



Bilfinger Industrier Norge AS

## 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 exceeding 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 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 and H0, A60 and H60. The system has also been tested for jet fire with a heat load of 250 kW/m<sup>2</sup> (ISO 22899-1) as well as 350 kW/m<sup>2</sup>. 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 thread and sealed with silicone, to avoid water ingress.

The PPS system is built up by a core of insulation material and stainless steel foil (for jet fire rated PPS), 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 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 test have been carried out:

Jet- and hydrocarbon fire to IMO Res. A.754(18), ISO 834-Part 3 / NS-EN 1363 Part 2 and ISO 22899-Part 1, as well as extended ISO 22899. All fire tests have been carried out at SP Fire Research (Sintef).

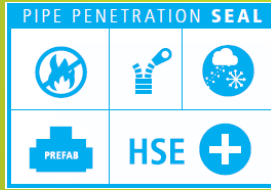
Explosion tests have been conducted by Gexcon, The system has been successfully tested for blast overpressure at 900 millibar (0.9 bar)

The Weatherproofing test has been completed to 3x10<sup>5</sup> PA, according to

### Key Product Benefits

- Extreme performance
  - Slim building
  - Low installed weight
  - High Impact resistance
  - No Water absorption
- HSE: No toxic ingredients, no ceramic fibres
- Maintenance free – tough silicone fabric exterior, stitched with Kevlar 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
  - ISO 22899-Part 1
  - Extended ISO 22899-Part 1
  - Norsok R-004 and IACS UR S.14.2.3
- Tested for blast overpressure to 900 millibar (0.9 bar)



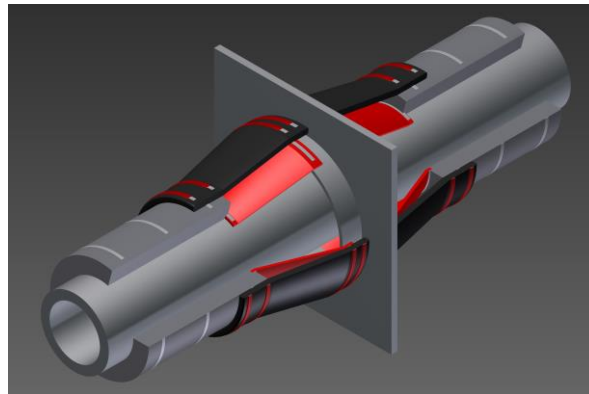
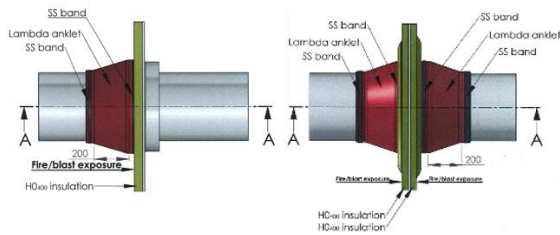


### Norsok R-004 and IACS UR S.14.2.3.

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 minimum recommended length of the PPS is 200mm, but shorter lengths can also be accommodated (through a DVR). The PPS can be tailor-made to fit most complex geometries, including penetration to bends, T's etc. Multi-PPS's can also be accommodated.



| 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)                | SP Fire Research AS (Sintef) | DNV GL        |
| Jetfire - 250kW/m2 - equivalent to 0.3kg Propane / second | Over 30 minutes   | ISO 22899-Part 1                  | SP Fire Research AS (Sintef) | DNV GL        |
| Explosion Tests   | Up to 0.9 bar     | Explosion Tests                   | Gexcon                       | DNV GL        |
| Weatherproofing Test                                      | Passed            | Norsok R-004 and IACS UR 2.14.2.3 | Internal                     | DNV GL        |

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