

# Fluid Sealing Association

## STANDARD

**FSA-DSJ-403-18**

**FLUOROPLASTIC  
BELT GUIDELINES**



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**FLUID SEALING ASSOCIATION STANDARD  
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**FLUOROPLASTIC BELT GUIDELINES**

**1. SCOPE**

**1.1** This standard describes composition and property recommendations for a single layer fluoroplastic/fiberglass fabric belt. The standard is not applicable for higher temperature rated multi-layer composite belt buildups. Fluoroplastics have been used for flue duct expansion joints because of their outstanding resistance to chemicals and heat. Fluoroplastic materials are particularly effective in applications where condensation and chemical attack are problems, such as sulfuric acid bearing flue gas in coal-fired power plants.

**1.2** While the materials, methods, applications and processes described or referenced in this standard may involve the use of hazardous materials, this standard does not address the hazards which may be involved in such use. It is the sole responsibility of the user/tester to ensure familiarity with the safe and proper use of any hazardous materials and testing and to take the necessary precautionary measures to ensure the health and safety of all personnel involved.

**2. DEFINITIONS**

Fluoroplastics are thermoplastic resins of general paraffin structures that have all or some of the hydrogen replaced with fluorine. Polytetrafluoroethylene, commonly called PTFE, and perfluoroalkoxy copolymer resin, commonly called PFA, are the major fluoroplastic resins used in expansion joints.

Commercial PTFE fluoroplastics include TEFLON®, POLYFLON™, ALGOFLON®, and DYNEON™ brands and commercial PFA fluoroplastics include TEFLON®, NEOFLON™, HYFLON®, and DYNEON™ brands.

The fluoroplastic component of the flexible element provides: 1) a gas seal layer with minimal to zero porosity; 2) mechanical strength and resistance to flex failures; and 3) resistance to attack from most chemicals.

Single layer fluoroplastic belts are used for flue duct applications with continuous operating/design temperatures ranging from -75 °F (- 60°C) up to 600 °F (316°C) at maximum pressures of ±3 psig (±20kPa).

**3. COMPONENTS**

A) Fiberglass Substrate – The base for the fluoroplastic belt is the woven fiberglass matrix which acts as the reinforcement and support for the fluoroplastic resin that is applied as the gas seal layer.

- Fiberglass cloth reinforcement shall be a minimum of 30 oz/sq yd (1020 g/sq m) in weight with a 1000 lbs/in x 1000 lbs/in (8900 N/50 mm x 8900 N/50 mm) (warp x fill) tensile strength.
- Woven fiberglass cloth shall be a minimum of E Grade glass.

B) Fluoroplastic Coating – Barrier protection for the fiberglass fabric is required for chemical resistance, mechanical support, and thermal protection. Proper coating will surround and encase the individual fabric fibers to protect and prevent flex fatigue failures. This barrier must contain, as a minimum, 35% – 40% by weight PTFE resin when using a 30 oz/sq yd (1020 g/sq m) fiberglass base. The suggested minimum fluoroplastic coating compound weight is 18 oz/sq yd (610 g/sq m).

- Compound must be 100% virgin PTFE with no reprocessed materials.
- Fiberglass substrate shall be thoroughly coated on both sides with the PTFE compound.
- Overall suggested minimum weight of fiberglass substrate and PTFE coating should be: 48 oz/sq yd (1600 g/sq m)

C) Chemical Barrier Layer – Due to extremely aggressive chemical environments caused by corrosive flue gas operating at or below dew point, significant protection is required for the fiberglass fabric reinforcement. The suggested minimum weight for the fluoroplastic compound gas film barrier layer is 6.4 oz/sq yd (220 g/sq m).

- Minimum thickness for the fluoroplastic chemical barrier laminated to gas side of coated fiberglass belt should be 0.004 in (0.1 mm).
- Overall weight of fiberglass substrate, PTFE coating, and fluoroplastic chemical barrier layer: 54.4 oz/sq yd (1850 g/sq m) minimum.
- Chemical barrier to be nonporous.
- Minimum adhesion strength between laminated films and fiberglass substrate shall be 5 lbs/in (45 N/50 mm).

#### 4. STYLES

Fluoroplastic flexible elements can be provided to accommodate either the Flat Belt or Integrally Flanged “U” expansion joint designs.

#### 5. GENERAL REQUIREMENTS

- Expanded PTFE joint sealant is required between the fluoroplastic belt and attachment flange to provide adequate sealing.
- Bolt holes shall be slotted on 1 in (25 mm) gauge for 1/2 in (12 mm) or 5/8 in (16 mm) diameter hex bolt sets on 4 in (100 mm) and 6 in (150 mm) centers respectively. Bolt torque should not exceed 35 foot-pounds (47 N m) to 55 foot-pounds (74 N m).
- All metal surfaces in contact with the belt shall be smooth with no sharp edges.
- Typical backup bars shall be 3/8 in x 2 in (10 mm x 50 mm) rounded edge ASTM A36 Carbon Steel, minimum grade, bar stock with rust inhibitive primer.
- Consult manufacturer when overall belt free width exceeds 16 in (410 mm).
- Thermal movement guidelines are the same as those listed for single layer fluoroplastics shown in Table D2 of the FSA Technical Handbook, Third Edition.

## 6. ABRASION

The presence of dust in the flue gas stream justifies the installation of a liner/baffle for non-metallic expansion joints with fluoroplastic belts. Fluoroplastic elements are susceptible to wear due to the poor abrasion resistance properties of PTFE.

## 7. TESTING

This section describes a number of useful standardized test methods and typical property values for the fluoroplastic fiberglass-fabric belt.  
**NOT ALL TESTS MAY BE APPLICABLE.**

Property	Typical Minimum Values (units)	Test Method	Comments
Weight/Unit Area	54.4 oz/sq yd (1850 g/sq m)	ASTM D4851	
Thickness	0.045 in (1,14 mm)	ASTM D751	
Breaking Strength, machine and transverse directions	1000 lbs/in x 1000 lbs/in (8900 N/50 mm x 8900 N/50 mm)	ASTM D4851	Cut strip method; Constant rate of extension = 2 in/min
Trapezoidal Tear Strength, machine and transverse directions	50 lbs x 50 lbs (222 N x 222 N)	ASTM D4851	Average of five high peaks or average value
Seam Peel Integrity/Coating Adhesion	5 lbs/in (44 N/50 mm)	ASTM D4851	Suitable for adhesive or thermal bonds only; seam specimen as for actual use; Average of five high and five low peaks.
Flexural Endurance	60% (retained breaking strength)	-1-ASTM D4851 Crease fold test. -2- After 5000 cycles, MIT Folding Endurance Tester or similar, as described in ASTM D2176.	Suitable for thin reinforced materials.

Other test methods unique to specific manufacturers exist and may be useful. Such test methods often measure retention of product properties. Product integrity can be determined, when possible, by the application of the standard test methods discussed above.

Note: Comparisons between belts tested with different test methods cannot be accurately made.

## **8. FLUTTER/VIBRATION**

Fluctuating flue gas pressure, often referred to as flutter or flow-induced vibration, can cause premature failure of fluoroplastic flexible elements in non-metallic expansion joint service through fatigue of the fabric. Often, the operating parameters associated with flutter in a typical flue gas application, such as the range and rate of pressure change, cannot be established. Thus, it is typically not possible to determine the forces that might be imposed on a fluoroplastic flexible element in flutter service. For these reasons, the conditions dealing with flutter/vibration are best addressed through the design and engineering of the non-metallic expansion joint. Contact the manufacturer for design details.

## **9. QUALITY CONTROL**

As documented evidence of product quality, manufacturers should either certify the belt materials to a defined product specification or provide test results for the specific rolls to be delivered. When selecting fluoroplastic expansion joints, one should compare the product specifications or roll test results for compliance with the standards previously described.

In-process component tests can and should be conducted by the manufacturers to ensure the integrity of the final product prior to testing. Specifiers may wish to discuss the in-process tests and process controls present during manufacture with the supplier in order to judge the quality of the product produced.

## **10. WARRANTY**

Standard manufacturer's warranty to apply.

## **11. APPENDIX**

TEFLON® is a registered trademark of DuPont

POLYFLON™ is a registered trademark of Daikin Industries, Ltd.

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