

A.F.I.A.P.®
Association française
des ingénieurs en appareils à pression

PnD-MD 2005 MILANO
WORKSHOP: ISPEZIONE SERBATOI GPL INTERRATI

Esempi applicativi Guida AFIAP

Acoustic Emission Testing of LPG vessels
Application to Mounded Spheres & Bullets

Dr Jean Claude LENAIN

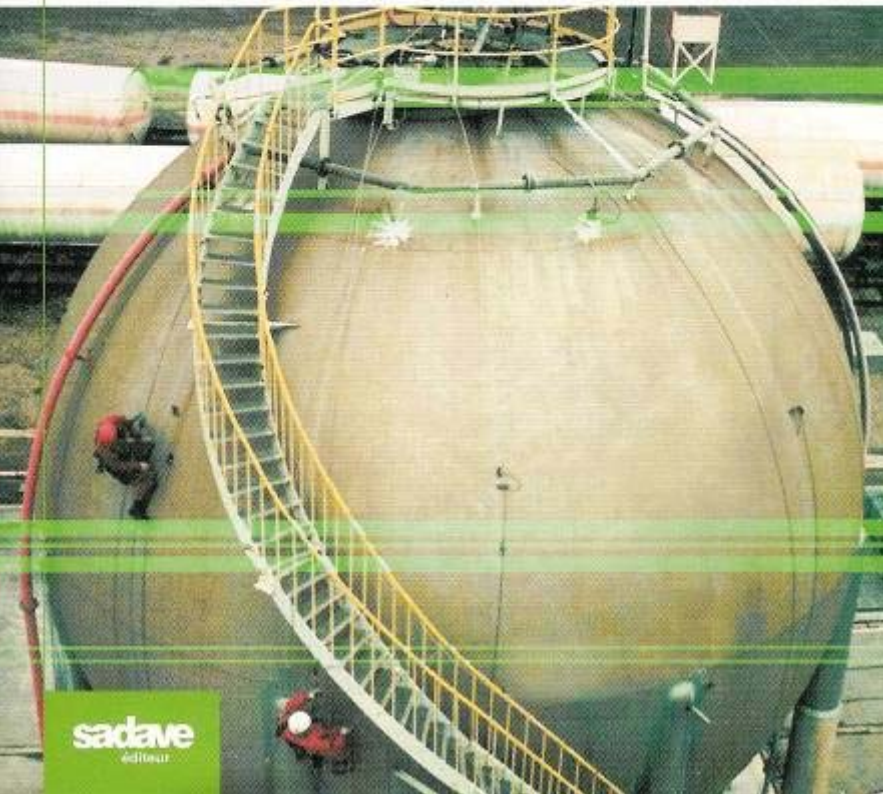


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Association Française des Ingénieurs en Appareils à Pression

Guide to Good Practice for Acoustic Emission (AE) Testing of Pressure Equipment

Edition May 2004

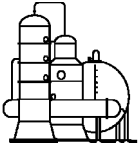


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éditeur

 **EURO
PHYSICAL
ACOUSTICS SA**

CONTENT: General Guide Appendix :

1. Codes & Standards
2. Examples
3. **Spheres**
4. Small buried LPG tanks
5. Not available
6. **Cylindrical pressure vessels**

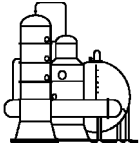


AFIAP – GEA - Appendix 3



SPHERES

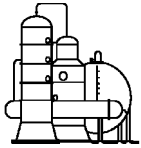
- Welded,
- Coating (internal, external)
- Aerial, mounted,
- Insulation, fire proof
- Yield Stress < 460 MPa
- T°C from -40 to 150°C
- Thickness < 100 mm
- Fluid: liquid or gas



Acoustic Emission Test (AE) of Mounded LPG Storage Spheres and Vessels

- **Data Base (1995): Spheres**
 - ⇒ Volume : 600 to 6 600 m³.
 - ⇒ More than 200 spheres (aerial, insulated, fireproofed ...) tested by AE in France
- **Mounded Spheres and Vessels since 1995**
- **GOAL** : Agreement from the French Gas Pressure Department of the Ministry of Industry to replace the hydraulic re-test for the re-qualification of the LPG pressure equipment
- **Development Program to apply AE in the case of mounded vessels:**
 - ⇒ Design of a special AE sensor R15LPG
 - ⇒ Procedure for permanent installation of sensors
 - ⇒ Test Procedure, criteria





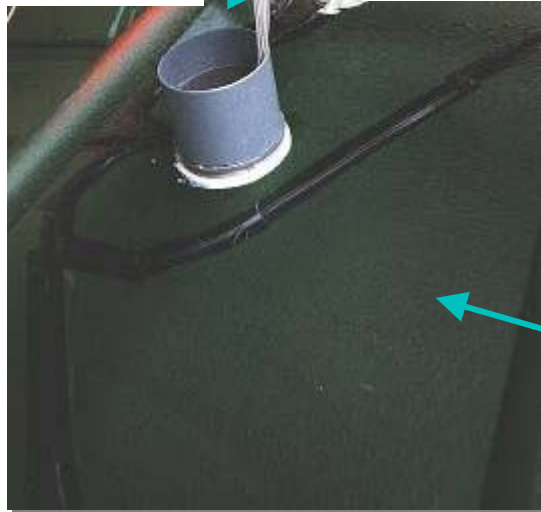
Acoustic Emission Test (AE) Application to Mounded LPG Spheres

Permanent Installation of AE Sensors



Cables

AE
Sensor

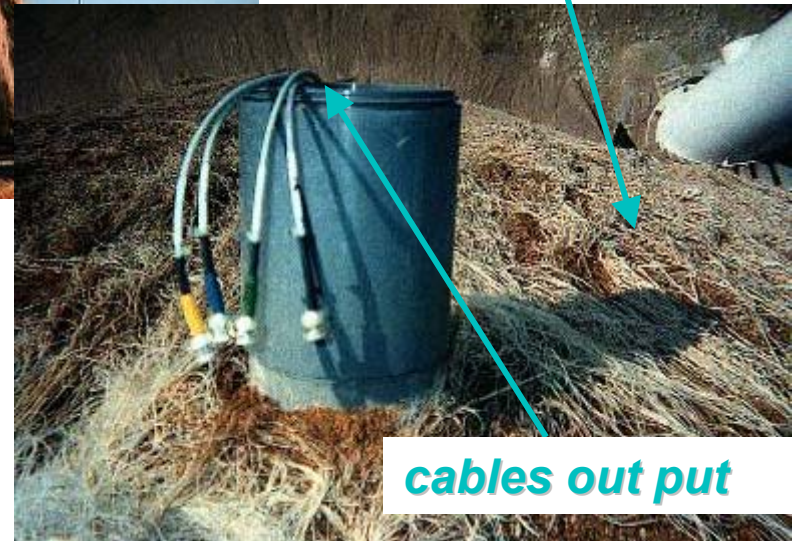


Sphere with
anticorrosion
coating

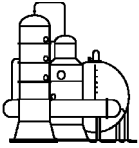


Mound
Installation

Mound **TEXSOL**
(Composite
Material sand +
polyester fibers)



cables out put



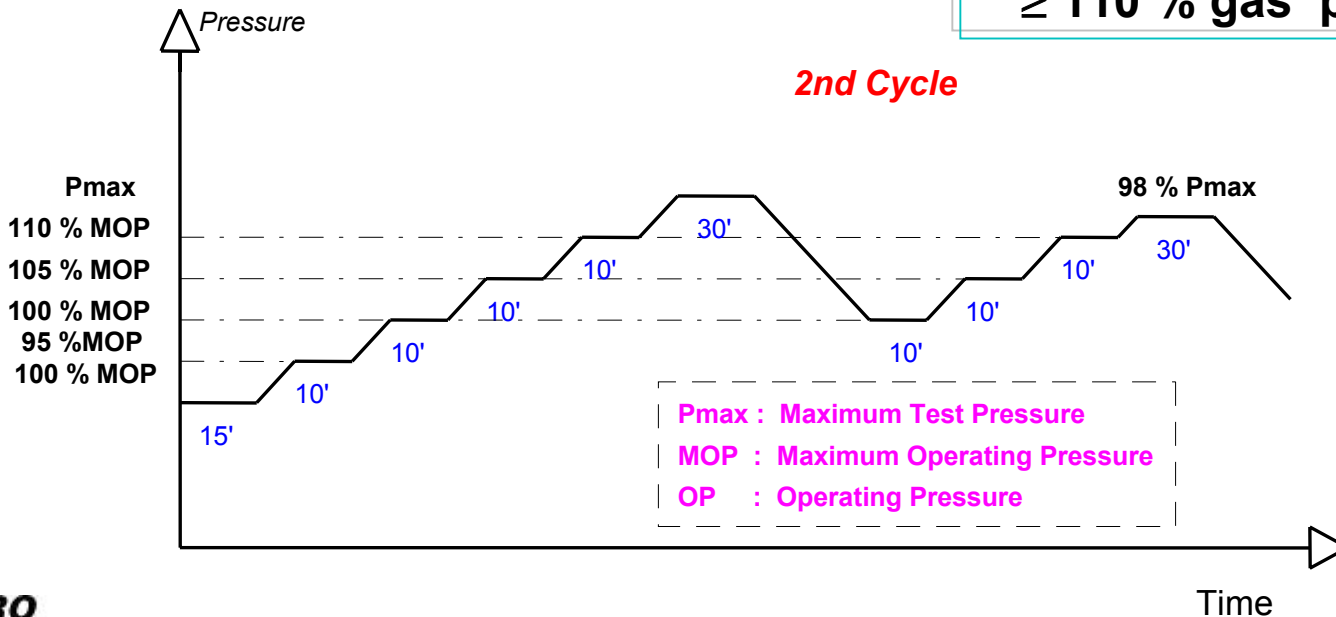
Acoustic Emission Test (AE) Typical In Service Re-qualification Test

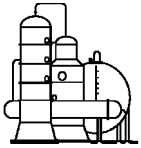
LOADING CYCLE

Test Conditions :

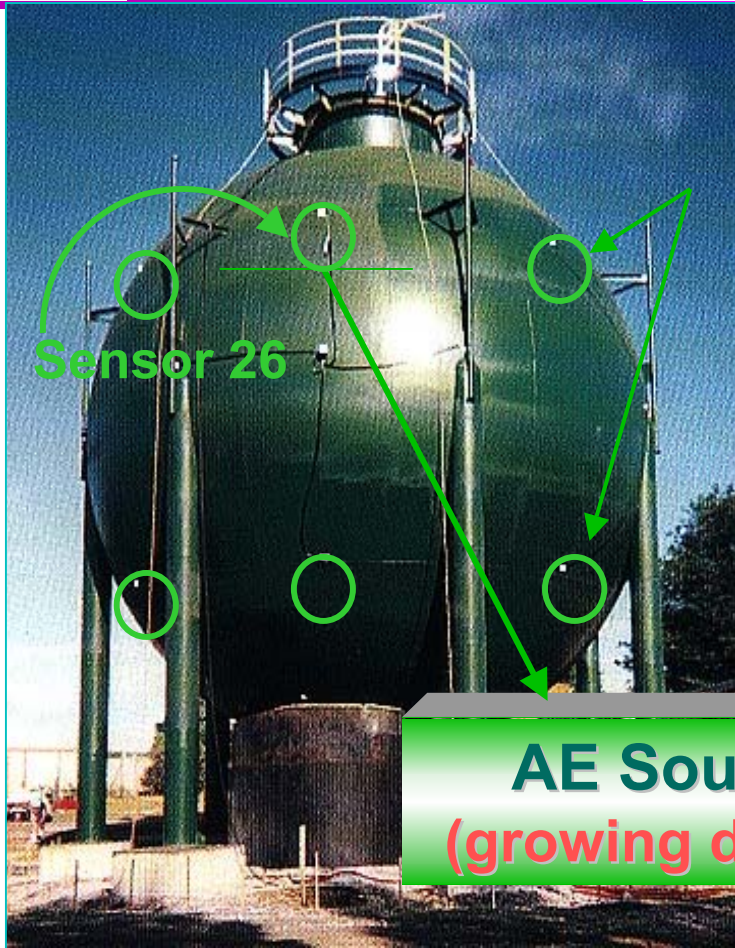
= 95 % liquid

≥ 110 % gas pressure

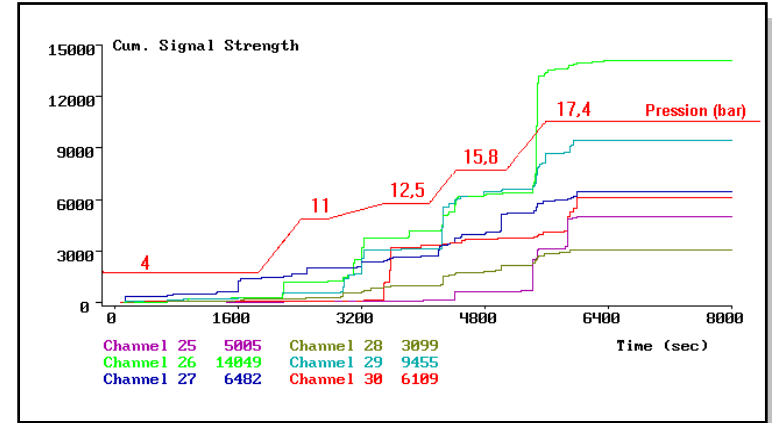




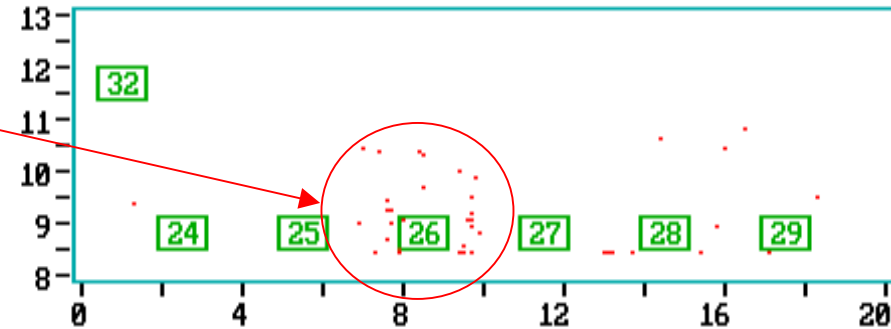
Acoustic Emission Test of Storage Spheres



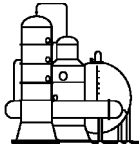
**AE
sensors
network**



Pressure Cycle – AE intensity

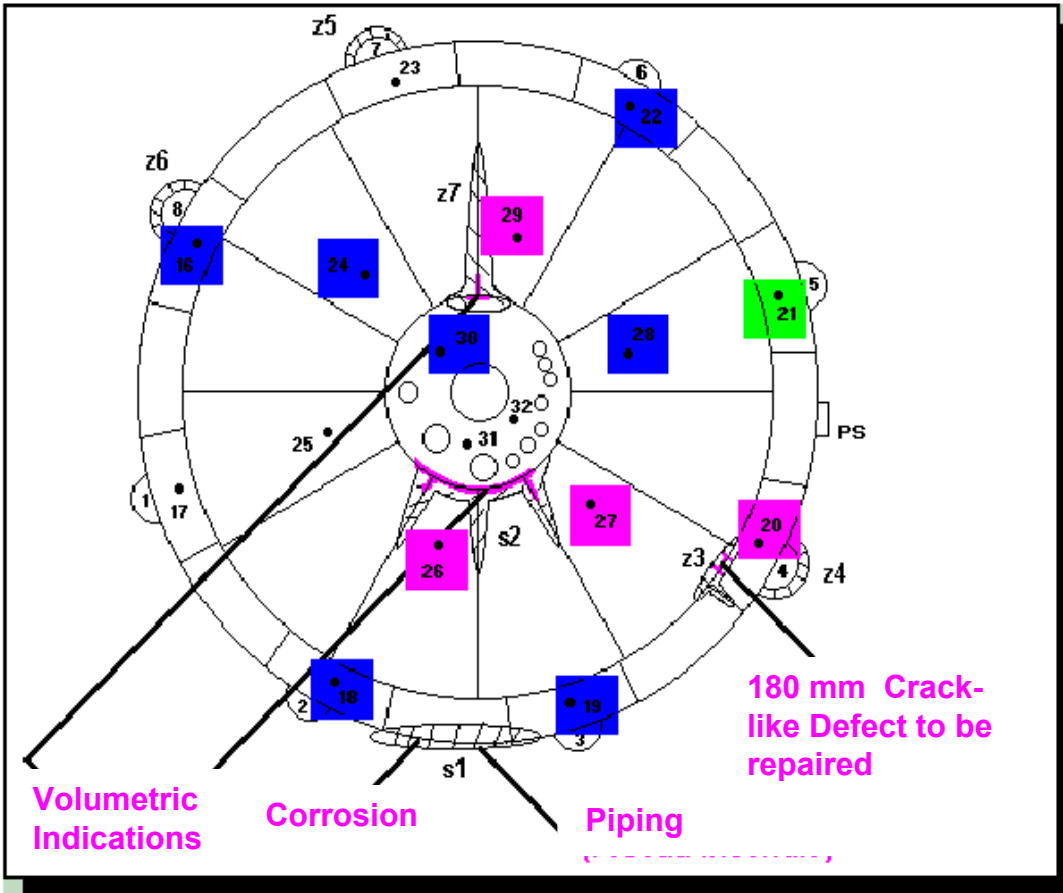


Planar Location



AE Periodic Tests of Spheres

Example of AE Severity Diagnosis




AE Zones and Sources

Category 1*:
A Very minor Source

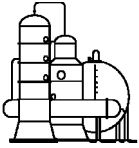
Category 2*:
B Minor Source
C Active Source

*according AFIAP Guide

 AE Located Sources , Zones for recommended follow up inspection

NDT Results

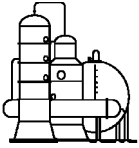
 Ultrasonic Indications



Acoustic Emission Test (AE) Application to Mounded LPG Spheres since 1995 (Data Base)

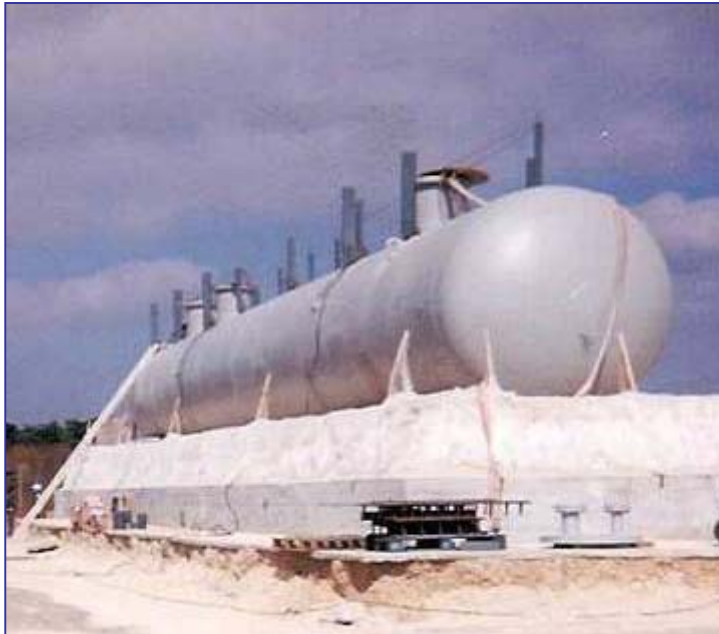
Spheres (from 600 to 2 000 m³) and vessels (from 150 to 400 m³) new and in service

- 1. Hydraulic Proof Test before mounding.**
Hydraulic Test after mounding (development phase)
Characterization the influence of the mound, by using the Kaiser effect .
- 2. In service Test with GPL (liquid + gas) after mounding (1st operating year).**
➔ 1st AE Signature - “0 Point”
- 3. Re-qualification Test in service (stored product) in 3 years according the regulations.**
- 4. AE In service Test after 8 years**
at mid term of the 10 years period of next requalification



AFIAP – GEA – Appendix 6

CYLINDRICAL PRESSURE VESSELS



- Welded,
- Coating (internal, external)
- Aerial, mounted, buried
- Insulation, fire proof
- Yield Stress < 460 MPa
- T°C from -40 to 150°C
- Volume > 30 m³
- Thickness < 100 mm
- Fluid: liquid or gas