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Cold Weather Operations

www.pepipe.org

Who is the Alliance?

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Social Media

Join thousands of **PE Alliance** followers!

 pepipeorg

 company/alliance-for-pe-pipe

 PEPipeAlliance

 hdpe4710

 allianceforpepipe

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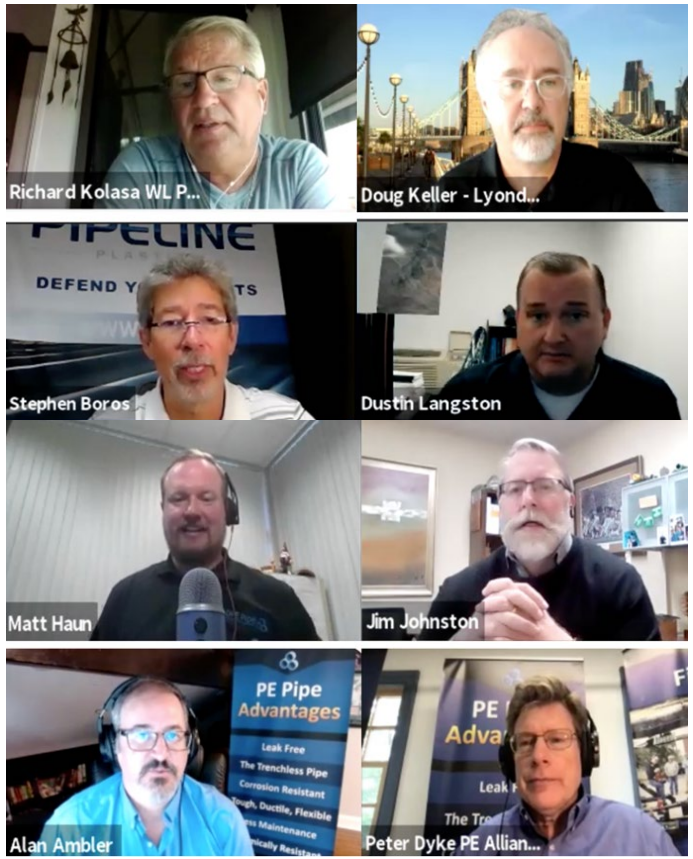
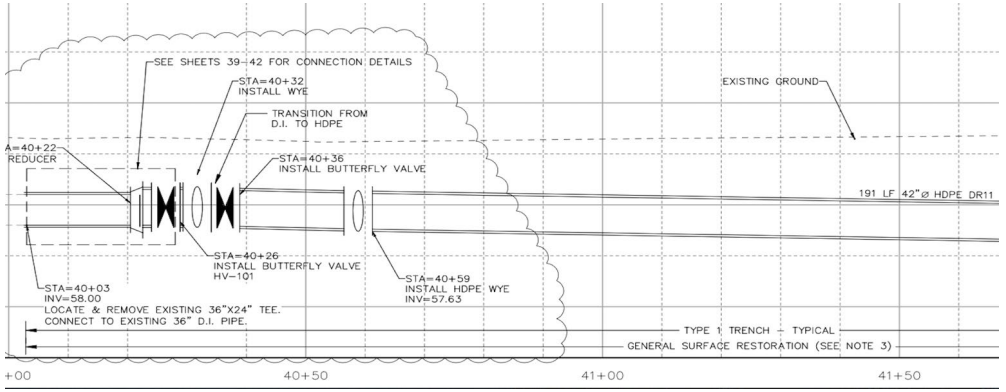
Free Resources

Email: DLANDY@pepipe.org

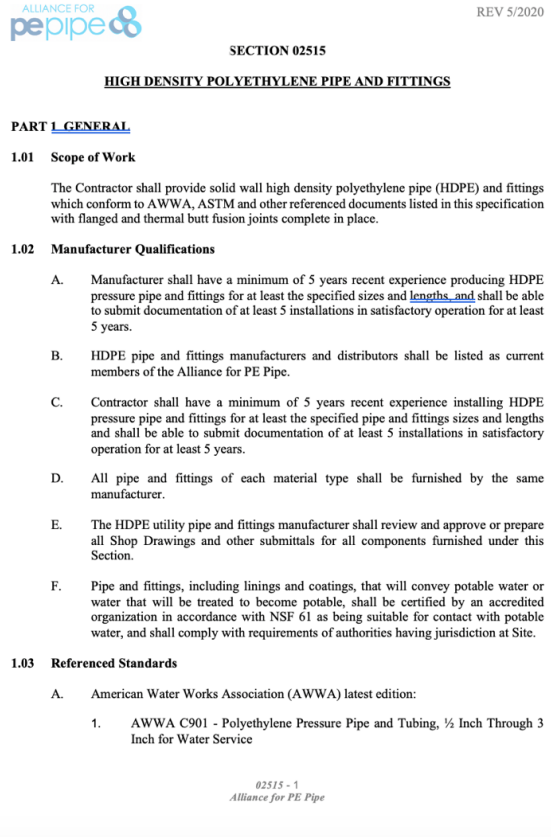
Schedule A Seminar



Project Review & Assistance



Spec Writing / Editing



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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, ½ Inch Through 3 Inch for Water Service

02515 - 1
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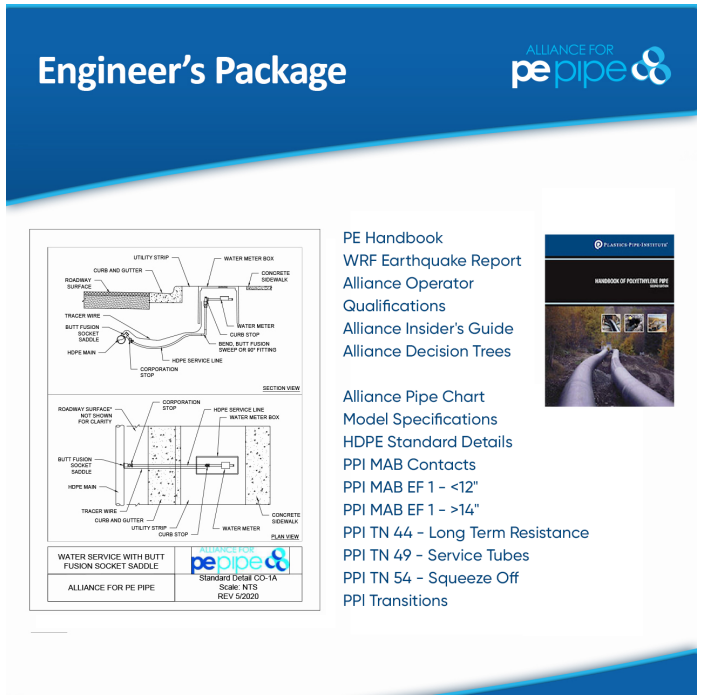
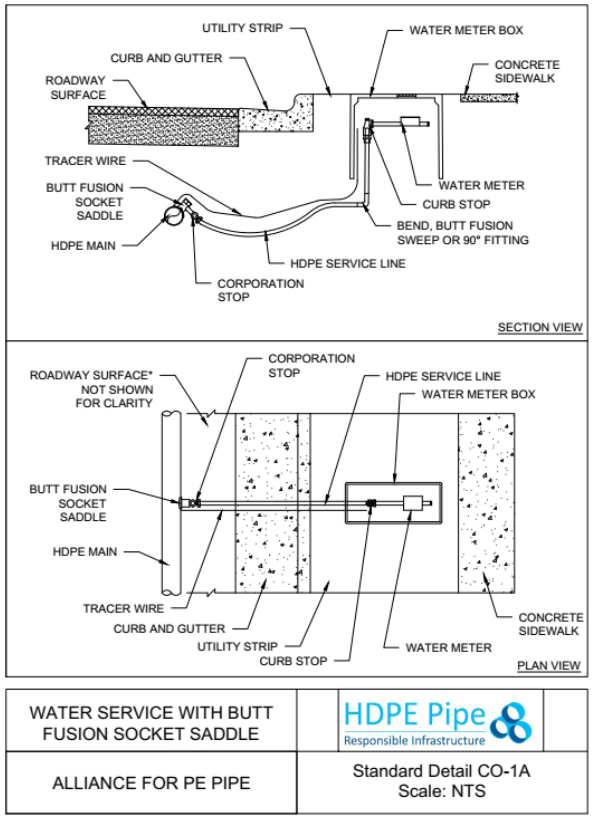
Free Resources

Engineer's Package



Standard Details



Case Studies

Email: DLANDY@pepipe.org

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Acknowledgments

Red Deer, Alberta
Integrity Fusion Products
ISCO Industries
SECOR
Core & Main
McElroy Manufacturing
PPI – MAB
ASTM
Sandale
Performance Pipe
WL Plastics
Pipeline Plastics
Fairbanks, AK
Strongbridge
ASTM

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

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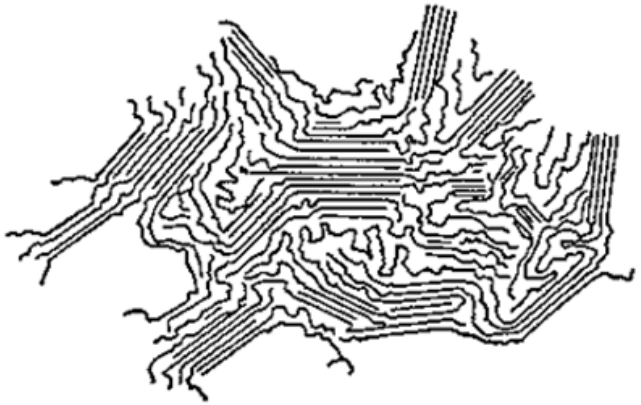
Training


SINCE 1981
McELROY
UNIVERSITY℠


INTEGRITY FUSION
ACADEMY
ELECTROFUSION INSTALLATION TRAINING

What is Polyethylene

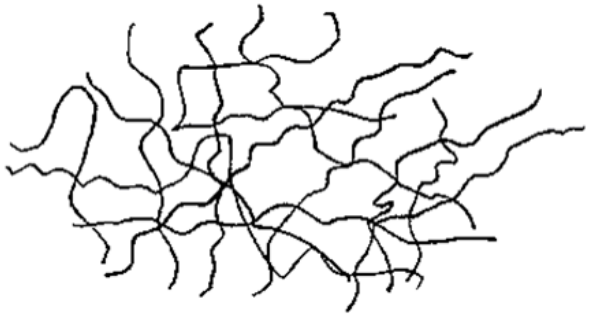
Semi-Crystalline Polymer



- Molecules pack in Tight Formations
- Up to 90% Crystalline region
- Side branching effects Density
- Tensile Strength, Stiffness, Abrasion, Hardness, Chemical Resistance

Thermoplastic

- Plastic that can be repeatedly softened by heating and hardened by cooling
- Process is reversible and repeatable
- Retains all physical properties



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Polyethylene - Thermoplastic

Molten

Heating

Solidified

Reshaping

Reform

Cooling

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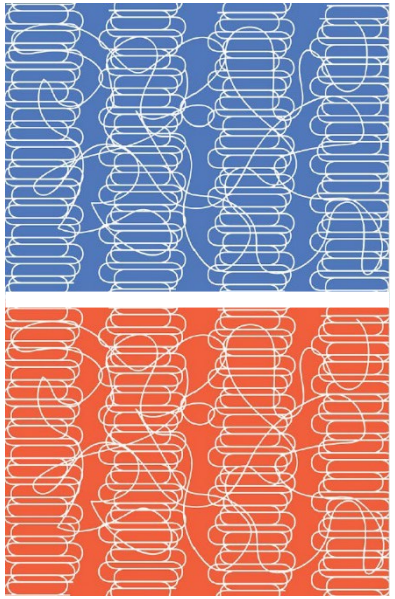
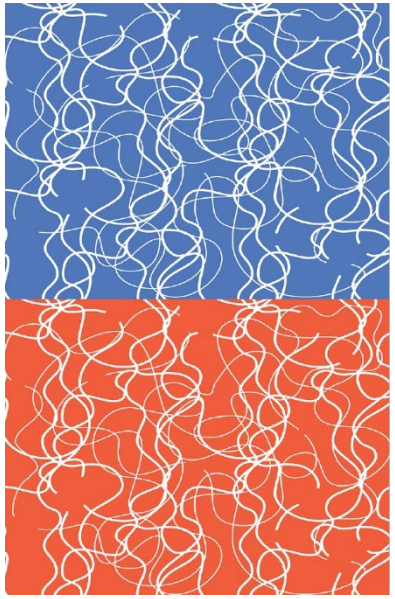
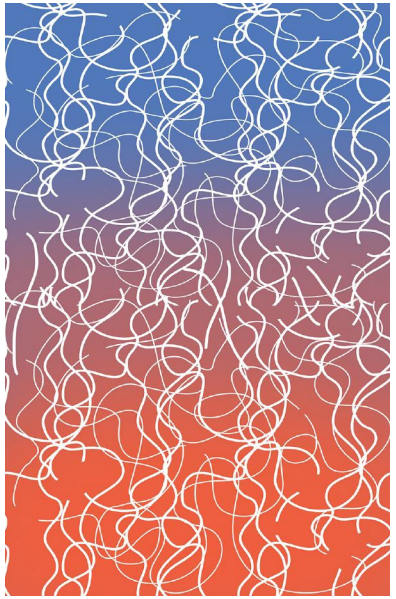
What Happens During Heat Fusion



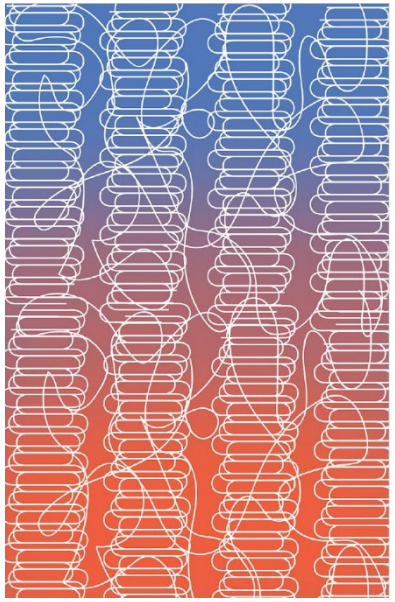
2 HDPE surfaces at rest. HDPE molecules in a semi-crystalline state



In the presence of heat the crystals disentangle



With time, the molecules travel across the boundary between the 2 surfaces



When cool, the molecules return to a semi- crystalline state across the fusion zone

T I M E

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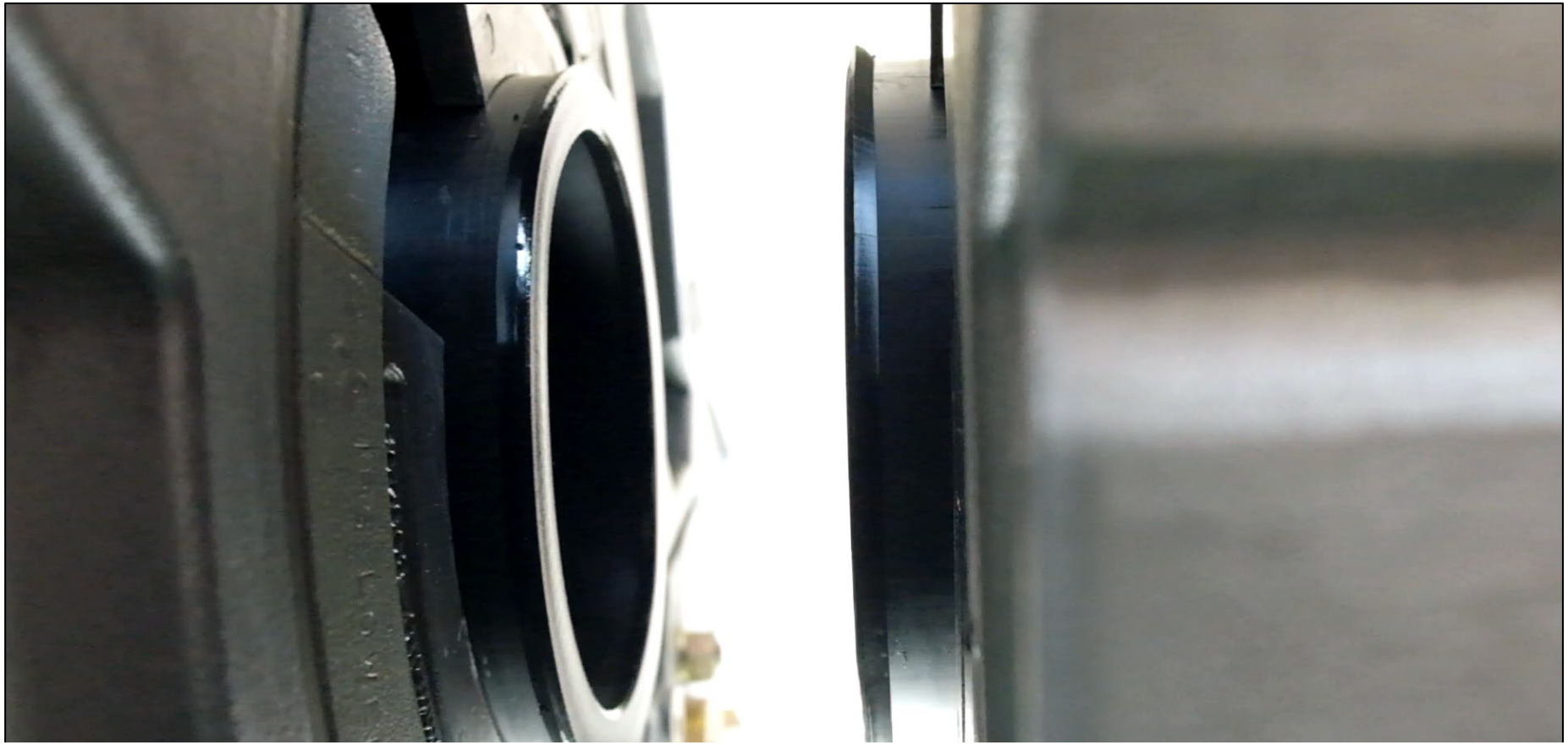
Strength of Fusion – Butt Fusion



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Butt Fusion –Steps to Completion

CLEAN IT, SHAVE IT, HEAT IT, FUSE IT!

Clean, clamp and align the pipe

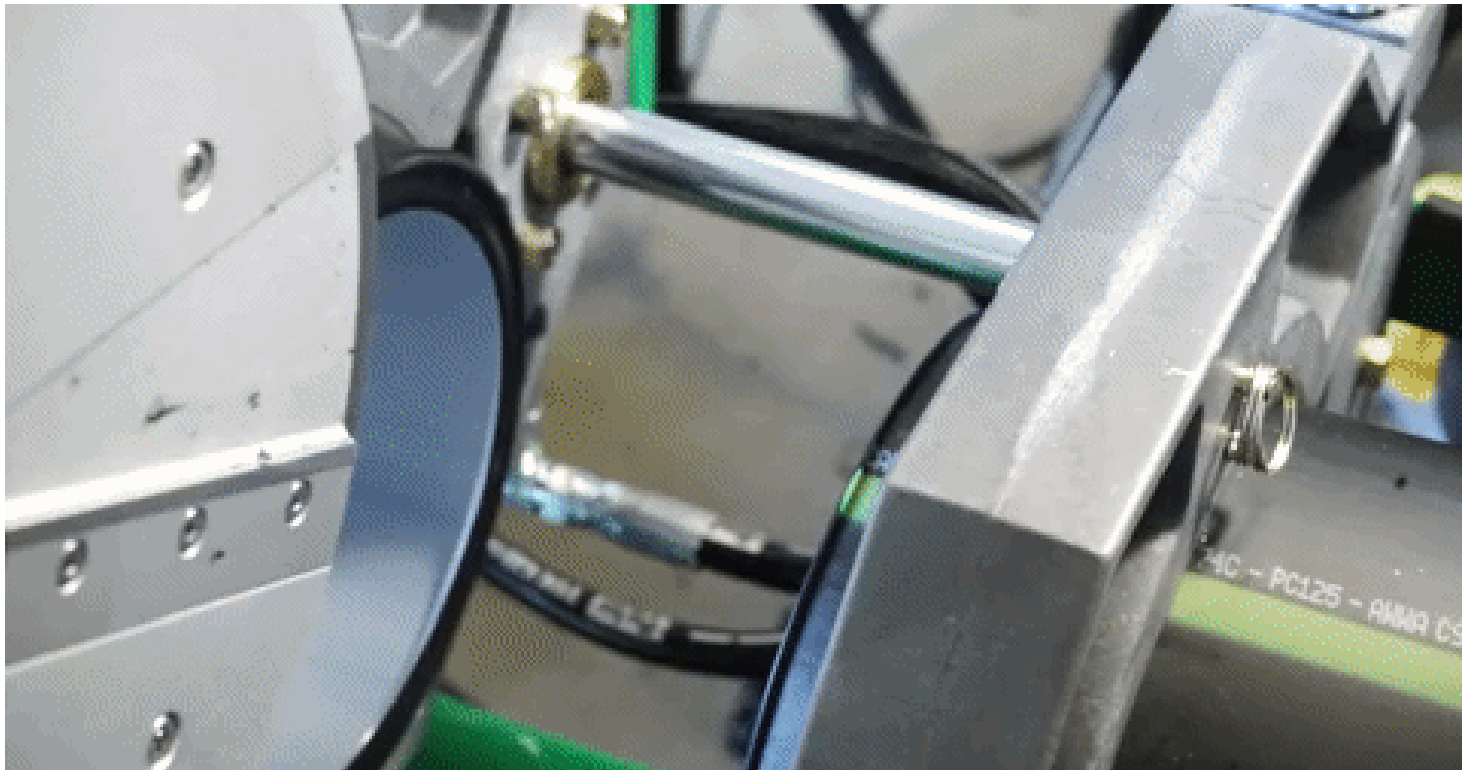
Face the pipe ends to establish clean, parallel surfaces

Align the pipe ends

Melt the pipe interfaces

Join the two pipe ends together by applying the force

Hold under pressure until the joint is cool



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Electrofusion – Process Overview

Requires an EF Fitting

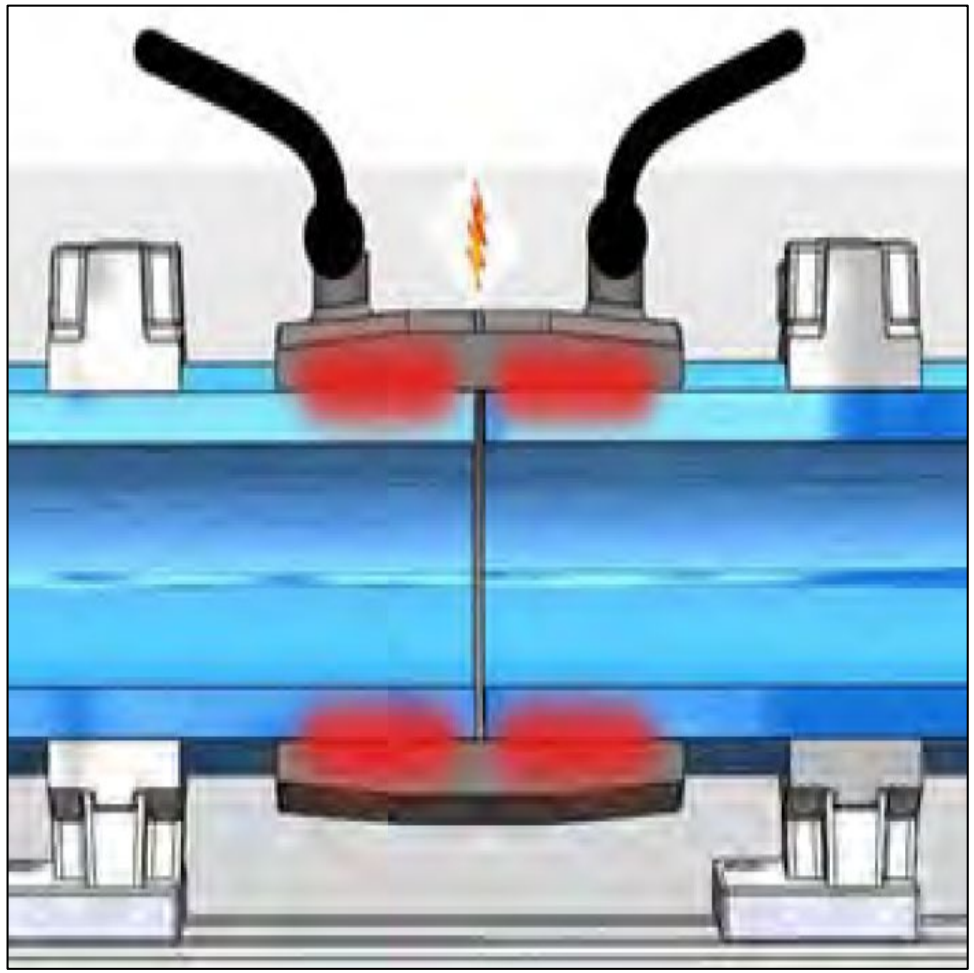
Peeled and Clean surfaces

Melt fitting - molten PE swells creating pipe contact

Pipe and Cold Zones contain melt and pressure develops

Molecules co-mingle during fusion time

Cool



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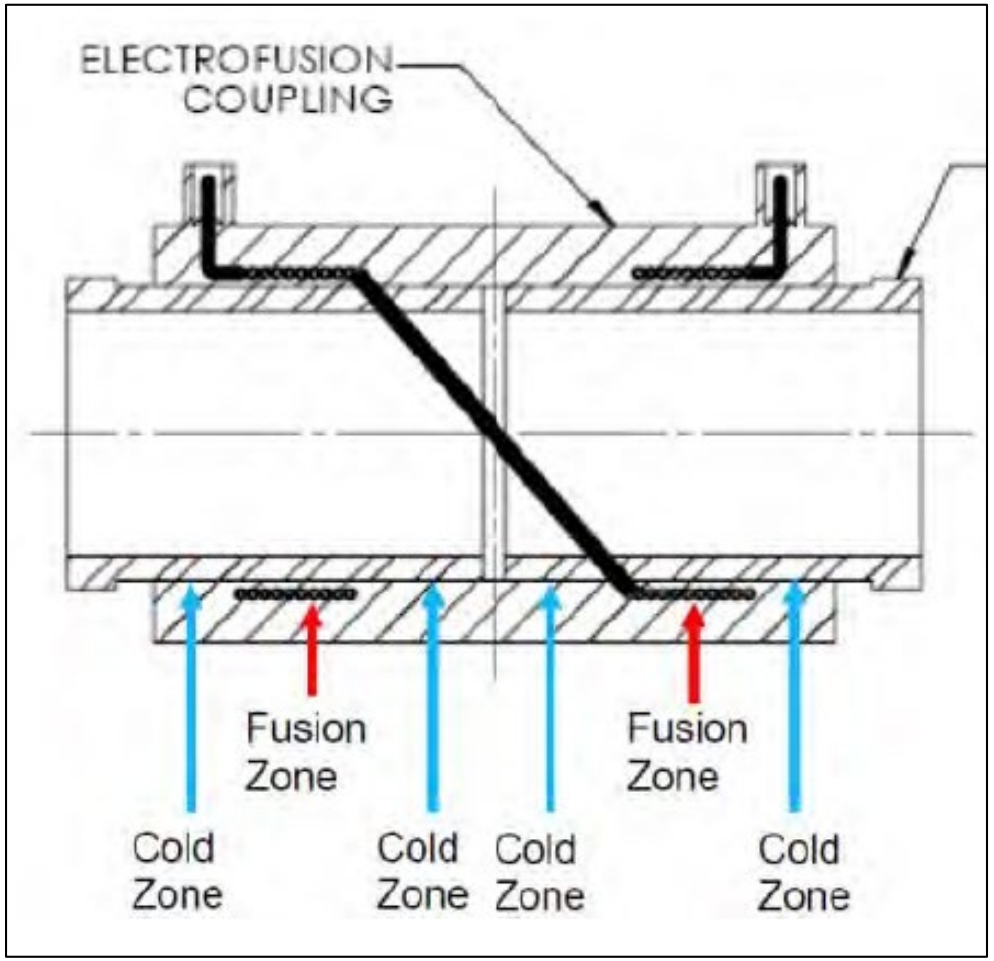
Electrofusion Fittings



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Electrofusion Processor

Electrofusion processor

Scans bar codes for any EF product

Recognizes product parameters instantly and performs required EF times for each specific fitting

Attached EF processor leads to EF fitting

Make certain information on EF processor screen matches barcode of fitting

Start electrofusion when ready

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Inclement Weather

"Inclement weather" is a generic term often used to describe **weather conditions that are either unsafe or undesirable for outdoor events**.

Inclement weather can come in many different forms (rain, snow, sleet, hail, cold, high wind, severe dust storm, extreme high temp).

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Safety

Safety must always be the #1 priority.

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HDPE Behavior & Things To Know

Water Can Freeze in HDPE pipe without Damage

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Insulated HDPE

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Use Tools to Help Align the Pipe

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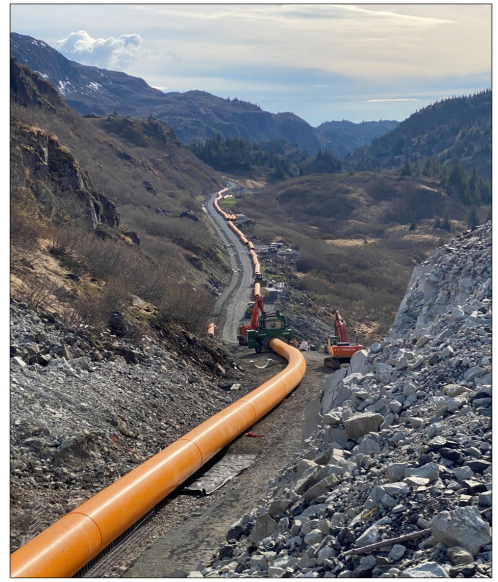
West Fork Upper Battle Creek Diversion

Innovative PE Solution

- State of Alaska, Bradley Lake Hydroelectric
- Engineer: Orion, GMC Contracting
- Project Type: raw water
- 2.3 miles DR17 63”
- Max grade of 18%, road built
- Utilized McElroy Talon
- “Toughest test yet for Talon” – Vince King



ISCO McELROY

What Is "Normal Operating Temperature?"

Most electrofusion fittings can be installed at ambient temperatures ranging from 14° F (-10°C) to 114° F (44.5°C) without any changes needing to be made to standard fusion times or procedures)

For temps outside of this temperature range, contact the fitting manufacturer for more information.

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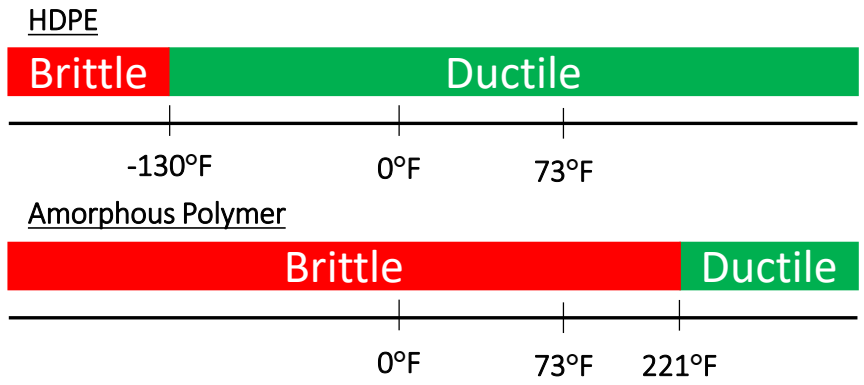
Temperature Operating Range

- Pressure Service Temperature between -40°F to 140°F
- Glass Transition Temperature for Polyethylene is -130°F



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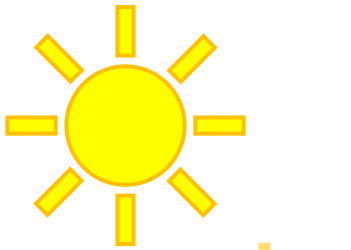
Thermal Effects – Temporary Condition

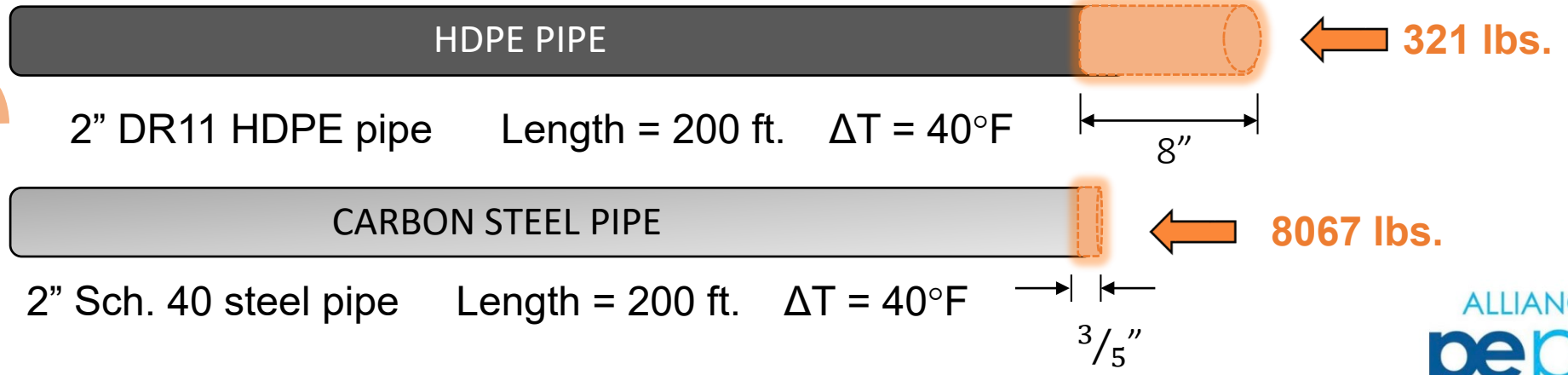
Thermal Expansion and Contraction

- PE expands and contracts at a rate of about 1 in/10°F/100 ft
- However, PE requires a much smaller force to restrain expansion and contraction compared to other materials

Piping Material	Coefficient of Thermal Expansion (α), in/in-°F	Elastic Modulus* (E), psi	Stress, psi ($\sigma = \alpha E \Delta T$)
^Carbon Steel	6.5×10^{-6}	29×10^{6}	188.5 x ΔT
^Stainless Steel	9.9×10^{-6}	28×10^{6}	277.2 x ΔT
Polyethylene	80×10^{-6}	0.065×10^{6}	5.2 x ΔT

*Polyethylene uses a time and temperature-dependent modulus of elasticity. Modulus shown in this table is for 10 hours at 73°F
^Values for carbon steel and stainless steel obtained from www.engineeringtoolbox.com





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Cold Weather

Lower temperatures require greater force to manipulate HDPE

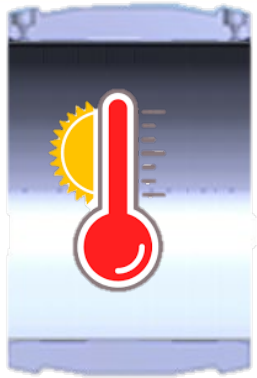
Coiled pipe is especially affected by cold weather

Understand how your uncoiling process is managed - higher pressures, slower speeds

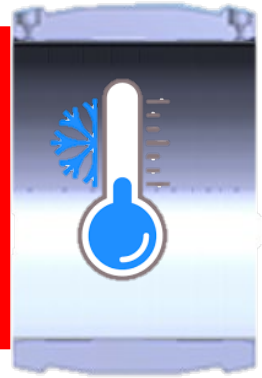
Safety procedures

System Equilibrium

Pipe & Fitting Acclimated to Same Ambient Temperature



Pipe acclimated to a **HIGHER** ambient temperature than the fitting



Pipe acclimated to a **LOWER** ambient temperature than the fitting

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Maintain Equipment

Use appropriate hydraulic fluid for the temperatures and the equipment manufacturer's recommendations

Hydraulic Fluid Characteristic Chart

Fluid	cST 100F	cST 210F	V.I.	−30°F −34°C	−15°F −26°C	0°F −18°C	15°F −9°C	30°F −1°C	45°F 7°C	60°F 15°C	75°F 24°C	90°F 32°C	105°F 40°C	120°F 49°C	135°F 57°C	150°F 65°C	165°F 74°C	180°F 82°C	195°F 90°C	Range
Mobil																				
DTE 10 Excel 15	15.8	4.1	168																	−16°F to 113°F −27°C to 45°C
DTE 10 Excel 32	32.7	6.6	164																	12°F to 154°F −11°C to 68°C
DTE 10 Excel 46	45.6	8.5	164																	23°F to 173°F −5°C to 78°C
DTE 10 Excel 68	68.4	11.2	156																	37°F to 196°F 3°C to 91°C
Univis N32	34.9	6.9	164																	12°F to 150°F −11°C to 66°C
Univis N46	46	8.5	163																	24°F to 166°F −4°C to 74°C
Univis N68	73.8	12.1	160																	39°F to 193°F 4°C to 89°C

NOTE: This chart is based on pump manufacturer recommendations of 13 to 500 cST. Temperatures shown are fluid temperatures not ambient temperatures.

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Check the Generators

Know what temperature the generators providing power on site are rated for

Check the amperage and voltage output of the generator in actual cold weather conditions

Varying power can affect the performance of fusion equipment

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Resources

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ASTM F2620-20A$^{\varepsilon 1}$

RESOURCES

ASTM

- ANNEX A1. COLD WEATHER PROCEDURES

Designation: F2620 – 20a$^{\varepsilon 1}$

An American National Standard

Standard Practice for Heat Fusion Joining of Polyethylene Pipe and Fittings[1]

This standard is issued under the fixed designation F2620; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

ε^1 NOTE—Table 2 was editorially corrected for clarity in October 2021.

ANNEXES

(Mandatory Information)

A1. COLD WEATHER PROCEDURES

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MAB-8

MAB Guidelines for Fusing HDPE Pipe in Cold & inclement Weather

RESOURCES

PLASTIC PIPE INSTITUTE
MUNICIPAL ADVISORY BOARD

Municipal Advisory Board
Established May 1, 2008 at the University of Texas, Arlington

HDPE MUNICIPAL ADVISORY BOARD

MAB Guidelines for Fusing HDPE Pipe in Cold and Inclement Weather
(MAB-8 2022)

https://plasticpipe.org/common/Uploaded%20files/Technical/MAB-08.pdf

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Cold Weather Fusion: MAB-08 Procedure

1. *Remove snow, ice and melted ice from pipe*
2. *HDPE has reduced impact resistance in cold weather - Don't drop pipe*
3. *Provide adequate enclosures without excessive heat*
4. *Plug or cap opposite ends of pipe*
5. *Ensure equipment is free of ice and snow*
6. *Ensure ID & OD are clear of moisture*
7. *Shield fusion area with an equipment shelter*
8. *Use portable space heaters. Direct fired heaters are not allowed in confined spaces*
9. *Preheat pipe*
10. *Keep heating tool in an insulated container between fusions*

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Golden Rule #1

BE PATIENT!

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Golden Rule #2

Change the conditions,
not the procedure

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Remove snow, ice, and melted ice from pipe

Remove any ice, frost, snow, dirt or contamination from the pipe and machine before loading into the machine

Clean and dry OD and ID of pipe in fusion zone

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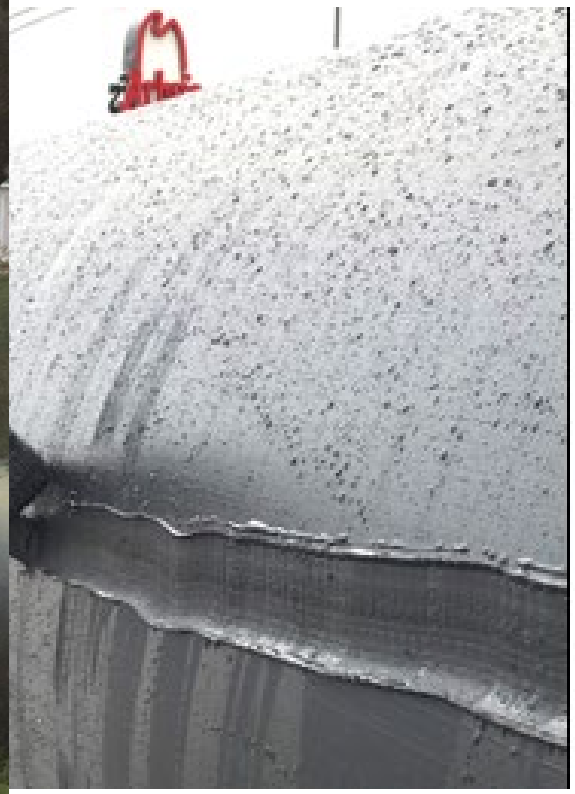
Examine Pipe

- Inspect for damage
- Cut out any compromised areas



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Don’t Drop The Pipe

HDPE has reduced impact resistance in cold weather

- *As always, handle with care to ensure pipeline integrity*
- *HDPE has the most impact resistance*

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Provide Adequate Enclosures

- *Without excessive heat*

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Protect The Fusion Area

Shield your fusion area from wind, dirt and moisture

- *Portable shelter*
- *Trailer*
- *Canopy*

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Protect The Fusion Area

ALLIANCE FOR pepipe

Protect The Fusion Area

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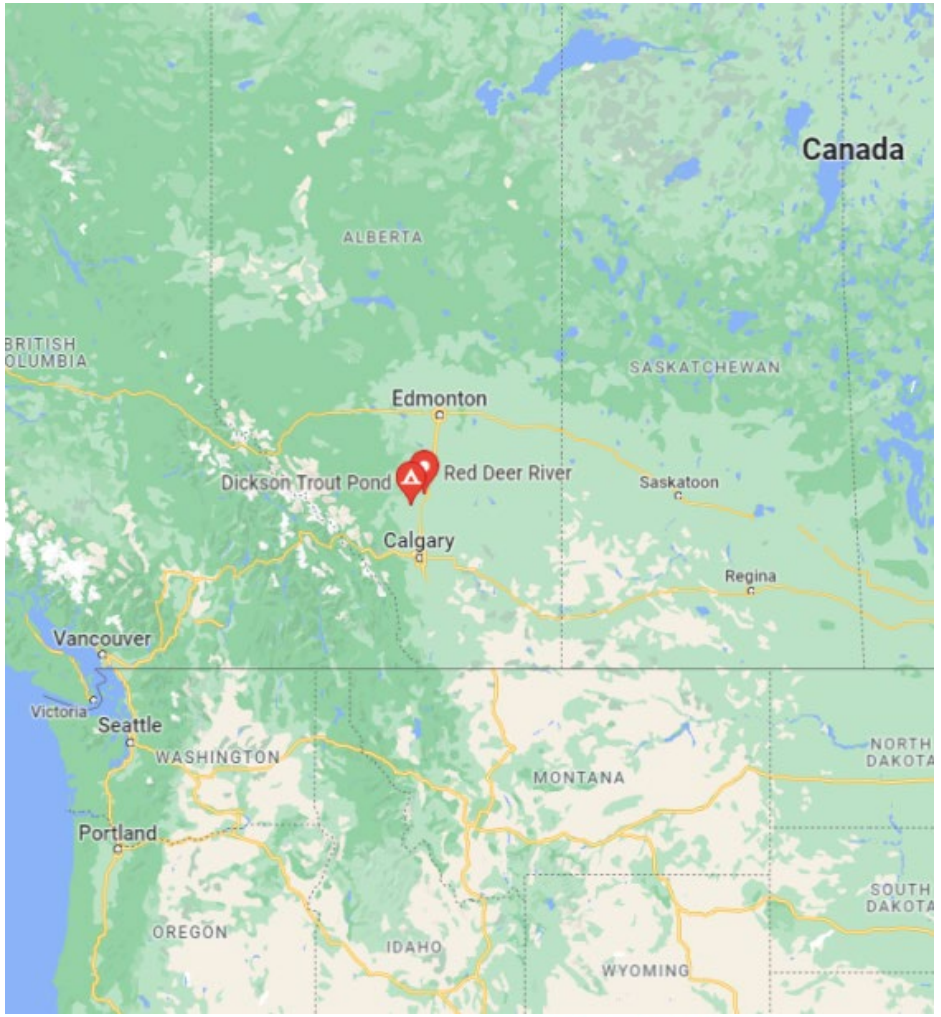
Central Alberta Regional Wastewater System, Red Deer

10 km pipeline in Red Deer

Larger project for 150,000 population growth

HDD and open cut to be used to install

Knibb Developments was the contractor for this project



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Central Alberta Regional Wastewater System, Red Deer

Previously attempted to use just tents

Opted for McElroy QuickCamp system

3300’ 32” HDPE was completed in 20 days

McElroy QuickCamp

Lighted, insulated and temperature controlled

Unfolds to 21’8”x24’7” shelter that has room for office or storage

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McElroy QuickCamp

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Use Tents, Tarps and Warm Air

Reels and/or stick pipes can be tented with tarps

Supply warm air from an indirect fired heater

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Plug Opposite Ends of Pipe

Ensure Equipment is Free of Ice and Snow

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Ensure ID & OD are clear of moisture

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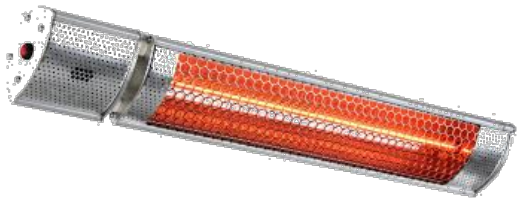
Use Portable Heaters

Salamander

Infrared heaters



Heating blankets

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Pre-Heat Pipe

Preheat pipe in insulated area

Do not heat pipe to great than 120° F (49° C)

Use multiple heaters or heating elements if necessary

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Protect the Heater

- *Keep heater in insulated bag or protective device until ready*
- *Check heater temperature before every fusion*

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Summary: Cold Weather Considerations

- Don’t Drop The Pipe
- Provide adequate enclosures
- Use Tents, Tarps, and Warm Air If Possible
- Protect The Fusion Zone
- Use Portable Space Heaters
- Pre-Heat Pipe
- Keep Heating Tool in Insulated Container

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Summary: Extreme Heat Considerations

- Understand thermal effects
- Provide adequate enclosures
- Protect The Fusion Zone
- Keep Heating Tool in Insulated Container

Summary: Windy Considerations

- Cap the pipe ends to protect fusion zone
- Provide adequate enclosure to protect fusion zone
- Keep Heating Tool Insulated Container

Summary: Precipitation Considerations

- Remove snow, ice & melted ice from pipe
- Ensure equipment is free of ice and snow
- Provide adequate enclosures
- Protect The Fusion Zone
- Ensure ID and OD are clear of moisture
- Keep Heating Tool in Insulated Container

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Dan Landy dlandy@pepipe.org

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

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