Q. How do non-metallic (fabric) expansion joints and metallic expansion joints compare in flue duct applications?

A. Let’s first define the two types of expansion joints in question.

*Non-metallic (fabric) expansion joints* are flexible connectors designed to provide stress relief in ducting systems by absorbing movement caused by thermal changes (Figure 1). They also act as vibration isolators, shock absorbers and, in some instances, make up for minor misalignment of adjoining ducting or equipment.

The flexible element of the non-metallic expansion joint is fabricated from a wide variety of materials, including synthetic elastomers, fabrics, insulation materials and fluoroplastics, dependent upon the design. The designs range from a single-ply to complex, multi-ply constructions attached to metal frames for operation under extremes of temperature and/or corrosion.

*Metallic expansion joints* function in the same manner as non-metallic expansion joints, but utilize a thin metallic sheet formed into multiple convolutions as the flexible element. The flexible metallic element is welded to pipe ends or flanges for attachment.

Most metallic expansion joints are circular, but square or rectangular joints with mitered or circular corners are sometimes specified for duct applications. The strength and robustness of the metal is an advantage in some applications, but this is countered by its relative stiffness and the problems of metal fatigue. However, the performance of metals can be defined more precisely than fabric or rubber. Comprehensive design codes allow the manufacture of metallic expansion joints for defined operating conditions and cycle life.

Expansion joints provide flexibility in ductwork and are used to allow for four situations:
1) Expansion or contraction of the duct due to temperature changes.
2) Isolation of a component to minimize the effects of vibration or noise.
3) Movement of components during process operations.
4) Installation or removal of large components, and erection tolerances.

The advantages of non-metallic (fabric) expansion joints include:

- **Tolerates large movements in a short length** to allow for fewer expansion joints, reducing the overall number of units and providing additional economies.
- **Ability to absorb simultaneous movements easily in more than one plane** allows the duct designer to accommodate multiple movements with fewer (and simpler) expansion joints.
- **Very low forces required to move the expansion joint.** The low spring rate enables their use to isolate stresses on large relatively lightweight, equipment. A specific example is a gas turbine exhaust, where it is crucial to minimize the forces from the duct expansion on the turbine frame.
Corrosive resistant materials of construction enable their use in aggressive chemical conditions.

- Noise and vibration resistance.
- Ease of installation and maintenance.
- Minimal replacement cost.

The advantages of metallic expansion joints include:

- High external temperature capabilities allow for external insulation of the expansion joint at temperatures above 550° F or placement close to external heat sources.
- Higher pressure resistance capabilities.
- Accommodates pressure fluctuations—resistance to flutter and pulsations.
- Gas tightness at all temperatures.
- Predictable design life: Comprehensive design codes allow for defined operating conditions and cycle life.

Both metallic and non-metallic expansion joints are crucial components in flue duct systems. The proper choice for effective performance depends on the specifics of the application. The information provided is intended as an educational aid only. Your expansion joint supplier can provide you with advice and/or recommendations on designs that will meet your specific application.

**P&S**

Next Month: A potpourri of trouble shooting questions on mechanical seals.

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**Sealing Sense** is produced by the FSA to provide technical information on sealing systems and devices to pump users, contractors, distributors, OEMs, and reps. Our education mission includes collaboration with the European Sealing Association (ESA) to support development of harmonized fluid sealing-related standards that are intended to enable effective solutions for pump issues based on Total Life Cycle Cost principles.

The Ducting Systems Non-Metallic Expansion Joint division of the FSA is one of six with a specific product technology focus. Its mission includes developing publications such as the Technical Handbook Ducting Systems Non-Metallic Expansion Joint Division, which provides construction, installation, and application details for the designer and user of gas ducting systems. This primer is intended to complement manufacturer's documents produced by the member companies. Additional standards such as FSA-DSJ-401-02 Specification for High Temperature and Acid-Resistant Terpolymer Fluoroelastomer, which is the basis for ASTM Standard D-6909-03 Standard Specification for High Temperature and Acid-Resistant Fluorocarbon Terpolymer Elastomer, have been developed in response to important user issues.

The following members of the Ducting Systems Non-Metallic Expansion Joint division sponsor this Sealing Sense:

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Comparison of metal and fabric flue duct expansion joints

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<td>+400/+2000</td>
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<td>Above 100° W.C.</td>
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<td>Lateral</td>
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<tr>
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<td>Low transportation costs</td>
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<td>Possibility of repair</td>
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<td>Economical to replace</td>
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<td>-</td>
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<tr>
<td>Gas tightness</td>
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Legend: + Yes - No

We invite your questions on sealing issues and will provide best efforts answers based on FSA publications. Please direct your questions to: sealingquestions@fluid-sealing.com