High Density Polyethylene Liners for Rehabilitation of Corroded Pipelines

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Introduction – HDPE Liners

- A cost effective and environmentally beneficial solution for protecting pipelines from internal corrosion and abrasion using high density polyethylene pipe.
- Applications include potable water, pressurized sanitary sewers, oil and gas pipelines, slurry and tailings pipelines.
- Basic and general knowledge of liner installation types will ensure successful project

Why HDPE?

- Chemical Resistance
- Corrosion Resistance
- Abrasion Resistance
- Toughness
- Ductility
- Flexibility
- Relative low cost

HDPE Liner in a Steel Pipeline

Interactive vs. Structural Liners

- Interactive Liners
  - For use where host pipe is structurally sound
  - Leaky joints, failed coatings
  - To span holes and gaps

- Structural Liners
  - For use where host pipe is NOT structurally sound
  - Severe corrosion
  - External Corrosion

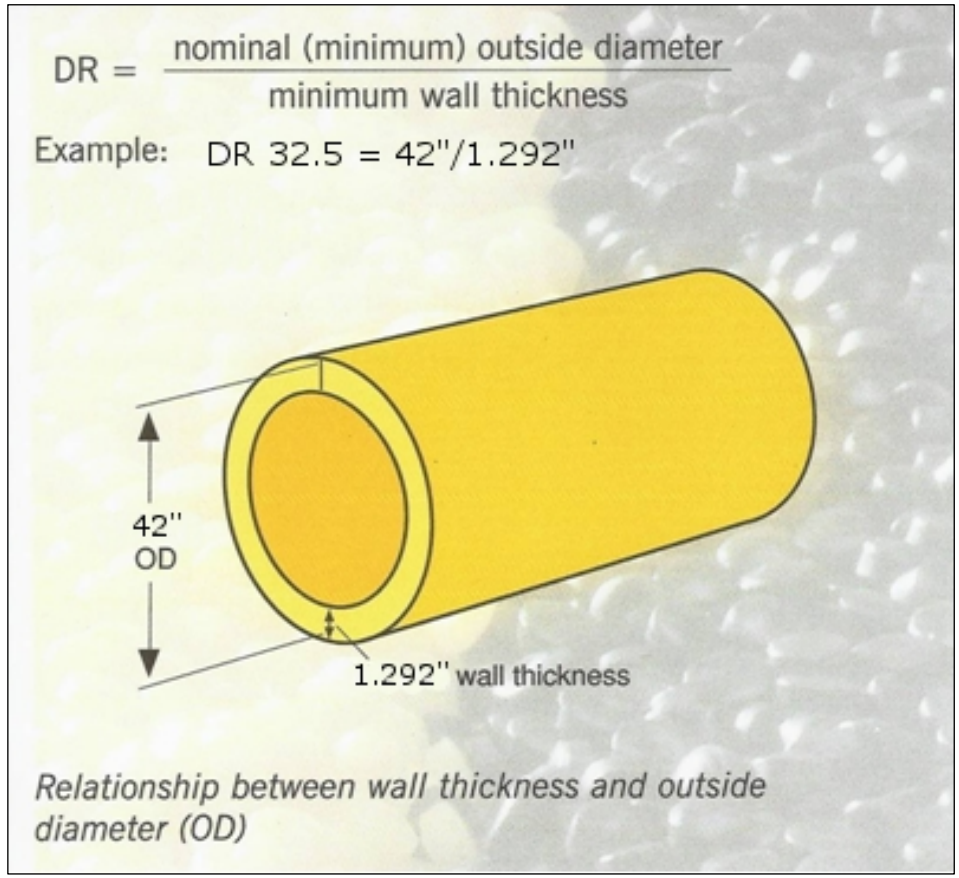
Tight Fit vs. Close Fit Liners

- Tight Fit Liners
  - Liner OD > Host ID
  - Constant hoop-compression
  - “Locked in” place

- Close Fit Liners (not “Slipliners”)
  - Liner OD slightly smaller than Host ID
  - Constant hoop-tension
  - Liner cycling possible

Pressure Ratings

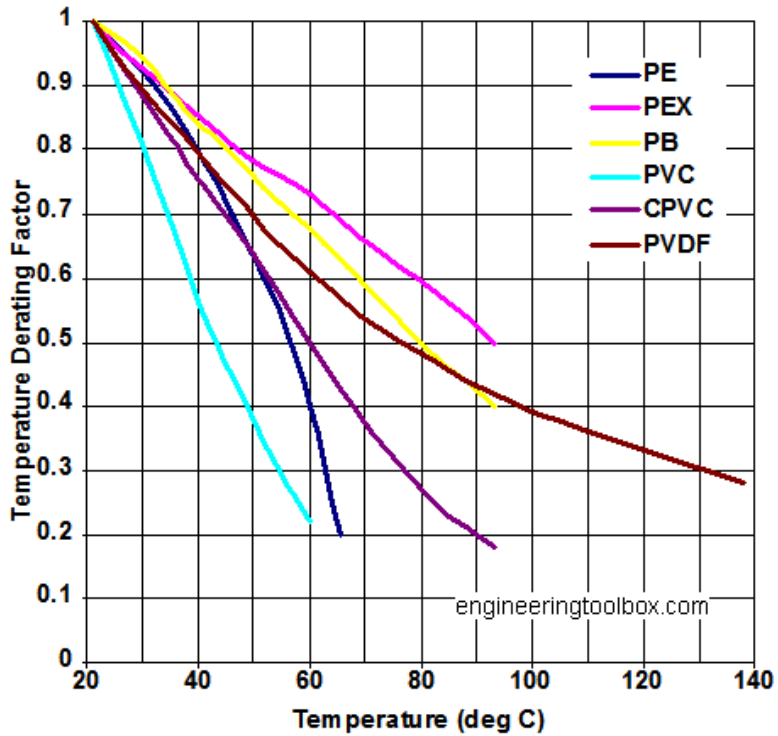
- Pressure ratings for interactive liners are determined by host pipe
  - No limitation on the pressure achieved
- Pressure ratings for structural liners are determined by HDPE “dimension ratio”
  - Pressure rating limited to HDPE extrusion limitations or installation method limitations (Generally max. 10 bar)



Relationship between wall thickness and outside diameter (OD)

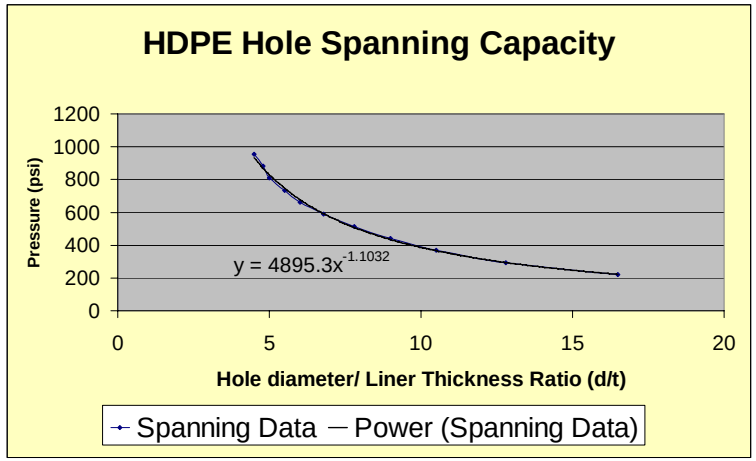
Temperature Ratings

- For interactive liners the HDPE softens but protective barrier remains. Temperatures up to 92C
- For structural liners the pressure rating must be reduced according to temperature. Generally not an issue for municipal applications



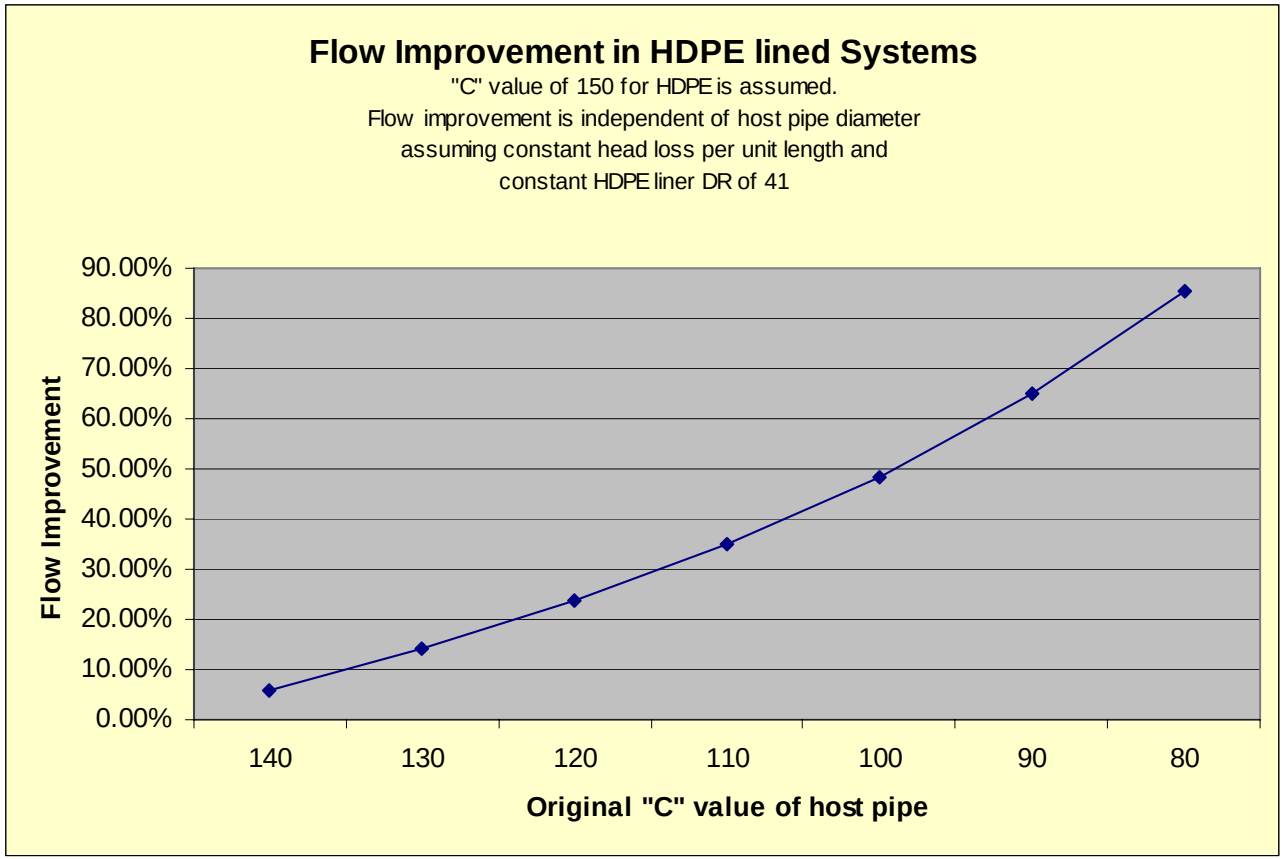
Hole and Gap Spanning

- Hole spanning is a function of pressure, hole diameter, and liner thickness
- Example - Theory
- Example - Test: 10 inch pipeline at 69 bar. 25mm diameter hole – no liner movement and no leaking.



Flow Improvements

- Despite slight reduction in diameter, interactive liners result in increased flow.



Liner Reduction Methods

Roller Reduction

- Diameter of HDPE is temporarily reduced (elastic deformation).
- For installation of tight fit liners
- Can be used for interactive or structural
- Timing is critical – liner is growing back to original OD

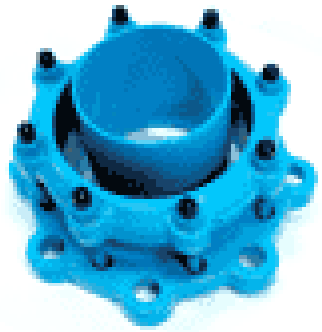
Folded Liner

- Can achieve significant cross section reduction
- For installation of close fit
- “Fuse and Fold” facilitates small worksite footprint
- Generally for interactive liners, but sometimes structural
- After installation banding is broken with water pressure.

End Terminations - Mechanical

- For interactive liners a mechanical coupling is used to terminate the end and seal the liner/host pipe annulus

- For structural liners a mechanical coupling is connected to the HDPE and not the host pipe



End Terminations – “Stubend”

Practical Considerations

- Liners best suited for relatively long straight sections of pipe
  - Less digging
  - Fewer installation sections
  - Large scope offsets tooling costs
- Liner cannot pass through fittings, tees, or taps
- Intelligence of pipeline condition
  - Previous repairs
  - Changes in wall thickness

Case Study – 12” Pressurized Sewer Main

- The Challenge
  - Affluent residential community, elementary school
  - Fluctuations between heavy rain and drought cause clay soils to shift
  - 30-year old 12” cast iron sanitary sewer main experiencing multiple repairs due to cracking
  - Over the past 30 years new pipelines, telephone lines, power cables, fiber optic cables installed above the sewer main

Case Study – 12” Pressurized Sewer Main

- The Solution
  - Fully structural liner required – host pipe was not expected to withstand operating pressure due to long longitudinal cracking
  - Tight fit liner to maximize internal diameter and flow
  - Rollerbox installation method best suited due to HDPE thickness and jobsite layout

Case Study – 12” Pressurized Sewer Main

- The Project
  - Summer break for school
  - Bypass required
  - No pre-installation video inspection available
  - Pre Fuse liner for quick installation
  - Excavate pits
  - Unknown repairs found!

Case Study – 12” Pressurized Sewer Main

- The Result
  - Extra pit excavation required to remove repair
  - Liner installed and pressure tested in 2 days
  - Tie-ins made and bypass removed. Restorations.
  - “Full replacement would have cost us 2 to 3 times as much and been much more disruptive to our residents”

Case Study – 48” Potable Water Main

- The Challenge
  - Madison Avenue, Manhattan New York
  - One of the most recognized areas for upscale fashion and finance
  - 150 year old 48” cast iron potable water main
  - Removed from service due to leaky joints
  - Impractical to dig in the streets

Case Study – 48” Potable Water Main

- The Solution
  - Host pipe structurally sound just needed to span leaky joints and stop future corrosion
  - Interactive liner installed by the folded method
  - To minimize public impact work at night only.
    - Access pits during week
    - Close 2 lanes for the weekend

Case Study – 48” Potable Water Main

- The Result
  - Logistics and coordination were carefully defined
  - Sections installed, end terminations fitted, liner reverted, pressure test, chlorination
  - Returned to service after being out of service for years
  - Social impact minimized, existing asset utilized instead of abandoned

Questions?

Thank you!

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