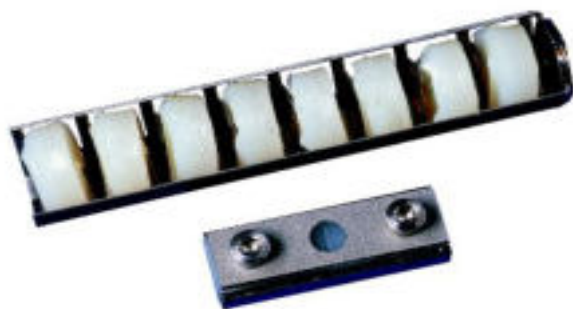
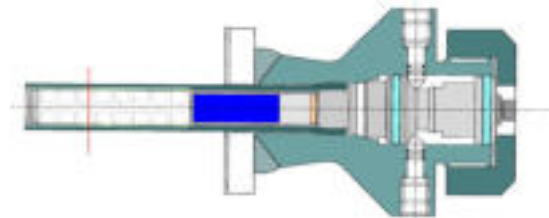


Flexible Pipe Polymer Monitoring with Coupons



Polymer coupons and holder arrangements



Polymer coupons and holder in hydraulic access fitting

Features and Advantages

To assess the integrity of the pressure sheath, polymer coupons of the same material as the sheath are exposed to the flow.

The polymer material is typically:

- PVDF
- PA 11 (Rilsan)
- XLPE.

There are four types of polymer coupons available:

- **Circular coupons** for examination of chemical properties and hardness
- **DMTA coupons** for examination of chemical and mechanical properties e.g. elongation at break
- **Notched pre-stressed coupons** for monitoring of crack propagation.
- **Bar coupons** for blistering and mechanical testing.

The coupons are placed in a holder arrangement based on 2" standard access fitting to be retrieved after exposure. The polymer retrieval may be carried out during full production. The retrieved coupons are analysed to assess ageing of the polymer.

Coupon holder design can be customised to sustain rough flow conditions such as slug flow, ensuring that the coupons are exposed through the full life of the pipe system. A strength and VIV calculation is done based on flow input from client.

Purpose

The purpose of the polymer monitoring is to ensure a reliable and quantitative measure of the condition of the polymer in the pressure barrier sheath. The objective being to provide an operator with the necessary information needed to assess the pressure sheath's condition related to an acceptance criterion for further use.

The rate of ageing and the instantaneous condition of the polymer is assessed by analysis of the coupons retrieved after various exposure periods.

Remaining service life of the pressure sheath can be estimated based on the measured coupon condition, the exposure environments history and predicted future, and existing service life models and data.

Equipment and operation

The coupon holder with the polymer coupons to be exposed is attached to the inside of a solid plug on an access fitting or another line entry point. The coupon holder has a protective cover with holes to allow flow of the oil or gas through the rack with polymer coupons. The protective cover prevents displacement of the polymer coupons.

A typical access fitting suited for this purpose is the 2" hydraulic access fitting, which allows extraction of coupons during operation.

In addition to polymer coupons and coupon holders, FORCE Technology Norway AS offers characterisation of fresh polymer material, analyses of coupons, estimation of remaining service life and presentation of the results.

FORCE Technology Norway AS also offers instrumented polymer coupons.

Polymer Coupon Description:

- **Circular Disc Coupons** are used to monitor changes in weight, density, chemical composition and structure of the polymer.
- **DMTA Coupons** are used for assessing changes in weight, density and mechanical properties e.g. E-module.
- **Notched Pre-stressed Coupons** are used to monitor crack initiation and crack propagation.
- **Bar coupons** are used to check for blistering and perform mechanical and chemical testing.

Typical specifications

Coupon holder dimensions:	Diameter 33.5 mm (3.1 inches, length 80 - 200 mm (3 - 8 inches)
Coupon holder pressure rating:	6000 psi / 414 bar
Coupon holder material:	All relevant steel materials
Coupon material:	Rilsan; PVDF
Coupon dimensions:	Circular disc coupon; diameter 25 - 28 mm, thickness as liner, Rectangular coupons; 65 x 2 x thickness of liner, Bar coupons 65 mm x thickness of polymer sheath ² , Notched coupons; 60 x 17 mm x thickness of liner, Pre-stressed coupons are available on request

The holder arrangement may typically contain 8 – 10 circular disc coupons, or 8 – 16 DMTA coupons, or 2 – 3 notched pre-stressed coupons. The exact number of coupons depends on pipe dimensions and available space. Custom design is possible.

References

The circular Rilsan disc coupons are installed on several offshore installations such as BP Schiehallion, Statoil Åsgard A and B, Esso Balder and Jotun, Draugen Shell, and PGS Banff.

On these installations, the circular Rilsan disc coupons can be used to determine condition of the pressure sheath through molecular weight assessment. The results can be used to predict remaining service life.

PVDF strip coupons and PVDF notched coupons are installed at Statoil Åsgard A and PGS Banff.

XLPE bar coupons are installed on the ExxonMobil Ringhorne field. A combination of coupons and instrumented polymer coupons are used on Esso Balder, Shell UMC field (subsea) and BP Schiehallion.



Further information: FORCE Technology Norway AS
Pål Tuset, tel. (direct) +47 64 00 35 12, ptu@forcetechnology.no

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FORCE Technology USA Inc.
Tel. +1 713 975 8300
FORCE Technology Rusland LLC
Tel. +7(812) 326 80 92

FORCE Technology Norway AS
Claude Monets allé 5
1338 Sandvika, Norway
Tel. +47 64 00 35 00
Fax +47 64 00 35 01
info@forcetechnology.no

FORCE Technology Sweden AB
Tallmätargatan 7
721 34 Västerås, Sweden
Tel. +46 (0)21 490 3000
Fax +46 (0)21 490 3001
info@force.se

FORCE Technology, Headquarters
Park Allé 345
2605 Brøndby, Denmark
Tel. +45 43 26 70 00
Fax +45 43 26 70 11
force@force.dk

www.forcetechnology.com