



LAMBDA F FLEX PIPE PENETRATION SEAL (PPS)

FLEXIBLE PIPE PENETRATION
FIREPROOFING TECHNOLOGY

Passive Fire Protection – Bilfinger Lambda Products

Lambda is the brand name used on all insulation products marketed by Bilfinger Oil & Gas. All products are designed and documented to be used in high risk environments within the oil & gas industry, nuclear power plants and process industry. The products have been developed and tested as a consequence of the rigorous requirements oil & gas industry, meeting NORSOK and ISO standards.

All Lambda products are highly recognized among professional engineers as "state of the art" insulation systems. Each product is tailor-made and pre-fabricated to fit the exact valve, flange or equipment to be protected.

In addition to meeting functional requirements, all products are designed for quick and easy removal and re-installation with a minimum use of personnel and tooling. Bilfinger Lambda is continuously and proactively recognizing customer demands and developing solutions to meet these requirements

Lambda F Flex Pipe Penetration Seal (PPS)

Lambda F Flex Pipe Penetration Seal (PPS) is a tailored and flexible insulation system designed as a fire and gas seal for single and multi-pipe penetrations installed in bulkheads and decks. It is fully tested and certified to meet the strictest on- and offshore specifications for oil and gas installations.

Lambda F Flex PPS's are tested and certified by DNV GL for classes A0, H0, A60 and H60. The system has also been tested for jet fire with a heat load of 250 kW/m² (ISO 22899-1) as well as 350 kW/m². The Lambda PPS's are flexible, easy to install and makes pipe inspection and maintenance efficient. The solution is also tested for extreme weather according to NORSOK and in cooperation with DNV GL. All seams are sewn with Kevlar reinforced stainless steel thread and sealed with silicone, to avoid water ingress.

The PPS system is built up by a core of insulation material, enclosed by a custom-built silicone fabric. The pieces are joined with Velcro in the overlap and the system is secured with stainless steel bands, ensuring the integrity of the insulation properties. The PPS's are very easy to install, and can be removed and re-installed repeatedly to ensure easy access for inspection / maintenance of the penetration. There is no curing time, and the PPS can be installed on one or both sides of the deck or bulkhead depending on requirements.

Design and Test results

The Bilfinger Lambda F Flex Pipe Penetration Seals have been extensively tested and certified by DNV GL. The following tests have been carried out:

Jet- and hydrocarbon fire to IMO Res. A.754(18), ISO 834-Part 3 / NS-EN 1363 Part 2 and OTI 95 634, as well as extended OTI 95 634. All fire tests have been carried out at RISE Fire Research (Sintef).

Explosion tests have been conducted by Gexcon, The system has been successfully tested for blast overpressure to 1200 millibar (1.2 bar).

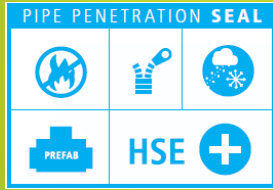
The Weatherproofing test has been completed to 3x10⁵ PA, according to Norsok R-004 and IACS UR S.14.2.3.

Key Product Benefits

- Extreme performance
 - Slim building
 - Low installed weight
 - High Impact resistance
 - No Water absorption
- Single or Multi-Penetrations
- HSE: No toxic ingredients, no ceramic fibres
- Maintenance free – tough silicone fabric exterior, stitched with Kevlar reinforced stainless steel thread
- Easy to install, remove, inspect, and re-install
- Pre-fabricated solution → low installation cost. No curing time
- Low Life Cycle Cost
- Slim building – less than 8mm for fire rated, 17mm for jet-fire rated PPS
- Tested and Certified according to
 - IMO Res. A.754(18)
 - ISO 834-Part 3 / NS-EN 1363 Part 2
 - OTI 95 634
 - Extended OTI 95 634
 - Norsok R-004 and IACS UR S.14.2.3
- Tested for blast overpressure to . 1200 millibar (1.2 bar)



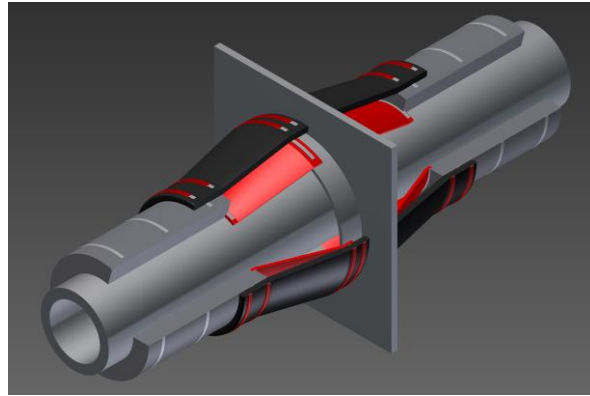
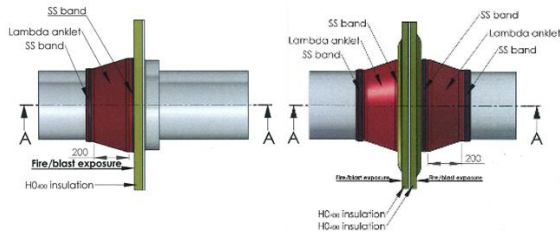
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The Lambda PPS are designed for penetrations of the following dimensions:

Class	Steel Pipe Outer Diameter		Sleeve Outer Diameter		Sleeve Length (mm)
	Min (mm)	Max (mm)	Min (mm)	Max (mm)	
A0	33,4	914,4	114,3	1250	150
A60	33,4	609,6	114,3	711,2	150
H0	33,4	914,4	114,3	1016	250
H60	33,4	609,6	114,3	711,2	250

The PPS' have been tested with both welded and bolted sleeves. The normal length of the PPS is 200mm, but shorter lengths can also be accommodated. The PPS can be tailormade to fit most complex geometries, including penetration to bends, T's etc. Multi-PPS's can also be accommodated for all penetration classes (A0, A60, H0, H60).



In order to provide additional protection in case of jetfire and explosion requirement, the PPS can be covered by a Lambda F Box – Polymer. This combination has been tested to 60 minutes according to an extended OTI 95 634 test, and explosion tested to 1900 millibar (1.9 bar).

Completed Tests	Results	Test standard	Test Institue	Certification
Hydrocarbon fire - ability to withstand constant 1200°C	Up to 120 minutes	IMO Res. A.754(18)	RISE Fire Research AS (Sintef)	Testreport
Jetfire - 250kW/m2 - equivalent to 0.3kg Propane / second	Over 30 minutes	ISO 22899-Part 1	RISE Fire Research AS (Sintef)	Testreport
Explosion Tests	Up to 1.2 bar	Explosion Tests	Gexcon AS	Testreport
Weatherproofing Test	Passed	Norsok R-004 and IACS UR 2.14.2.3	Internal	Testreport (DNV-GI)

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