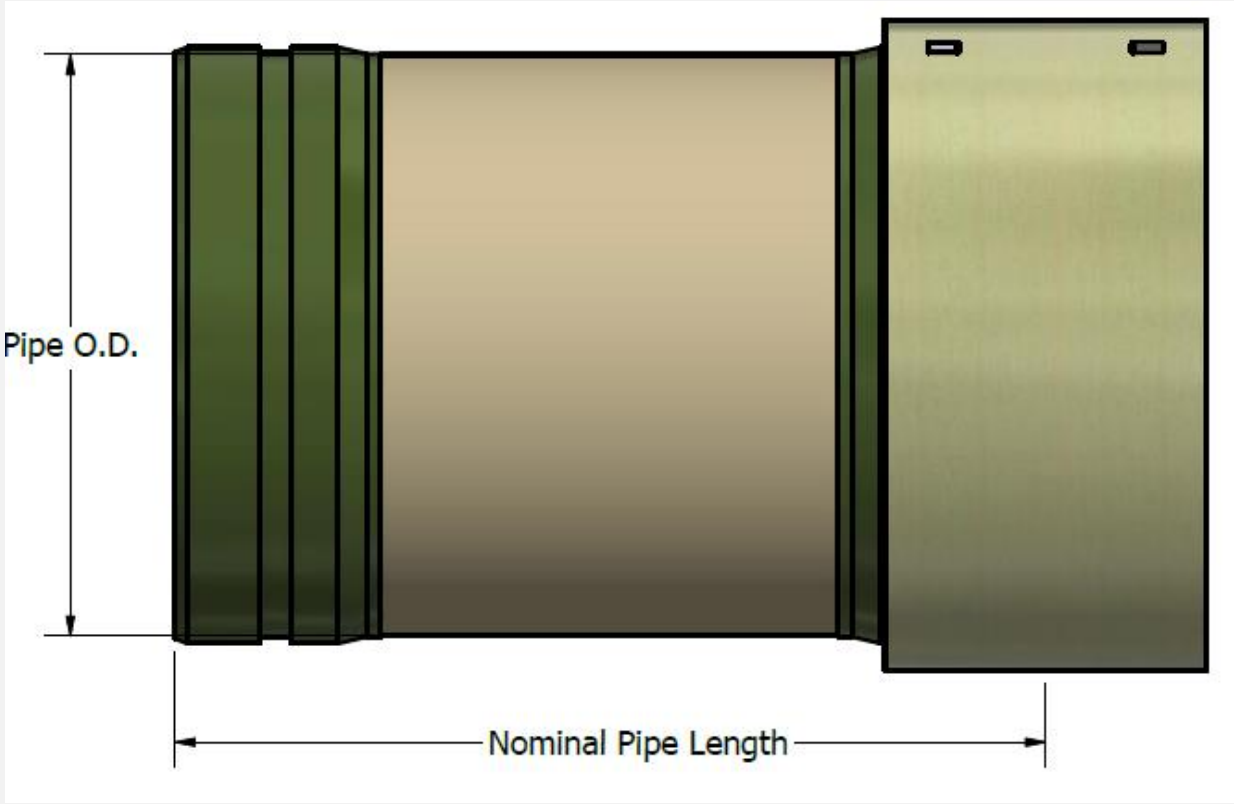
- Defines Pipe Production
- Pressure Classification
- Specifies long-term and short-term test requirements

NOMINAL DIAMETER, DN (inches)	PRESSURE CLASS, PN (PSI)	MAXIMUM SURGE PRESSURE (PSI)	MAXIMUM TEST PRESSURE (PSI)
18-66	450	630	675
72	350	490	525
78-90	300	420	450
96-118	250	350	375
120-126	150	210	225

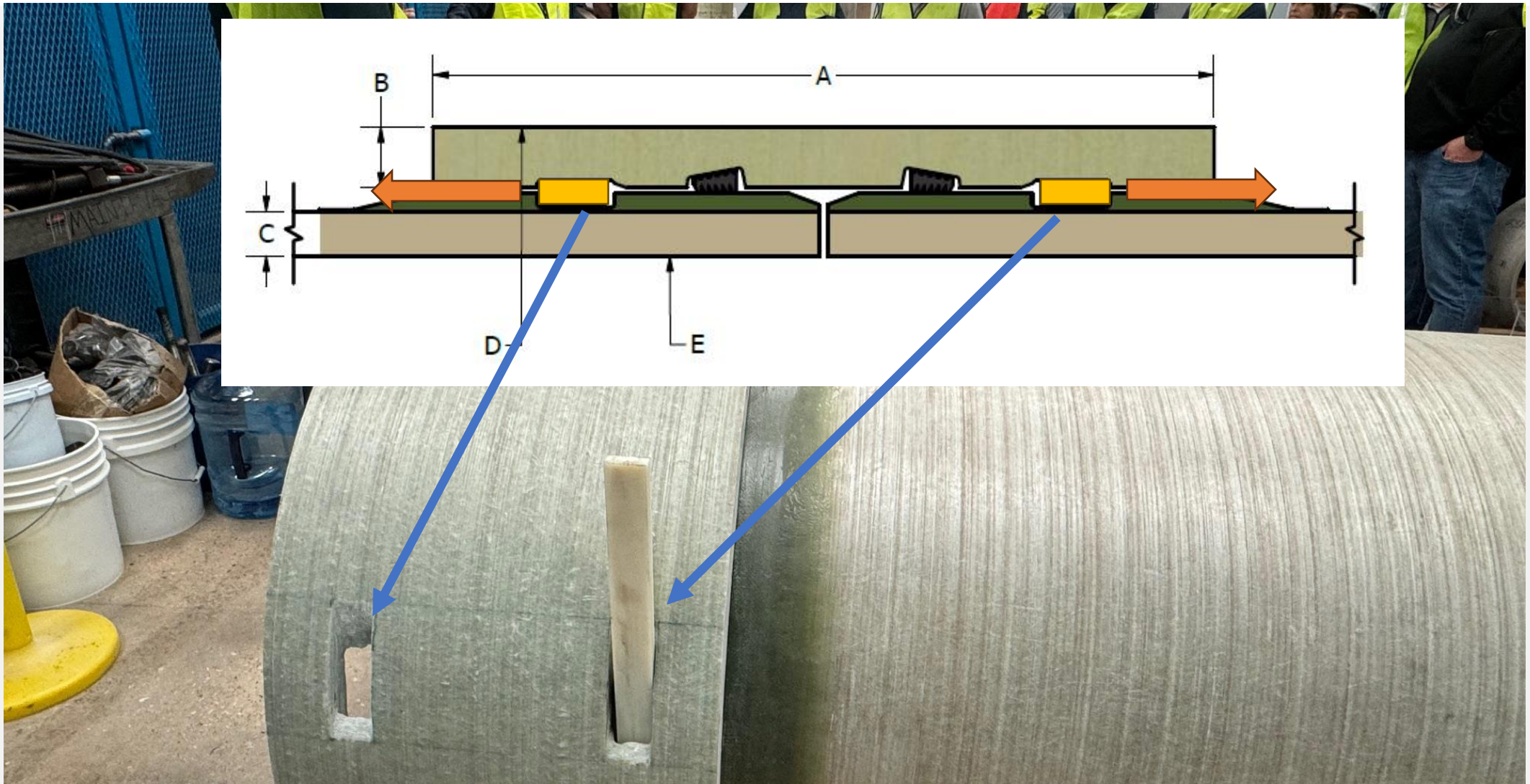


FRP Restrained Key-Lock Joint

Restrained Keylock Coupling range				24 Jan 24
DN/PN	100	150	200	250
12				
14				
16				
18				
20				
24				
30				
36				
42				
48				
54				

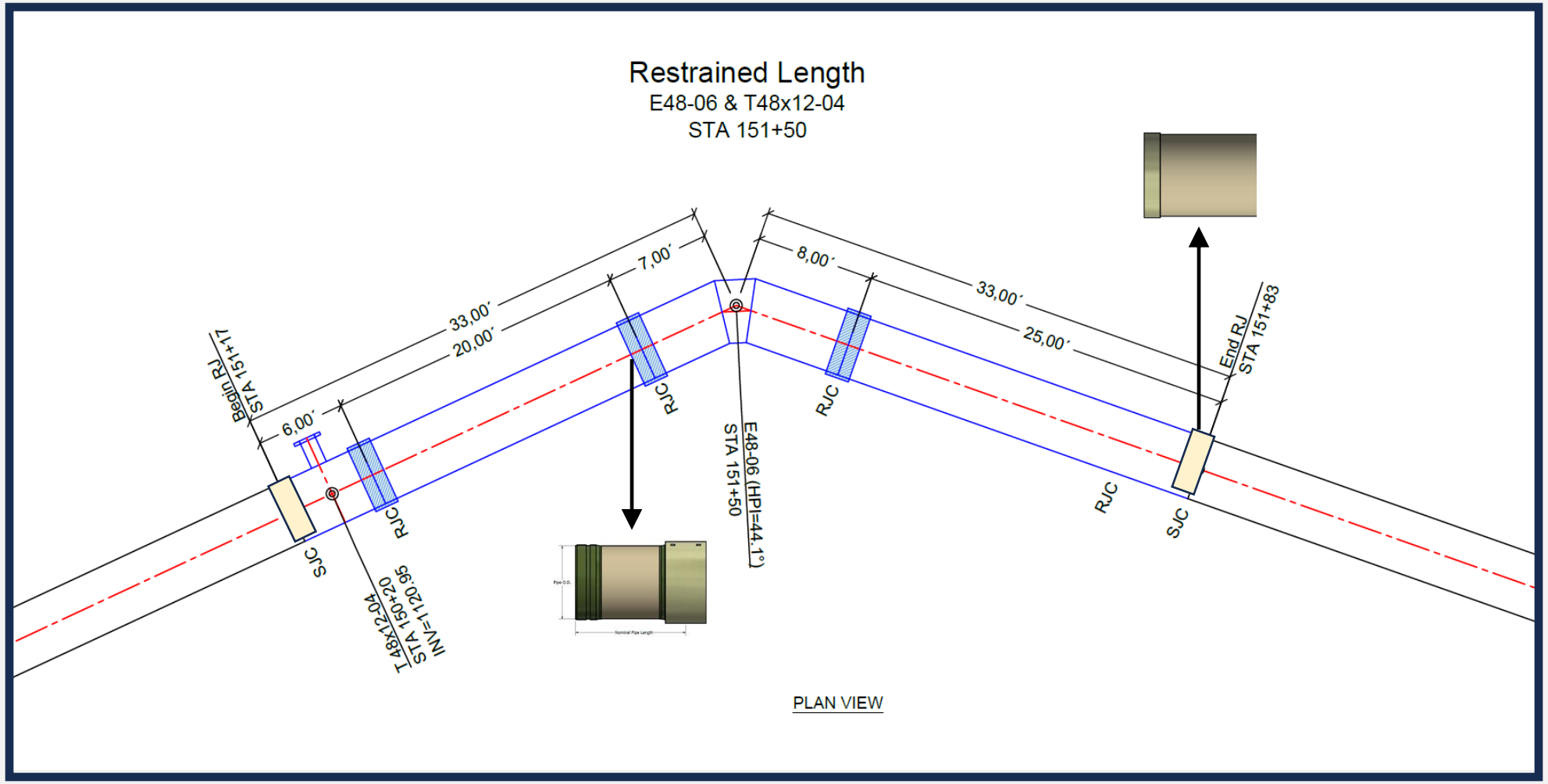


FRP Restrained Key-Lock Joint

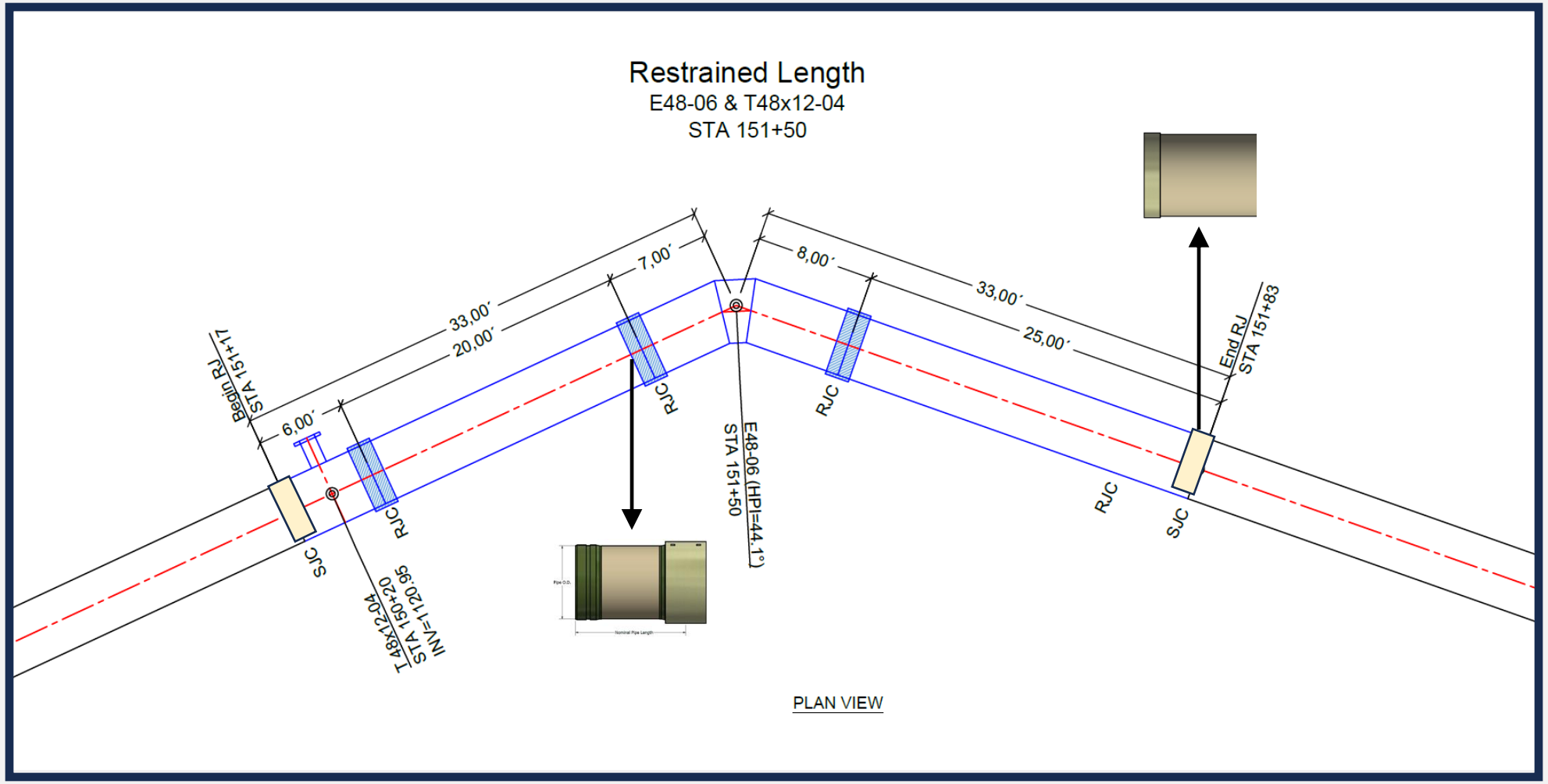


FRP Restrained Key-Lock Joint

Restrained Length (Key-Lock Joint)



Restrained Length (Key-Lock Joint)



Restrained Length (Axial Concrete)

- **Pine Street Waterline Replacement**
- Beaumont, TX
- 14000 LF – 48” PN150
- Value Engineered option to PCCP
- Saved city $8M

$$L_{bend} = \frac{P * A * sin\frac{\Delta}{2}}{\mu * (W_E + W_p + W_{ae} + W_f) + \frac{1}{2} * R_s * cos\frac{\Delta}{2}}$$

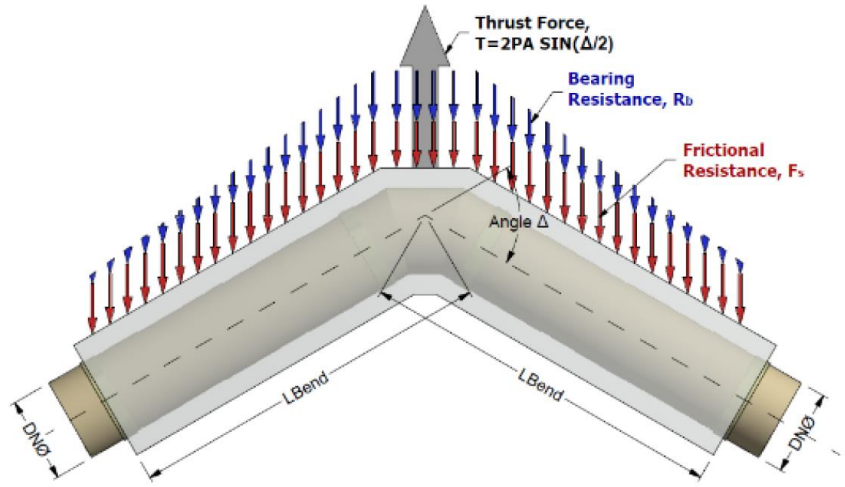
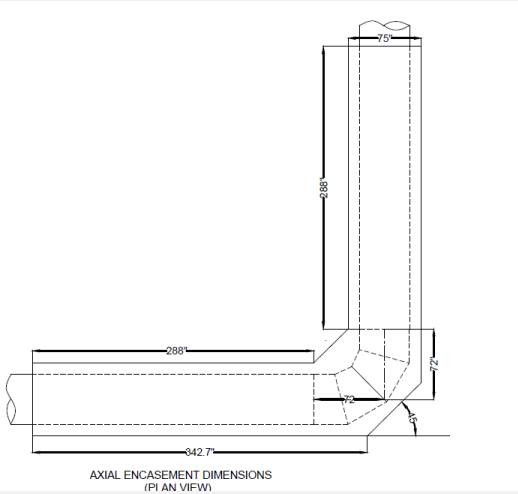
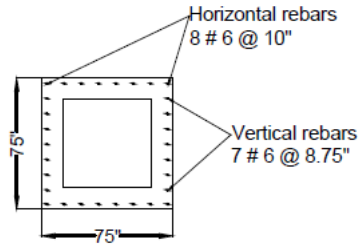


Figure 1. Encasement Geometry



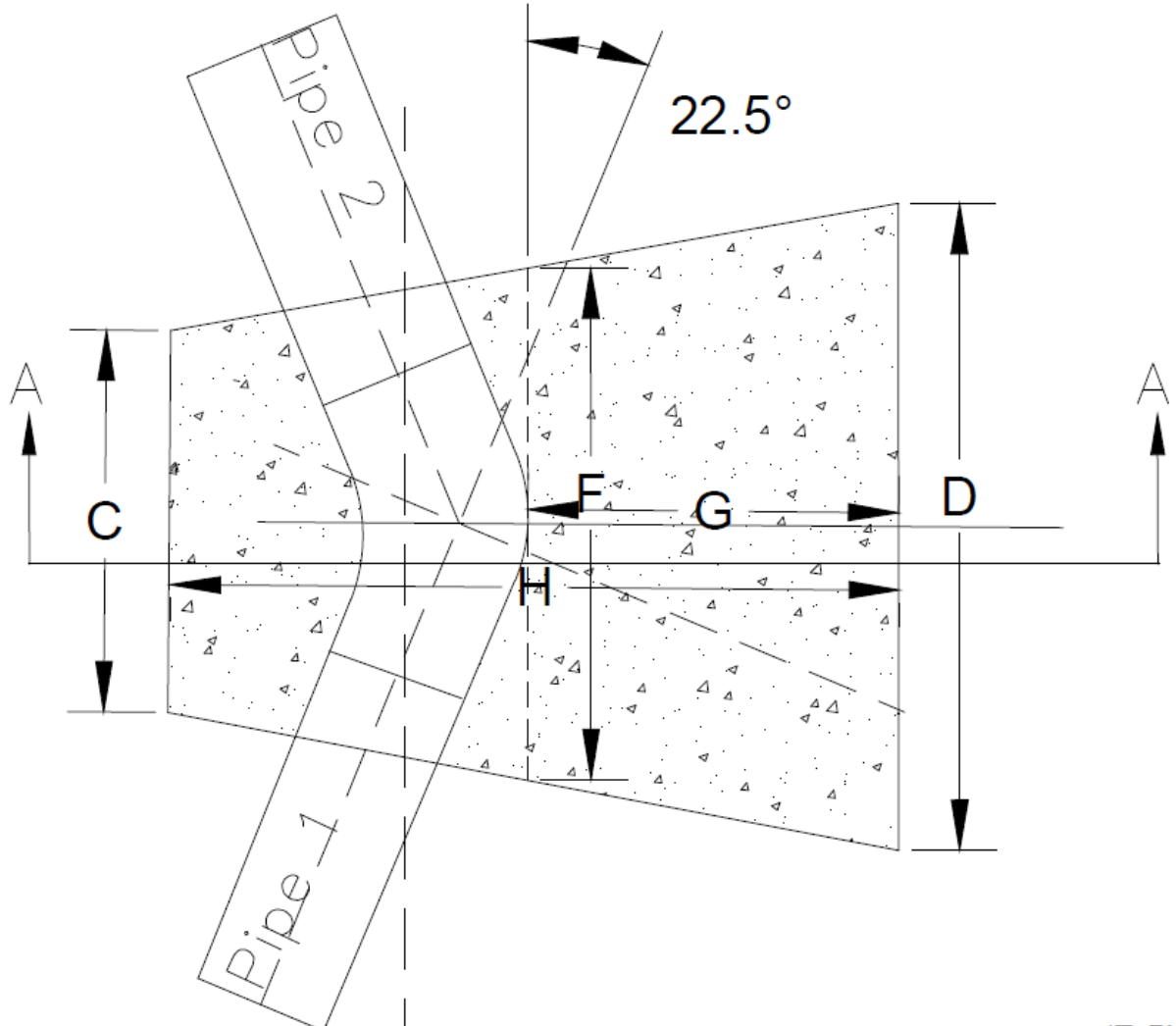
AXIAL ENCASEMENT DIMENSIONS
(PLAN VIEW)



CORSS SECTION OF
AXIAL ENCASEMENT

Restrained Length (Thrust Block)

- **WRA Grimes Connector - Contract 3**
- Grimes, Iowa
- 5000 LF – 36” PN150
- Value Engineered option to DI
- First HOBAS FW Pressure Project



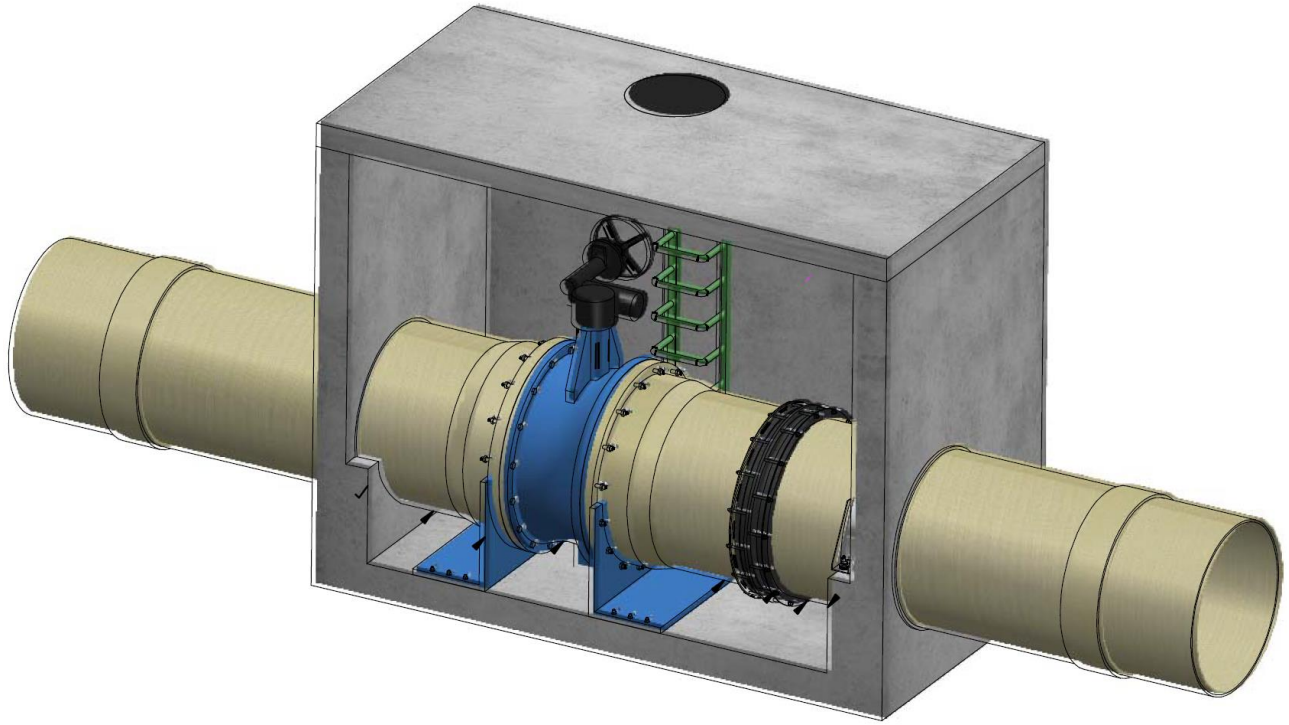
Pressure Pipe Parts & Fittings

Fibeglass Flanges:.

- Used to connect to Valves & Steel Blind Flanges at Air Release Valve‘s
- Pressurized blind flanges **require restraint such as J-bolts into concrete encasement.**
- AWWA C207 / ANSI B16.1 bolt pattern.

Pressure Pipe Parts & Fittings

- **In Line Valve Connections**
  - Flange connections are needed on either end
  - FRP Flanges (AWWA C207 / ANSI B16.1)
  - Valve needs to be restrained (anchored) such that thrust is taken by the concrete structure
  - Valve and pipe supported to prevent shear load at the joints.
  - Pipe cradles supports (150 deg)

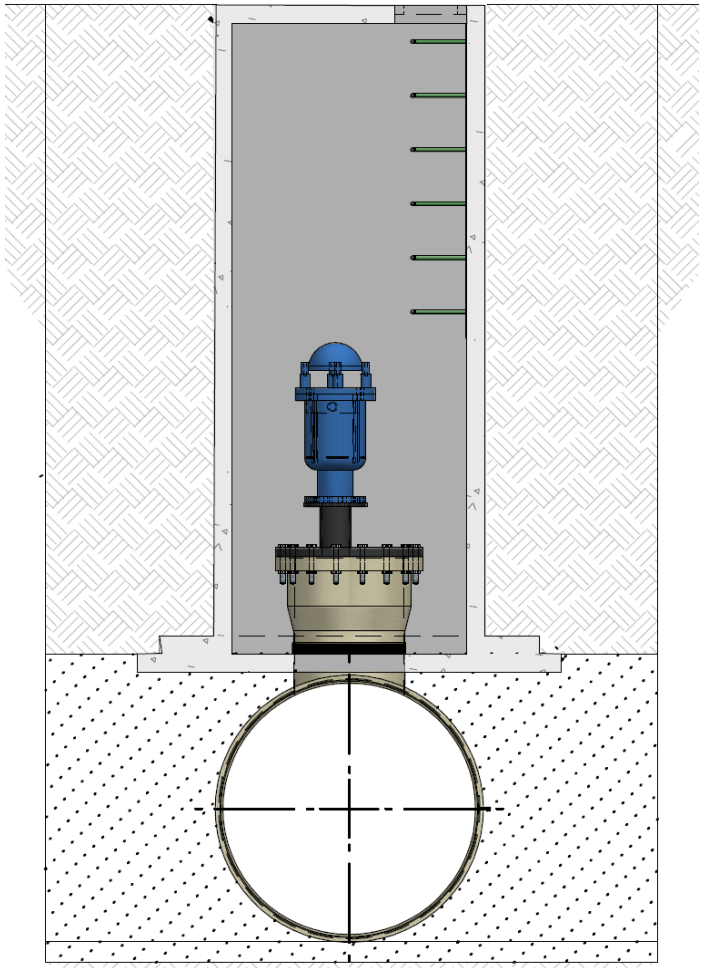


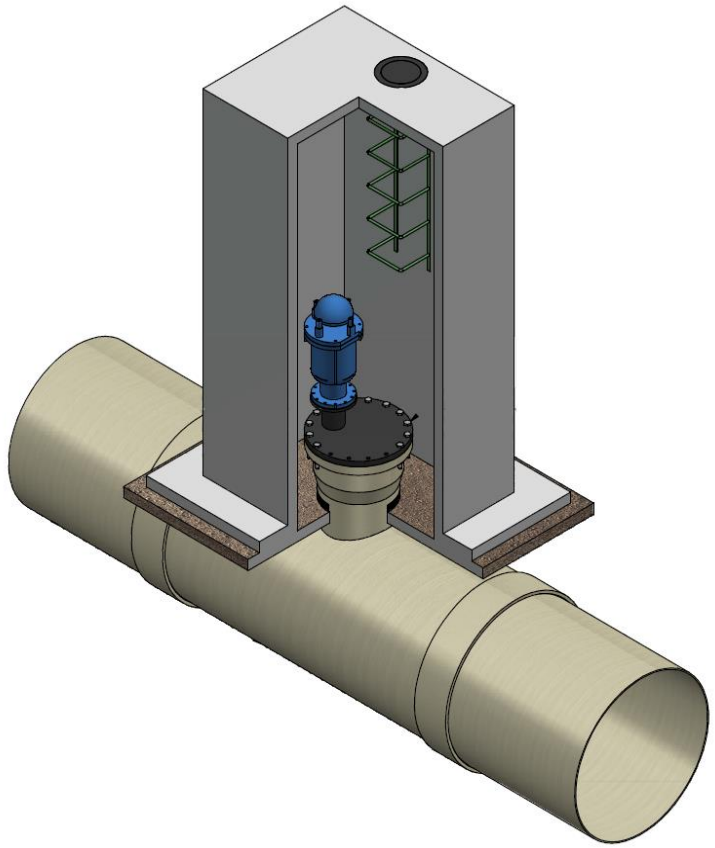
Pressure Pipe Parts & Fittings

- **Air Release Valve Structures**

  A tee w/ flanged branch as shown can be used.

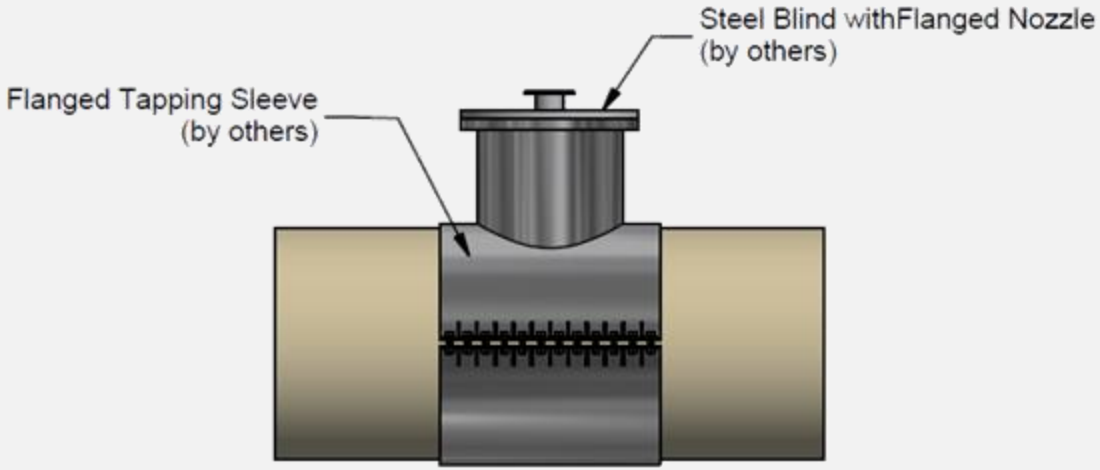
  - Transitions to other materials at the flange.
  - Steel blind flange and ARV by others.

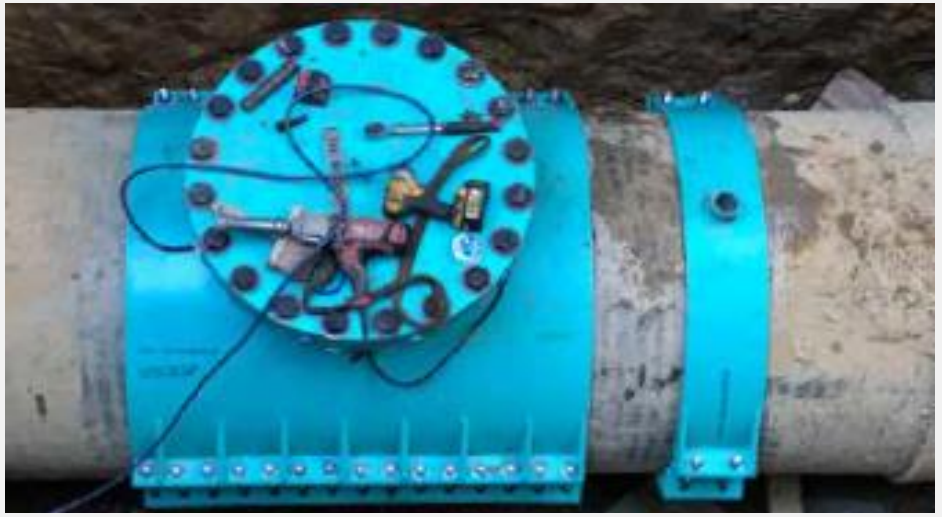




Engineering
Pressure Pipe Parts & Fittings – Tapping Sleeves

- **Tapping Sleeves**
  - Tapping Sleeve needs Full circumferential, full gasketed high strength steel sleeve that conforms to the OD of the pipe.
  - Holes can be cut with diamond coated core drill with small closely spaced teeth.
  - Manufacturer of tapping sleeves:
    - JCM Industries
    - Romac Industries
    - Smith-Blair





Testing Standards (Quality Control)

ISO 9001

ISO 14001

Full checks in all raw materials

ZERTIFIKAT ◆ CERTIFICATE ◆ 認證證書 ◆ СЕРТИФИКАТ ◆ CERTIFICADO ◆ CERTIFICAT

TÜV SÜD Management Service

CERTIFICATE

The Certification Body
of TÜV SÜD Management Service GmbH
certifies that

HOBAS®

HOBAS PIPE USA
1413 East Richey Road
Houston, TX 77073-3058
USA

has established and applies
a Quality Management System for

Development, production, sales and customer service of Centrifugally Cast Fiber-Reinforced Polymer Mortar (CCFRPM) Pipe-Systems.

An audit was performed, Order No. **707104701**.
Proof has been furnished that the requirements
according to

ISO 9001:2015

are fulfilled.
The certificate is valid from **2019-10-27** until **2022-10-26**.
Certificate Registration No.: **12 100 58444 TMS**.

Product Compliance Management
Munich, 2019-08-14

TÜV SÜD Management Service GmbH • Zertifizierungsstelle • Ridlerstrasse 57 • 80339 München • Germany
www.tuev-sued.de/certificate-validity-check

BESCHEINIGUNG ◆ ATTESTATION ◆ 证明书 ◆ СВИДЕТЕЛЬСТВО ◆ CONSTANCIA ◆ ATTESTAZIONE

TÜV SÜD Industrie Service

Attestation

Attestation No. IS-AN5-MUC-2002-492186-001

The

TÜV SÜD Industrie Service GmbH
Westendstraße 199
80686 Munich / Germany

hereby declares that

HOBAS®

HOBAS PIPE USA
1413 E. Richey Road
Houston Texas 77073-3508
USA

HOBAS PIPE USA is a producer of Centrifugally Cast Fiber Reinforced Polymer Mortar (CC-FRPM or CC-GRP) Pipes for i.e. buried applications, jacking, tunnel lining, sliplining rehabilitation according to the following FRP Piping Standards:

ASTM D3262, ASTM D3517, ASTM D3754 and AWWA C-950

The design of Pipes, Joints and Fittings follows the guidelines of:

AWWA M45

Validity: This attestation was checked during the ISO 9001 and ISO 14001 Audit in May 2019 and is valid until December 2022. The next Audit is planned in May 2020.

The production and product monitoring are carried out every year.

Date of issue: February 10, 2020

TÜV SÜD Industrie Service GmbH
Institute for Plastics

i. A. Schweizer

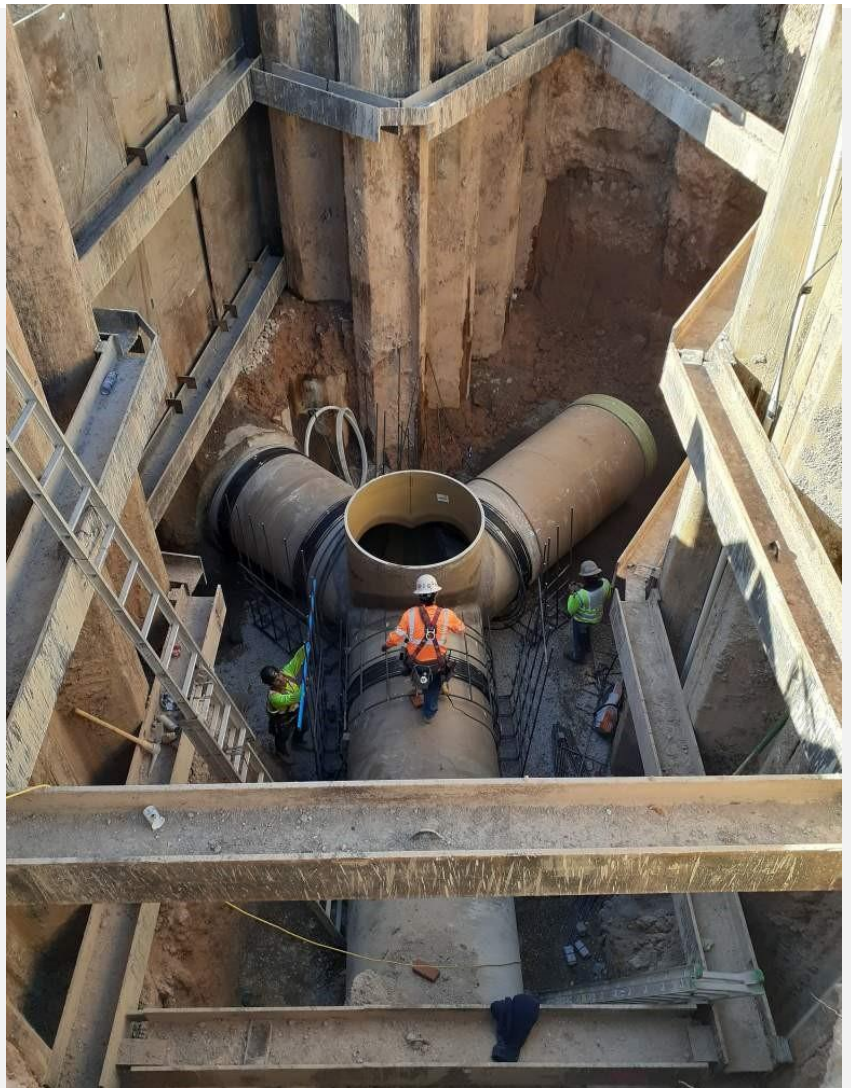
Hobas-USA-Bescheinigung-englisch-ASTM und AWWA-ju-2020-02-10.docx

Fittings

Elbows, Tees, Wyes, Reducers

FITTINGS

Fittings – Elbows and Junction Wye



Fitting Production - FRP “Layup”

FRPMP Fittings

Drop Manhole Connection to PVC

Fittings Non-Standard
If you can draw it…..we can make it!

Wall Connections

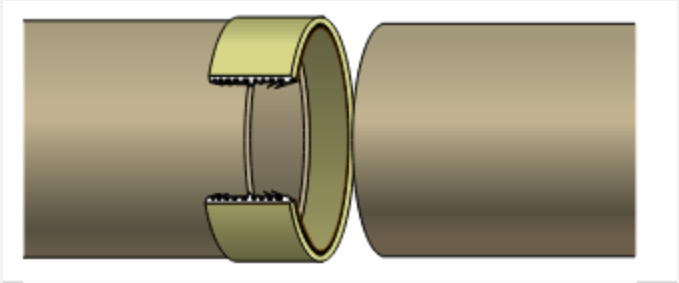
Wall Connection

City of Phoenix

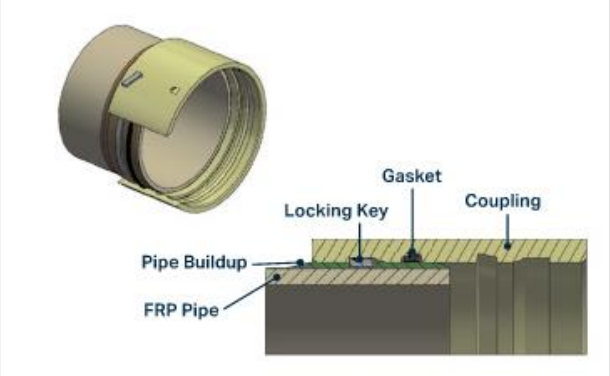
91st Ave WWTP

Wall Connections

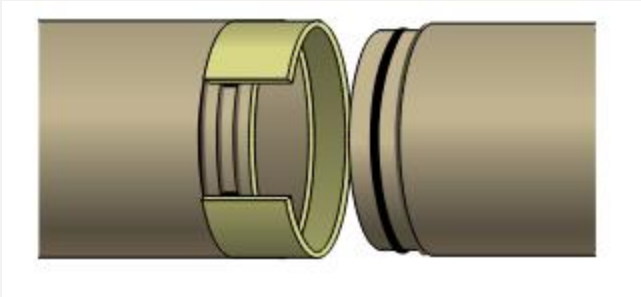
Joints / Couplings



FWC Coupling



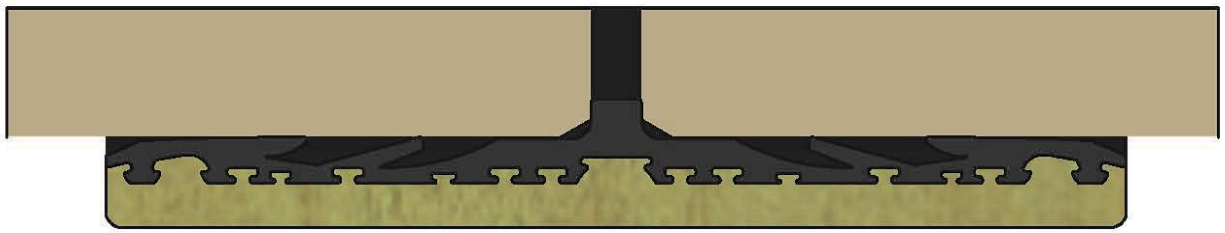
Restrained Joint



Flush Bell-Spigot

FWC Coupling (Unrestrained)

- Full-face Elastomeric Interior (EPDM)
- Direct bury, above ground and pressure
- Simple Push together assembly (no welding)
- Cut and join pipes anywhere (no special fab)
- High Performance
    - Zero leakage
    - >1,000 psi (straight alignment)
    - 500 psi (shear load / angle)
    - **250 psi (ASTM D4161 rating)**
- Compatible with DIP up to 48“ Dia.



FWC Assembly Animation Video

FWC Coupling – Direct Bury Install

FWC Coupling up to 40’ Pipe

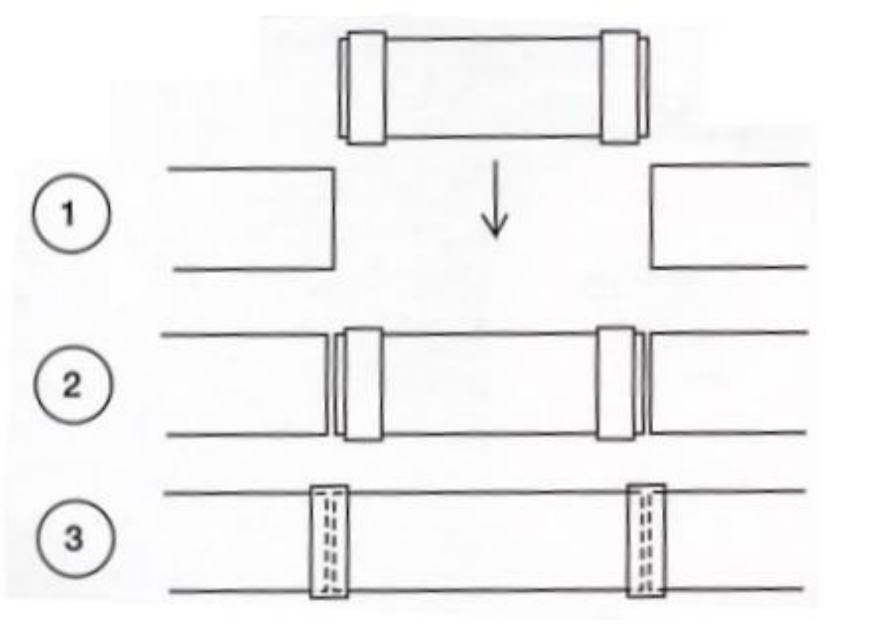
20’ Lengths

40’ Lengths

Field Cutting

Flush Slipline Bell & Spigot Joint

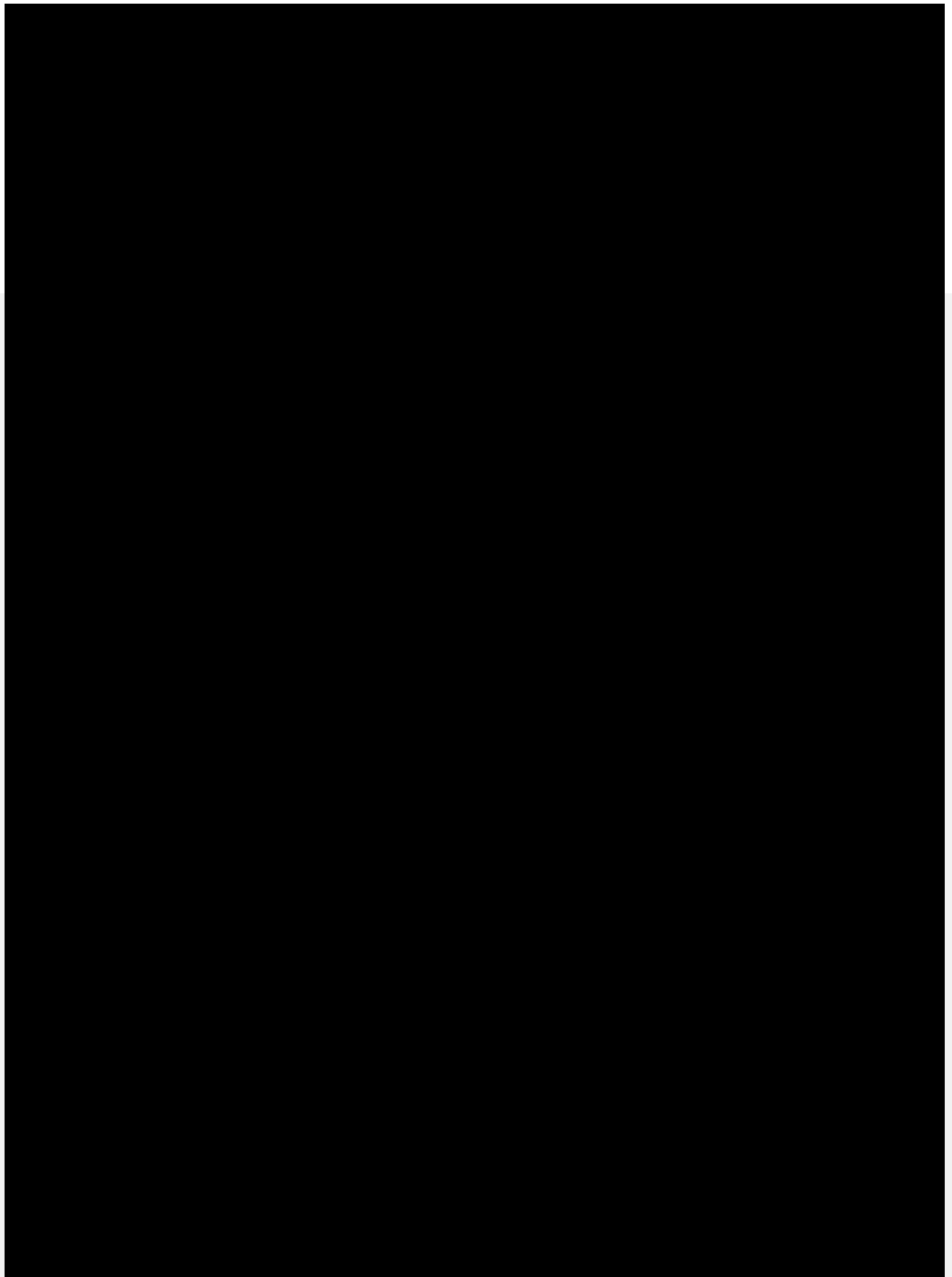
Closure Coupling/ Repair Couplings



Stainless Closure Couplings for Direct Bury, Slipline or Repair

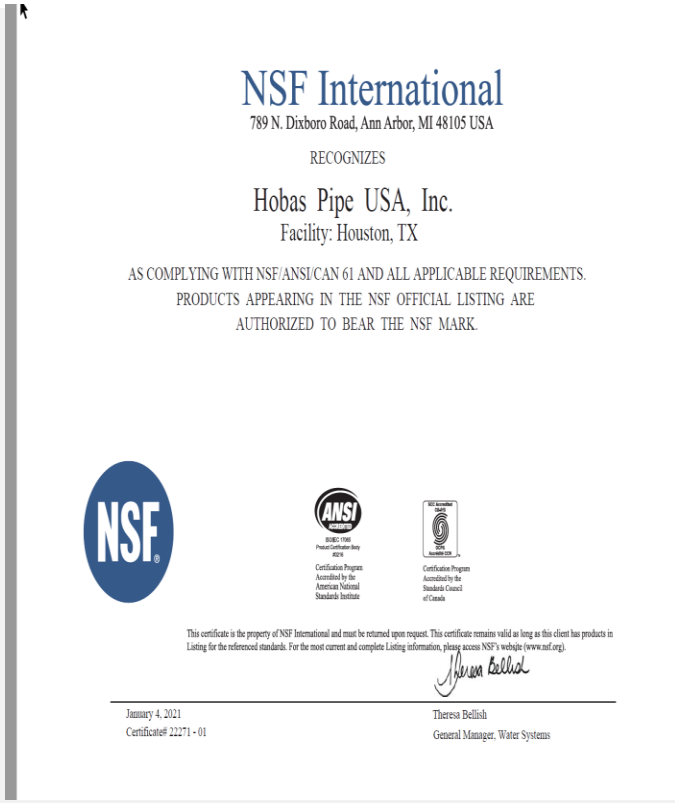
Field Lamination at Joint location

Video



Hobas Pipe USA – Providing Water Solutions with FRPMP

- ✓ Manufacturing Capability (2 Winders)
- ✓NSF Approval
- ✓In Line Factory Pressure Tester (AWWA)
- ✓Fiberglass Flanges
- ✓Key Lock Restrained Joint
- ✓Engineering Support Services



NSF International

789 N. Dixboro Road, Ann Arbor, MI 48105 USA

RECOGNIZES

Hobas Pipe USA, Inc.

Facility: Houston, TX

AS COMPLYING WITH NSF/ANSI/CAN 61 AND ALL APPLICABLE REQUIREMENTS. PRODUCTS APPEARING IN THE NSF OFFICIAL LISTING ARE AUTHORIZED TO BEAR THE NSF MARK.

NSF

ANSI

Certification Program Accredited by the American National Standards Institute

Certification Program Accredited by the Standards Council of Canada

This certificate is the property of NSF International and must be returned upon request. This certificate remains valid as long as this client has products in Listing for the referenced standards. For the most current and complete Listing information, please access NSF's website (www.nsf.org).

January 4, 2021

Certificate# 22271 - 01

Theresa Bellish

General Manager, Water Systems

Hobas Pipe Committed to the Pressure Water Market

SUMMARY

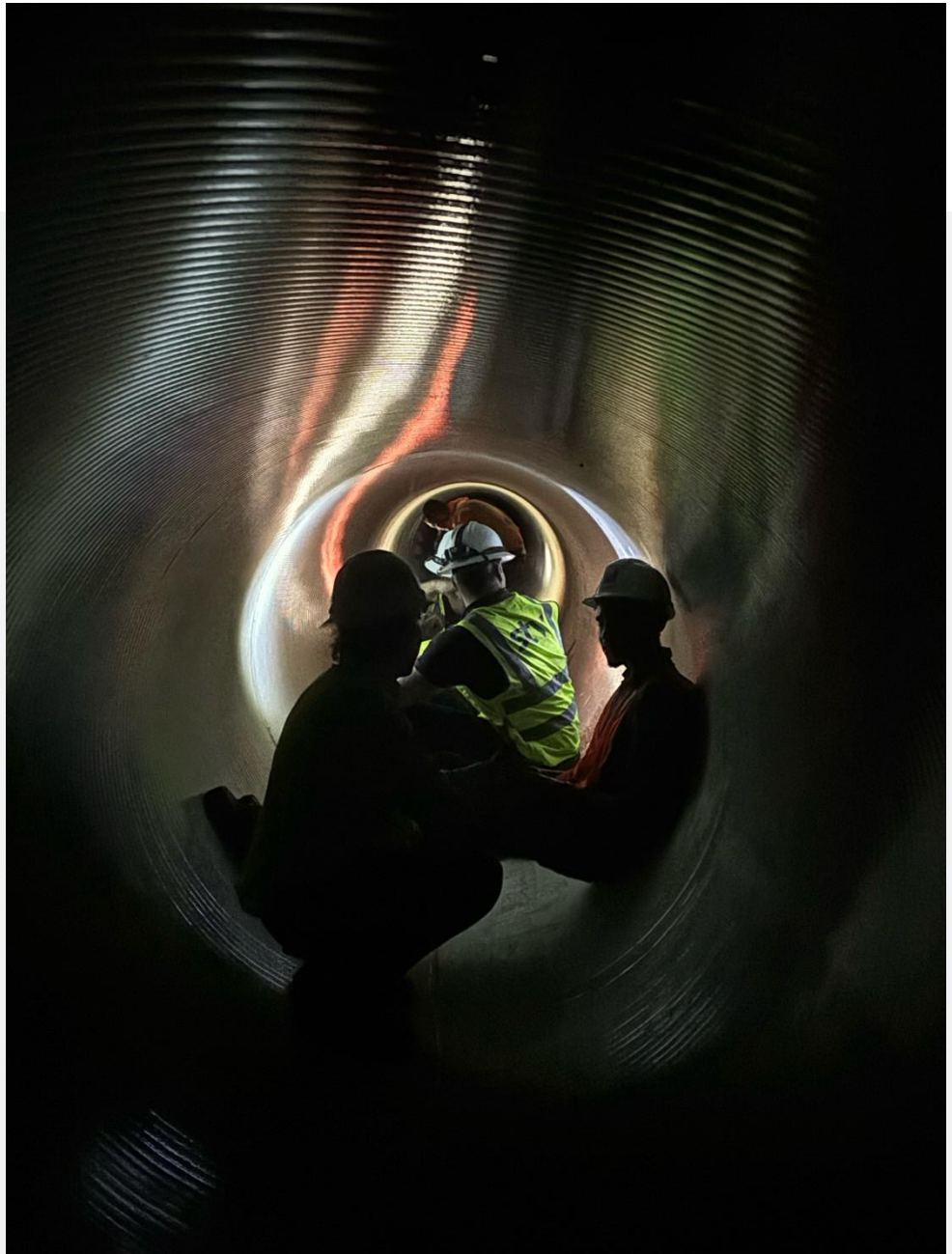
IF YOU NEED:

- ✓Corrosion Resistance
- ✓Long-Life
- ✓Leak-Free Joints
- ✓Structural Reliability
- ✓High Flow Capacity
- ✓Easy Installation
- ✓Lower Life Cycle Cost
- ✓ Prepared to be your supplier of Pressure Water Pipe Systems

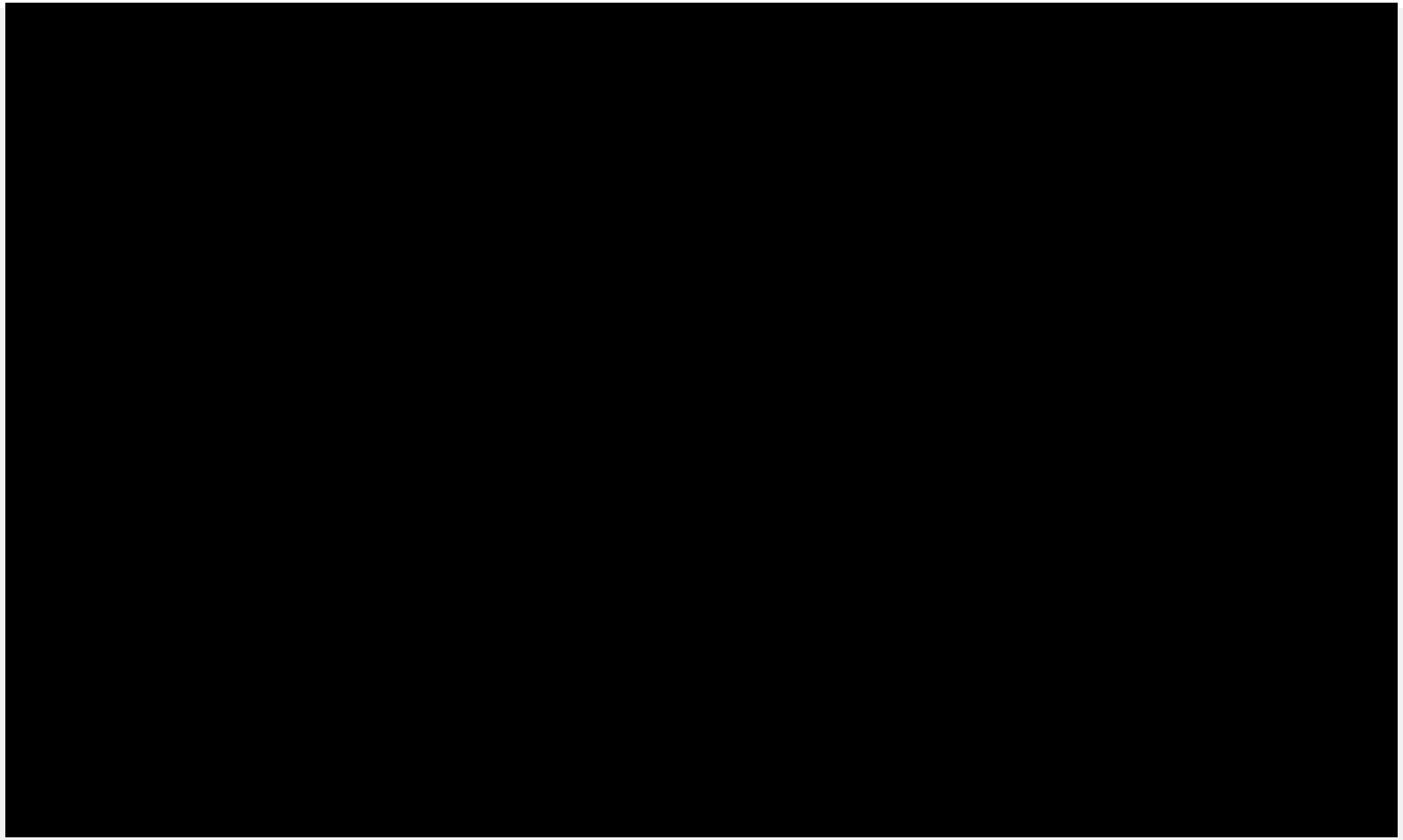
The End !

What Projects Do You Have?

How Can We Serve You?



Live Flow Slipline Video



Above Ground Penstocks or WWTP

Engineering
Restraining System - Thrust Blocks

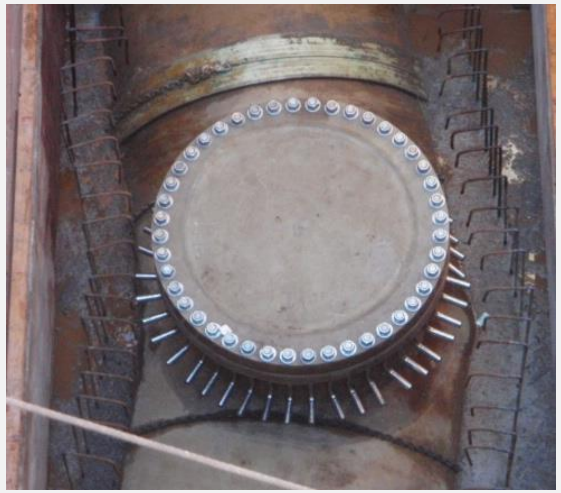
Thrust Blocks

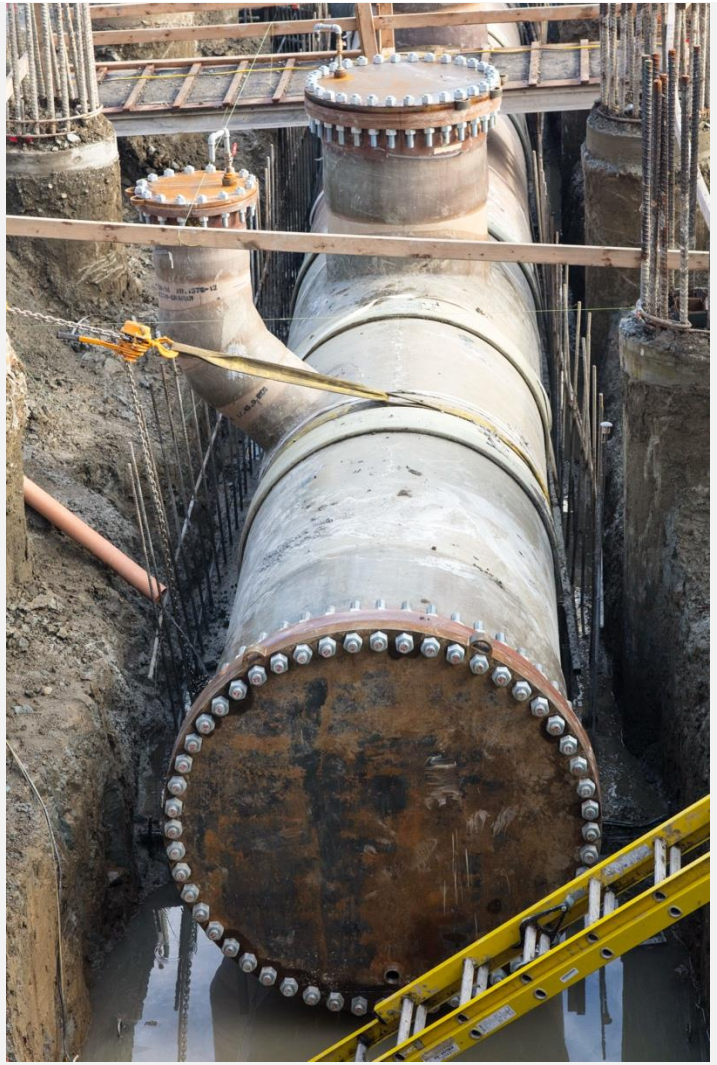
- Block mainly uses the **undisturbed** bearing capacity of the soil to keep the elbow in place and prevent joint separation of connecting pipes.
- For flexible pipes (not just Hobas), block is to fully encase the fitting.
- Block is poured against undisturbed soil in the backside.
- Block is designed for compression so there is typically a smaller amount of reinforcement that is needed.

Engineering:
Pressure Pipe Parts & Fittings – Flanges

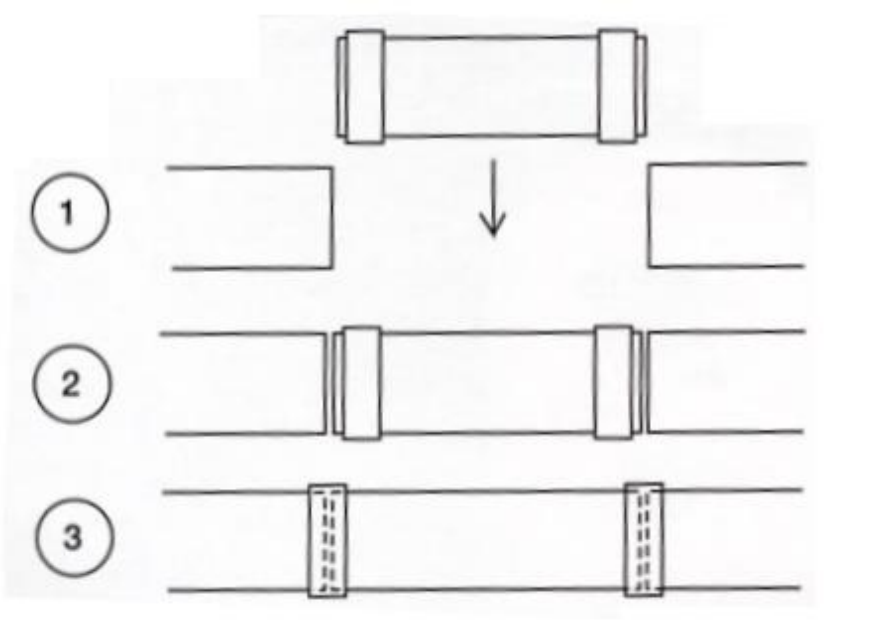
Flanges:

- Used to connect to valves.
- Connect to other pipe materials
- Generally better with shorter lengths inside structures because of the rigidity of the flange
- If blind flanges are connected then J-bolts are needed to concrete encasement.



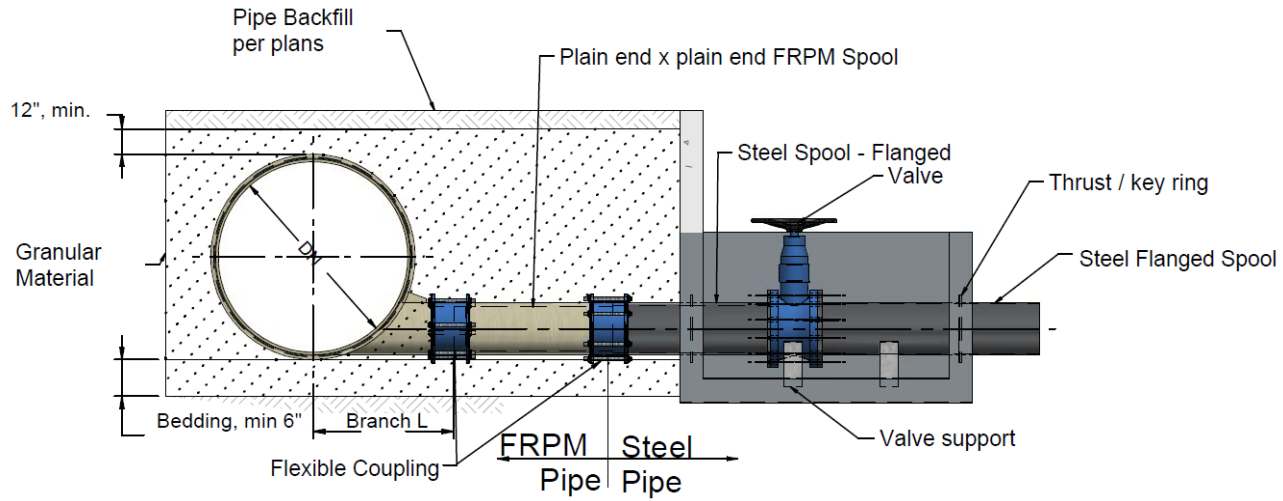


Closure Couplings



Pressure Pipe Parts & Fittings

- Drain – Tangential Tee
  - FRPM-Tee
  - Granular Backfill
  - Flexible coupling by others:
    - Viking Johnson
    - Smith-Blair

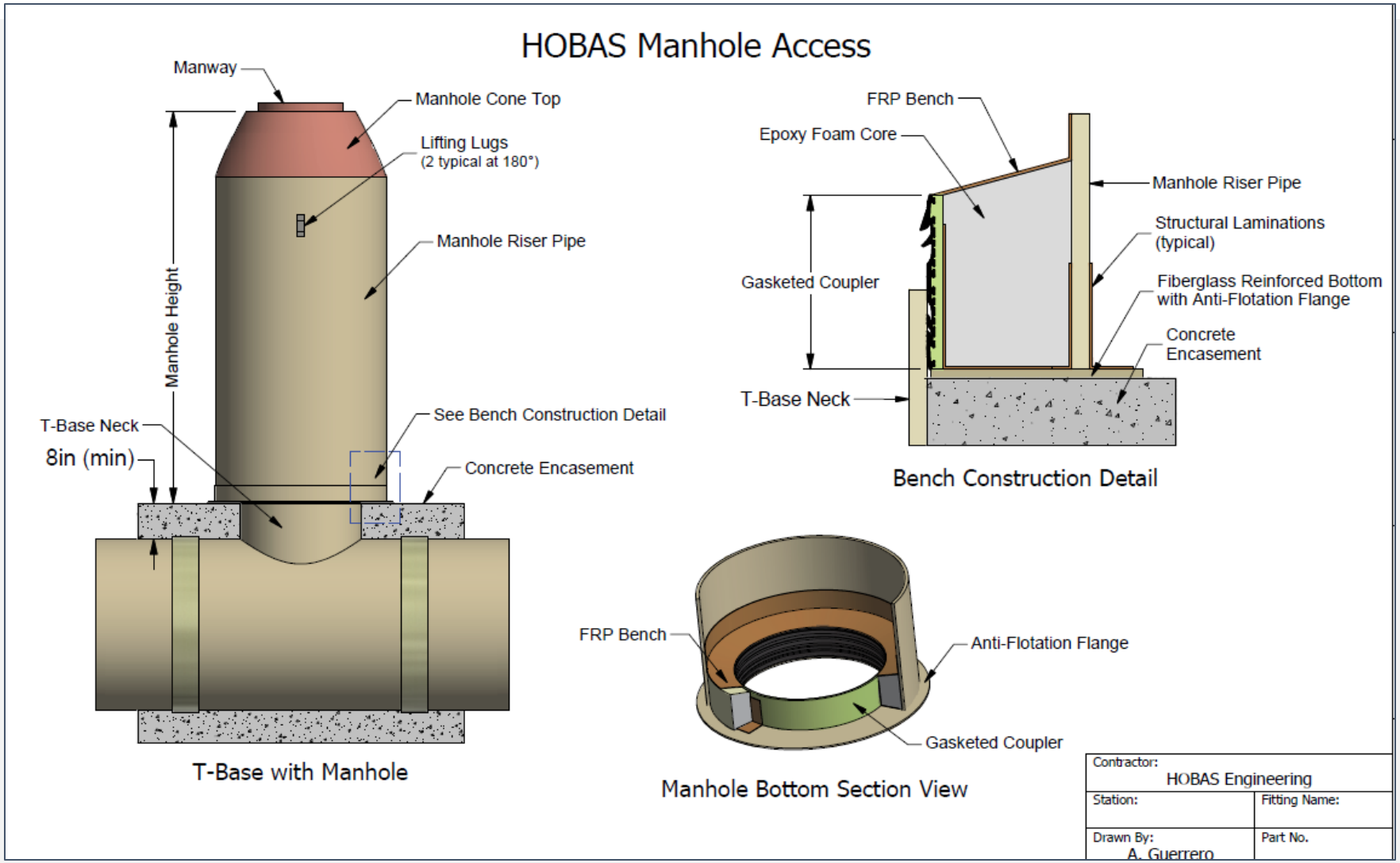


Fittings

Elbows, Tees, Wyes, Reducers

Fitting Production - FRP “Layup”

The Complete Hobas Manhole



Hobas Manhole Tee Base and Riser

Fittings Non-Standard
If you can draw it…..we can make it!

Hobas FRP Tee Base Manhole System

ASTM & AWWA Related Standards

• ASTM D3754	Sewer Force Mains & Industrial
• AWWA C950	Potable Water Pressure Mains
• ASTM D3517	Raw Water Pressure
• AWWA M45	Fiberglass Pipe Design Manual
• NSF 61	Drinking Water System Components
• ASTM D4161	Fiberglass Pipe Joint Using Flexible Elastomeric Seals
• ASTM D3262	Gravity Sanitary Sewers

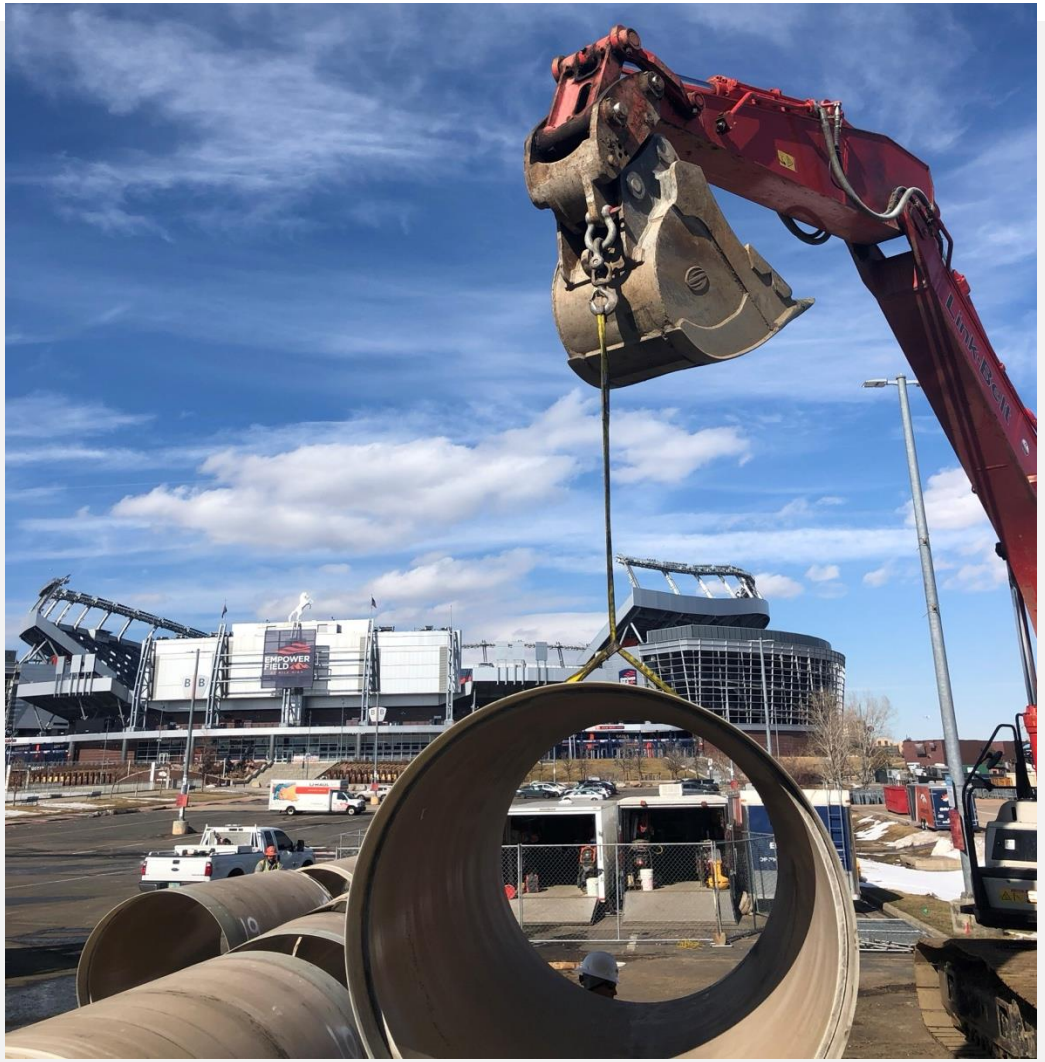
Long-term Performance Testing

- Extended pressure and ring bending tests continue for a minumum of 10,000 hours
- Safe operating limits are established by following appropriate standards

27,000’ of 36” Hobas Direct Bury - Zero Leaks !

SUMMARY

- ✓**Corrosion Resistance**
- ✓Long-Life
- ✓Leak-Free Joints
- ✓Structural Reliability
- ✓High Flow Capacity
- ✓Easy Installation
- ✓**Lower Life Cycle Cost**
- ✓Consistent High Quality
- ✓Superior Service



Standards Governing our Products & Industry

ASTM D3262	Gravity Sanitary Sewers
ASTM D3754	Sewer Force Mains & Industrial
AWWA C950	Water Pressure Mains
AWWA M45	Fiberglass Pipe Design Manual
NSF 61	Drinking Water System Components
BNQ	Bureau de normalisation du Québec
ISO 9001	Quality Management Systems
ISO 14001	Environmental Management

AWWA M45 / C950 Pressure Class for Hobas

Table 4. Hydrostatic Pressure

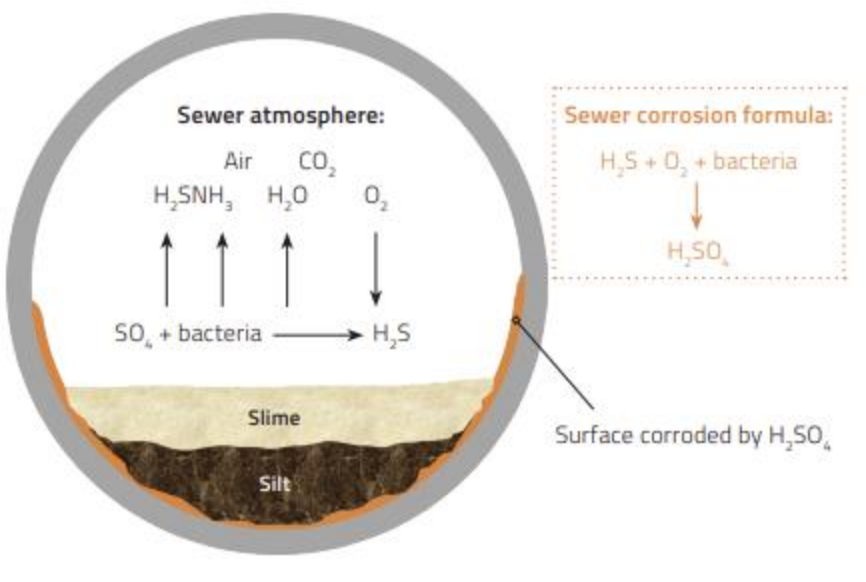
Pressure Class (PN)	Maximum Sustained Operating Pressure[1] (psi)	Maximum Transient Pressure (psi)	Maximum Field Test Pressure (psi)	Minimum Initial Burst Pressure (psi)
25	25	35	37	100
50	50	70	75	200
100	100	140	150	400
150	150	210	225	600
200	200	280	300	800
250	250	350	375	1000
300	300	420	450	1200
350	350	490	525	1400
400	400	560	600	1600
450	450	630	675	1800

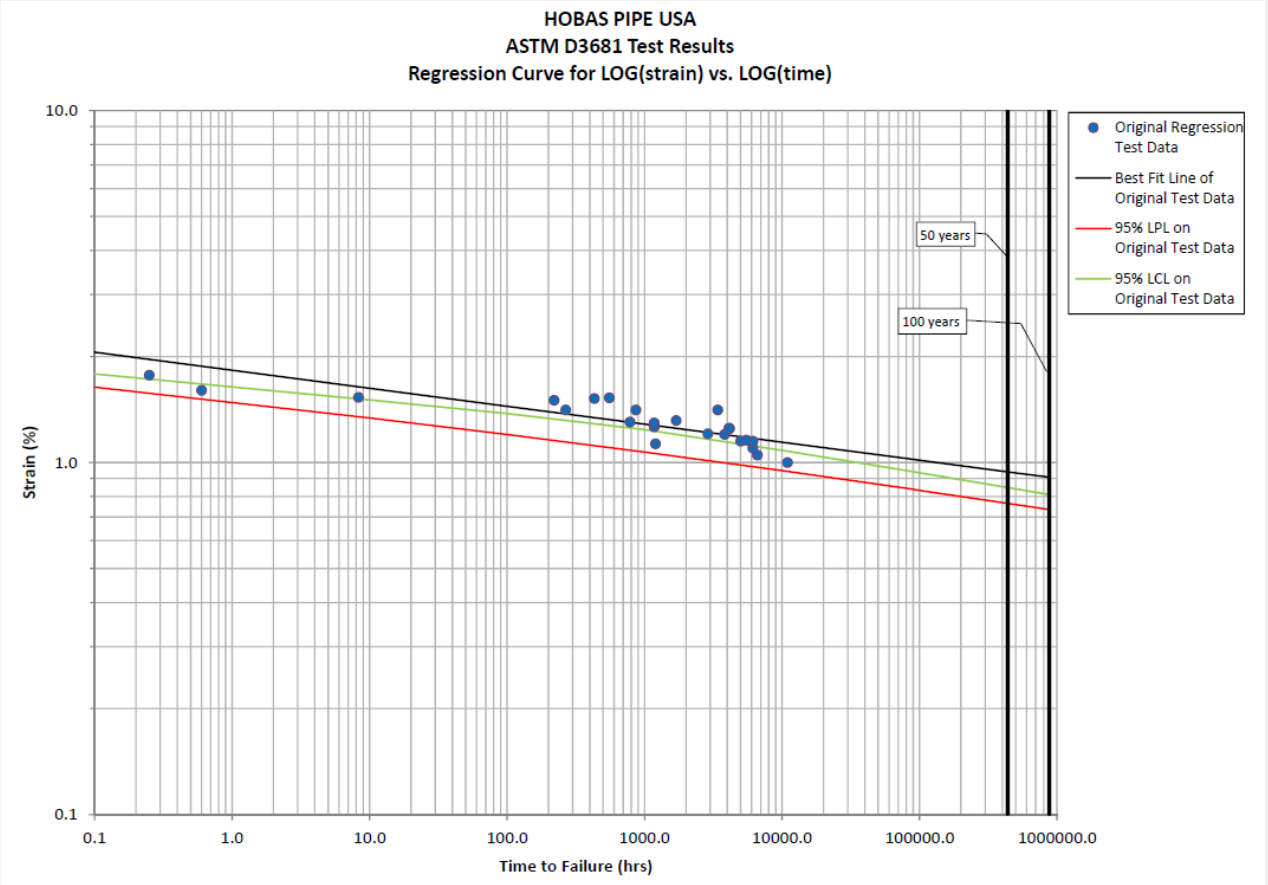
[1] Maximum pressure may be reduced for buried pipes

Note Factory test per AWWA/ASTM Standards 1.5x PN >54 up to 96 and 2x PN for ≤54

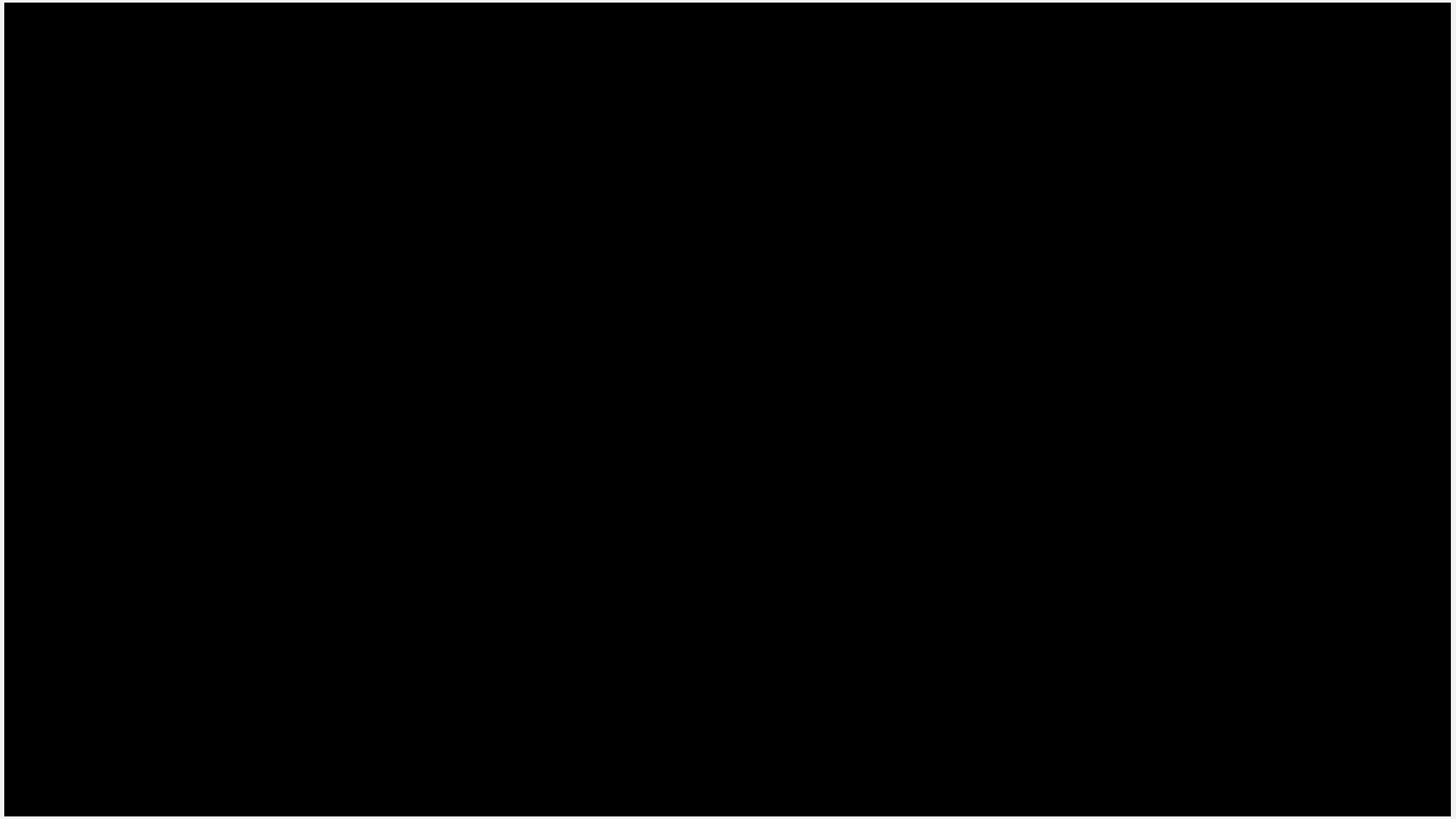
Strain Corrosion Test Results (H_2SO_4 per ASTM D3262)

log (time) = -19.537 log (% strain) + 5.12

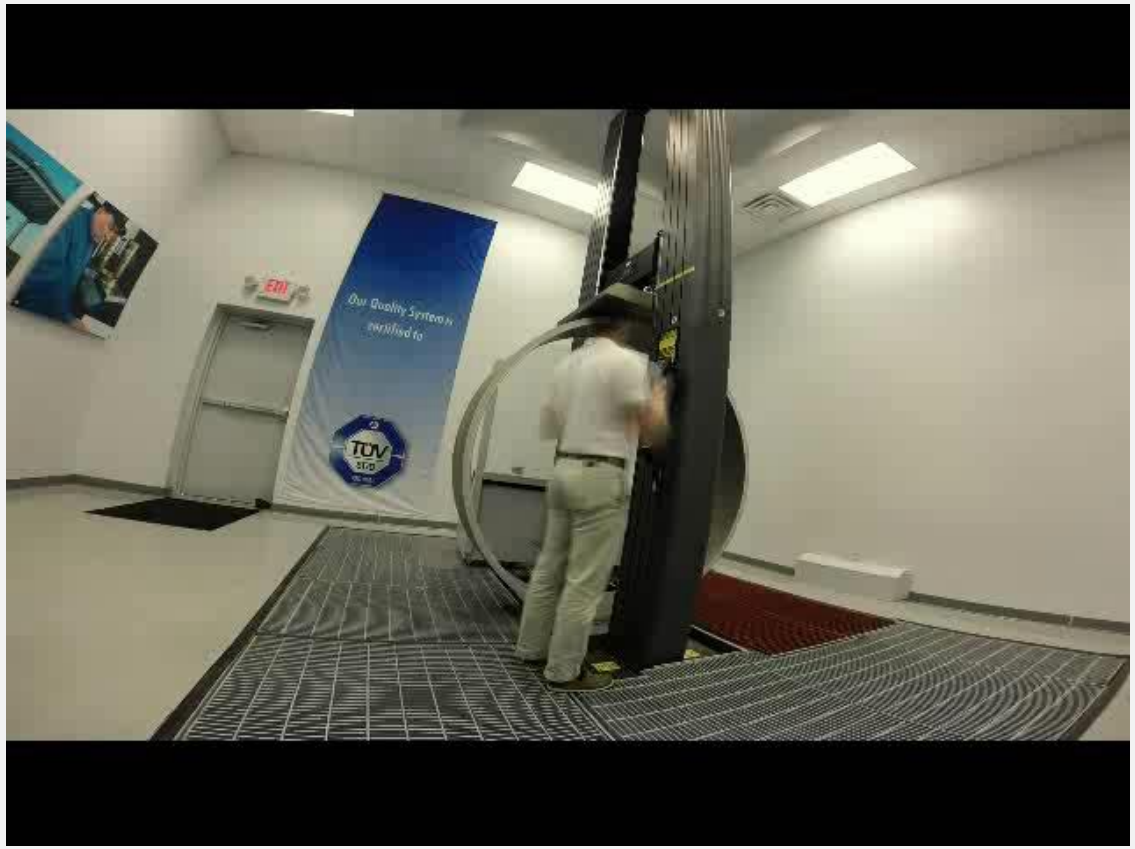




Sliplining (SL Machine Process)



Stiffness Test (ASTM D2412)



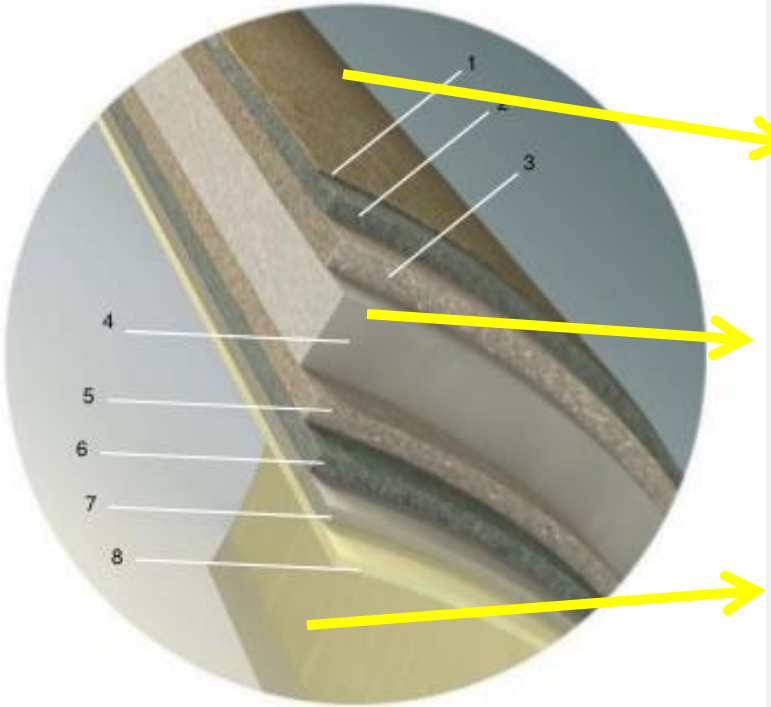
- DN 72
- SN 72
- 34 minutes of test time (testing rate)
- Failure 17.3 inches
  ~ 24% deflection
- Nearly 10,000 lbs of load
- Actual SN = 79.55 psi

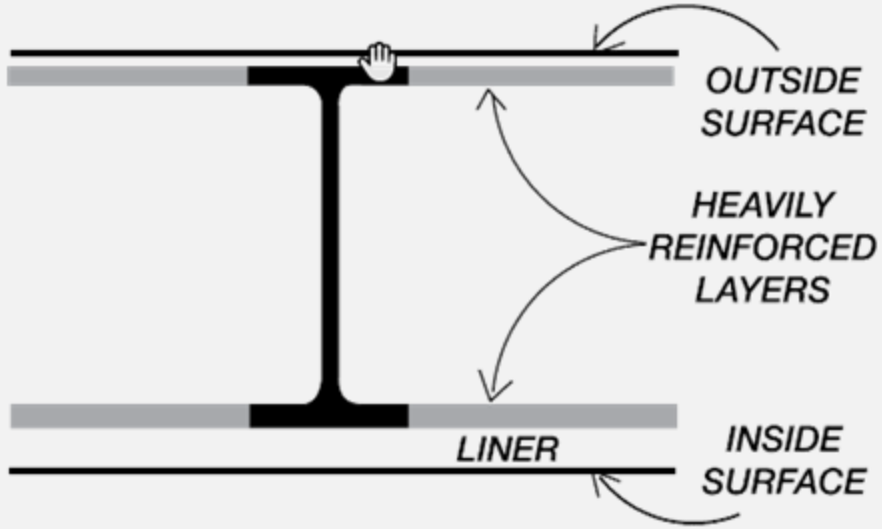
Pounds per inch per inch PSI

Composite Pipe Wall
I- Beam Design

◊ **Thermoset Lining Materials**

1. External protective layer
2. Outer reinforced layer (glass fiber, polyester resin)
3. Transition layer (glass fiber, polyester resin, sand)
4. Reinforcing layer (sand, polyester resin, glass fiber)
5. Transition layer
6. Inner reinforced layer
7. Barrier layer
8. Inner layer
   – pure resin = 1mm+





FRPMP Slipline Rehabilitation – Live Flow, Long Pushes, High Strength Hobas

FRPM Features & Benefits

HOBAS®

Features

- Corrosion resistant
- Computer-controlled consistent manufacturing process
- **Lightweight**
- **Constant OD**
- **High Jacking Capacity**
- Smooth Interior

Benefits

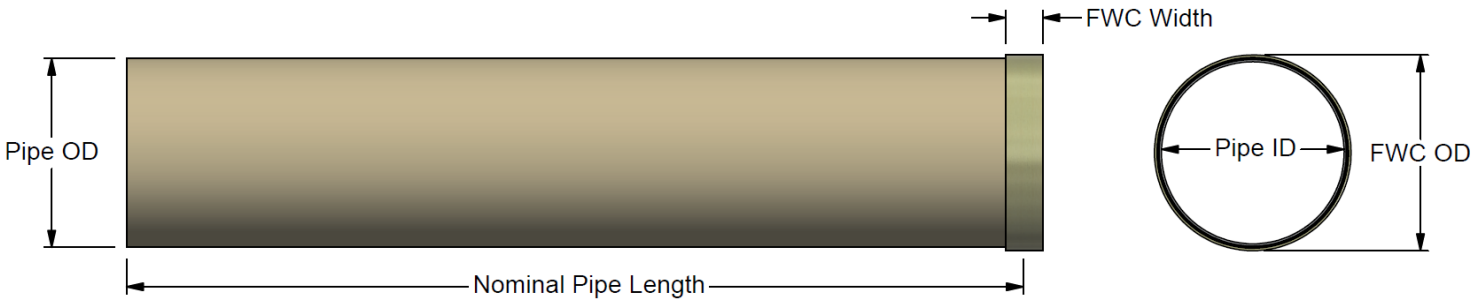
- Long maintenance-free life
- Reliable performance
- Fast assembly
- Leak-free
- Excellent long-term hydraulics
- Abrasion resistant
- Consistent high quality
- No need for cathodic protection or coatings

Testing proof of calculations

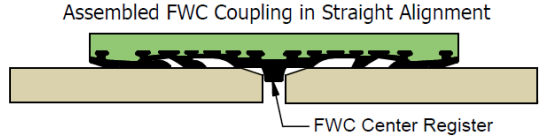
- Pipe production is sampled per ASTM requirements
- Tests include stiffness, deflection characteristics and mechanical properties

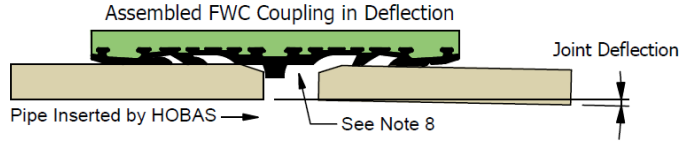
FWC Coupling

- Direct Bury
- Tunnel Carrier
- Above Ground
- Pressures up to 250 psi
- Over 75,000 miles installed
- Since 1961



Standard Pipe Section DN 48 SN46 PN150		
Description	Value	Unit
Pipe Outside Diameter (OD)	50.8	in
FWC Coupling OD	52.8	in
Pipe Nominal (Avg.) ID	49.3	in
Pipe Minimum Thickness	0.75	in
Max Service Pressure	150	psi
Pipe Weight	111	lbs/ft
FWC Weight	67	lbs
FWC Width	9.8	in
FWC Gasket Material	EPDM	-
Nominal Pipe Length	20	ft
Pipe Length Tolerance (90% typ.)	+/-0.5	in
FWC Joining Force	8,400	lbs
Max Allowable Joint Deflection	1.13	deg





Applicable Standards & Test Methods		
ASTM D3517	NSF 61	ASTM D3681
AWWA C950	ASTM D3839	ASTM D4161
ASTM D3754	ASTM F477	ASTM D2412

Notes:
1. HOBAS Pipe is an OD controlled product and can be field cut.
2. See cutting instructions for bevel dimensions & safety measures.
3. 24-hour deflection recommended max is 3%.
4. 30-day deflection recommended max is 4%.
5. Assembly can be bell into spigot or spigot into bell. Seal is symmetrical.
6. Do not push directly on FWC couplings.
7. See installation instructions for more info.
8. Maximum gap for all FWC's is 1-inch (pipe end to center register).
9. Cell class shall be Type 1, Liner 1, Grade 1 per ASTM D3517.

Description:

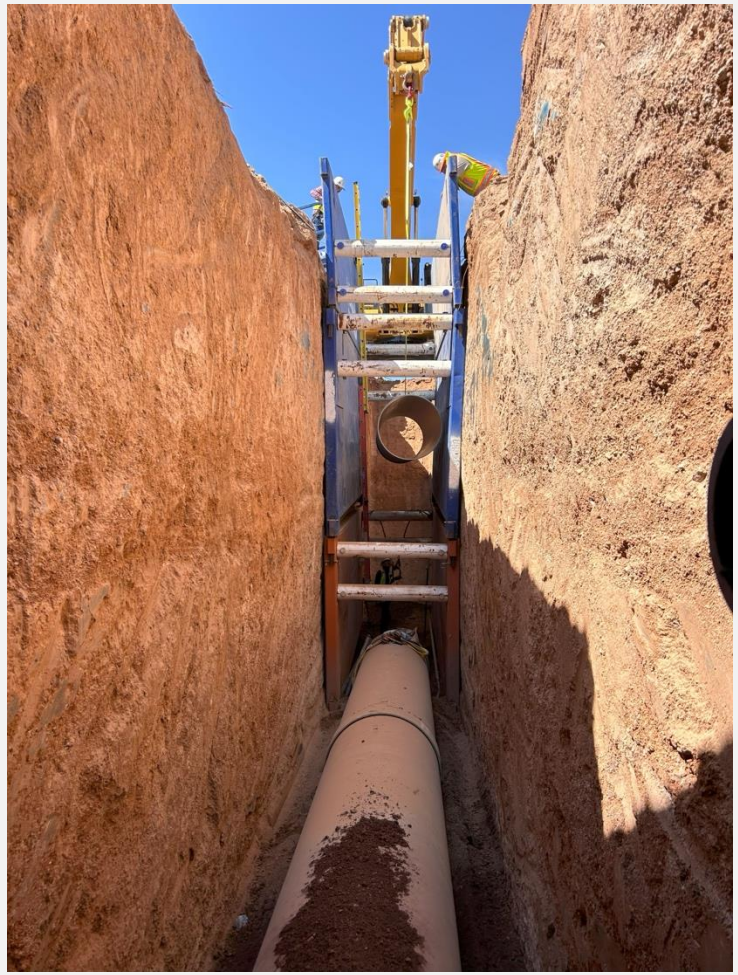
48in FW FRPM PIPE

Project Name:
Project Location:
Contractor:
Agency:
Drawn By: A. Guerrero
Part No.

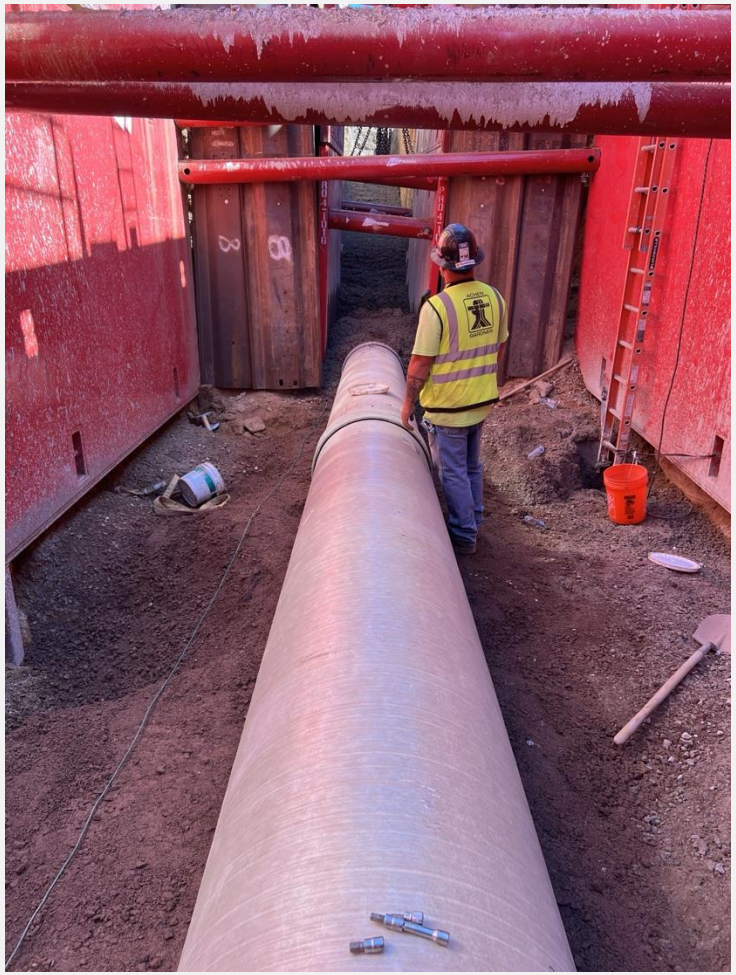
HOBAS Pipe USA
1413 E. Richey Road
Houston, Texas 77073
281-821-2200
www.hobaspipe.com

11/24/2020 1:43:23 PM - GUA

Direct Bury – TPC Scottsdale
City of Scottsdale & Achen Gardner



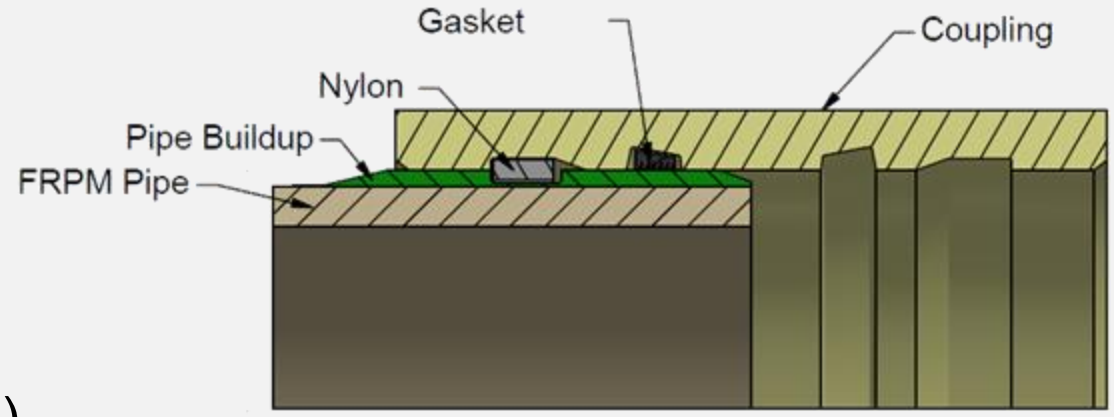
Direct Bury – Optima Gravity Sewer
City of Scottsdale & Achen Gardner

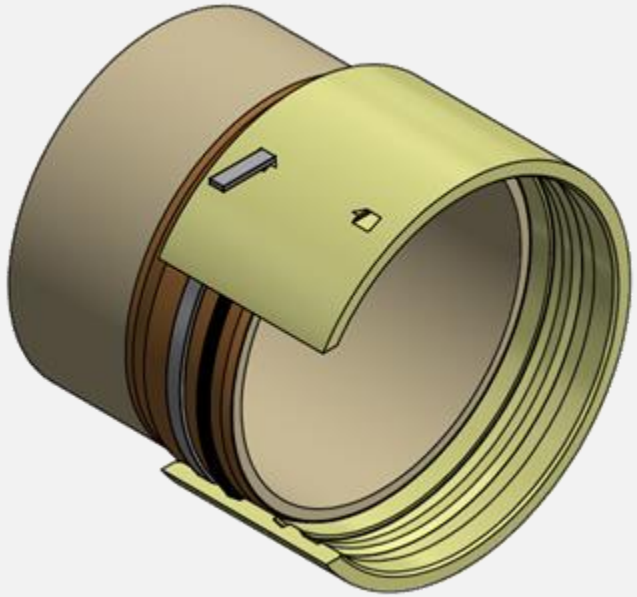


Hobas Non-Circular Pipes

Engineering
Restrained Joint, Key-Lock

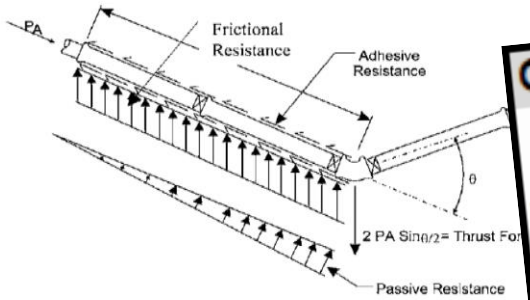
- Reka- EPDM Gasket
- Push together assembly
- Up to 54“ Dia. Nom
- Up to 250 psi PN. (i.e. 375 psi max test pressure)





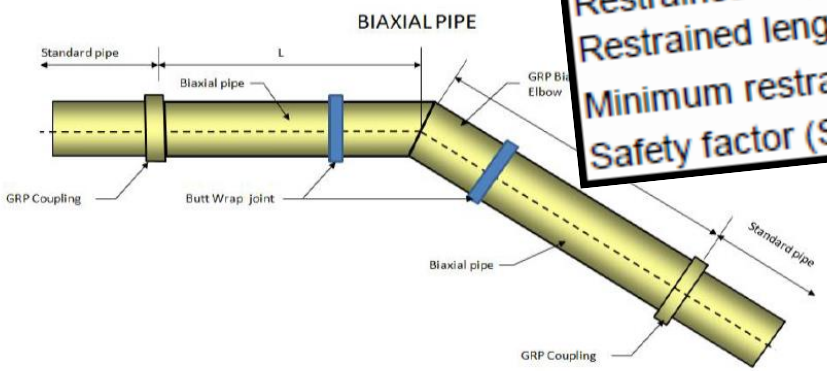
FRP Flanges – Black Mesa – Albuquerque/AMAFCA

Thrust Restraint



$$L_1 = \frac{S_f[PA(1-\cos(\theta))]}{\mu[2\alpha W_e + W_p + W_w]\sin(\theta/2) + \frac{\pi D f_c C}{2}}$$

$$L_2 = \frac{S_f[PA\sin(\theta/2)]}{\mu[2\alpha W_e + W_p + W_w] + \frac{\pi D f_c C}{2}\sin(\theta/2) + \frac{1}{2}K_n}$$



INPUT DATA

ELBOW ID : ST XX - STA. XX+XX.XX

Enter only Data in blue colors Cells	Value	Unit
Pipe specifications		
Nominal Diamater (in)	48	I(in)
Nominal Pressure (PSI)		
Pipe Stifness SN		
Outside diameter of pi		

Calculated Values

	Value	Unit
Nϕ	3.12	(Adimensional)
Rankine Passive Pressure (Pp)	2102	(lbs/ft2)
Weigth of water (Ww)	824	(lbs/ft2)
Weigth of soil (We)	1863	(lbs/ft)
Weigth of pipe (Wp)	128.5106383	(lbs/ft)
Thrust Force Resultant T	72755	(lbs)
Calculated restrained length (to each leg of elbow)		
Restrained length L1	**40.93**	ft
Restrained length L2	**9.09**	ft
Minimum restrained length (Higher value between L1 y L2)	**40.93**	ft
Safety factor (Sf)	**1.5**	

	Value	Unit
Nϕ	3.12	(Adimensional)
Rankine Passive Pressure (Pp)	2102	(lbs/ft2)
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Safety factor (Sf)	**1.5**	

Jackson Street Storm Sewer Phase 2

Jackson Street Storm Sewer Phase 2 – City & County of Denver , Denver CO

- 110” FRPMP Direct Bury
- 84” FRPMP Jacked