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kiwa
Partner for progress

RTP Systems for Gas Distribution

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Materials used in gas distribution systems

Pressure class	<0.1 bar	<4 bar	<10 bar	<16 bar
Steel	+	+	+	+
PE	+	+	+ (PE100)	-
Ductile PVC	+	-	-	-

Objectives

- **Development and evaluation of the suitability of a tailor-made RTP pipeline system for gas distribution up to 16 bar.**

Requirements

- Strong
- Third party resistance
- Complete system
- Jointing technique
- Emergence measures
- Cost efficient

Partners in this study

- EON-Ruhrgas
- Gaz de France
- GasNatural
- Thuega
- Pipelife
- Friatec
- SKZ, Germany
- Veenker, Germany
- University of Twente/Kiwa Gastec

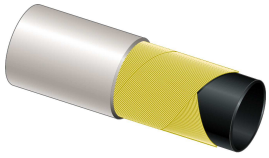
- GERG Project

Starting point of the study

- **Aramid fibre-reinforced PE pipes (RTP) for high pressure (40 – 100 bar) applications in the oil and gas industry**
- **RTP systems have a good set of properties :**
  - **high pressure rating**
  - **excellent corrosion resistance**
  - **low cost installation due to coiling**
  - **high impact strength**

Three-layer RTP pipe

- **PE/aramid fibres/PE**



A tailor-made RTP system for gas distribution (RTP “light”)

- **Aramid-based, but reduced number of fibres (40% of that of „classic“ RTP systems)**
- **Specially developed jointing system based on electrofusion**

Long-term strength values for RTP “classic” and RTP “light”

Material	50-year “strength” at 65 deg.C Average value (MPa)	50-year “strength” at 65 deg.C Lcl value (MPa)
“classic”	112.8	101.9
“light”	49.4	44.4

Pressure rating RTP “light”

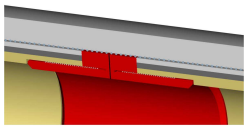
- 50-year strength at 65 deg.C (lcl-value) = 44.4 bar
- Design coefficient = 2
- >>> MAOP = 22 bar (>16 bar)
- Blow-off pressure > 42 bar

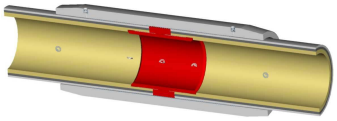
Resistance to third party damage

- Field tests with backhoe hitting and horizontal drilling
- Worst case situations
- Usually only superficially damage of the outer cover layer, not affecting pipe performance
- Only in one extreme situation (backhoe hits the pipe vertically on top of the pipe) a hole was created
- Similar tests on coated steel pipes resulted in damage of the coating, which may affect long-term performance

Specially developed jointing technique

- **Based on well-proven electrofusion technique for PE**





Performance of joints

- In internal pressure testing failure always occurs in the pipe (>>>joint is stronger than the pipe)
- Axial tensile loading : no failure
- Bending test using a bending radius of 1.5 meter + internal pressure of 40 bar : no leakage

Pre-conditions for market introduction

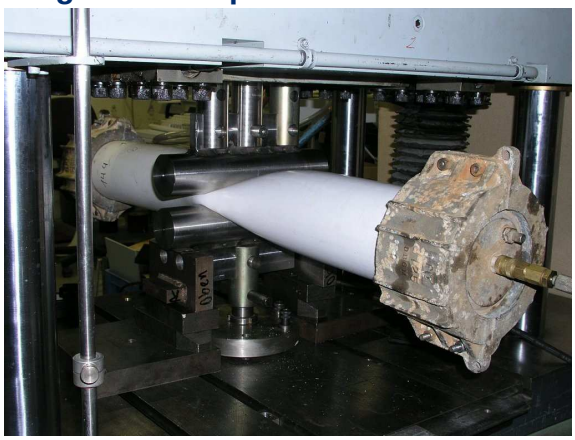
- **Availability of specifications**
  - **ISO TS 18226 (will be published soon)**
  - **DVGW VP 642 (Germany)**

Pre-conditions for market introduction (II)

- **Safety and risk analysis**
  - **Safety of steel and RTP systems is equal**
  - **Failure probabilities for both systems are within acceptable limits**

Pre-conditions for market introduction (III)

- **Availability of emergency measures**
  - **Squeezing of RTP is possible**



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Pre-conditions for market introduction (IV)

- **Cost efficient system :**
  - **Comparison with steel systems**
  - **Material costs of RTP > costs of steel**
  - **Sometimes cost-effective installation of RTP (e.g. ploughing)**
  - **RTP systems only available in 4” (100 mm) and 5” (125 mm)**

Conclusions

- Alternative plastic pipeline system is now available for high-pressure (<16 bar) distribution systems
- An aramid-based RTP with an electrofusion-based jointing technique
- This RTP “light”system fulfills all the requirements of the (draft) ISO specifications
- RTP is attractive when installation with ploughing techniques (using RTP from coils) is possible
- RTP system for gas distribution is safe
- Up to now only available in small diameters