Flue Duct Expansion Joints
EFFOX Inc. is the recognized leader in providing non-metallic expansion joints to the utility and industrial markets around the world. We incorporate a comprehensive engineering and manufacturing approach to meet the ever-increasing expansion joint challenges from our customers.

Our staff of experienced professionals utilizes the latest computer aided engineering platforms. Their experience coupled with our state-of-the-art 100,000 square feet (9,290 square meters) manufacturing facility located in Cincinnati, Ohio, makes EFFOX the one source for all your expansion joint needs.

- EFFOX offers complete design, engineering and manufacturing with a staff of over 150 professionals worldwide.
- EFFOX provides cost-effective solutions by packaging both expansion joint and damper products within a single, one-source contract.
- EFFOX offers oversized shipping capability via barge from Cincinnati, Ohio.
- EFFOX offers field services to assist in installation of your expansion joints and dampers.
Capabilities

In-house engineering and fabricating capabilities enable EFFOX to provide unique and specialized equipment to the marketplace. Our EFLEX™ expansion joints reflect the highest engineering standards and professional workmanship demanded by all EFFOX customers.

Industries throughout the world rely on EFLEX™ expansion joints well-earned reputation for reliability and performance.

- Power Generation
  - Coal or Oil Fired
  - Gas Turbine
  - Cogeneration
  - Selective Catalytic Reduction (SCR)
  - Flue Gas Desulfurization (FGD)
- Pulp and Paper
- Refineries:
  - Petro-Chemical
  - Chemical
- Steel Mills
- Foundries
- Smelters
- Cement
- HVAC - Heating, Ventilating and Air Conditioning
- Industrial Automotive

Commitment

Our objective is to continue building upon EFFOX’s reputation as a world leader in the expansion joint and damper markets. Our experienced engineering staff and fabrication facilities enables EFFOX to meet customer requirements with quality products at the lowest total cost and delivered according to our customer’s schedule.

We monitor every phase of our operation - from engineering through shipment - with quality guidelines that strictly adhere to the product specifications and comply with our audited Quality Assurance Program. Our quality assurance plan parallels the ISO 9001 guidelines. All welding processes are qualified per AWS D1.1 and ASME Section IX.

Fluid Sealing Association FSA
Flue Duct Expansion Joints

The primary purpose of an expansion joint is to provide a point of flexibility in flue ducts and relieve stress caused by system movement. The design parameters which influence the performance of any expansion joint and which must be defined for proper design analysis include:

- Movements
- Design / Operating Temperature
- Design / Operating Pressure
- Flue Gas Composition

A properly designed expansion joint successfully accommodates operating factors that include:

- Absorption of Vibration or Shock
- Minor Misalignment of Ductwork

Benefits of Non-metallic Expansion Joints

Non-metallic expansion joints incorporate the latest advancements in engineering and materials providing both superior technical and commercial benefits:

**Technical:**
- Axial & lateral concurrent movements
- Superior corrosion resistance
- Vibration reduction
- No end loading on attachment flanges

**Commercial**
- Lower material costs
- Lower shipping costs
- Lower installation costs
- Reduced replacement costs
- Face-to-face reduction
Types of Non-Metallic Expansion Joints

Composite

Composite expansion joints consist of layers of material bonded, sewn or mechanically fastened together along the edges. Each layer of material is designed to function independently of the others.

EFLEX™ Fluoroflex composite expansion joints are recommended for temperature applications from 400°F (204°C) to in excess of 2000°F (1093°C). EFLEX™ Fluoroflex material used as the outer layer of the composite expansion joint consisting of a fluoropolymer fiberglass product with a secondary corrosion barrier of cross-plied PTFE resulting in a superior chemical resistant product with ZERO porosity.

**Outside Cover Layer**
Fluoroflex - PTFE liner laminated to a PTFE/fiberglass composite product designed for wet and corrosive services.

**TFE Layer**
Cross-plied PTFE, highly resistant to chemicals, serves as a vapor (gas) barrier.

**Fiberglass / Cloth Layer**
Vermiculite coated fiberglass fabric acts as an insulator and provides expansion joint durability and strength.

**Insulation Layer**
Protects the cover and vapor barrier from heat degradation. The thickness of this layer is determined by the system temperature to ensure that the heat transfer from the flue gas is reduced to a point less than the maximum temperature of the cover and the vapor barrier.

**Fiberglass / Cloth Layer**
Vermiculite coated fiberglass fabric acts as an insulator and provides expansion joint durability and strength.

**Inside Layer / Tube**
Close weave material binds the belt together, acts as an insulator and gives the belt a finished appearance. The edge of this layer is hemmed and rolled over the edge of the expansion joint to form a cuff. This cuff establishes a barrier between the cover and the back-up bar, protecting the cover from any excessive heat that may be conducted into the back-up bar through the fasteners.

Elastomeric

Elastomeric material is laminated with one or more reinforcing plies and vulcanized into a homogeneous product.

Elastomeric expansion joints are used in flue ducts operating at or below 400°F (204°C). Material selection is based on maximum duct temperatures detailed below:

- Neoprene: 220°F (104°C)
- Hypalon®: 250°F (121°C)
- Butyl: 300°F (149°C)
- EPDM: 300°F (149°C)
- Fluoroelastomer: 400°F (204°C)
- Viton®, Fluorel®
Expansion Joints Design Guidelines

Expansion Joints Profiles

Belt Type
This expansion joint profile is mounted parallel to the plane of the duct.

"U" Design - Integrally Flange Type
This expansion joint profile incorporates its own flanges which are perpendicular to the plane of the duct.

Single Flow Liner
In positive flue gas systems with flush mount composite designs, baffles are recommended to extend the life of the expansion joint. In negative systems, a single flow liner is used to prevent the joint from being pulled into the flow causing the joint to fail prematurely from flutter and erosion.

Double Flow Liner
The double flow liner is used in systems with large duct movements and elevated temperatures.

Insulation Pillow
An insulation pillow is recommended for all composite joints continuously operating at temperatures 800°F (426°C) and above. The insulation pillow keeps belt temperatures down and increases the service life of the joint. The pillow consists of fiberglass or ceramic fiber (determined by flue gas temperature) encased in high temperature fabric and/or stainless steel mesh. An insulation pillow is also supplied in heavy fly ash environments to prevent ash buildup between the flow liner and the expansion joint.

Movements

Axial Compression
The dimensional shortening of the expansion joint face-to-face gap parallel to its longitudinal axis.

Axial Extension
The dimensional lengthening of the expansion joint face-to-face gap parallel to its longitudinal axis.

Lateral
The dimensional displacement of the inlet and the outlet flanges of the expansion joint perpendicular to its longitudinal axis.

Torsional Rotation
The twisting of one (1) end of the expansion joint with respect to the other end about its longitudinal axis.

Angular Rotation
That movement which occurs when one (1) flange of the expansion joint is moved to an out-of-parallel position with the opposite flange.
## Expansion Joints Specification Sheet

### Basic Configurations

<table>
<thead>
<tr>
<th>Item Number</th>
<th>Basic Configurations</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td><img src="#" alt="1" /></td>
</tr>
<tr>
<td>II</td>
<td><img src="#" alt="2" /></td>
</tr>
<tr>
<td>III</td>
<td><img src="#" alt="3" /></td>
</tr>
<tr>
<td>IV</td>
<td><img src="#" alt="4" /></td>
</tr>
<tr>
<td>V</td>
<td><img src="#" alt="5" /></td>
</tr>
<tr>
<td>VI</td>
<td><img src="#" alt="6" /></td>
</tr>
<tr>
<td>VII</td>
<td><img src="#" alt="7" /></td>
</tr>
<tr>
<td>VIII</td>
<td><img src="#" alt="8" /></td>
</tr>
<tr>
<td>IX</td>
<td><img src="#" alt="9" /></td>
</tr>
<tr>
<td>X</td>
<td><img src="#" alt="10" /></td>
</tr>
</tbody>
</table>

### Flowable Movements for Belt Type Expansion Joints

<table>
<thead>
<tr>
<th>Active Length</th>
<th>6”</th>
<th>9”</th>
<th>12”</th>
<th>16”</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inches</td>
<td>3/4”</td>
<td>2”</td>
<td>1 1/4”</td>
<td>3/4”</td>
</tr>
</tbody>
</table>

### Allowable Movements for “U” Design Expansion Joints

<table>
<thead>
<tr>
<th>Breach Opening</th>
<th>5 1/2”</th>
<th>8 1/2”</th>
<th>11”</th>
<th>15”</th>
</tr>
</thead>
<tbody>
<tr>
<td>Joint Face to Face</td>
<td>6”</td>
<td>9”</td>
<td>12”</td>
<td>16”</td>
</tr>
<tr>
<td>Inches</td>
<td>1/2”</td>
<td>1 1/2”</td>
<td>1”</td>
<td>1/2”</td>
</tr>
</tbody>
</table>
A World of Service

• Quality Assurance Program
  Quality assurance is in accordance with ISO 9001 guidelines. All welding processes are qualified per AWS D1.1 and ASME Section IX.
• Product Testing
  We have the ability to test our products at temperatures up to 1500°F (815°C) and at system operating pressure.
• Retrofit/Repair Capability
  Field service is available worldwide from our global field service network for repairs, alterations or replacement regardless of the original manufacturer.

A World of Solutions

A World of Benefits

• Worldwide operating experience
• Financial stability
• Leading edge design and engineering
• Fully equipped manufacturing facility in the U.S.
• Worldwide manufacturing capability
• Domestic and International field service capability

Slide Gate Dampers
Isolation capability with minimum pressure drop across the dampers. Available in low leak and zero leak designs.

Louver Dampers
Parallel blade design offers tight shut-off. Opposed blade design offers flow control capability. Double and tandem louver designs offer zero leak isolation.

Diverters
Provides extremely high-sealing efficiency in systems that require a through flow with bypass capabilities. Commonly used in HRSG applications.

Wafers
Cost-effective tight shut-off capability for round ducts.

Radial Vane Dampers
Fan inlet control capability.

Stack Isolation Dampers
Cost-effective shut-off and weather protection capability. Commonly used in HRSG and industrial boiler applications.

Metallic Expansion Joints
Applications for high pressure and high temperature designs which are beyond the capabilities of non-metallic joints.

EFFOX INC.
Worldwide Headquarters
EFFOX Inc.
9759 Inter Ocean Drive
Cincinnati, Ohio USA 45246
513-874-8915
Fax 513-874-1343
www.effox.com
E-Mail: sales@effox.com

...