

Concepts, Terms & Gear



Who is the Alliance?



Stay Up To Date

Feature Videos



HDPE: The Trenchless Choice

- #1 choice for trenchless installs
- Reduce restoration and roadway reconstruction costs.
- Need to go under a river or lake? No problem with HDPE.



Try
HDPE
Pipe!

HDPE Video #43 Alliance Roadshow TimeLapse



Playlist includes:

- HDPE Video #43 Alliance Roadshow Time Lapse (:55)
- HDPE Pipe is the Future (:59)
- Your Roads are Safe when HDPE is used (:49)
- Casselberry Solves the AC Pipe Issue (1:27)
- DC Water Solves Bridge Xing w/ HDPE (2:29)
- Palo Alto Hosts HDPE Roadshow (4:49)
- HDPE Pipe solves issues for Lago Vista (3:34)
- The Butt Fusion Moment - full and half speed (:31)



Social Media

Join thousands of **PE Alliance** followers!



pepipeorg



company/alliance-for-pe-pipe



PEPipeAlliance



hdpe4710



allianceforpepipe

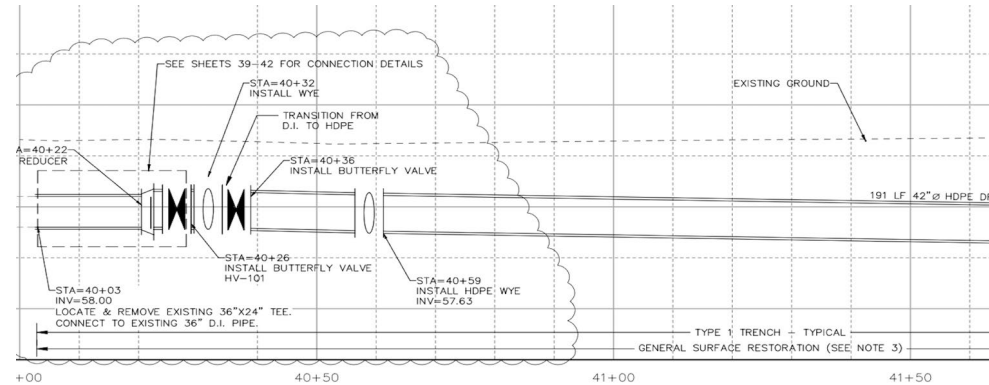
Free Resources

Email: DLANDY@pepipe.org

Schedule A Seminar

Project Review & Assistance

Spec Writing / Editing



REV 5/2020

SECTION 02515

HIGH DENSITY POLYETHYLENE PIPE AND FITTINGS

PART 1 GENERAL

1.01 Scope of Work

The Contractor shall provide solid wall high density polyethylene pipe (HDPE) and fittings which conform to AWWA, ASTM and other referenced documents listed in this specification with flanged and thermal butt fusion joints complete in place.

1.02 Manufacturer Qualifications

- A. Manufacturer shall have a minimum of 5 years recent experience producing HDPE pressure pipe and fittings for at least the specified sizes and lengths and shall be able to submit documentation of at least 5 installations in satisfactory operation for at least 5 years.
- B. HDPE pipe and fittings manufacturers and distributors shall be listed as current members of the Alliance for PE Pipe.
- C. Contractor shall have a minimum of 5 years recent experience installing HDPE pressure pipe and fittings for at least the specified pipe and fittings sizes and lengths and shall be able to submit documentation of at least 5 installations in satisfactory operation for at least 5 years.
- D. All pipe and fittings of each material type shall be furnished by the same manufacturer.
- E. The HDPE utility pipe and fittings manufacturer shall review and approve or prepare all Shop Drawings and other submittals for all components furnished under this Section.
- F. Pipe and fittings, including linings and coatings, that will convey potable water or water that will be treated to become potable, shall be certified by an accredited organization in accordance with NSF 61 as being suitable for contact with potable water, and shall comply with requirements of authorities having jurisdiction at Site.

1.03 Referenced Standards

- A. American Water Works Association (AWWA) latest edition:
 1. AWWA C901 - Polyethylene Pressure Pipe and Tubing, 1/2 Inch Through 3 Inch for Water Service

02515 - 1
Alliance for PE Pipe

Free Resources

Engineer's Package

Engineer's Package

ALLIANCE FOR
pe pipe

SECTION VIEW

PLAN VIEW

WATER SERVICE WITH BUTT FUSION SOCKET SADDLE

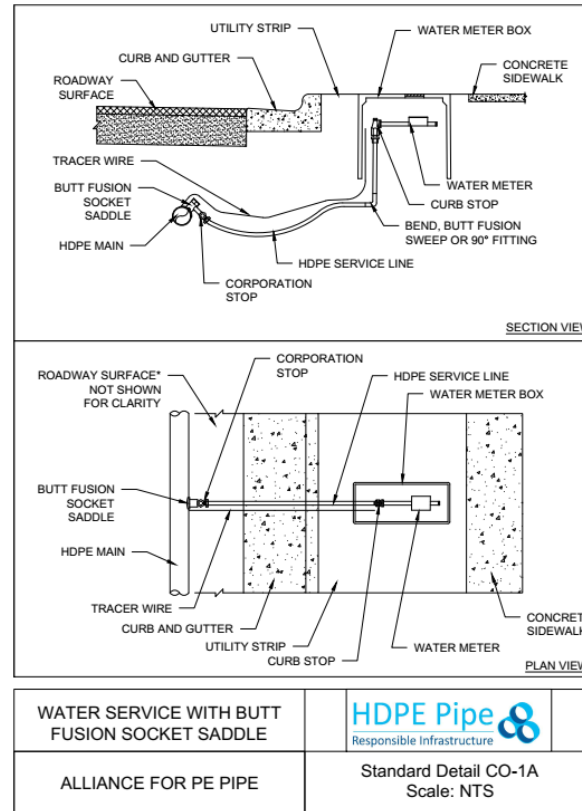
ALLIANCE FOR PE PIPE

STANDARD DETAIL CO-1A
Scale: NTS
REV 5/2020

PE Handbook
WRF Earthquake Report
Alliance Operator Qualifications
Alliance Insider's Guide
Alliance Decision Trees

Alliance Pipe Chart
Model Specifications
HDPE Standard Details
PPI MAB Contacts
PPI MAB EF 1 - <12"
PPI MAB EF 1 - >14"
PPI TN 44 - Long Term Resistance
PPI TN 49 - Service Tubes
PPI TN 54 - Squeeze Off
PPI Transitions

Standard Details



Case Studies



Email: DLANDY@pepipe.org

Today's Speakers



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- Questions
- PDH (leave contact info in survey)
- Project Assistance
- Specification Writing
- Engineers Package
- Case Studies

Please fill out post webinar survey:

- *Request follow up information*
- ***Request PDH's***
- *Project review/assistance*
- *General questions*



Take the Plunge



SECTION 1: BASIC CONCEPTS

1. A Few Numbers
2. HDPE
3. PE HDPE Poly Polyethylene
4. Butt Fusion
5. Electrofusion
6. Dimension Ratio
7. Repair Clamp, Mechanical Fittings
8. IPS, DIPS
9. MDPE
10. PE Alliance
11. PPI



Background

1959

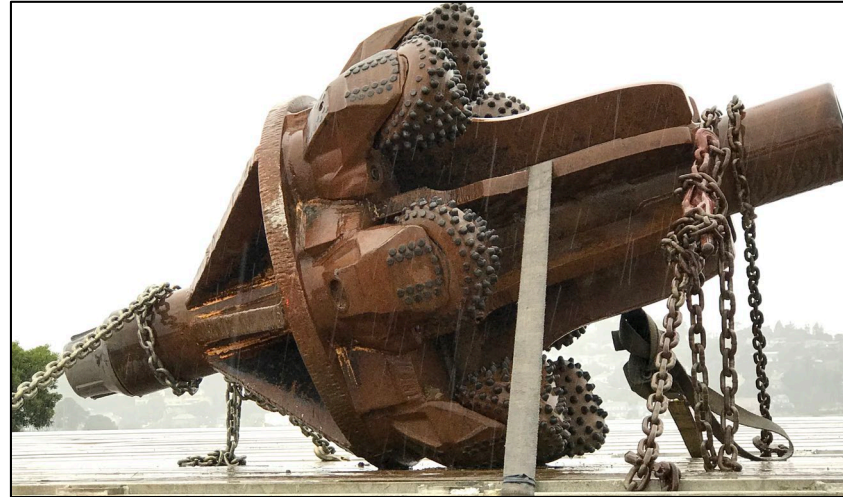
2.1 Trillion

240,000

14

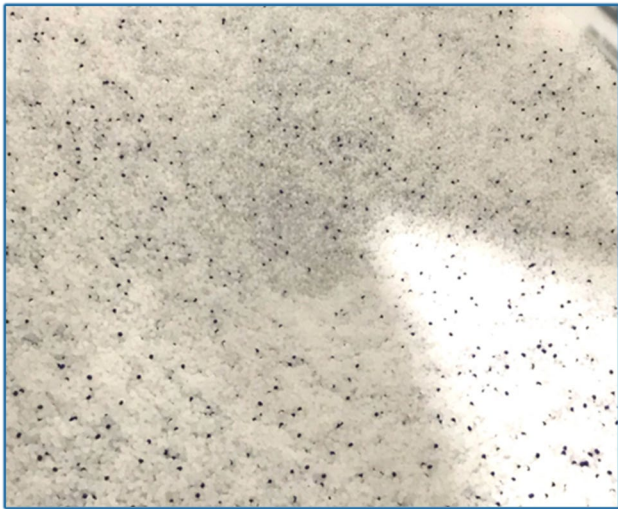
1.4 Trillion

18,000



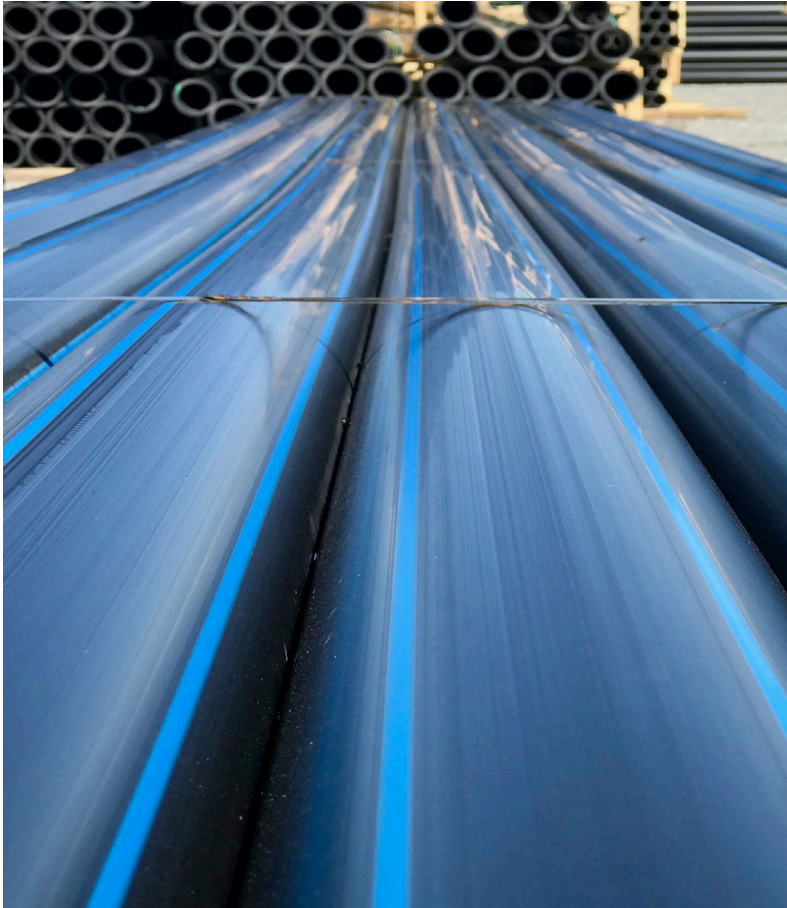
HDPE

High Density Polyethylene Pipe is a thermoplastic pipe known for leak free joints, low installed cost, no corrosion, flexibility, low maintenance, seismic resistance and outstanding durability. The pipe ends are joined with fusion and once the fusion is complete the joint is seamless.



The key to understanding HDPE is how different it is from the other pipe materials. It is a superior material with its own unique set of features, benefits and considerations which inherently save in installation, repair and lifetime costs.

PE HDPE POLY POLYETHYLENE



Various names all mean the same thing

Common acronyms include HDPE, PE, 4710, poly and polyethylene.

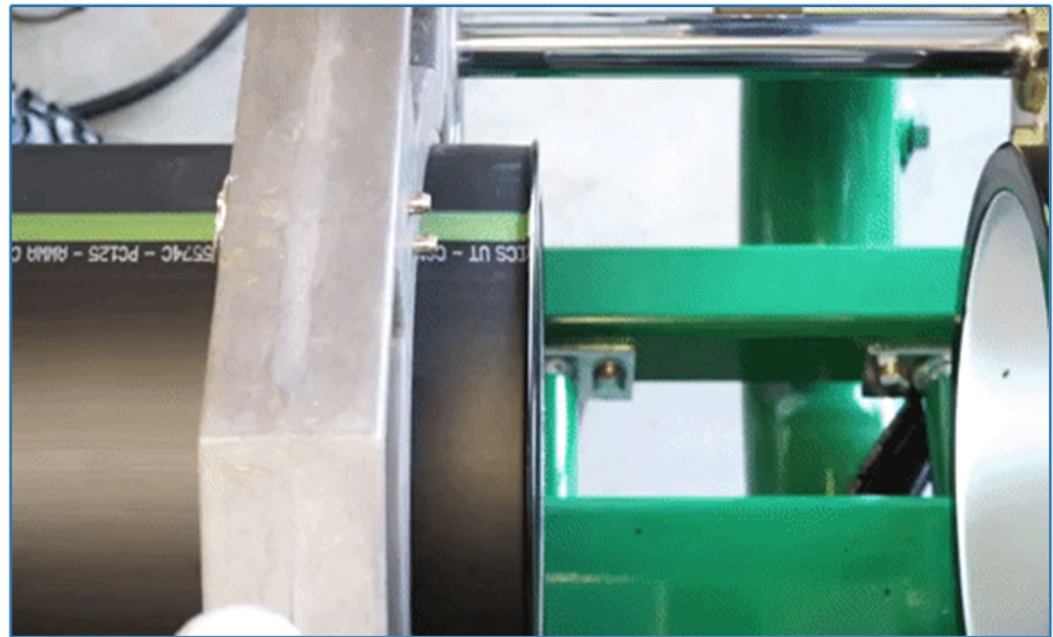
In conversation, HDPE is often shortened to PE, but means HDPE. Present day resin is 4710 and is more stout and high performing than previous versions.

PE Pipe represents the best practice for W and WW systems in the US and Canada.

BUTT FUSION

Butt fusion is the joining of two pipe ends using heat and is the primary joining method all over the world.

Fusion is a skill taught by experts to operators who develop the skill over time through experience. This training and skills development not only helps them understand the process and equipment, but also the materials they are working with.



ELECTROFUSION (EF)

Electrofusion is a method of joining HDPE pipe by using special fittings that have built in electric wires which are used to melt the resin then join the pipe together.



Owners must require operators to receive EF training. Utilize the Plastics Pipe Institute's (PPI) manual of practice found in the Engineer's Package.

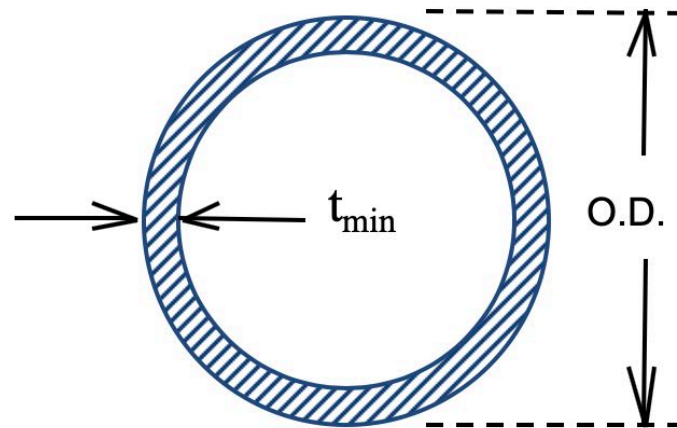


DIMENSION RATIO aka DR

The outer diameter of the pipe divided by the minimum wall thickness.

The lower the Dimension Ratio number the more pressure the pipe will take. If a contractor buys a 6" DR 11 pipe, She is buying a 6" 200 psi working pressure class pipe.

$$DR = \frac{OD}{t_{MIN}}$$



DR 9 – 250 psi working, 500 surge
DR 11 – 200 psi working, 400 surge
DR 17 – 125 psi working, 250 surge

REPAIR CLAMP / MECHANICAL FITTING

When butt or electrofusion is not appropriate, mechanical joints are an option. Made of steel or iron, these fittings are typically couplers or full band clamps. The industry does now consider them to be permanent repairs as many of them are made specifically for HDPE pipe.



+GF+

GEORG FISCHER
PIPING SYSTEMS

GEORG FISCHER CENTRAL PLASTICS



HYMAX[®]
Repair the past. Connect the future.
KRAUSZ is the creator of HYMAX



Full circle band clamps may be used for permanent repair in water systems for localized damage, holes, scrapes and cuts. The Hymax Versa is an excellent product to repair large and small issues with HDPE pipe.

IPS (Iron Pipe Size)

DIPS (Ductile Iron Pipe Size)

HDPE pipe is available in both IPS and DIPS and is an OD controlled product. IPS is the most common size across multiple industries and is most available and has the same outside diameter as black iron or carbon steel pipe. IPS features a smaller ID and OD than DIPS.

DIPS sized HDPE has the same outside diameter as cast/ductile iron pipe.

The HDPE manufacturing industry has focused on providing additional DIPS stock to provide to the potable water and wastewater market every year.

8" DR 11	DIPS vs IPS Compare	
	OD	ID
8" DIPS	9.05"	7.31"
8" IPS	8.625"	6.96"

MEDIUM DENSITY POLYETHYLENE MDPE



Gas distribution systems primarily use MDPE (and now HDPE). It is less dense than HDPE, more pliable, but very easy to fuse.

98% of new and replacement pipe is PE and typically does not go larger than 24" dia.

ALLIANCE for PE PIPE

aka PE Alliance

The PE Alliance is a not for profit trade association dedicated to educating municipal staff, civil engineers and contractors on the features, benefits and practice of using HDPE pipe.

The Alliance conducts roadshows, trade shows, webinars and directly assists owners and engineers on HDPE design and installations.

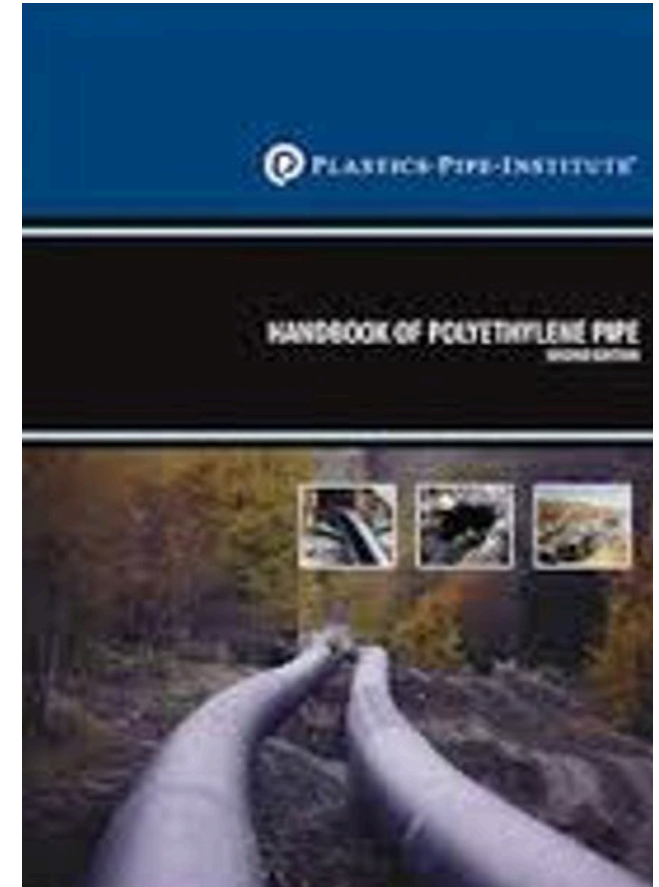


PPI is a technical association representing all segments of the plastics piping industry and seeks to broaden awareness and create opportunities that expand market share and extend the use of plastics pipe in all applications.

PPI is organized into 5 categories:

- Building and construction
- Conduit
- Corrugated pipe
- Energy piping systems
- Municipal and industrial

PPI continues to do a great job in developing technical data, obtaining certification for products and giving the industry the technical foundation to advance use of HDPE.



SECTION 2: HDPE GEAR & PHRASES

1. Butt Fusion Machine
2. Facing
3. Fusion
4. Bead
5. Datalogging
6. EF Processor
7. EF Peeling Tool
8. EF Coupler
9. EF Saddle
10. EF Alignment Clamps
11. Fabricated Fittings
12. Specialty
13. MJ Adapter & Sweep
14. Tracer Wire

Trench Width Requirements

Marker Balls – Spaced Every 20' – 1' Above Pipe

Nominal Pipe Size	Trench Width
<3"	12"
3 - 24"	OD + 12"
>24"	OD + 24"



e.g. 10" IPS needs

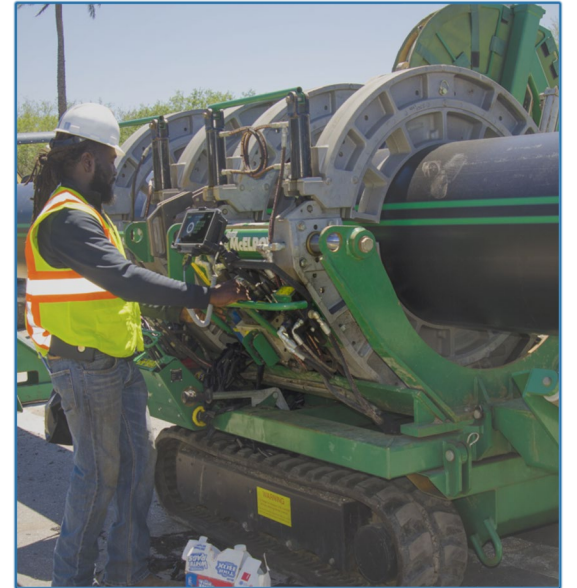
22" Trench

$10 + 12 = 22''$ min
(24" bucket typ.)

ASTM D2321

BUTT FUSION MACHINE

The butt fusion machine is the workhorse of the HDPE industry. Market leader, McElroy Manufacturing makes the ubiquitous green machines found on every HDPE jobsite in North America.



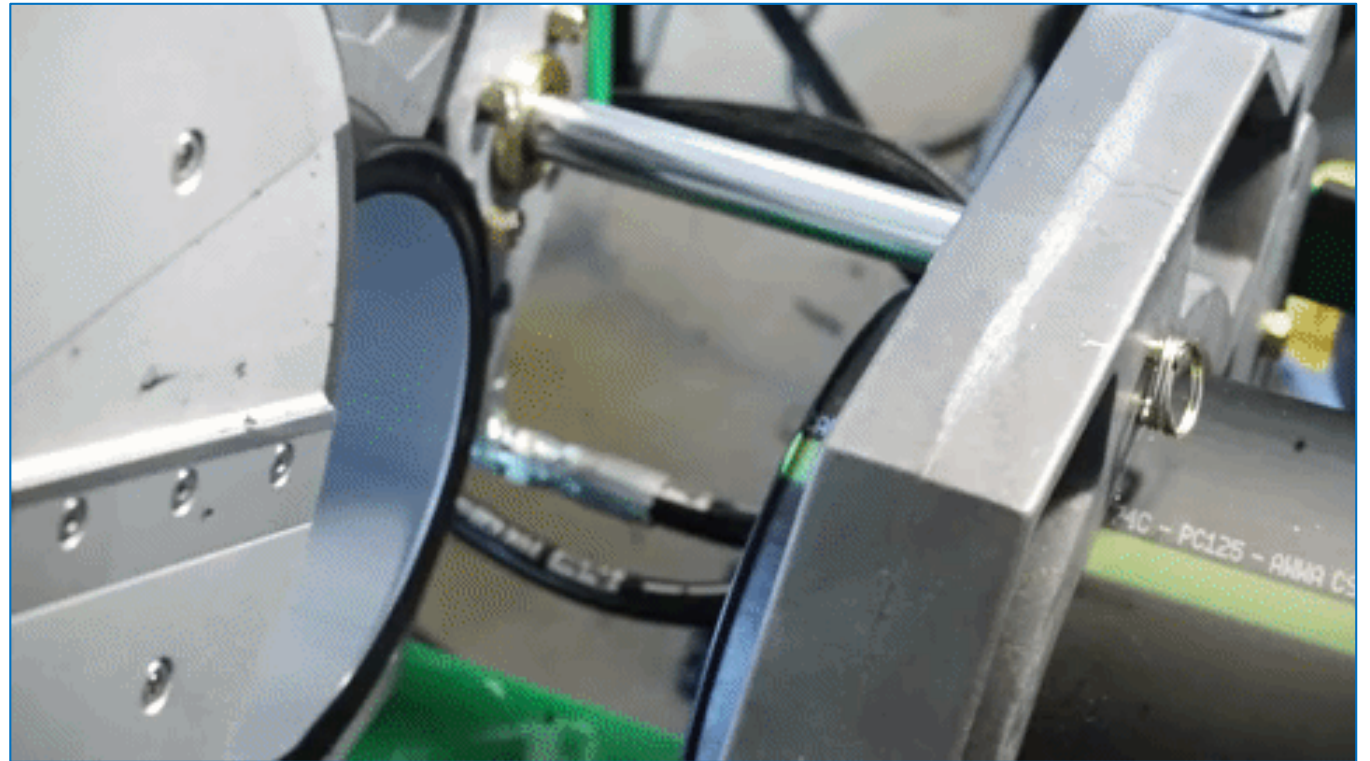
The machines are the gold standard for butt fusion productivity in the world. The PE Alliance carries these machines on its truck and demonstrates butt fusions with them.

FACING

In butt fusion, facing refers to the shaving of the pipe ends to prepare them for proper fusion.

We say,
 CLEAN it,
 SHAVE it,
 HEAT it,
 FUSE it.

Shave is another word for facing the ends of the pipe.



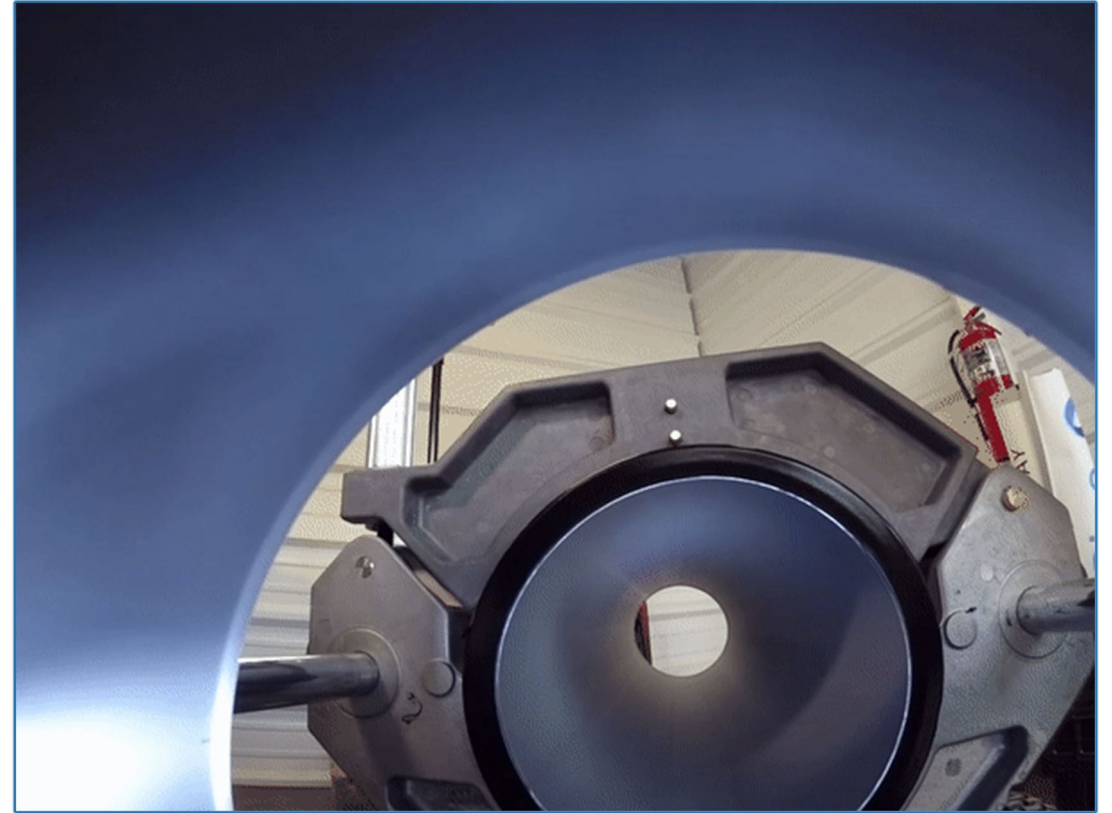
FUSION yields a bead

The heating process begins with a “heater plate” 400 – 450 degrees.

“Heat soak” the heater is removed, the ends are inspected

The ends are pushed together under prescribed fusion pressure.

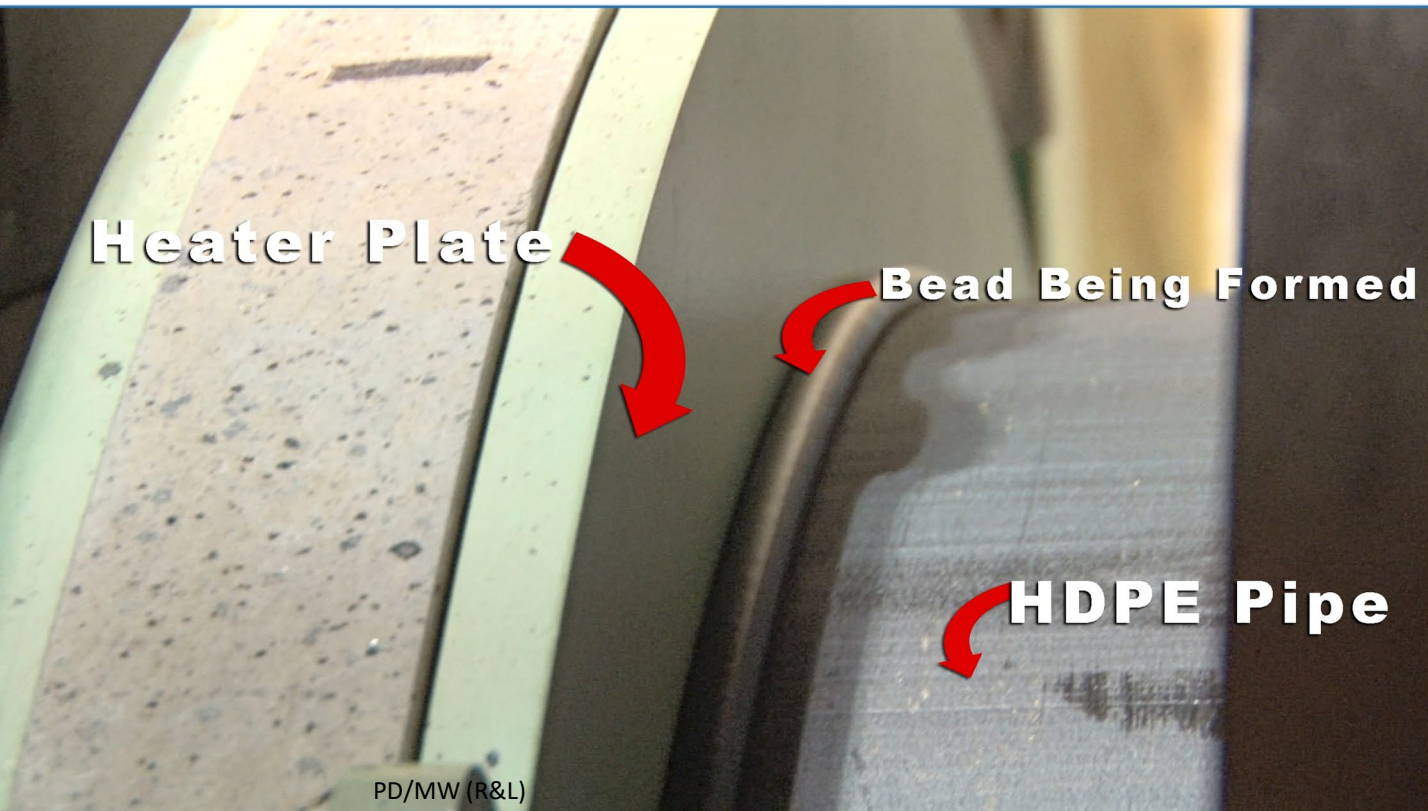
The result is the double rollback bead formed on both the outer wall and inner wall of the pipe.



ASTM F2620-19

BEAD HEAT SOAK REMOVAL

The bead forms against the heater plate during the “Heat Soak.” The C factor was established with the bead present. It is uncommon to remove internal beads, as they have little or no effect on flow. Removal can be time consuming, but bead removal tools are easy to use.



DATALOGGING

Datalogging technology exists for both butt fusion and EF to provide fusion data to operators, owners, engineers and inspectors. While the methods for harvesting the data differs by manufacturer, the principle of providing documentation is well established and sees widespread use.



The technology allows stakeholders (inspectors, design engineers, owners) to monitor and/or review a record of fusion details. The implementation of this technology means that fusion quality can be monitored remotely either in real time, hourly or in daily uploads. For butt fusion, you can use the Datalogger 6 and for EF, a USB is plugged into the processor and data downloaded.

EF PROCESSOR

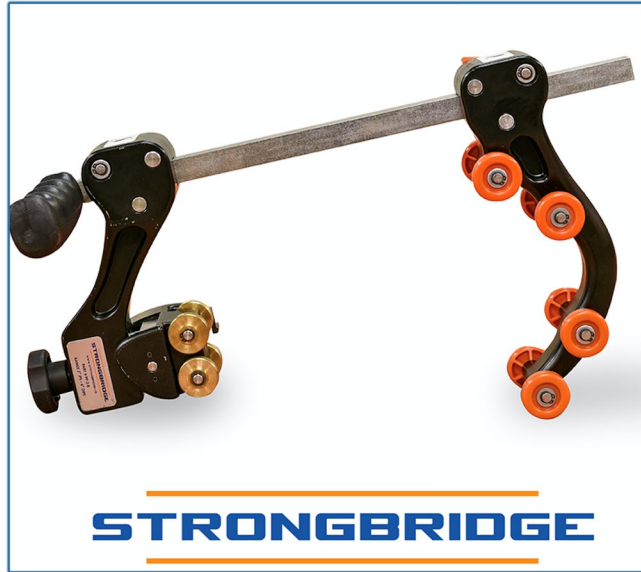
The EF processor is the control box, controlling the electric current and fusion times applied to EF couplings and saddles. It employs a bar code scanning system and features an on board datalogger.

With the new generation of electrofusion equipment, the process has become more simple. There is no pipe movement required and no heater plate to remove, which makes this process ideal for trench installations, services and laterals. Operator training is required.

STRONGBRIDGE



EF PEELING TOOL



Peeling tools are used for proper pipe preparation in EF applications. The pipe surface must be clean and free of debris and the oxide layer on pipe must be removed. Peeling is preferred over scraping.

The tool will provide the clean virgin surface to assist in proper bonding of the pipe and fitting.

Remember, operator training is required.



EF COUPLER

Coupler fittings connect two pipe ends to one another. They contain two separate regions of copper coils, thus creating two distinct fusion zones during welding.



The copper wires convey heat to simultaneously melt the OD of the pipe and the ID of the coupler.



Couplers are found mostly on main lines and less so on services. Trench installations are sometimes made much easier using EF couplers.

EF SADDLE

Saddles are used to connect laterals and services to the main. Saddles also utilize copper wires embedded in the ID of the molded saddle. The copper wires convey heat to simultaneously melt the OD of the pipe and the ID of the saddle.



Saddles ride on top of the main pipe. Tapping is done as it is with other materials.

EF ALIGNMENT CLAMPS

Alignment clamps are essential, even for smaller size pipe, to keep the pipe aligned while the electrofusion process is completed.



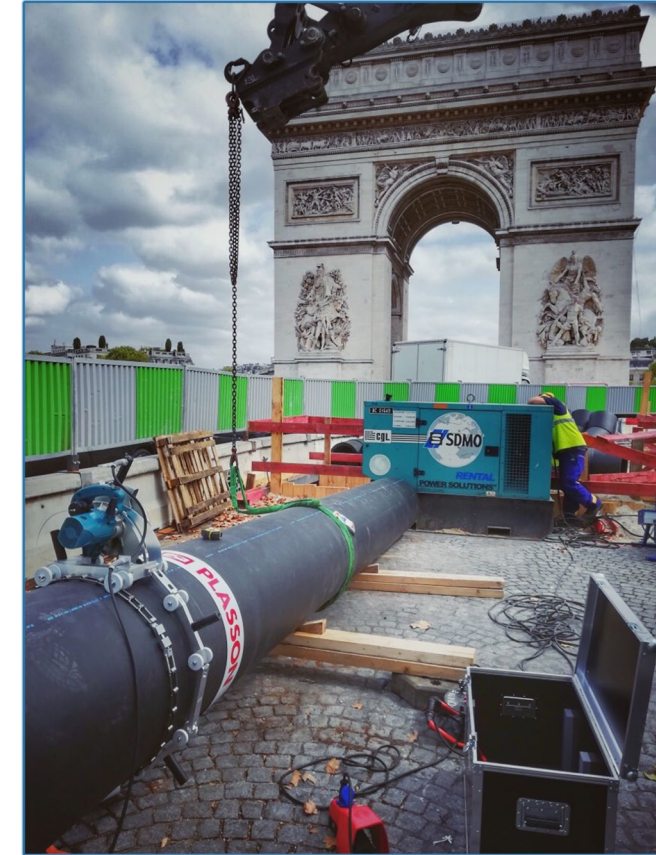
STRONGBRIDGE



STRONGBRIDGE

FABRICATED FITTINGS

Large diameter PE fittings fabricated by fusing together special shapes to create reducer fittings, tees, ells and bends. Fittings > 12" in diameter are usually fabricated because their size exceeds injection molding equipment capacities.



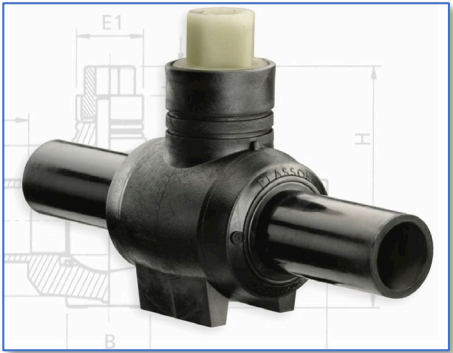
SPECIALTY



STRONGBRIDGE

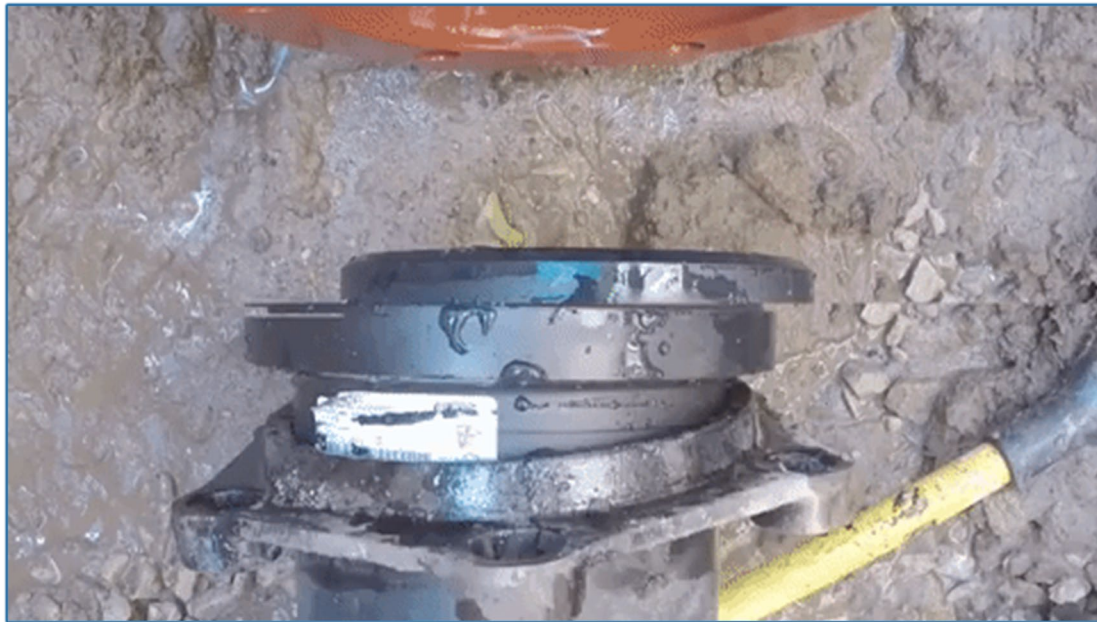


IP IMPROVED
PIPING PRODUCTS, INC.



MJ ADAPTER & SWEEP

Connections to legacy materials are made easy with the mechanical joint (MJ) adapter. Fully restrained, buy as a kit.



A seamless long radius HDPE sector. Now being used in treatment plants and in place of fabricated and molded fittings.

TRACER WIRE

Also called locator wire, it is used to assist in locating HDPE, PVC, MDPE and HDPE conduit and other lines after they are buried. When a pipe is buried, pipe burst or drilled, tracer wire is placed along the length.



Open cut installation on the left, pipe bursting on the right



SECTION 3: FEATURES

1. Seismically Resistant
2. Bending Radius
3. Scratch Resistant
4. C Factor
5. Print Line
6. Striping
7. Pipe String
8. Carbon Black/UV Degradation
9. Thermal Effects
10. Poisson's Effect
11. Pull Back
12. Squeeze Off
13. Sinkhole
14. Slow Crack Growth (SCG)



SEISMICALLY RESISTANT

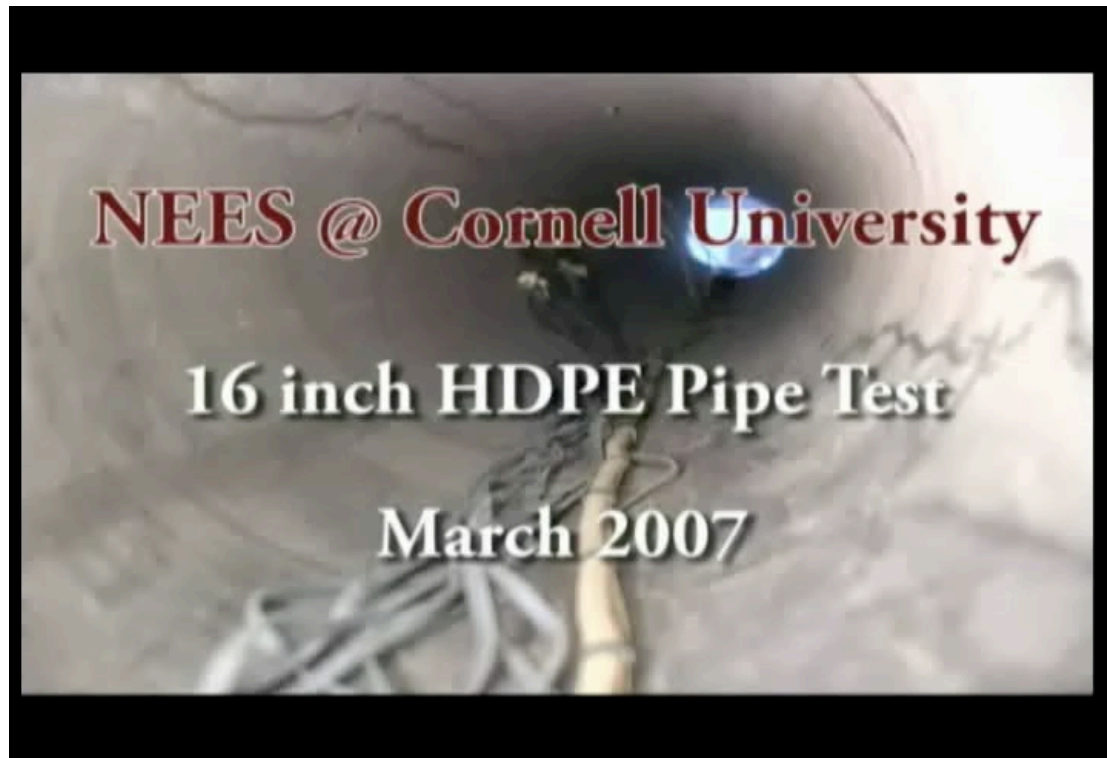
HDPE pipe is seismically resistant as confirmed by the Water Research Foundation in their semiannual report # 4408 entitled *Recent Earthquakes: Implications for US Water Utilities*.

It will withstand earthquake activity, freeze thaw cycles, soil constriction, pressure spikes and typical ground movement that typically fractures incumbent pipe systems.

It will withstand severe ground deformation without failure.



SEISMICALLY RESISTANT – The US View



Napa Water CA 2014

6.0 Earthquake caused
132 main breaks

Napa does not use HDPE



Napa Sanitation had many
Miles of HDPE, same earthquake

NO HDPE failures

BENDING RADIUS

The minimum radius a contractor can bend HDPE without kinking it.

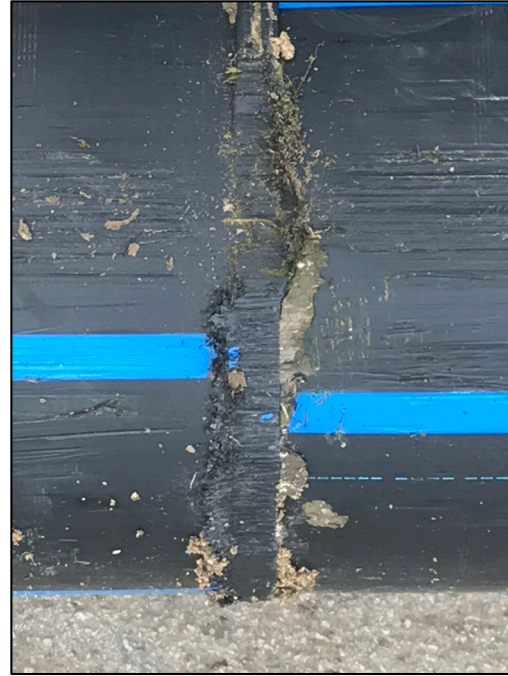
The tight bend radius of HDPE makes it the preferred HDD, bursting and lining product. If the pipe DR is ≤ 9 the bending radius is 20x the pipe OD.



Minimum Bending Radius for Replacement Pipe (ft)

Nominal	PE4710	PVC		Steel	RJDIP	
Pipe Size "		B & S	Fused		Fastite	Flex-Ring
4	12	80	100	400	206	230
6	17	115	144	600	230	230
8	23	151	189	800	230	230
10	28	185	231	1000	230	230
12	33	220	275	1200	230	230
14	38	255	319	1400	230	285
16	44	290	363	1600	230	305
18	49	325	406	1800	230	305
20	54	360	450	2000	230	327
24	65	430	438	2400	230	380
30	80	533	667	3000	230	458

SCRATCH RESISTANCE



PE pipe can resist minor blemishes such as scratches and grooves up to a 10% of wall thickness.



C FACTOR

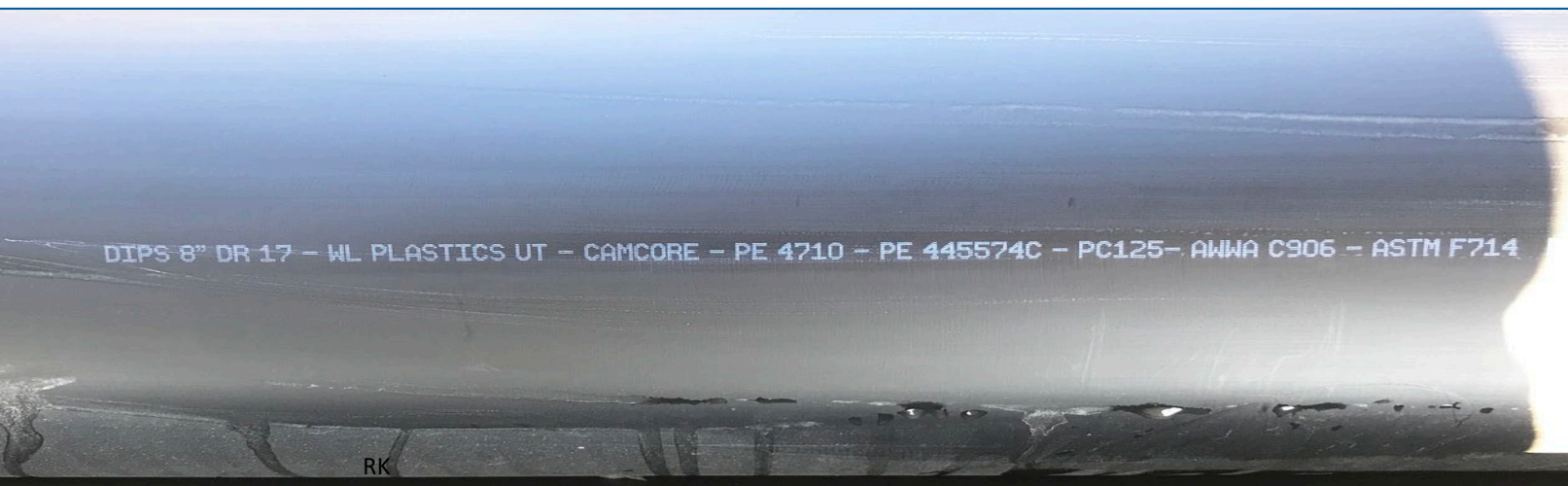
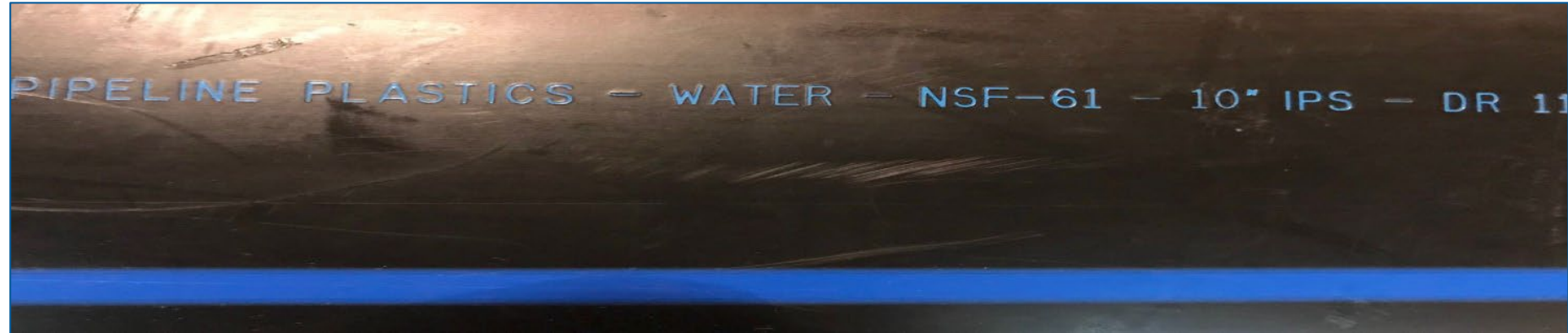
The classic Hazen-Williams roughness constant is known as C factor.

The 150 C factor remains constant for the over 100-year life of PE pipe.

hazen williams
c factor 150

PRINT LINE

The print line appears on sticks and rolls of HDPE pipe so users can determine the specifications to which the pipe was manufactured.



STRIPING

HDPE stripe colors are co-extruded into the pipe so that they cannot be removed. The number of stripes and their location vary from manufacturer to manufacturer.

Blue – water

Yellow – gas

Green – WW

Red – fire

Purple – reclaimed



Black pipe without stripes is the most commonly available pipe in the industry. A double stripe sometimes denotes DIPS pipe vs IPS.

PIPE STRING

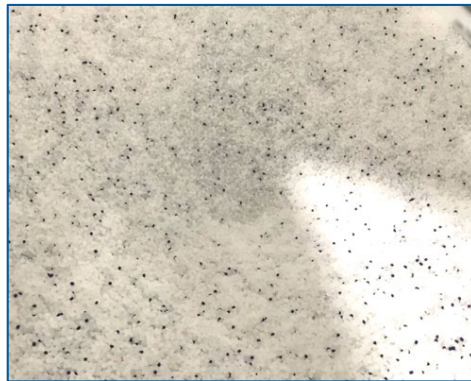
Phrase used to describe fused up lengths of HDPE pipe.

Strings vary in length based upon the job and can be installed in strings in all HDPE installation methods.



CARBON BLACK / UV DEGRADATION

A black pigment provides highly effective protection against ultraviolet rays. Carbon Black is manufactured and tested within the formulation matrix of polyethylene pipe. The black resin is an additive that permits the black pipe to last indefinitely in an above ground situation.



THERMAL EFFECTS

tale of the frog

The fractional change in length of a material for a unit change in temperature

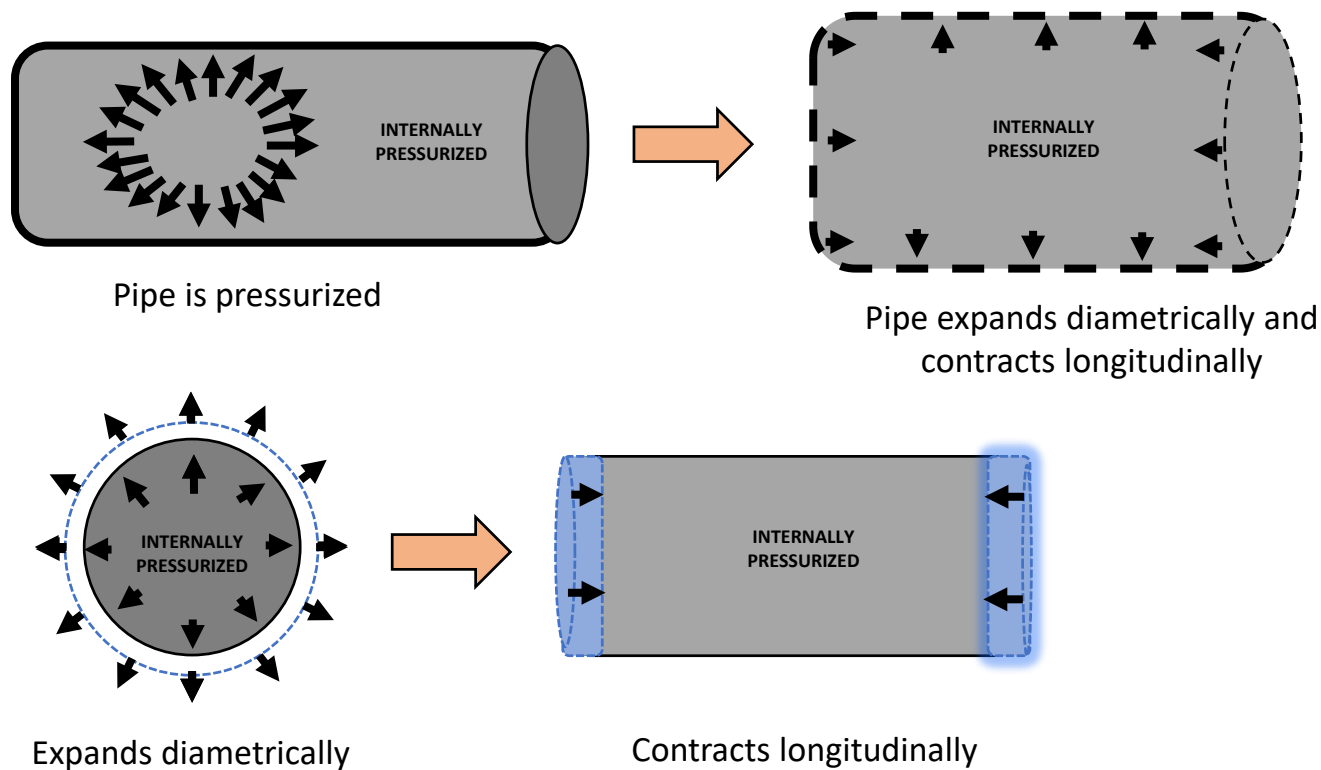
When pipe gets hot, it expands according to the formula. The same is true for when it cools down. The temperature of the material passing through the pipe also impacts the dimensions of the pipe diameter and the length of the HDPE segment.



1" \Rightarrow 10 deg. \Rightarrow 100'

POISSON'S EFFECT

Operating Condition



The ratio in the decrease in lateral strain to the increase in axial strain is called Poisson's Ratio.

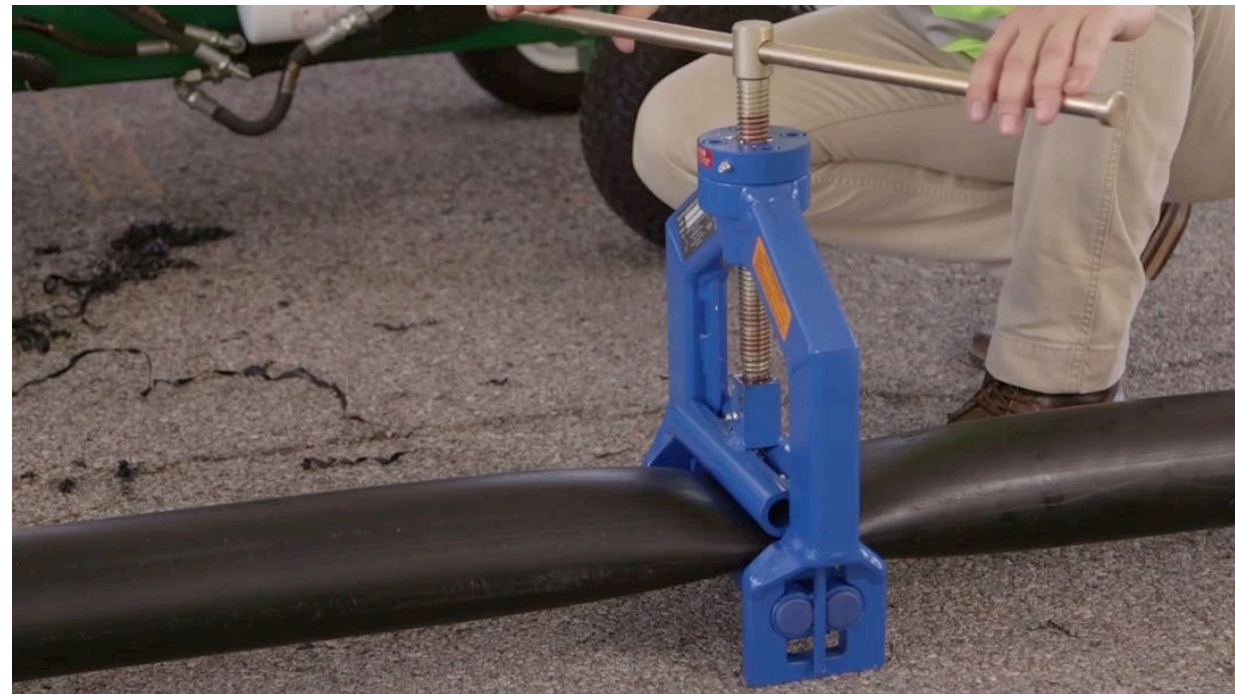
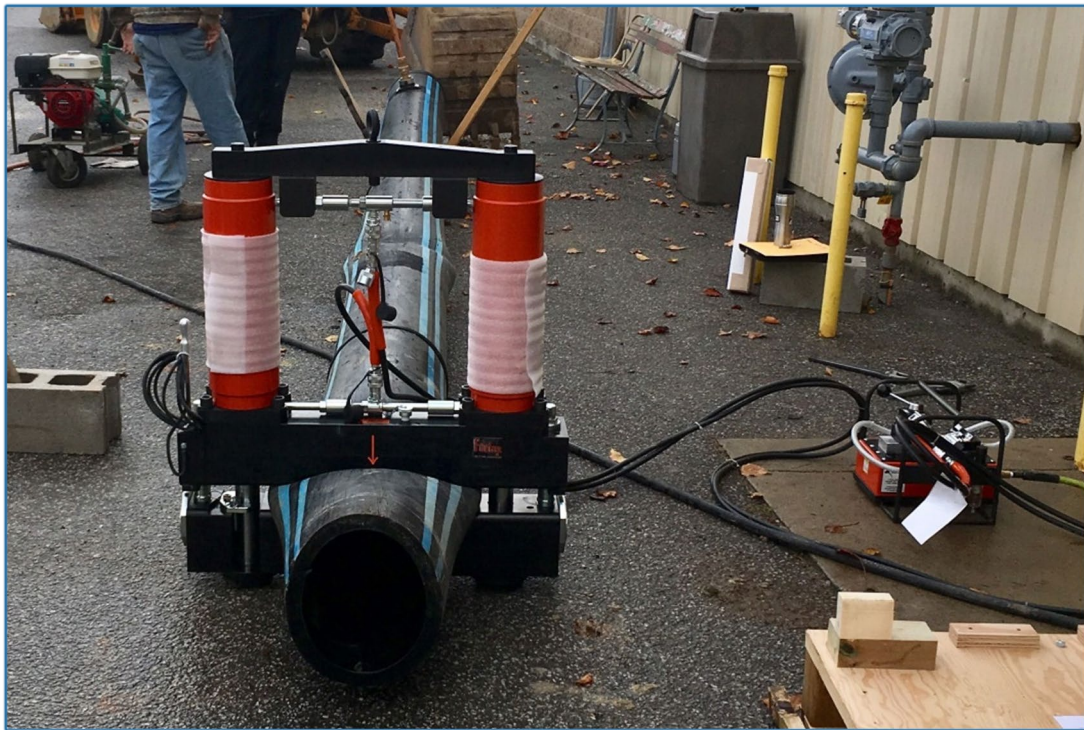
It creates axial stress where the PE connects to the incumbent system.

PULL BACK



Pull back describes a critical activity in a number of trenchless applications. In pipe bursting it occurs when the pipe string is pulled back toward the launch/receiving pit and the operator removes the rods that had previously been sent down the host.

SQUEEZE OFF



A PE line can be squeezed off by a squeeze off tool which clamps down on the pipe to stop the flow.

SINKHOLE

Why all this attention on HDPE?

Used to mean a geologic formation in limestone. Today it means the hole created by a failed water line.

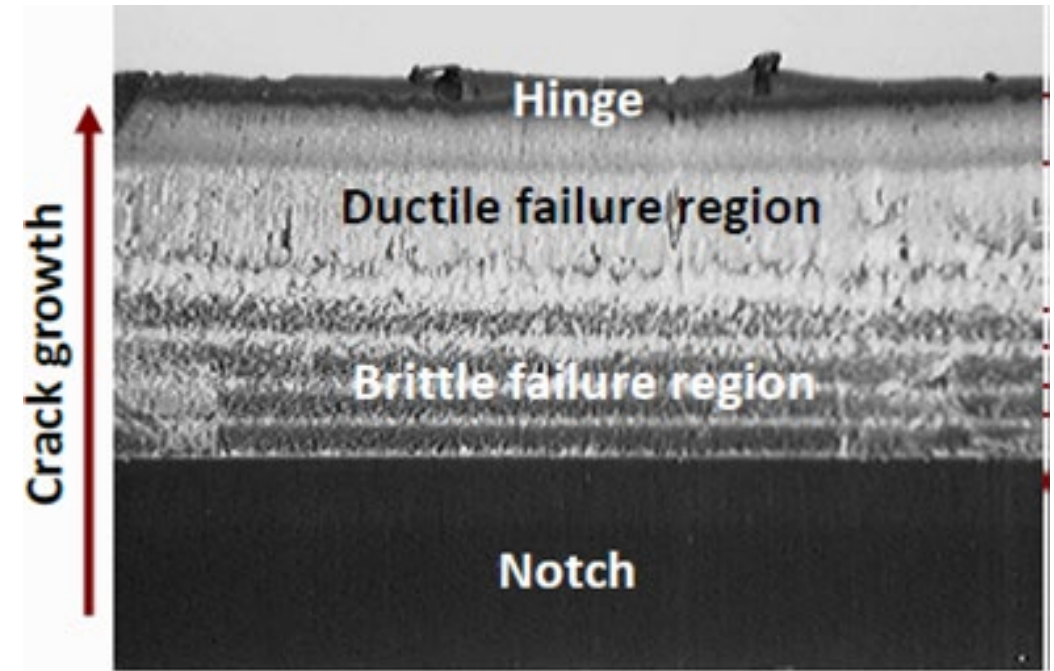


HDPE solves for:
Joint failure
Ground movement
Tuberculation
Midnight repair

SLOW CRACK GROWTH . . . was

The slow extension of the crack with time but something needs to cause a crack. SCG does not exist in current versions of HDPE resin.

The new versions of the resin do not see cracks grow. This is no longer a failure mechanism we see in the water market.



SECTION 5: PROCEDURES & METHODS

1. Standards
2. Longevity
3. Side Bend Test
4. Pipe Bursting
5. Open Cut
6. Sliplining
7. Compression Fit (Swageling)

General Guidelines For Squeezing Off Polyethylene Pipe in Water, Oil and Gas Applications

TN-54

2017



ASTM AWWA NSF PPI CSA

The American Society of Testing and Materials is an international standards organization that collects and publishes information on technical standards of materials, products, systems and services in terms of their characteristics and performance.



ASTM Specifications

- ASTM D 3350-14
- ASTM D2239 water service
- ASTM D2737 water service
- ASTM D3035 water distribution, transmission
- ASTM F714 industrial, water, sewer
- ASTM D2683, F2206, D3261, F1055 fittings

AWWA

- AWWA C901 water service
- AWWA C906 -15 (accepts PE4710 materials)
- AWWA M55 Design Manual
- AWWA C651 Disinfecting

PPI

- Technical Notes
- Technical Reports

NSF

- NSF/ANSI 14 Compound
- NSF 61
- NSF 14

CSA

- B137.1 PE pipe for cold water pressure services

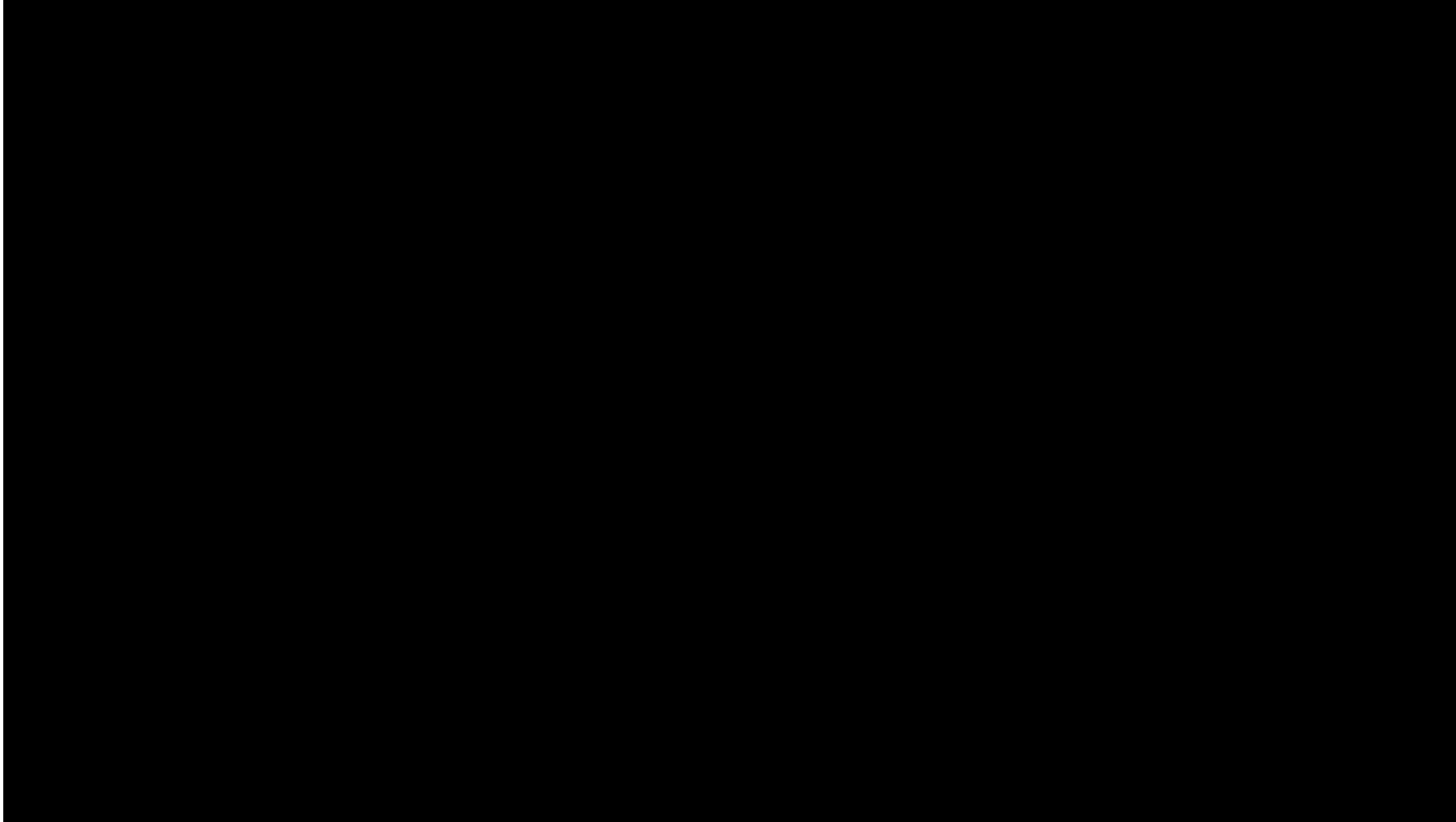
Longevity



Based on these results, and previous accelerated testing data, PE100 material, similar to the pipes exhumed from Great Gates, could last as long as 160 years, hence a minimum renewal rate of 0.7% per annum is needed.

UKWIR is the water research organization similar to our Water Research Foundation. They published a new study on the performance of HDPE pipe in the UK where 90% of the new and rehab water main market goes HDPE. They don't even consider metallic pipe.

Side Bend Test



Strong Yes But



Mechanics

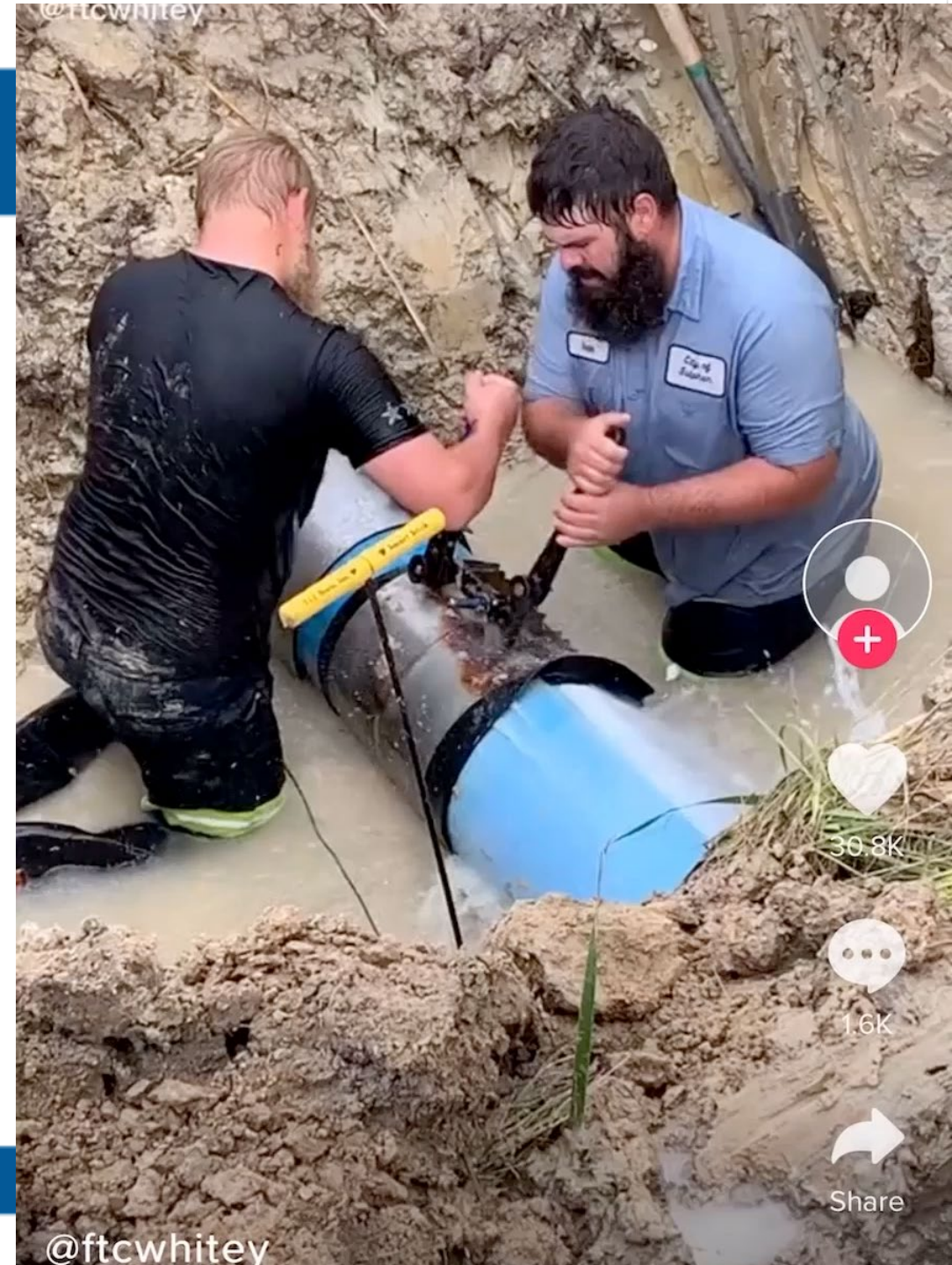


WWW.PEPIPE.ORG

PD/RK

People Unable to Post Bail are Being Imprisoned...

NowThis Politics



@ftcwhitey

30.8K

1.6K

Share

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Alan Ambler, PE aambler@pepipe.org

Aaron Davey adavey@pepipe.org

Dan Landy dlandy@pepipe.org

- Questions
- PDH (leave contact info in survey)
- Project Assistance
- Specification Writing
- Engineers Package
- Case Studies

Concepts, Terms & Gear

