Repair of In-Service HDPE Water Distribution Pipe

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Task A (USA Survey)

Large Number (95) Utilities Contacted*

- Relative frequency of repairs (HDPE vs. other pipe types)
- Description of damage or leakage experience
- Circumstances of repairs
- Type of repair couplings and fittings normally stocked by utility
- Repair methods actually employed
- Repair time
- Repair cost

* Primarily water (but also some gas) utilities.
Large Number Utilities Contacted (cont’d)

- Initial vs. permanent repairs and types (mechanical vs. fusion)
- For fusion repair, methods used to create clean dry environment
- Long-term evaluation/reliability
- Training of maintenance crews
- Additional required support from manufacturers.
- “Best” type of repair (utilities’ experiences)
Task B (Europe Survey)

Relatively Few (19) Utilities Contacted

- Similar objectives as US Survey
- Questionnaires completed by 9 water utilities:
  - UK 6
  - Germany 2 (questionnaire translated to German)
  - Belgium 1
- Responses received from 9
- All are water utilities and big users of PE pipe
- Interviews held with 5 in UK, Germany and Belgium
Task C (Manufacturers Survey)

Large Number (36) Mfrs/Distrs Contacted

• Manufacturers’ products for field repair of HDPE pipe
• Length of time available
• Sales volume (if provided)
• Customer support and training
• Reported errors commonly made by users
• Feedback regarding field performance of products (as available; see Task A)
• Recommendations or suggestions improving reliability of repairs
• Manufacturers’ method of verifying product reliability
USA Respondents

![Graph showing the length of installed pipe for USA respondents.](chart.png)
Europe Respondents

![Bar chart showing responses in kms by categories](chart.png)
Fusion vs. Mechanical

Fusion (heat or electrofusion)

• Ideal for new installations
  • Essentially seamless
  • Leak proof
  • Retains full strength (e.g., for trenchless pulling)

• Not necessarily optimum for in-service field repairs
  • Requires clean, dry conditions
  • Requires skill, judgment for such applications
Fusion vs. Mechanical

Mechanical

- May be used for new installations, if convenient
  - Fittings may be installed in pit
  - Minimal training and equipment
  - Improper installation typically evident upon pressurization

- Most appropriate for in-service field repairs
  - Forgiving to non-ideal field conditions
Failure Causes (USA)
Failure Causes (Europe)
Fusion – Errors/Failures

- Improper Surface Preparation: 3
- Inadequate Clamping During Cooling Phase: 2
- Improper System Design: 2
- Not providing Dry/Clean Conditions: 9
Mechanical – Errors/Failures

- Improper Tightening: 10
- Rubber Gasket Not in Place: 1
- Lack of Stiffener Insert: 5
- Failure to Home Pipe into Fitting: 3
- Lack of spring washers on service saddles: 3
Main Conclusions

• Fusion procedures difficult to perform for typical field repairs of leaking water pipes
  • Requires clean, dry environment
  • Skill, judgment

BUT

• Mechanical connections/repairs can represent efficient, practical permanent repairs
Recommended Mechanical Repairs

Localized Damage (full-circle band clamps)

(Courtesy Teekay)
Recommended Mechanical Repairs*

Extensive Damage (replace section)

- **Circumferentially bolted** mechanical coupling
- **Radially bolted** type mechanical restraint with MJ gasket
- **Compression fittings** (various types), using internal stiffeners, with full axial restraint capability, as available (may depend on pipe size)

* Typically require inserts.
Recommended Mechanical Repairs

Circumferentially bolted

(Courtesy Victaulic®)  (Courtesy Robar/ARPOL®)
Recommended Mechanical Repairs

Radially bolted (fitting, ...)

(Courtesy Star® Pipe Products)
Recommended Mechanical Repairs
Radially bolted (dissimilar pipe materials)

(Courtesy EBAA Iron, Inc.)
Mechanical Repair Procedure

Repair Assembly Using Spool Piece and Sleeves

Step 1.

Step 2.

Step 3.

Step 4.

Notes:

1. This method of repair is acceptable when area is wet or fusion equipment not available.

2. All steps must be followed.
Conclusions

• 25% water distribution in Europe is of HDPE -- order of magnitude greater than that in the USA

• Fusion difficult and sometimes impractical for field repair of leaking water lines

• Mechanical solutions, properly installed, represent permanent repairs for water distribution applications

• Most mechanical repair fittings for HDPE pipe will also repair DIP and PVC pipe; converse not true

• Most water applications use DIPS sizes vs. some HDPE fittings with only IPS sizes currently available
Conclusions (cont’d)

• When pipe section replacement not necessary (local damage): recommend full circle band clamps

• When pipe section replacement necessary (more extensive damage):
  • Radially bolted
  • Circumferentially bolted
  • Compression fittings (may depend on pipe size)

• Fusion methods require proper (extensive) training, including judgment when not to apply
THANK YOU!

(Please provide feedback on results of applications)