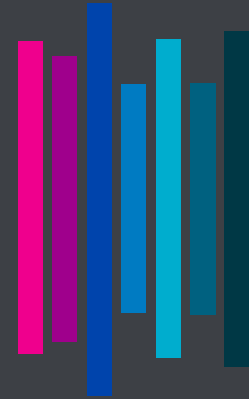


## Utilities - Continual Improvement

### PE Welding

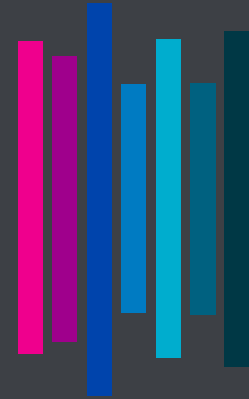
- Electro Fusion
- Pressure Testing

EXOVA



Steve Gordon

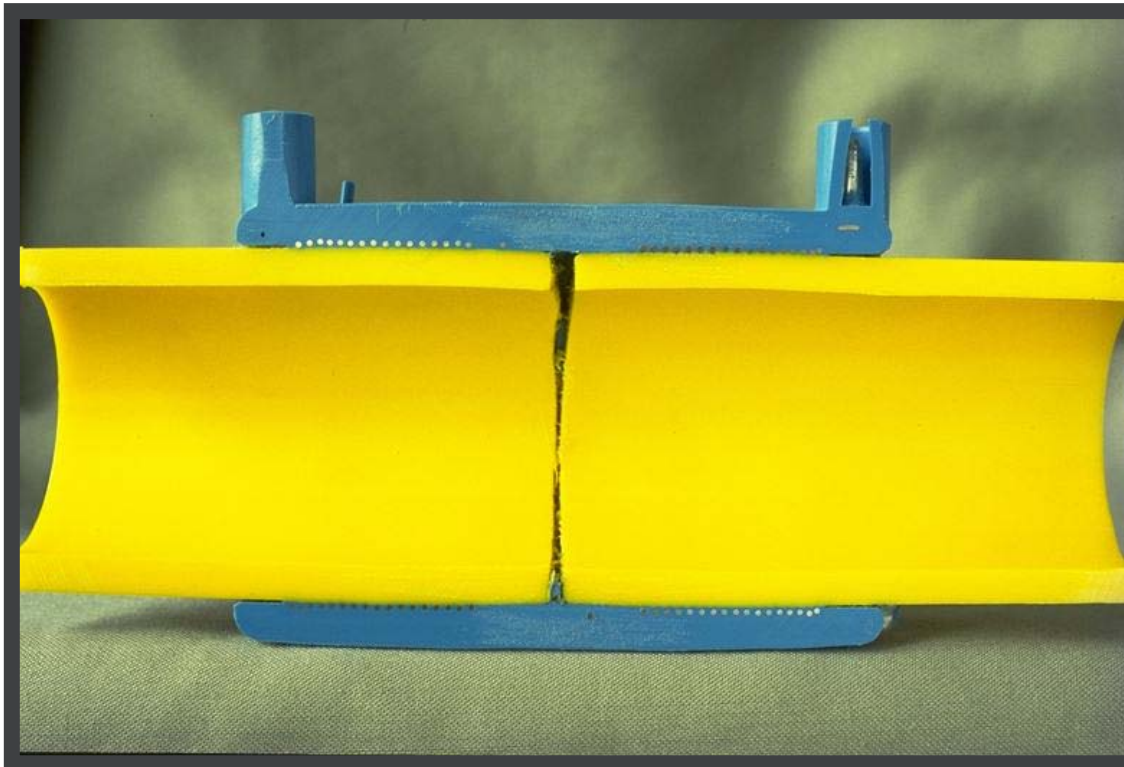
**EXOVA**



# **PE Jointing Fusion Welding**

# Electrofusion Welding of PE

Ideally, this System

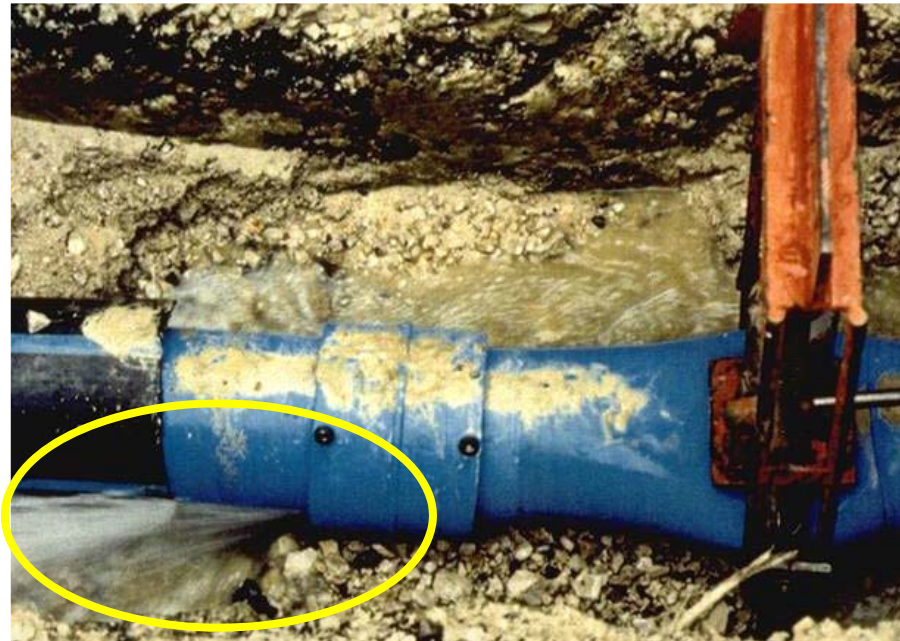


Should perform like this:



EXOVA

## Service Failures of Electrofusion Joints



**And not this:**

**EXOVA**



## Electrofusion Fitting Failures

- Majority of problems seen are:
  - Unsatisfactory training
  - Poor welding practices: Clamping (Misalignment), Scraping, Moisture and Contamination
  - Poor or unsuitable equipment
  - Excessive pipe ovality

## Training perception of trench welding?



---

**EXOVA**

## Reality







---

**EXOVA**

**... in Summer**

# Understanding Electro Fusion Welding Principles

- **Prepare** → 
- **Align** → 
- **Cook** → 
- **Cool** → 

---

**EXOVA**



## Why do we scrape pe pipes?

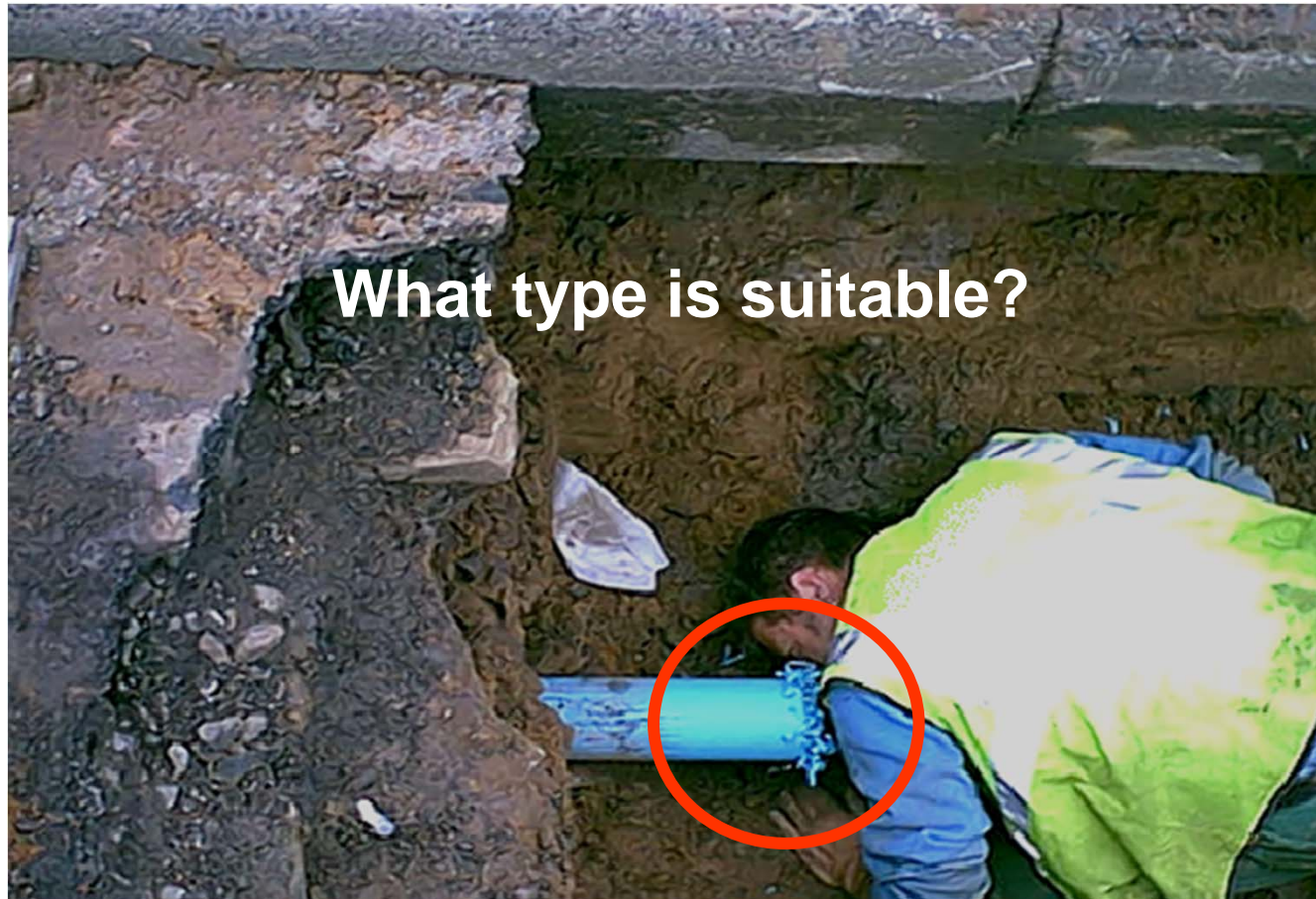


**Pigmentation**

**UV Stabiliser Packages**

**Oxidisation**

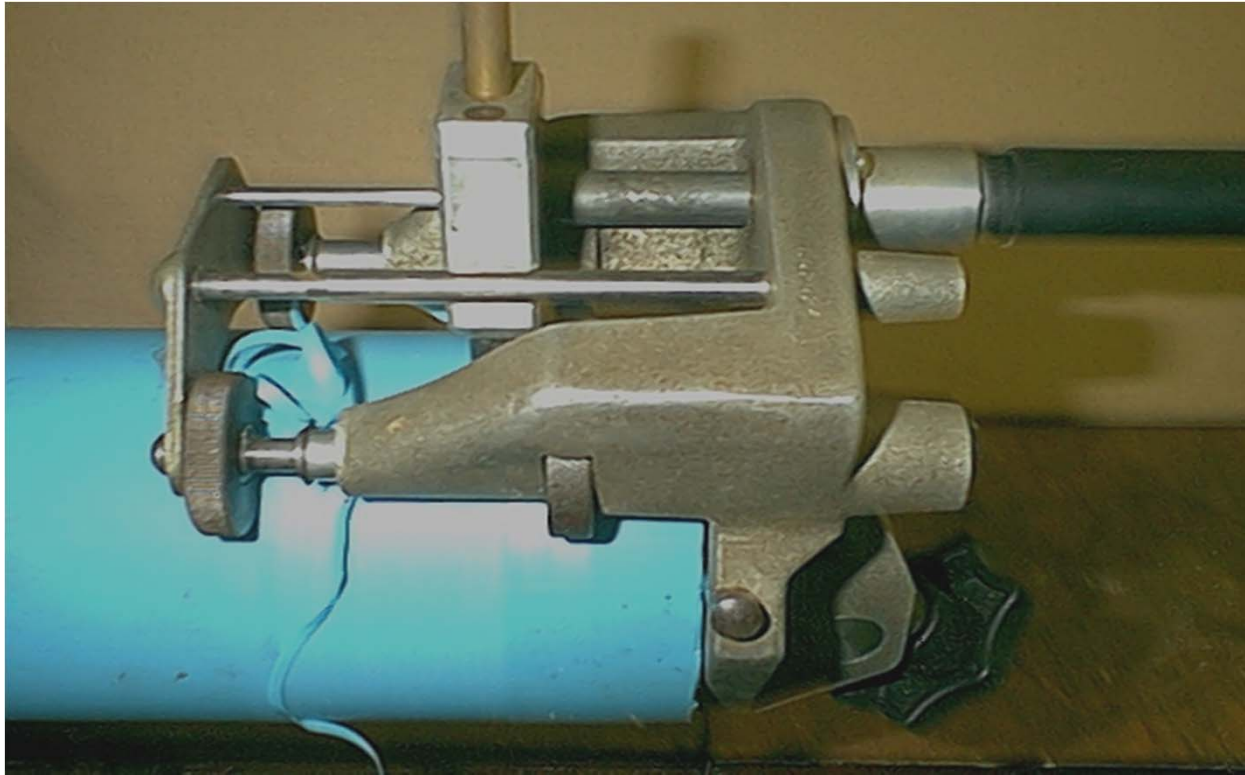
# SCRAPING



---

**EXOVA**

## PREFERRED METHOD



Mechanical scrapers provide a uniform removal of between 0.2 to 0.4mm during pipe end preparation

---

**EXOVA**

## Hand Scraping



---

**EXOVA**

# CONTAMINATION

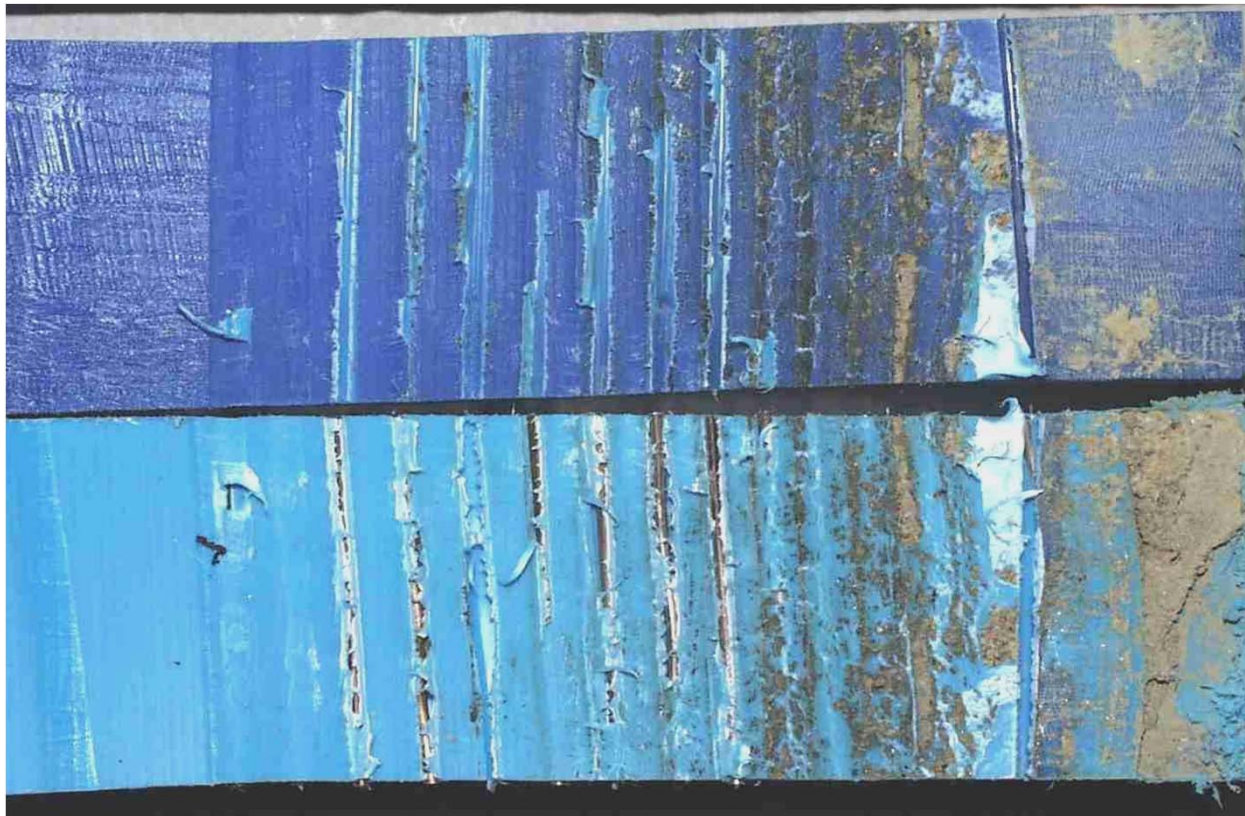


---

**EXOVA**

# CONTAMINATION

When contamination is present on the pipe or coupler, fusion becomes increasingly more difficult to achieve!

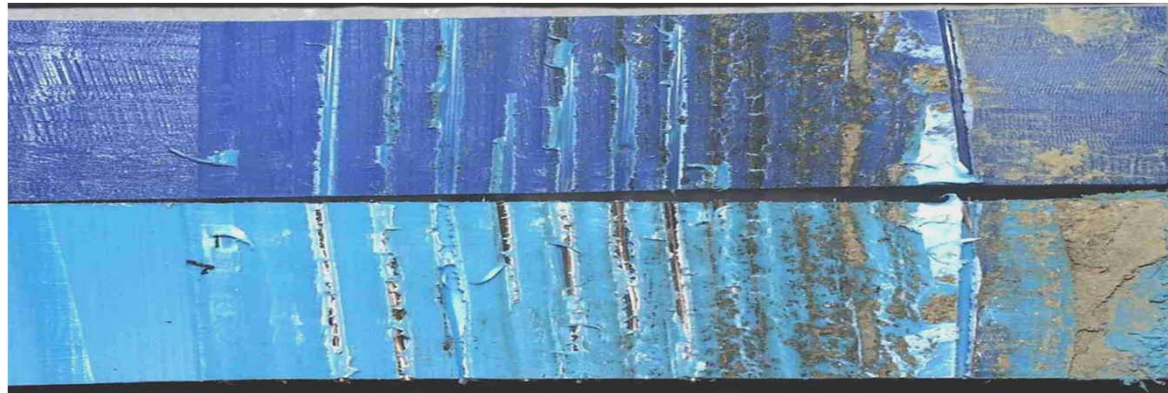


---

**EXOVA**

# WIS 4 32 08

|                  |                 |                      |                        |
|------------------|-----------------|----------------------|------------------------|
| >75% Ductile and | $K > 1.7$       | Pass                 | Satisfactory           |
| <75% Ductile and | $K > 1.7$       | Technical failure    | Problems very unlikely |
| <75% Ductile and | $1.2 < K < 1.7$ | Non-critical failure | Problems unlikely      |
| <75% ductile and | $K < 1.2$       | Critical failure     | Problems likely        |



## CONTAMINATION



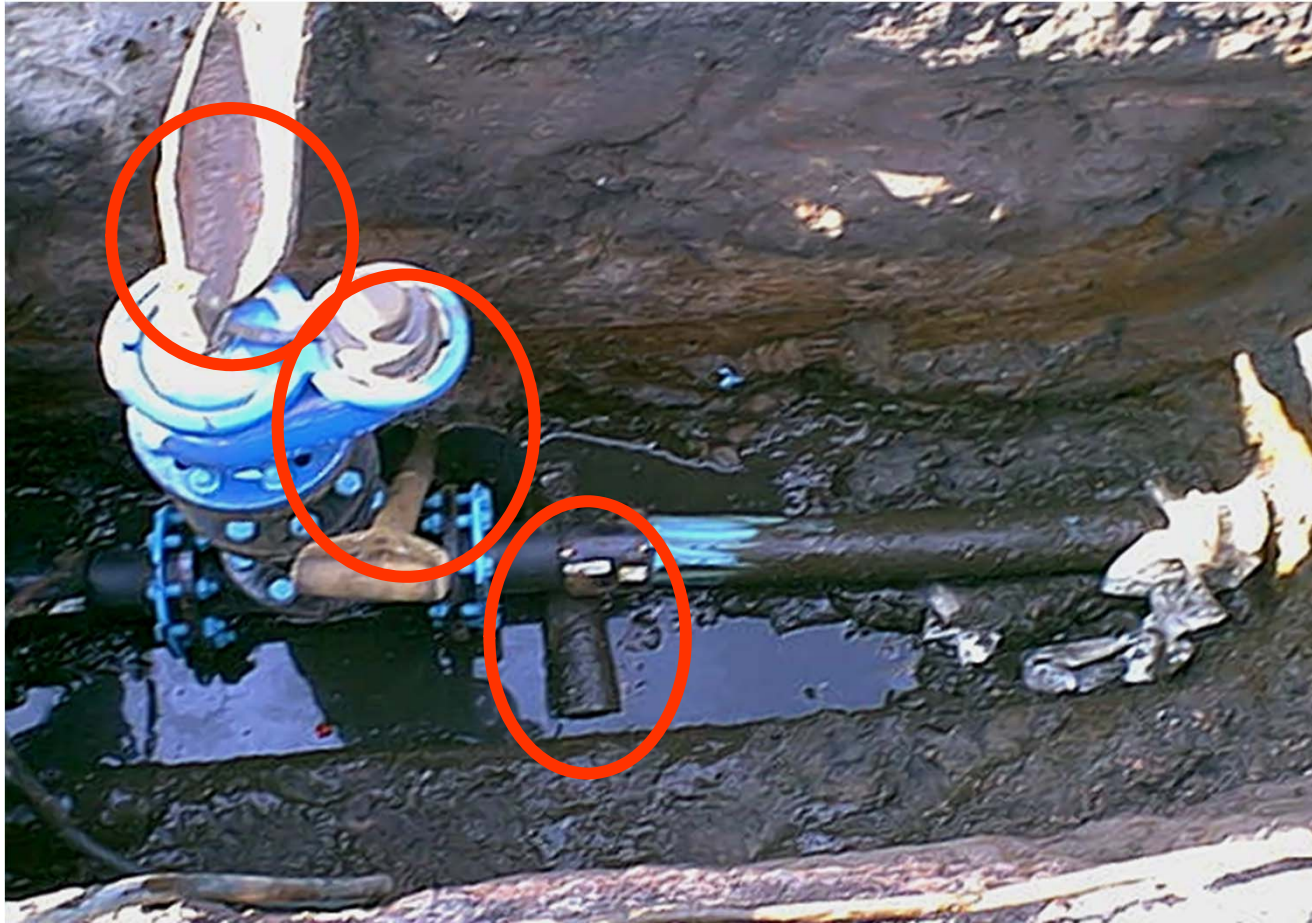


## ALIGNMENT - OVALITY



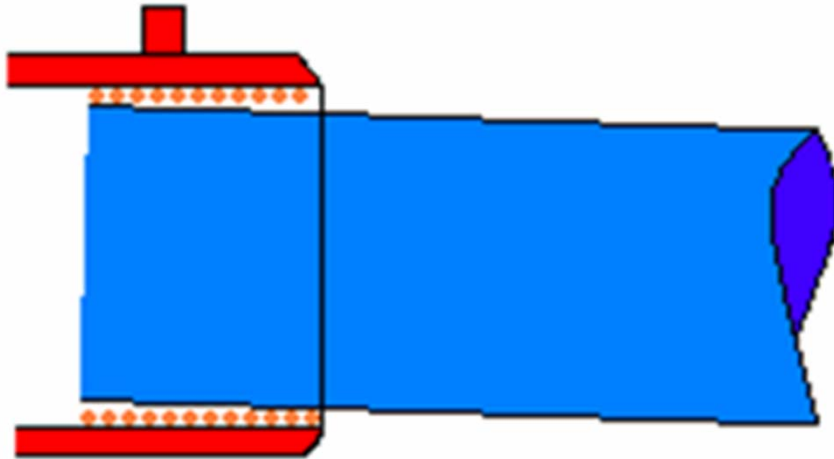
Suitable alignment clamps can assist with re-rounding of pipe

# MISALIGNMENT



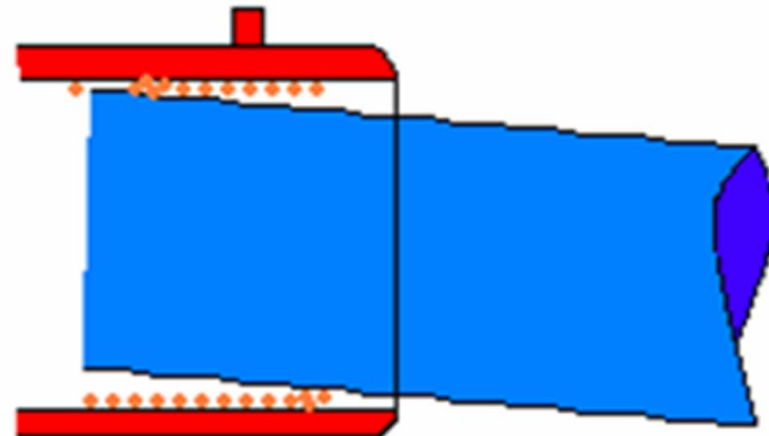
EXOVA

# MISALIGNMENT

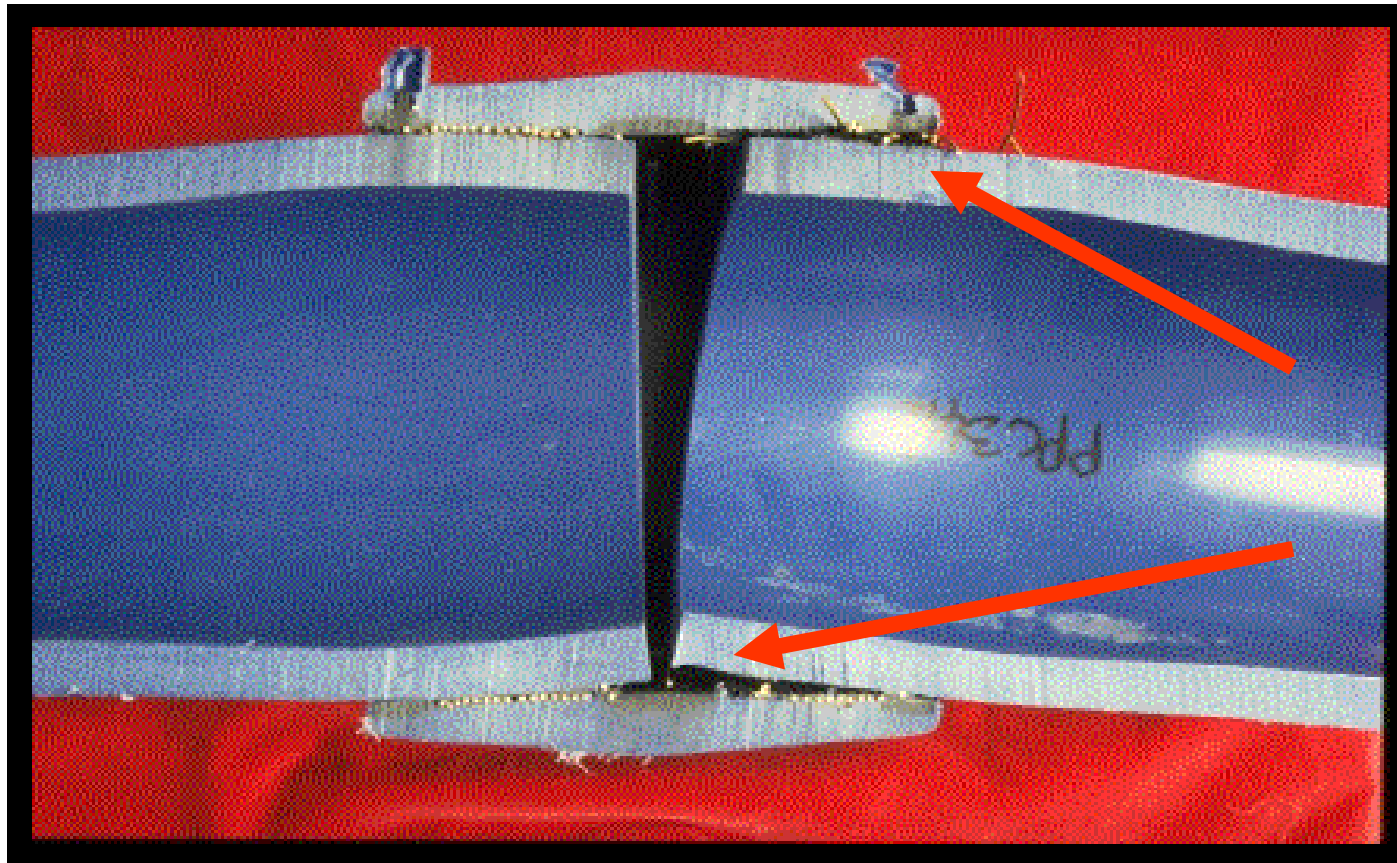


Pipe misaligned into EF fitting

During fusion heat & pressure  
create movement of wires

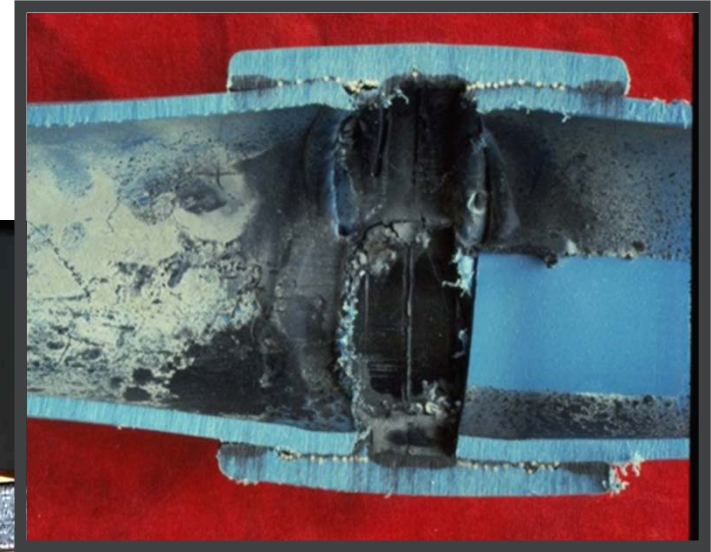
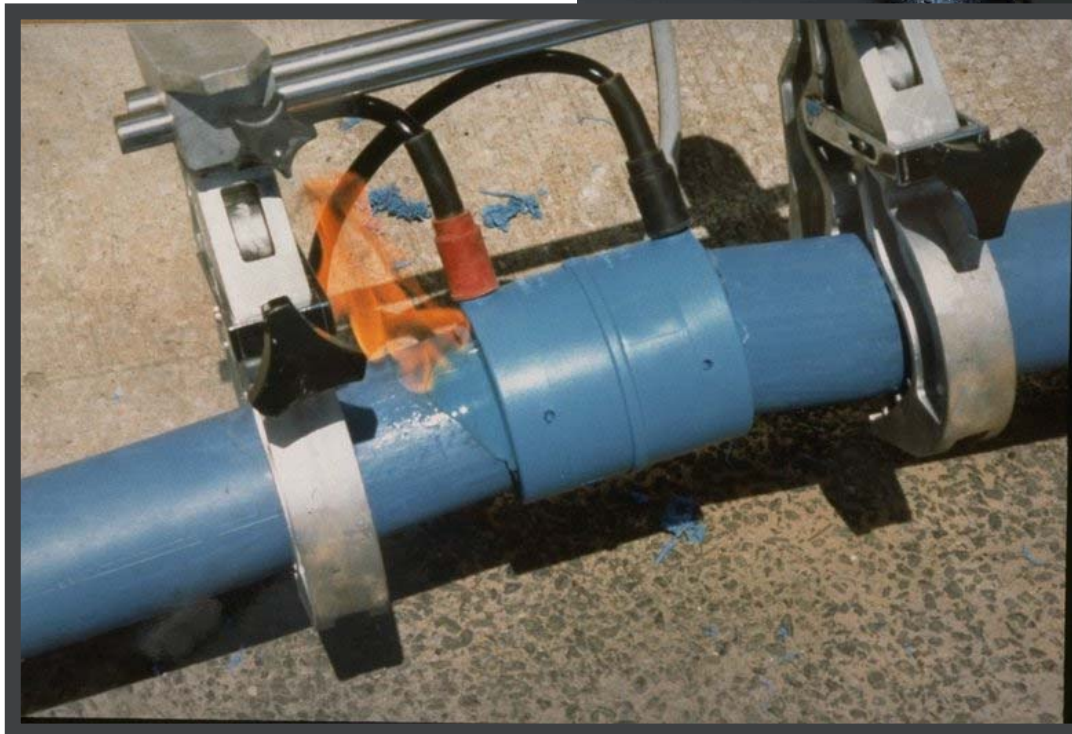


# MISALIGNMENT

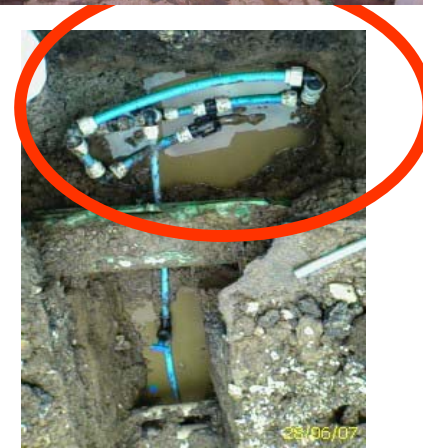


## Clamping/ Misalignment

- Misalignment
- Wire movement
- Overheating



## Why Audit – what do we find?



# Improving Site Quality

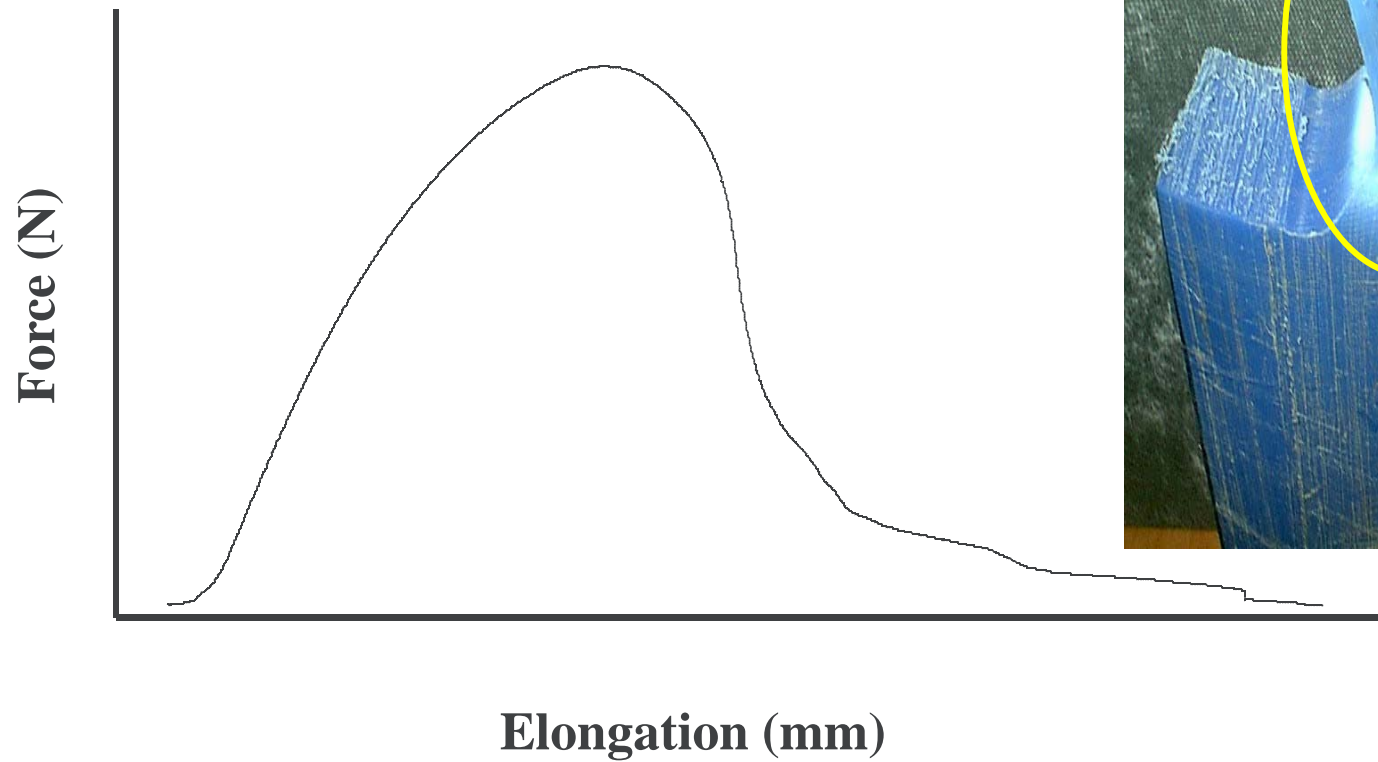
- Site PE Audits, Testing and coaching
- Giving clients and partners an understanding of the quality being installed.
- Highlights any potential failures



---

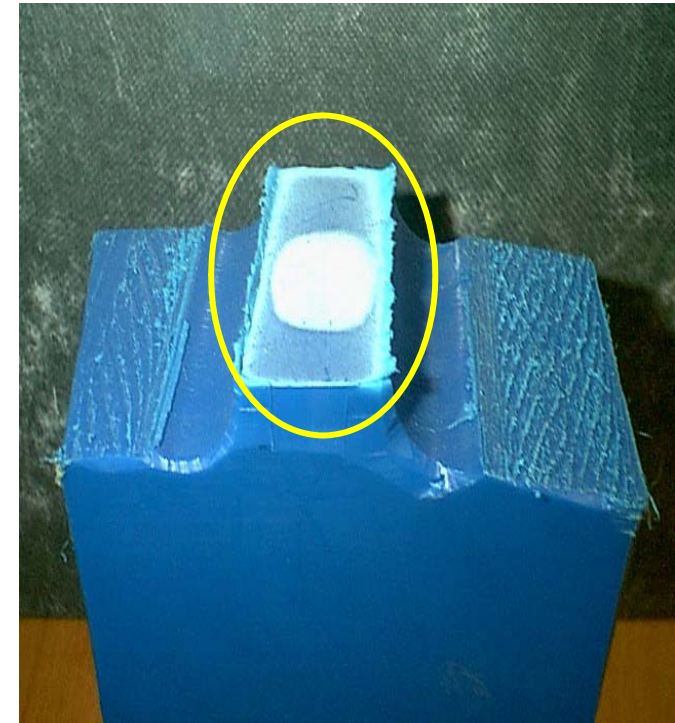
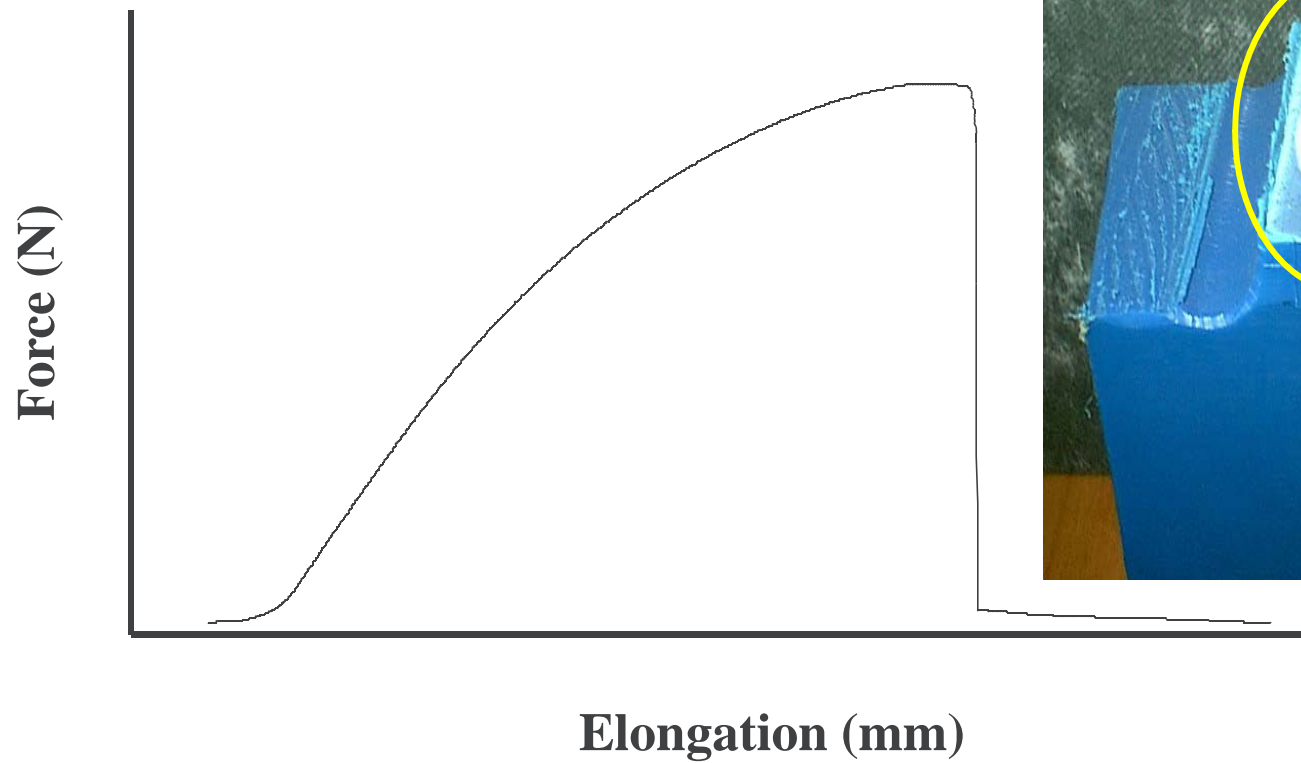
**EXOVA**

# ENERGY GRAPH: DUCTILE JOINT

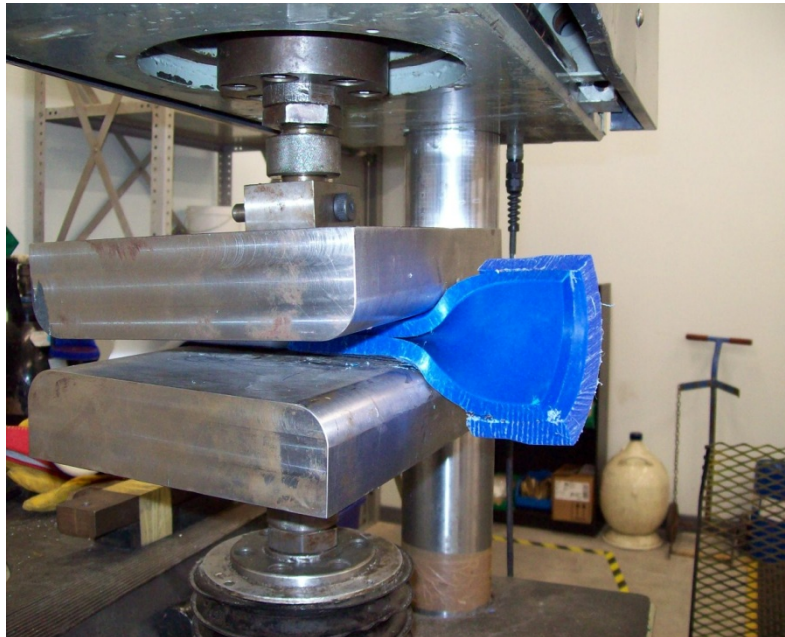





# ENERGY GRAPH: BRITTLE JOINT



# Lab UKAS Schedule – Failure Investigation



## Schedule of Accreditation Issued by United Kingdom Accreditation Service 21 - 47 High Street, Feltham, Middlesex, TW13 4UN, UK

|  |   |  |
|--|---|--|
| <br>Accredited to<br>ISO/IEC 17026:2006 | <b>Exova (UK) Ltd</b><br>Issue No: 007 Issue date: 29 July 2009                 |  |
|  | Exova (UK) Ltd<br>8 Coronet Way<br>Centenary Park<br>Epsom<br>Surrey<br>M60 1RE | Contact: Mr D Lowe<br>Tel: +44 (0)181-787 3250<br>Fax: +44 (0)181 787 3251<br>E-Mail: david.lowe@exova.com<br>Website: www.exova.com |
| Testing performed at the above address only  |   |  |

### DETAIL OF ACCREDITATION

| Materials/Products tested                                    | Type of test/Properties measured/Range of measurement | Standard specifications/ Equipment/Techniques used  |
|--|---|---|
| PLASTICS including PE, PVC and GRP and thermoplastic liners. | <u>Mechanical and Physical Tests</u>                  |   |
|  | Tensile Strength, Strain and Modulus                  | BS EN ISO 527-1:1996<br>BS EN ISO 527-2:1996<br>BS EN ISO 527-3:1996<br>BS EN ISO 527-4:1997<br>BS 4994:1987            |
|  | Lap Shear   | BS 4994:1987 (B.9)  |
|  | Shear Strength of Bond                                | BS 4994:1987 (B.10)   |
|  | Short-term Flexural Properties                        | BS EN ISO 178:2003<br>BS EN ISO 14125:1998<br>WIB 4-34-02, April 1986, Issue 1<br>WIB 4-34-04, March 1995, Issue 2      |
|  | Long-term Flexural Creep Modulus                      | Documented In-house Method PDL-GOP09  |
|  | Butt Fusion Joining and Electro fusion Weld Tests     | WIB 4-32-06, April 2002, Issue 3<br>WIB 4-32-14, March 1995, Issue 1  |
|  | Fracture Toughness                                    | Documented In-house Method PDL-GOP12<br>WIB 4-32-17, August 2001, Issue 2   |
|  | Charpy Impact   | BS EN ISO 179:1997<br>BS EN ISO 179-1:2001<br>WIB 4-32-17, August 2001, Issue 2<br>Documented In-house Method PDL-GOP15 |
|  | Peel Test   | BS 4994:1987  |



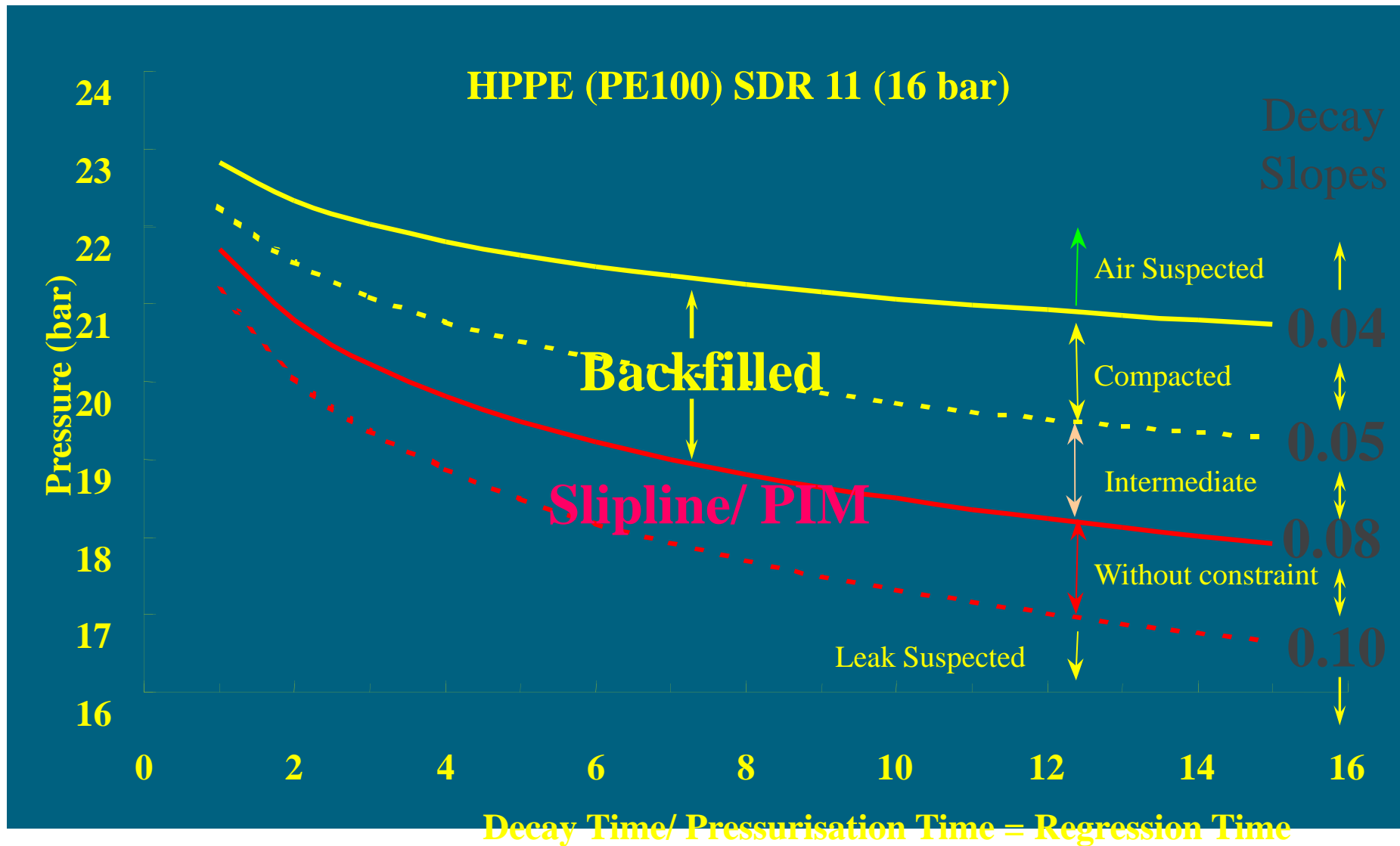
# Pressure Testing

EXOVA

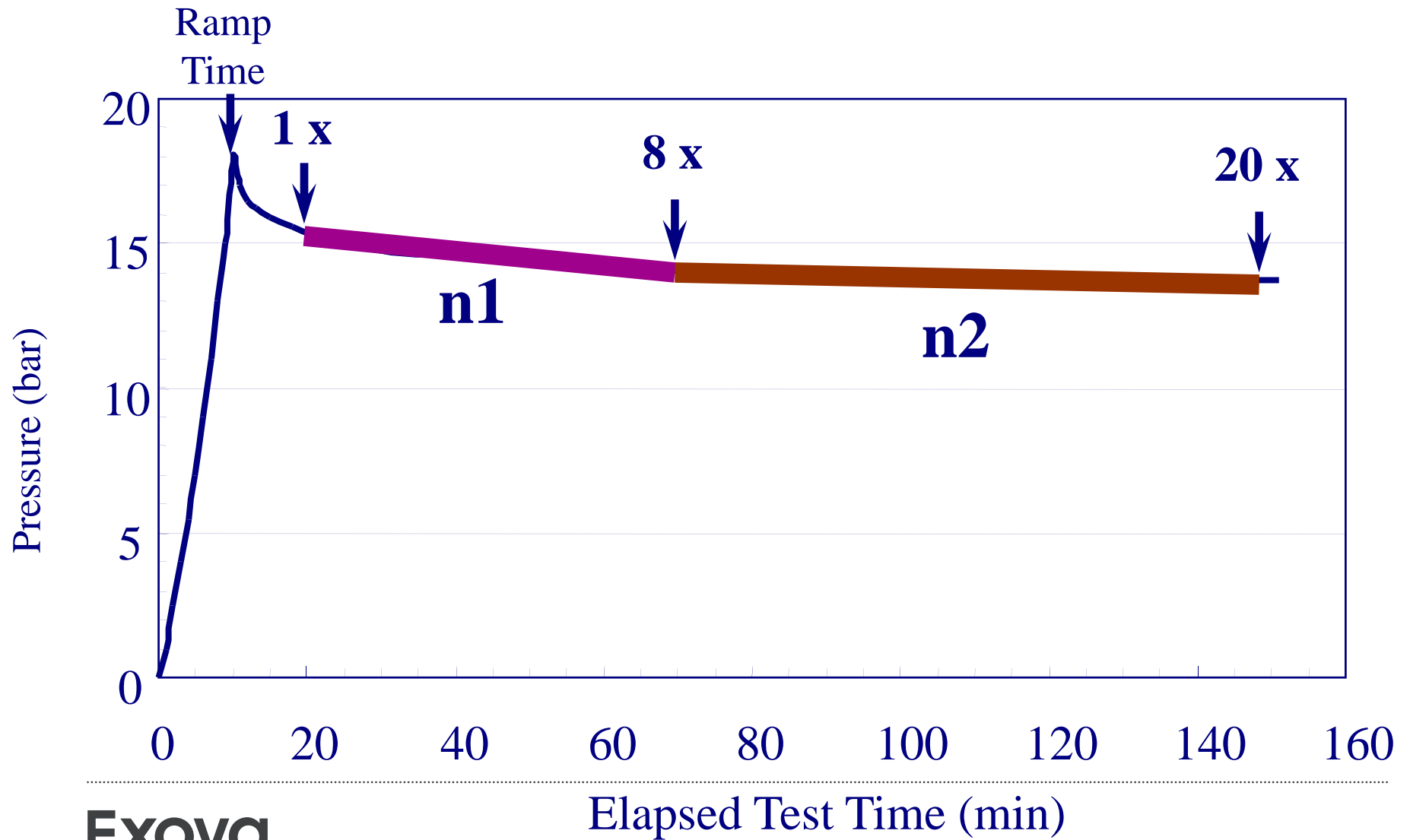
## Type 2 Test Analysis

| <b>n</b>          | <b>Assessment</b>        |
|-------------------|--------------------------|
| $< 0.04$          | Air Indicated            |
| $0.04 < n < 0.05$ | Pass Compacted Ground    |
| $0.05 < n < 0.08$ | Pass Intermediate Ground |
| $0.08 < n < 0.10$ | Pass Exposed Pipe        |
| $n > 0.10$        | Leakage Indicated        |

# Expected PE Decay Curves



# Type 2 Test: Analysis



# Pressure Test Equipment: Loggers

## GPS Data Log Technology (ANT Hire)

- No more down time for operator as test is remotely accessed
- Remote dialling access allows instant results for critical tests
- Validation of test data and location is confirmed
- Individual web access (paper-less trail)

Professional analysis at lower costs (Exova)



---

**EXOVA**

Pressure Test



**Thank you**

**Questions?**

---

**EXOVA**