Excellence in Manufacturing

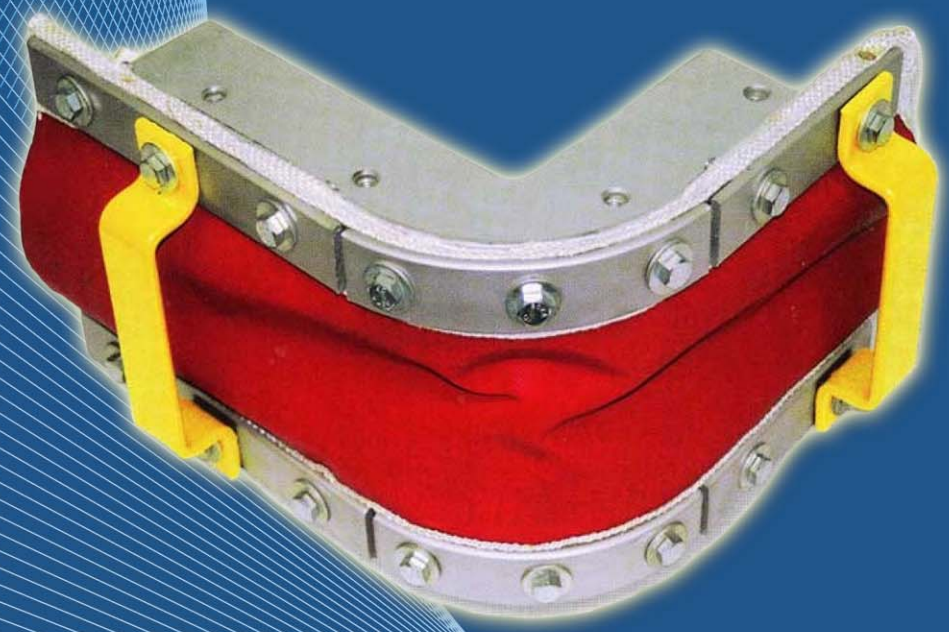
UNAFLEX® LLC.

ISO 9001:2008 CERTIFIED

FABRIC

Therma Flex Expansion Joints

2011 Revision



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INTRODUCTION TO "THERMA*FLEX" EXPANSION JOINTS

THERMA*FLEX Expansion Joints are Non-Metallic Flue Duct Expansion Joints or flexible connectors which when properly designed, provide stress relief for piping and ducting systems by absorbing thermal growth & shock, isolating mechanical vibration and allowing for misalignments.

Flue duct expansion joints are custom engineered products designed to handle low pressure (±3 psig) applications with temperatures form -100°F to +2000°F. The expansion joints are manufactured using innovative non-metallic materials and designs.

Unaflex is one the country's leading Expansion Joint Manufacturers. Since 1972 Unaflex has been dedicated to state of the art technologies combined with industry proven processes. In the 1990's Unaflex has become the industry leader in "Combined Technologies" for the Expansion Joint and Flexible Hose Industries.

Unaflex is a full service Engineering and Manufacturing Company dedicated to providing flexible solutions. Our capabilities include; Metal, Fabric and PTFE Expansion Joint Manufacturing, Laboratory Testing and Analysis and Field Service.

INDUSTRIES AND APPLICATIONS

Power Generation:

Fossil Fired Plants
Combined Cycle Plants
Industrial Gas Turbines
CFB's
(Fluidized Bed Boilers)
Nuclear Plants

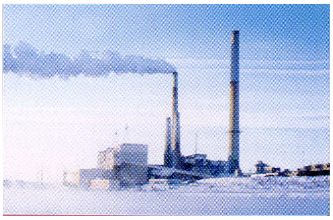
Pulp & Paper Plants:

Chemical Applications
Paper Processing
Power and Recovery Boilers
Fans / Blowers

Petrochemical:

Byproduct Incineration:
Elevated Temperatures
(>2000° F)
Severe Chemical Attack
Refineries

Environmental Applications:



SCR & NOx Systems
Waste Water TReatment Plants
Waste & Recycling Incinerators
Stack & Chimney Seals
CEMs

Heavy Industrial:

Foundries
Steel MIlls
Cement Plants
Aluminum Plants
Kilns & Smelters

Others:

HVAC
Marine
Food Processing
HRSG / Congeneration
Chemical Processing

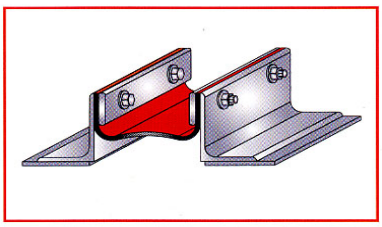
DESIGN ADVANTAGES OF NON-METALLIC DUCTING EXPANSION JOINTS

1. Large movement capability / Multi-plane movements
2. Corrosion / Chemical Resistance
3. Range of Design Temperature Capability
   (-110°F to +2000°F)
4. Negligible Spring Rates / Loads
5. Vibration Dampening & Sound Attenuation
6. Lower Overall Costs
   (Design, Installation, Replacement & Repair)
7. Easily Repairable / Installable
8. High Cycle Life
9. Unique Application Solutions

APPLICATIONS

Industrial applications can be separated into general categories based on the media composition (Air or Gas) and temperature. The following section is designed to aid in the selection of the appropriate expansion joint for the specific application range. All plants are different, there fore the service locations and temperatures may vary. This section is only a guide and should be confirmed with a Unaflex Engineer.

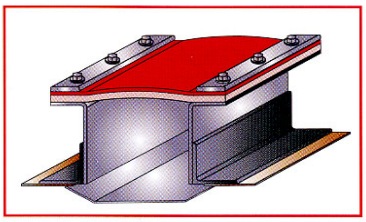
AMBIENT AIR SERVICES (-40°F to 150°F)



Ambient temperature clean air without particulate or chemicals to damage the flexible element. Expansion Joint is used frequently for vibration and sound attenuation from fan equipment.

Locations: FD Fan Intake / Outlet — Primary Air Fan to Air Heater
Service Air Intakes — Primary Air to Recovery Boiler

A Unaflex integrally flanged elastomeric joint is suggested, using either the THERMA*FLEX or MIGHTY SPAN styles. Neoprene or EPDM single layer belts are frequently used.

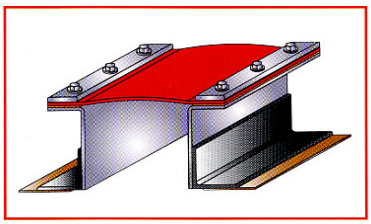


HOT AIR SERVICES (500°F to 800°F)
Clean Air after coming in contact with hot flue gases at the Air Pre-Heater where temperatures are elevated with minimal particulate and or gas carryover. Expansion joint will see thermal movements and vibration. E;Elevated temperatures require a composite flexible element and a flow liner.

Locations: Air Heater Air Outlet — Secondary Air Fan
Over Fire Air Fans — Mill Air

A THERMA*FLEX flat composite belt with a bolt or weld in frame design and a flow liner is suggested. The weld-in outboard angle frame design with field welded flow liner **(TWCP600VIFL)** is shown

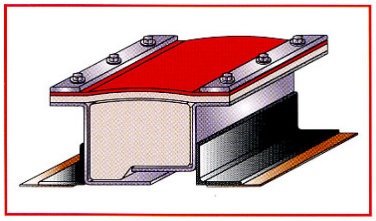
LOW TO MODERATE TEMPERATURE FLUE GAS SERVICES (150°F to 600°F)



Flue gas which has passed through an air preheater and dust collector to reduce the temperature and particulate level. Flue gas may cycle near the dew point where condensation can occur and chemicals are present. Expansion joint may see thermal movements vibration and chemical attack.

Locations: Precip. Outlet — Scrubber Inlet / Outlet — Reheater Inlet / Outlet
I.D. Fan Inlet / Outlet — HRSG Outlet

A Unaflex single layer belt with chemical barrier is suggested in either integrally flanged or flat belt type. Such as the THERMA*FLEX weld in outboard angle frame design and PTFE coated single layer belt with gas film layer **(TWFPR500TA)** shown.

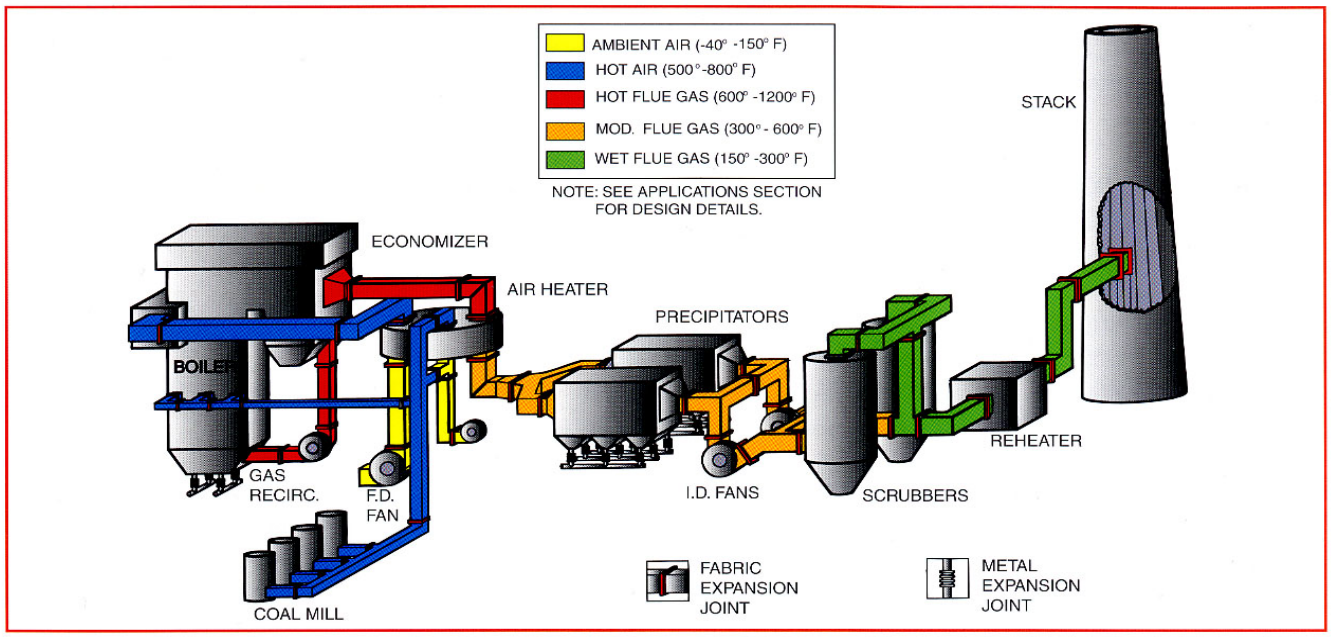


HOT FLUE GAS SERVICES (600°F to 1200°F)

Flue gas directly after combustion stage at elevated temperatures with possible particulate present. Expansion joint is used for possible large thermal movements at elevated temperatures.

Locations: Economizer Outlet — Recovery Boiler Outlet
Cyclone Inlet /. Outlet — Air Heater Gas Inlet / Outlet
Precip. Inlet — Gas recirculation System

THERMA*FLEX high temperature composite flat belt style with setback frames, cavity pillow and flow liners are suggested. The standard "Z" frame design with telescoping flow liners **(ZZWCP1000FPRP shown)** or "J" frame with shop liner are two designs used in these applications.



SPECIAL APPLICATIONS

Unaflex's expertise extends to applications where service conditions require special designs / considerations such as:

- Gas Turbine Exhaust & HRSG EJs - Large Axial Movements, Thermal Shock and Radial Growth
- Cyclone Inlet / Outlet & Loopseals at CFBs - High Flow Velocity or Turbulence and Elevated Temperatures
- Stack & Penetration Seals (HRSG) - Lateral Movement and field Installation / Splicing
- Cement Plant Applications - High Particulate Loading and Cementous Media
- Pulp & Paper Plants - Severe Chemical Attack and Vibration
- Petro Chemical Plants - Elevated Temperatures and Chemical Attack
- Fabric wrap of Existing Metal Expansion Joint - Quick inexpensive replacement / Possible on-line repair

OUR CUSTOMERS

INDUSTRIAL

Alstrom Energy Systems
Bath Iron Works
Bethlehem Steel Company
Chrysler Motor Corporation
Champion International
Deltak
Dow Chemical Corporation
E.I. DuPont Company
General Electric
General Dynamics
Ingalls Shipbuilding
LaFarge Cement
Mitsubishi
Medusa Cement
Mobile Oil Company
Monsanto Chemical Company
Niro
Nooter/Eriksen
Phillips/ Chevron
Shell Oil Company
Union Camp
U.S. Steel Company
Vogt - Mem
Wayerhauser Corporation
Wheelabrator APC
Westvaco Corporation

ENGINEERING & CONSTRUCTION

ABB
Bechtel Corporation
Black & Veatch
Babcock & Wilcox
Calpine
Dorr-Oliver Company
Fluor Daniel
Foster Wheeler Corporation
ICF Kaiser
Kvaerner Songer
Parsons E+C
Sargent & Lundy
Stone & Webster
Washington Group

POWER GENERATION

Allegheny Energy Service
American Electric Power
CalEngergy Company
Cincinnati Gas & Electric
Cogentrix
Consolidated Edison Company of N.Y.
Commonwealth Edison
Detroit Edison
Florida Power Corporation
Florida Power and Light
Indianapolis Power & Light
Kentucky Utilities
Potomac Electric Power Company
Public Service Company of Colorado
MIssissippi Power & Light
N.Y. State Electric & Gas Corporation
South Carolina Electric & Gas
Tampa Electric Company
Tucson Electric Light & Power
T.V.A.
Virginia Electric Power Company

STANDARD BELT MATERIALS (Material code refers to Continuous Operating Temperature Limit in degrees F.)

Various single layer and composite belt materials are available and are selected based on the specific application temperatures and flow media characteristics. The following is a list of Unaflex's standard belt designs.

Single Layer: (EL or FPR)

EL200NP **(NEOPRENE)**
EL300EP **(EPDM)**
EL400VI **(Flouroelastomer - Viton®)**
FPR500TA & TB **(Fluoropolymers - PTFE**

** Other elastomers are available in style 600 including FDA Materials

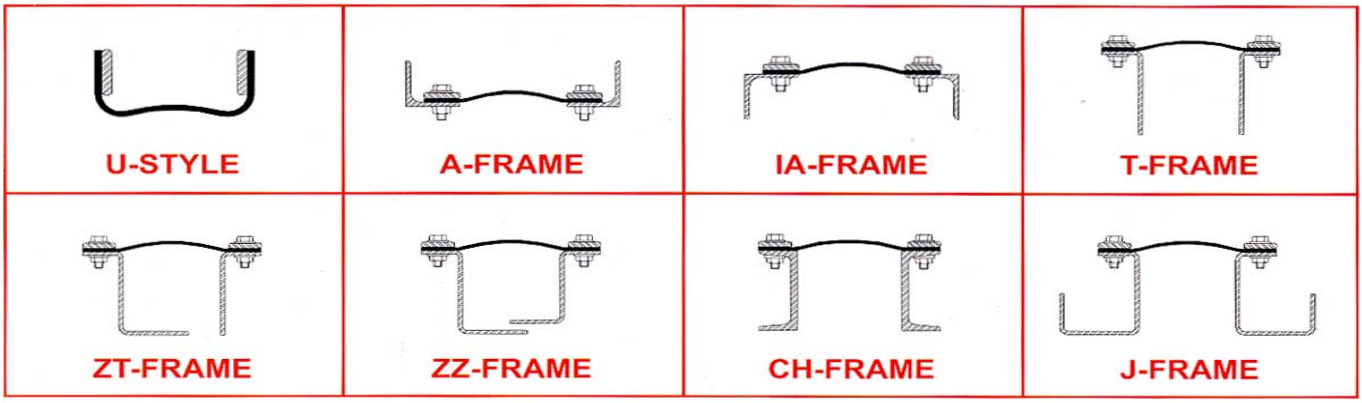
Composite: (CP)

CP500VI	CP800VI	CP1000VI	CP1200SI
CP500SI	CP800SI	CP1000SI	CP1200FPR
CP700TA	CP1000TA	CP1000FPR	CP1200GT

** Other composite buildups and covers are available per request up to 2000° F

Unaflex utilizes the highest grades of materials including: Elastomers, Fluoroelastomers, Fluoropolymers, Fluoroelastplastics and Metals. (Carbon & Stainless Steel, Monel®, Inconel®, and Hastelloy®.) in manufacturing our products. We are a Genuine DuPont Dow Elastomers Viton® Licensed Manufacturer and supply FSA-DSJ-401-02 (ASTM-D6909-03) specified Fluoroelastomer materials. For more information or a copy of this specification contact Unaflex or the Fluid Sealing Association.`

Standard Non-Metallic Expansion Joint Profile

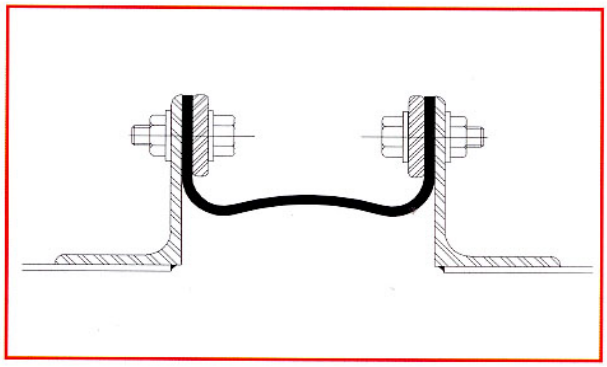


Design Configurations

INTEGRALLY FLANGED / "U" TYPE

The single layer belt can be provided either a fully hand molded Unaflex "Mighty Span" Style 600 Elastomeric expansion joint or a continuous molded corner THERMA-FLEX Style Elastomeric or Fluoropolymer joint. Style 600 joints are available with or without various arch profiles molded into the body. The service temperature is limited by the material rating.

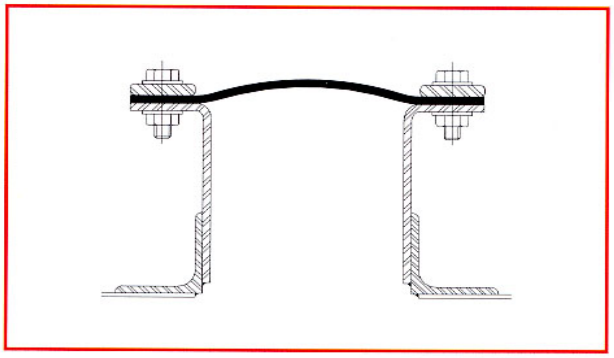
U-type joints are used frequently in fan application due to their minimal hardware requirements and Vibration / sound attenuation.



FLAT BELT TYPE

Available in single layer or composite belts mounted parallel to the duct on attachment frames. The frames may be either bolted to mating flanges or welded directly to the ductwork. See above for standard frame profiles.

Flat belt types are commonly used in high temperature applications and where a setback is recommended or required or required. This configuration can be designed to readily accept various accessories such as telescoping or floating flow liners, cavity pillows and fly ash seals



COMPANY PROFILE

Unaflex is located in Upstate South Carolina in a 117, 000 square foot manufacturing facility. Our Personnel are actively involved in setting industry standards through organizations life the FSA **(Fluid Sealing Association).** and have over 100 combined years of experience in the expansion joint industry.

Unaflex welders are certified to *ASME Boiler and Pressure Vessel Section VIII , Division I.* Our Quality Control Program is rigorous and **ISO 9001:2000 CERTIFIED**. We also comply with Government requirements for MIL-I-45208A and the U.S. Coast Guard. Unaflex maintains a complete Full Service Laboratory for testing and analysis of non-metallic materials.

Unaflex has been a contributing member of the FSA since 1974. The FSA is the International Trade Association made up of manufacturers of fluid sealing products. Their goal is to be a source of information, education and standards for the end user in reference to the sealing industry. For a copy of the association's Non-Metallic Expansion Joint Technical Handbook please contact Unaflex or the FSA directly.

Other products and capabilities of Unaflex include:

- **RUBBER EXPANSION JOINTS**
- **METAL BELLOWS EXPANSION JOINTS**
- **PTFE AND PTFE LINED EXPANSION JOINTS**
- **FLEXIBLE METAL AND RUBBER HOSE**
- **FIELD SERVICES INCLUDING:**
  - **SUPERVISION AND INSTALLATION**

WARRANTY

Unaflex warrants that our engineered products are to manufactured from all new and unused materials, to be free from defects in material and workmanship, and to be of sufficient design and capabilities to meet the requirements of the specified operating conditions, for a period of 12 months after the product has been placed into service, or 18 months from the date of shipment, whichever comes first.

Except as set forth, no other warranty either expressed or implied is made by UNAFLEX. Our maximum liability is limited to the total purchase price of the equipment found to be defective or, at UNAFLEX's option, product will be repaired or replaces free of charge including transportation charges but not cost of removal or installation.

Correction of defects shall constitute UNAFLEX's sole and exclusive responsibility to purchaser under this warranty, and the supplier shall in no event be liable for injuries to persons, property, or direct, incidental or consequential damages caused by the use of this product.

UNAFLEX shall not be liable if the products are used for any purposes or under any conditions beyond those originally specified, including modification, repair, or improper installation by anyone other than an authorized UNAFLEX agent, or damage due to misuse or negligence.

UNAFLEX®
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STANDARD WARRANTY

All merchandise sold by UNAFLEX is subject to this Standard Warranty. Our products are warranted to be free from defects in material or workmanship. Our liability for breach of any and all warranties, expressed or implied, is limited to refunding our invoice price of the product, or at our option, to replacement of the product. If any product manufactured by UNAFLEX is found by us to be defective either in material or workmanship, under proper usage and service, the invoice price will be refunded or at our option will be replaced free of charge including transportation charges, but not cost of installation. The refund of the invoice price or the replacement of the product is the maximum liability of the company. The sale of our products under any other warranty or guarantee, expressed or implied, is not authorized by the company.

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