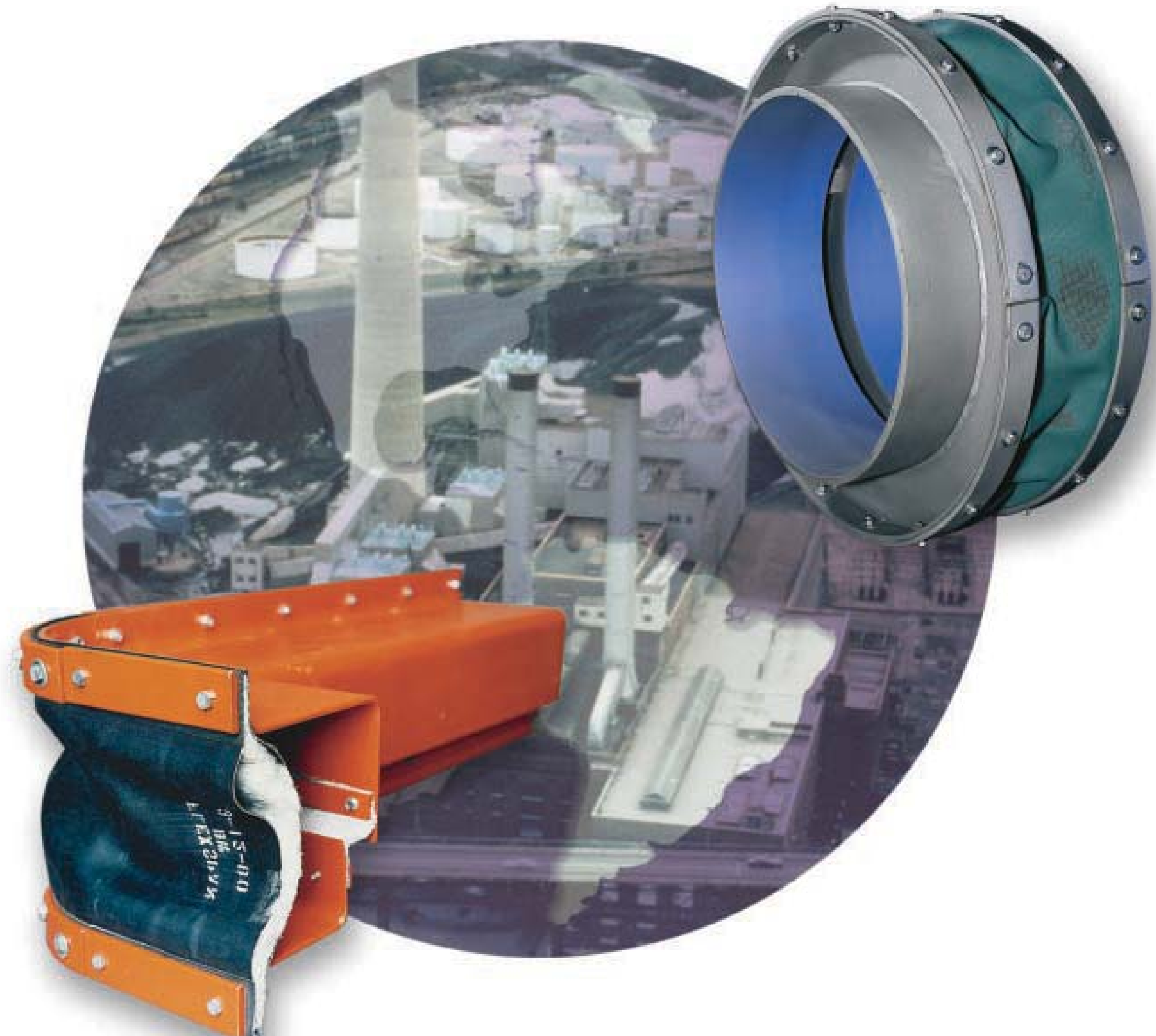
SENIOR FLEXONICS PATHWAY



Engineered Solutions For Ducting Applications of Fabric Expansion Joints

senior

MANUFACTURING CAPABILITIES & QUALITY ASSURANCE

COMBINED FACILITIES

Manufacturing Floor Area	200,000 sq. feet (18580 sq. meters)
Total Land Area	31 acres (125,000 sq. meters)
Bridge Crane Capacity	40-ton max. (36,288 kq)
Maximum Hook Height	37 feet max. (11.28 meters)
Fork Lift Capacity	30,000 Ibs. (13,608 kg)

FABRICATION

Vulcanizing Presses	Digital Controlled, Flat belt, corners
Welding	Sub Arc, Arc, Pulse Arc, TIG, MIG, Core Wire, Resistance, Electroslag, Tube Welding, Track Welding, Large Turn Tables, Rolls, and Positioners.
Plate Roll	1 1/2" Thickness (38.1 mm)
Angle Roll	5" x 5" x 1" (127 x 127 x 25 mm)
Press brakes	5 ton through 400 ton (4536 through 362,880 kg)
Radial Expanders	5 ton through 400 ton (4536 through 362,880 kg) 1/2 through 96" diameter (13 mm through 25 m)
Shear	.003 through 1" (.08 through 2.5 mm)
Flame and Plasma Cutting	4-torch computer controlled water table
Abrasive Blasting	16' x 16' x 24', recirculating system (4.9 x 4.9 x 7.3 m)
Painting and finishing equipment	

BELLOWS FORMING

Expanding mandrel forming from 1/2" (10 mm) to 30' (9.1 m) diameter
Large bellows of unlimited diameter can be made in sections
Roll forming to 14' (4.27 m) diameter
Hydraulic forming, 1200 ton (1,088,640 kg) press for heavy wall and specialized toroidal bellows

QUALITY ASSURANCE

Compliance Senior Flexonics Quality Assurance System has been certified to ISO 9001 and is in with ASME Section VII, Division 1, ASME B31.1 and ASME B31.3, AWS B1.1, AISI, ASIC, Stoomwezen and T.U.V.
Section VIII (U Stamp)
Section III (N Stamp)
Section III (NPT Stamp)

TEST CAPABILITIES AND DESIGN VERIFICATION TESTS

Various Fabric Test Fixtures
Elevated Temperature/Pressure Fabric Expansion Joint Cycle Testing
Fabric Belt Oven Tester
Durometer Hardness
Specific Gravity
X-ray 300KV – 10 MA and 5 MA Magnetic Particle, Dye Penetrant, Zyglo, Ultrasonic and Eddy Current Testing
Mass Spectrometer and Halogen Leak Detection
Positive Material Identification (PMI)
Hydro Testing
Cycle Testing
Spring Rate Testing
Dead Weight Testing
Hardness Testing
Ambient Temperature Bellows Fatigue Testing
Elevated Temperature Bellows Fatigue Testing
Seismic Analysis of Fabricated Components
Vibration Analysis of Fabricated Components
Shock Loading Performance Testing
Bellows Spring Rate Testing
Expansion Joint Deflection Testing
Bellows Torsion Testing
Burst Testing

Table of Contents

For high temperature applications see our literature covering materials, designs, testing and options for this demanding service. The brochure is entitled "Dextra™ Composite Expansion Joint, Engineered Solutions for High Temperature Duct Applications".

Introduction

Senior Flexonics Pathway, with origins dating to 1902, pioneered development of the first fabric expansion joints for flue gas ducting applications in 1964 as a practical alternative to large round and rectangular metal expansion joints. With superior flexibility to absorb the large motions occurring in ducting systems, fabric expansion joints have become the preferred product for these demanding applications.

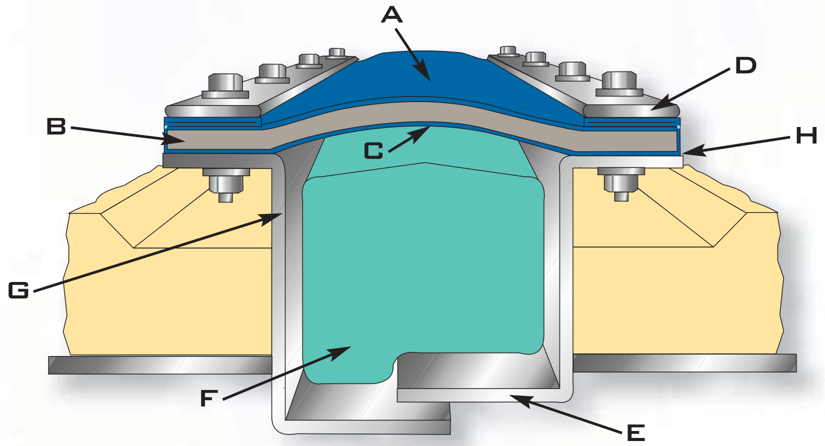
Since those early days, we have stayed at the forefront of product design innovation and materials development technology. As a member of the Fluid Sealing Association (FSA) and the Expansion Joint Manufacturers Association (EJMA), Senior Flexonics Pathway has set the highest standards for furnishing engineered nonmetallic materials, combined with proven frame designs to yield durability, reliability and extended service life.

This design manual has been developed to provide knowledgeable insight into the proper application of fabric expansion joints. Useful design information, installation instructions and engineering reference data have been included to assist the reader in selecting a product that will provide the best overall value through increased operating efficiency, reduced maintenance and extended reliability.

Senior Flexonics Pathway provides the following services to meet your special needs:

- **48 hour shipment:** Any catalog standard fabric expansion joint can be fabricated and shipped in as little as 48 hours, sometimes even faster.
- **On-Site Installation:** Senior Flexonics Pathway can mobilize an experienced field crew to perform turn-key installations; or simply provide an experienced Installation Specialist to advise your plant personnel.
- **Emergency Hotline:** We understand that emergencies usually don't happen during business hours. Our Emergency Hotline (830) 660-0337 is monitored 24 hours per day, every day, to provide immediate contact with responsible and knowledgeable personnel.

FUNCTION OF FABRIC EXPANSION JOINT COMPONENTS



A. GAS SEAL MEMBRANE

The gas seal membrane is intended to withstand system pressure and be resistant to chemical attack from the interior and the exterior. The gas seal must also have the flexibility to absorb thermal movements. Depending on system temperature, it may require additional thermal protection.

B. INSULATING LAYERS

The insulating layers provide a thermal barrier to ensure that the inside surface temperature of the gas seal membrane does not exceed its maximum service temperature. The insulating layer can also reduce condensation caused by the gas stream coming in contact with the "cool" surface of an uninsulated gas seal membrane.

C. INSULATING RETAINER LAYER

This layer is provided to keep the insulating layers in place in order to maintain thermal integrity. The retaining layer must be capable of withstanding gas stream temperatures and must be chemically compatible with system media.

D. BACK UP BARS

Back up bars, positioned at the flange attachment, use clamping pressure to create the fabric-to-duct seal and restrain the fabric when it is subjected to the system pressure. The thickness and width of the back up bars should be sufficient to perform this function with the bolt spacing being used. The edges of the back up bars should have a radius to preclude cutting of the fabric.

E. METAL LINER OR BAFFLE

A liner is designed to protect the gas seal membrane and insulating layers of the flexible element from abrasive particles which may be present in the gas stream. A liner is also used to reduce flutter of the fabric element caused by turbulence, to help control the accumulation of dust or ash in the expansion joint cavity, and to reduce the temperature of the flexible element.

F. ACCUMULATION BAG

An accumulation bag is intended to deter flyash from building up in the expansion joint cavity. It is typically used, in conjunction with a liner, in duct runs from boilers to air clean-up equipment such as precipitators, scrubbers and bag houses, or whenever high amounts of dust or ash are present in the gas. A flyash barrier must be capable of retaining its strength and flexibility while being exposed to maximum system temperatures and media.

G. FABRIC ATTACHMENT FLANGES

Fabric attachment flanges are required to connect the flexible element to the ductwork. Properly designed, they can be attached directly to the duct work and thus eliminate the necessity for an adjoining duct flange. Flanges can be designed with a "landing bar" duct attachment which allows some installation misalignment without affecting the flexible element. The flanges establish the stand off height of the fabric, which is necessary to achieve thermal integrity during all movement conditions. The edges of the flanges in contact with the gas seal membrane should also have a radius to prevent damage.

H. GASKET

Single ply fluoroplastic and fluoroelastoplastic belt designs such as Ultrachem materials require flexible chemically inert gaskets.

PRODUCTS, MARKETS & APPLICATIONS

FOSSIL FIRED POWER MARKET APPLICATIONS

Applications range from the FD fan to the primary air, tempering air, coal mill, boiler flue duct joints, economizer, air heater, precipitator, baghouse, fabric filter, ID fan, scrubber, absorber, reheater and stack expansion joints.

ENGINEERING SERVICES

Senior Flexonics Pathway supports its fabric expansion joint products with experienced field engineers, On-Site service installation, repair services, and CAD supported application engineers to help you solve your expansion joint problems.

MANUFACTURING CAPABILITY

We have the unique ability to react quickly to support your outage needs for fabric expansion joints. Senior Flexonics Pathway can produce round, rectangular and custom shapes for every application. We are well known worldwide for our “Round the Clock” Service.

ULTRACHEM AND FLEXON MATERIALS

Senior Flexonics Pathway is the company that first developed the use of fluoropolymer (PTFE) materials in expansion joint systems. Specifically designed for a variety of wet and dry corrosive applications, these materials will exceed your system requirements.

GAS TURBINE EXHAUST APPLICATIONS

Our fabric expansion joints are currently in service in peaking plants, on shipboard power systems, on co-generation turbines, natural gas pipeline pump stations and a variety of heat recovery.

WET SCRUBBER APPLICATIONS

There is no more demanding service for expansion joints than wet scrubbers. Senior Flexonics Pathway can provide the correct PTFE or FKM gas seal materials to handle this hostile environment.

ECONOMIZER APPLICATIONS

Our fabric expansion joints are ideally suited for this flyash laden application. Flexible high strength and lightweight fabric belt elements in combination with our engineered frames offer longer life and lower installed costs.

CRUDE OIL REHEAT DUCTING APPLICATION

More sensitive to downtime than most industries, our refinery customers appreciate the high quality of our fabric expansion joints. These joints were designed with turned out angle flanges and a 'flat belt' design for easy installation and access.

PULP AND PAPER MARKET APPLICATIONS

The corrosive conditions around the power and recovery boilers as well as the duct joints to the fans, precipitator, scrubber, and stack are all locations where you will find expansion joints.

REFINERY MARKET APPLICATIONS

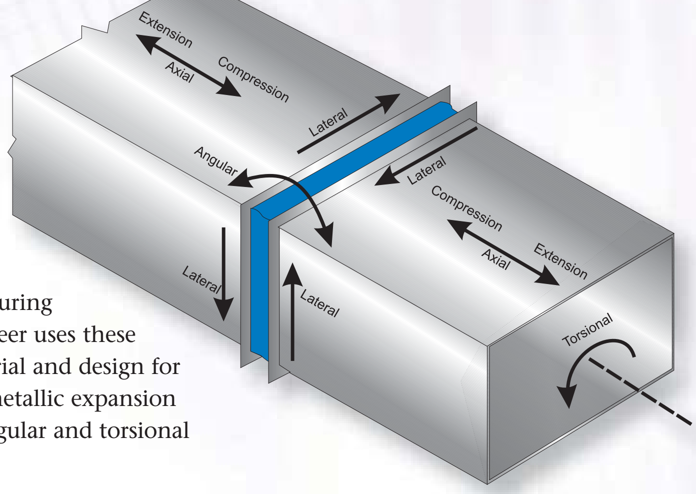
Our products are installed at the CO boiler, exhaust gas ducting, precipitator, fans, crude reheat units, and the balance of the air and gas ducting.

SPECIAL DESIGNS

In addition to Senior Flexonics Pathway's standard configurations provided in this catalog, many specially engineered designs have been produced for the following applications:

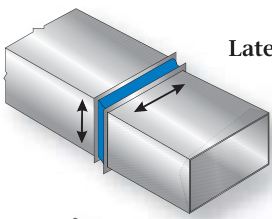
- Heat Recovery Steam Generators (HRSG)
- Circulating Fluid Bed Boilers (CFB)
- Cement Industry
- Steel Industry
- Windtunnels, HVAC, etc.
- Selective Catalyst Reduction (SCR) Units

MOVEMENT CAPABILITIES

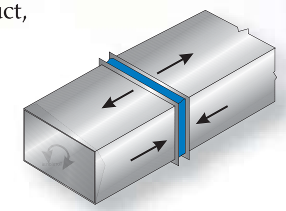


The system thermal expansions are the differential expansion/contraction of operating and/or excursion temperatures and the minimum ambient temperature during installation and shutdowns. The expansion joint engineer uses these movements and temperatures to select the proper material and design for each expansion joint. Senior Flexonics Pathway's nonmetallic expansion joints frequently can handle combined axial, lateral, angular and torsional movements in a single assembly.

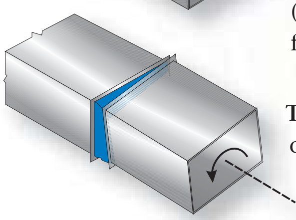
The expansion joint locations can often be optimized, reducing the total number required. Consideration should be given for accessibility and belt replacement, for new ducting systems, it may be more economical for the duct fabricator to provide a portion of the expansion joint frame.



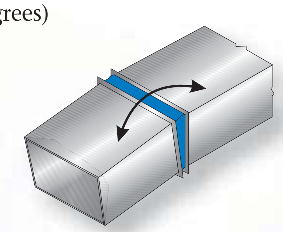
Lateral Movement - The amount of duct movement occurring in either or both of the two perpendicular planes to the longitudinal axis of the duct, which moves the expansion joint flanges out of alignment.



Axial Compression/Extension - The dimensional shortening (compression) or lengthening (extension) of the expansion joint face-to-face dimension parallel to it's longitudinal axis.



Torsional Deflection - The amount of twisting movement (in degrees) occurring in the perpendicular planes to the longitudinal axis of the duct system.



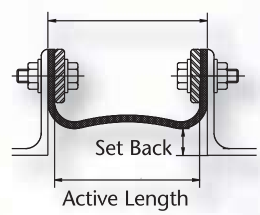
Angular Deflection - The amount of rotation (in degrees) of the duct system which flexes the expansion joint flanges out of parallel position with each other.

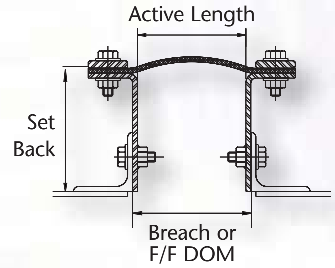
TYPICAL MOVEMENT CAPABILITIES

Belt Type	Active Length	6″ (152mm)	9″ (229mm)	12″ (305mm)
Single Layer	Axial Compression	2″ (51mm)	3″ (76mm)	4″ (102mm)
Fabric Element	Axial Extension	1/2″ (13mm)	1/2″ (13mm)	1/2″ (13mm)
(Non-concurrent)	Lateral	1″ (25mm)	1 1/2″ (38mm)	2″ (51mm)
Composite Belt (Concurrent)	Axial Compression	1″ (25mm)	1 1/2″ (38mm)	2″ (51mm)
	Axial Extension	1/4″ (6mm)	1/4″ (6mm)	1/4″ (6mm)
	Lateral	1/2″ (13mm)	3/4″ (19mm)	1″ (25mm)
Integrally Flanged	Axial Compression	2″ (51mm)	3″ (76mm)	4″ (102mm)
Single Layer	Axial Extension	1/2″ (13mm)	1/2″ (13mm)	1/2″ (13mm)
(Concurrent)	Lateral	1″ (25mm)	1 1/2″ (38mm)	2″ (51mm)

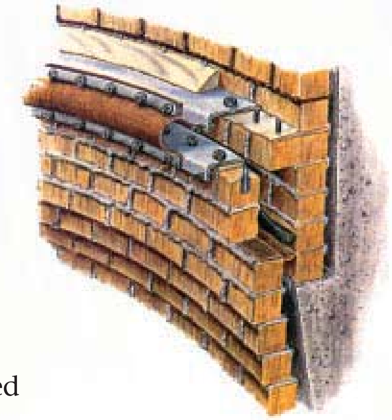
Notes:
1. Special considerations must be made when movements exceed those listed above or differ from nonconcurrent or concurrent ratings. Consult with factory for these applications.
2. Breaching tolerances: Axial extension 1/4″ (6mm), axial compression 1/2″ (13mm), lateral + 1/4″ (6mm). Exceeding these tolerances will affect movement capabilities.
3. Lateral movement exceeding 3″ (76mm) should utilize cold lateral offset (preset) to reduce the relative belt movement.

BREACH OPENING FACE-TO-FACE





SPECIAL APPLICATION CHIMNEY GAS SEALS



THE PROBLEM

Numerous fossil-fueled utility chimneys built between the years 1950 and 1970 used a rope packing design as a gas seal between adjacent sections of brick liners. Should the rope packing leak, flue gas may attack the less resistant concrete chimneys causing leakage and chimney deterioration.

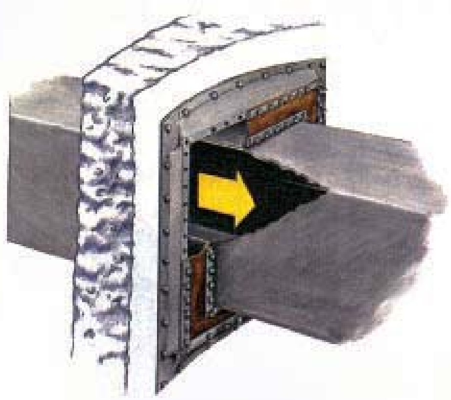
DESIGN SOLUTION

A fabric expansion joint has been designed to eliminate the need for the original seals as well as provide for improved inspection and maintenance. Features of the design include:

- Lower installed cost due to lighter weight materials.
- Gas seal membrane for long life
- Easily repairable by heat sealing methods
- Easily accessible
- Unique frame design for easy access
- Chimney air seal

THE PROBLEM

Penetration of flue gas ducts through the chimney liner and outer shell require an air tight seal for a pressurized chimney annulus. Leaky seals allow the flue gases to enter the annulus and attack the outer concrete structure shell.



DESIGN SOLUTION

A dual picture frame attached to the duct and the liner (or shell) utilizing UltraChem™ Gas Seal Membrane is installed to span between the two frames creating the seal. Benefits of the design are:

- Easily repairable by heat seal methods
- Lower installed cost due to lighter weight materials
- Easily accessible for inspection or repair

OPERATIONAL & DESIGN CONSIDERATIONS

The following background information on the plant and application can have significant influence to the design life of the expansion joint.

- Plant type
- Location of expansion
- Environmental conditions
- Base or peak load plant
- Relevant history of existing and adjacent equipment

FLOW MEDIA

In defining system media, the designer should specify the type of fuel, sulfur content, and any additives, cleaning agents or catalysts, which may be used in the system. Ph in the vicinity of the expansion joint should be specified, if known, especially if the media is extremely acidic or caustic.

The probability of condensation should be determined by comparing dew point and normal operating temperatures. Even in systems which normally operate quite hot, shutdowns and startups may produce condensation resulting in excessive corrosion. This condition can also occur on the outside of the steelwork and should be considered.

Abrasive components of the media such as flyash should be identified. Flyash buildup within a flue gas duct should be estimated, and the dead weight calculated to determine the maximum load on an expansion joint element. Plant operating procedures such as duct cleaning (wash-down or vacuuming) are also considered in the design.

TEMPERATURE

Temperatures affect the selection of fabric expansion joint materials. The following temperatures for the system should be provided to the engineer.

- Normal operating temperature
- Maximum continuous operating temperature
- Design temperature
- Excursion temperatures and duration
- Ambient temperatures (the lowest, highest and average)
- Dew point temperatures

Caution: Specifying a "design temperature" which includes excessive safety factors may actually be detrimental to the design of the flexible element and should be avoided.

PRESSURE & EXPANSION JOINT LEAKAGE

Fabric expansion joints are typically designed for low pressure duct systems with maximum rating at +5 psig for elastomeric and +3 psig for fluoroplastic and fluoroelastoplastic belts.

Fabric expansion joints are designed to be as leak tight as practical. When an unusual amount of liquid is present within the ducting, or leakage requirements are specified, special caulking or gasket materials can be used when attaching the fabric element to attain the desired results. In industrial applications, minor leakage, detectable by soap bubble solution, is considered acceptable.

When replacing a fabric element, leakage through bolt holes is minimized if holes are aligned and punched in the field as opposed to prepunching the holes at the factory. Backup bar bolts should be tightened to 35 to 45 ft. lbs. (45-61 Nm) to ensure optimum clamping pressure.

MOVEMENTS

Various movements resulting from thermal expansion of the breeching, both Maximum Continuous System Operating Temperature (MCSOT) and excursion temperatures should be specified. Contractions of the breeching due to cold winter shutdowns, mechanically induced movements such as fan and equipment vibrations, and structural deflections due to wind loads and seismic events must also be specified.

Movements in various directions should be analyzed to determine if they occur simultaneously or if they can occur individually without a corresponding deflection in another direction. The designer to make certain that the expansion joint design is capable of absorbing a combination of the total maximum movements should specify maximum installation misalignment.

SYSTEM GEOMETRY/INSTALLATION

The geometry of the expansion joint system, including duct size, orientation, material and attachments all have an effect on the selection of expansion joint frame configuration. The installation of an expansion joint can be performed either internally or externally. Specific frames are designed for each application depending on preferences or accessibility.

EXTERNAL ENVIRONMENT

Correct operation of high temperature expansion joints requires that a portion of the system heat be dissipated to the external environment. Abnormally hot ambient conditions or an adjacent heat source, reflective surface, or duct insulation may create temperatures that exceed the limits of the gas seal membrane and should be considered when designing the system.

An external cover may be desirable to help protect against failing objects or the accumulation of combustible materials such as coal or saw dust. Covers should be designed by the expansion joint manufacturer to ensure that proper air circulation requirements are satisfied.

EXPANSION JOINT FLUTTER

The inherent flexibility of expansion joints can cause fatigue problems as a result of physical fluctuations known as flutter. Flutter is a result of either flow induced or operating pressure oscillations. Both conditions can cause a premature failure and must be identified in the quotation/evaluation stage. This condition is commonly found adjacent to turning vanes, ID fan and stacks. This pressure oscillation typically exists in ductwork locations where the static pressure is very low ±1 to ±2″ w.c (±25 to ±50 mm H_2O).

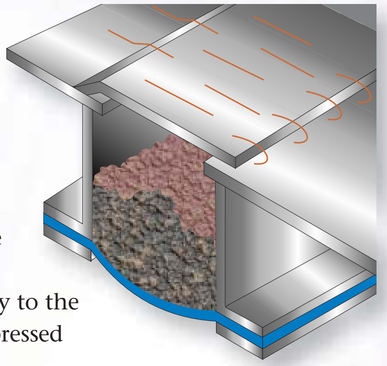
INSTALLATION CONSIDERATIONS

The system designer must consider all installation requirements such as mating duct flanges, adjacent ducting equipment, insulation, painting/ finishing, field assembly, erection and necessary qualified supervision.

RESPONSIBILITY

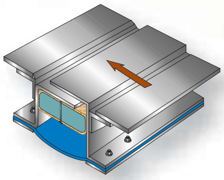
The system designer must evaluate whether the lines of responsibility are clear between the ducting supplier, erector, and the expansion joint supplier, and if they will result in a system that meets specification requirements at an optimum overall cost. It is usually in the best interests of the end user to specify and/or order the expansion joints themselves.

CAVITY PILLOW

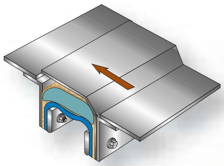


CAVITY PILLOW STYLES

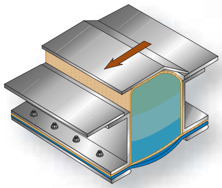
The Senior Flexonics Pathway cavity pillows serve three purposes, retarding the intrusion of particulate, thermal protection, and resistance to pressure pulsation. Our pillows are fabricated from selected insulation materials and wrapped with a high temperature fabric, designed for the operating conditions. Standard pillows are provided with "ears" or tabs that fasten under the belt and backup bars to hold the pillow in place. The ears are designed to provide a memory to the pillow such that it will return to an "as installed" uncompressed state after plant cool down, during outages.



Style - 1



Style - 2



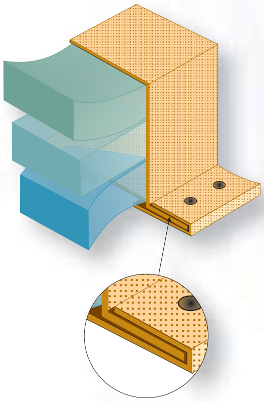
Style - 3

CAVITY ACCUMULATION PILLOW (CAP)

A cavity created between the structural steel frame/flanges and the gas seal (fabric expansion joint) is designed to provide a standoff between the fabric element and the flue gas. This cavity can fill with particulate falling out of the flue gas. If these deposits are allowed to buildup the expansion joint will fail to operate properly and could become damaged. Senior Flexonics Pathway recommends the use of an accumulation pillow designed to occupy this "dead space", preventing the deposits from entering and filling this cavity. The cavity pillow in conjunction with a flow liner will prevent the accumulation of particulate/fly ash. Many maintenance managers view this option as a low cost insurance policy that extends the service life of the expansion joint.

HIGH TEMPERATURE CAVITY INSULATION PILLOWS (CIP)

Cavity Insulation Pillow (CIP) - A style CIP provides additional thermal protection to the belting material for high temperature applications.

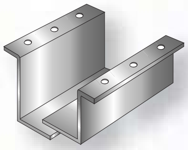


Typical cavity pillow construction consisting of layers of insulation encased in a protective high temp sleeve.

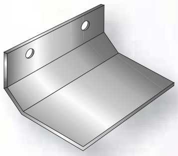
FLOW LINERS

Flow liners (baffles) are metal shields designed to provide protection for the fabric element and/or cavity pillow from direct impingement of particulate or particulate accumulation. A liner is also used to reduce flutter of the fabric element caused by turbulence, to help control the accumulation of dust or ash in the expansion joint cavity, and to reduce the temperature of the flexible element. Flow liners can be supplied on a variety of profiles (straight, airfoil, semi-airfoil or telescoping) and materials. (Standard profile and material are straight 10 GA. A569 C.S.). Flow liners fall into the following categories.

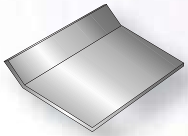
- Integral liners are pre-manufactured parts of the expansion joint frame as on SR2700 and SR2750 series frames.
- Bolt-in liners are primarily used on integrally flanged style expansion joints as on our U1000 series, between the belt or expansion joint flange and the mating duct flange. Gaskets are required on metal-to-metal and/or Teflon®-to-metal connections.
- Weld-in liners spanning the breach opening can be either welded in the field to the duct interior or can be supplied welded in factory to the expansion joint frame.



Integral Liner



Bolt-in Liner

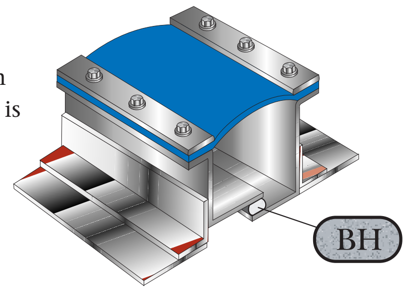


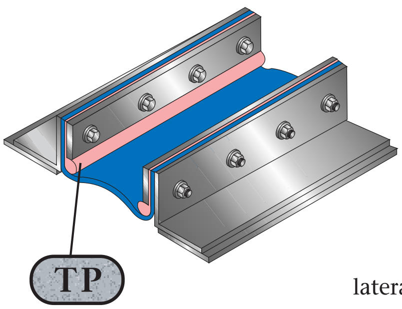
Weld-in Liner

OPTIONS & ACCESSORIES

BRAIDED HOSE SEAL (BH)

Flexible stainless steel braided hose with enclosed ceramic insulation is often specified for expansion joints in areas of high particulate loading. The hose is secured between the flow liners to prevent particulate from entering the expansion joint cavity. This accessory along with a cavity pillow works well in cement plants.



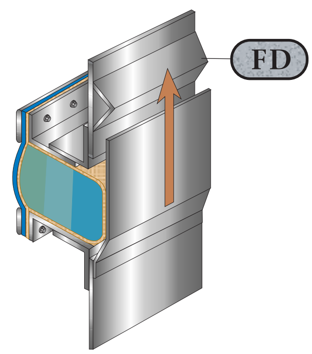


TADPOLE GASKET TAPE (TG)

When using integral flange-type expansion joints in duct systems with positive pressure operating conditions, Senior Flexonics Pathway recommends the use of tadpole gasketing between the flexible element flange and backup bars (as illustrated). This prevents the heads of the erection bolts from abrading the outside cover of the flexible element. This option also protects both flat and integrally flanged belts during large lateral or compression movements.

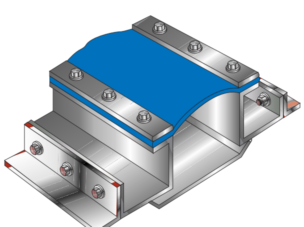
FLOW DEFLECTOR (FD)

In some expansion joint installations, an angle flow deflector is added to the design to increase the service life of the joint. A flow deflector is used to prevent moisture and particulate from sliding down vertical duct walls and being trapped in the expansion joint cavity by the flow liner.



FRAME STYLES

Senior Flexonics Pathway provides numerous frame designs for various applications. The integrally flanged U-belt design has a very economical initial capital cost. The flat belt frame design has a lower replacement belt cost and existing hardware can be reused. The following is a sample of several standard arrangements.

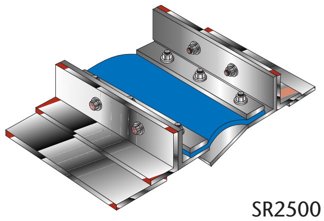

SR2400

SR2400

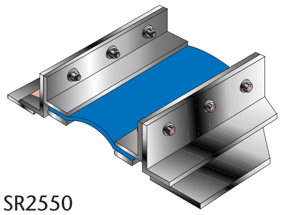
Design applications where the ductwork flanges are present and a complete frame assembly is preferred. This style works well for high temperature applications.

- Complete drop-in assembly
- Prefabricated standard frames reduce cost
- Belting hardware accessible from outside
- Best choice when adjacent structures or equipment cannot permit liner protrusion beyond attachment flange.
- Accepts shop welded flow liner
- Readily accepts eared pillow design
- Used to fill large breech openings
- Accommodates large lateral movements
- Provides proper setback for belt protection

Senior Flexonics Pathway expansion joints are furnished assembled or unassembled.



SR2500

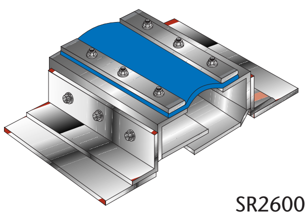


SR2550

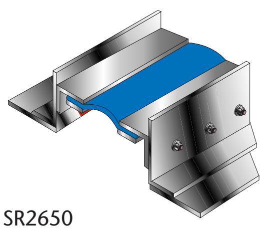
SR2500

Complete drop-in assembly design which works well with low to moderate temperature applications with low levels of particulate accumulation.

- Economic frame using standard angle sizes
- Accessibility to bolting hardware
- Accepts shop welded flow liner
- Designed for internal (SR2550) or external belt replacement (SR2500)
- Used frequently with fan applications
- Studs or tack welded nuts are optional on belt flange



SR2600

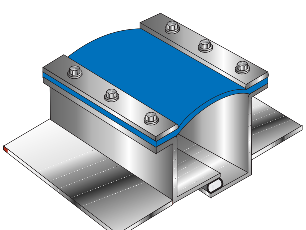


SR2650

SR2600

Similar to the SR2500 style and is used where additional standoff is necessary or preferred. This design works well in low to moderate temperature applications with low levels of particulate accumulation.

- Economic frame using standard angle sizes
- Fabric wrap design used to retrofit over existing metal expansion joints (possible on-line installation)
- Complete assembly drop-in design
- Designed for internal (SR2650) or external belt replacement (SR2500)
- Used frequently with fan applications
- Accepts shop welded flow liner
- Studs or tack welded nuts are optional on belt flange

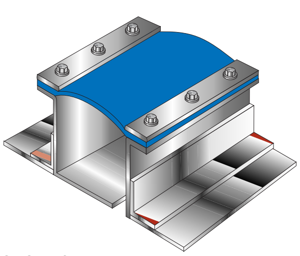


SR2700

SR2700

Used for low-to-high temperature applications with a cavity pillow, where high levels of particulate are present.

- Accommodates both flanged and non-flanged ductwork
- “Z” style with integral telescoping flow liners
- Reduces particulate accumulation in frame cavity
- Provides protection for belts and pillows
- Complete accessibility to bolting hardware
- Accepts eared pillow design
- Accommodates large lateral movements
- Tack welded nuts are optional
- Provides proper setback for belt protection



SR2750

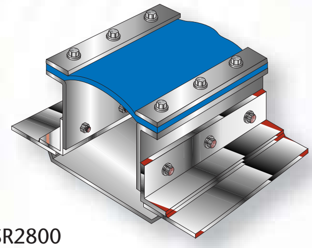
SR2750

Similar to SR2700 with the exception of a single integral flow liner. This design works well with lower particulate levels or vertical duct applications.

- Accommodates both flanged and non-flanged ductwork
- “Z” style integral upstream flow liner
- Provides protection for belts and pillows
- Complete accessibility to bolting hardware
- Accommodates large lateral movements
- Tack welded nuts are optional
- Provides proper setback for belt protection

Senior Flexonics Pathway expansion joints are furnished assembled or unassembled.

SR2800

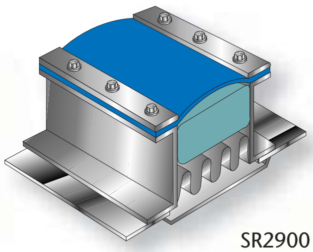


SR2800

This style frame is well suited for installation with field assembly over existing expansion joints, and is utilized for all temperature ratings.

- Economic frame utilizing standard prefabricated angle iron
- Either welded or bolted frame can be utilized
- Fabric wrap design can be used to retrofit over existing metal expansion joints (possible on-line installation)
- Accepts eared pillow design
- Facilitates field assembly and fit-up
- Tack welded nuts are optional
- Provides proper setback for belt protection

SR2900

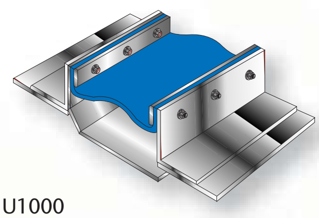


SR2900

Best utilized where flanges are not present and field assembly is required or preferred.

- Fabric wrap design used over existing metal expansion joints (possible on-line installation)
- Provides additional stiffener reinforcement to existing ductwork
- Utilizes standard structural steel channels for economical design
- Flanges act as duct stiffiners

U1000

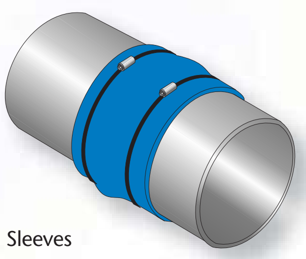


U1000

The standard integrally flanged U-belt design is used for low to moderate temperatures applications where duct flanges are present and particulate loading is minimal

- Lowest initial cost due to reduced metal frame and fasteners cost
- Molded corners provided for rectangular ductwork
- Accommodates flanged ducting or equipment and utilized frequently for fan applications
- Minimal shipping costs
- Standard 3" (75mm) high flange design

SLEEVES



Sleeves

Sleeves are primarily used for vibration in H.V.A.C. applications with minimal pressures.

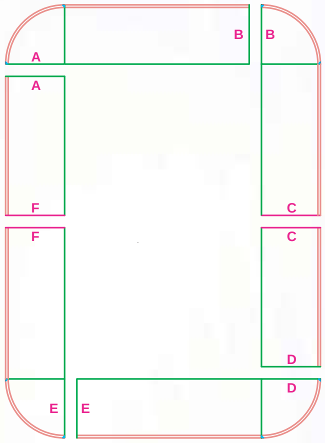
- Least expensive design
- Supplied endless or open ended for field-wrap of pipe penetration applications
- Supplied with worm gear band clamps
- For vibration applications
- Provided with gaskets for Teflon® belt material

Senior Flexonics Pathway expansion joints are furnished assembled or unassembled.

INSTALLATION CONSIDERATIONS

MATING DUCT FLANGES

Mating duct flanges affect expansion joint design. Senior Flexonics Pathway Frame Systems SR2700, SR2800 and SR2900 are designed to completely eliminate mating flanges on the duct work. Other frame systems are designed to be welded to existing flanges, thereby decreasing installation time and corrosion problems associated with bolted designs. The design of duct flanges should be coordinated with the expansion joint manufacturer.



Field Assembly Diagram

INSTALLATION MISALIGNMENT

Duct systems, which require fabric expansion joints, are often extremely large and therefore subject to substantial dimensional errors. It is possible that misalignment could exceed the expected thermal movement. A convenient solution to this problem is to design the expansion joint frame to absorb the duct misalignment. Note that the flexible element is installed in its neutral position, and retains full movement capability. Field drilled holes are the best way to assure proper fit up.

ADJACENT DUCTING EQUIPMENT

The expansion joint flange and liner designs can be affected by location of adjacent equipment such as fans, dampers, etc. Expansion joints must be designed so that they do not interfere with the operation of adjacent equipment during maximum movement conditions.

PAINTING & FINISHING

A fabric expansion joint assembly, complete with attachment flanges, may require final painting after installation. The metal components, therefore, should be prime coated only by the manufacturer for protection during shipment, storage, and erection.

EXPANSION JOINT ASSEMBLY

Senior Flexonics Pathway normally recommends the purchase of complete assemblies, ready for final assembly into the duct. The fabric element is attached to its flanges at the factory and its fit and assembly is the total responsibility of the expansion joint manufacturer.

Large expansion joints, requiring shipment in sections, must be factory pre-assembled, matched-marked, and packaged for easy assembly after storage. Complete instructions are included with each expansion joint and experienced filed service supervisors or installation crews are available if desired.

ON-SITE INSTALLATION SERVICE

Senior Flexonics Pathway can provide on-site installation service, mobilize, and be at your job site within 24 hours. Using our trained factory personnel, we can assist you with installation supervision or complete the turnkey installation.

Senior Flexonics Pathway performs work in both union and non-union facilities.

- Installation Service
- Field Supervision
- Ducting System Inspection
- Field Training
- Plant Surveys

SPLICING AND REPAIRABILITY

Pathway Flexon and Ultrachem materials can be easily spliced in the field during expansion joint installation. These materials are easily repaired in the event of damage after installation. The “Thermowelding” characteristics of these materials provide splicing and repair material strength equal to or greater than the basic material strength.

FLEXSPAN HEAT SEAL IRON

Lightweight and portable for use at any plant location. Available for rent or purchase. May be operated easily by plant personnel.

REQUIRED MATERIALS

Heat seal film is required and placed between the ends of the joint to be spliced. No chemical prep of the belt or mechanical abrasion is required prior to splicing.

SPLICE VERIFICATION

Sample material and splicing film is supplied to allow verification of iron operation at the joint location in your plant to assure leak proof splices.

SPLICING YOUR EXPANSION JOINT BELT

Joints may be spliced in the vertical or horizontal positions. The temperatures of the heat seal iron is electonically controlled and heat loss is minimized with the use of an insulated back up board.

EASY TO WORK WITH

No special tools or skills are required to perform the splice. The Installation Manual completely details the procedure.

THE COMPLETED SPLICE

In minutes the splice is completed. Compared to hours spent vulcanizing rubber expansion joint materials, not to mention the cost on the required factory technician, our products offers a practical and economic solution.

PERMANENTLY REPAIRABLE

Unlike fluoroelastomer materials, Ultrachem and Flexon expansion joint systems are repairable over the life of the product. Repairable not just with a mechanical patch but repairable without degrading the tensile strength of the joint. This contrasts with the inability to effectively revulcanize fluoroelastomer products after installation because of the “aging” inherent with fluoroelastomer and other rubber products.

MECHANICAL DAMAGE

This expansion joint at a fossil fired plant was mechanically damaged accidentally. Normally the joint would have to be replaced at the next outage or shutdown depending on the extent of damage.

TEAR PROPAGATION

Ultrachem materials have greater tensile strength and will not continue to propagate holes or tears like rubber materials. This benefit allows you to run longer without the damage getting worse or generating catastrophic failure of the joint.

HEAT SEAL REPAIR

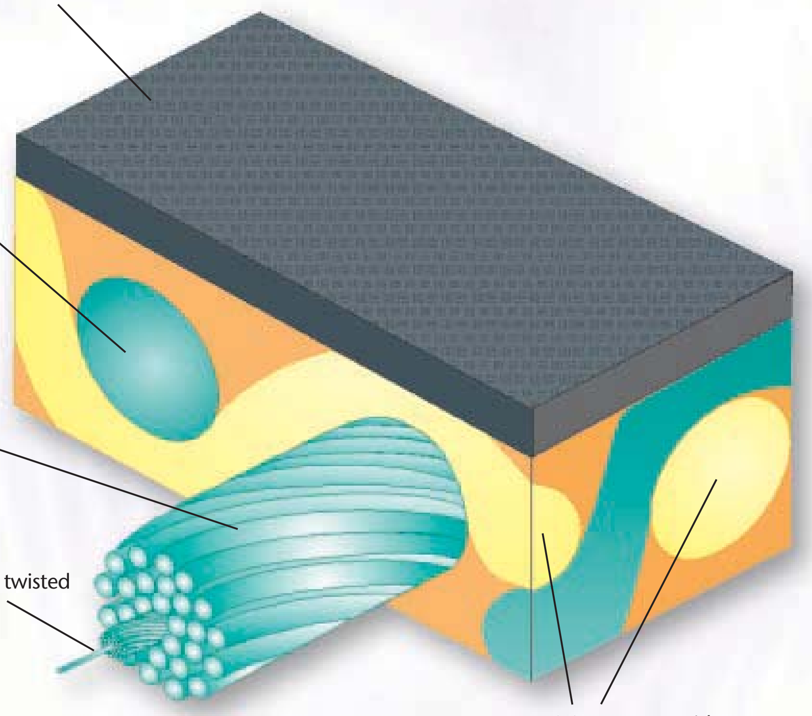
Using the procedures above, the joint may be repaired and will retain original tensile strengths. No special preparation is necessary. This repair can be easily made by plant personnel.

FIELD REPAIRABILITY

The ability to repair your expansion joint materials with plant personnel gives the plant more independence to solve its own problems. Expansion joint replacement and repairs can now be performed in a fraction of the time and expense normally allocated for fluoroelastomer repairs.

FLEXON PRODUCT LINE

Senior Flexonics Pathway manufactures a variety of composite belt configurations to meet the varied needs of all our customers. Shown for illustration purposes is one of the premium grade belt constructions for each rated continuous operating temperatures.



FLUORINATED ELASTOPLASTICS

Fluoroelastoplastics combine the corrosion resistance of a fluoroplastic with the flexibility of a fluoroelastomer through the addition of FKM to the PTFE compound. Fluoroelastoplastic materials have been used successfully in over 10,000 expansion joints worldwide, providing exceptional performance even in the severe chemical environments found in flue gas desulfurization plants (FGD), pulp and paper (recovery boilers), refuse derived fuels (RDF) and smelters.

DARLYN® PRODUCT LINE

Senior Flexonics Pathway is an authorized fabricator of expansion joints utilizing Chemfab Corporation's DARLYN fabrics. These products were first introduced in 1983. The DARLYN line of materials are fluorinatedelastoplastic alloys. Because of their thermal and chemical capabilities, fluoroelastoplastic fiberglass reinforced, PTFE-coated and laminated belting materials are being used extensively in expansion joint designs for all types of systems.

PATENTED PTFE/FKM ALLOY PROVIDES ADDITIONAL FLEXIBILITY

Perfluoroplastic, due to its crystalline nature, is inherently stiff which reduces the long term flex endurance and life of PTFE fabric expansion joints. To overcome this shortcoming, fluoroelastomer (Viton®/Fluorel®) is blended into a patented alloy which bathes the coated fiberglass matrix significantly increasing the flexibility, tear resistance, tensile and shear strength of DARLYN fabricated belts. This means longer in-service life.

DARLYN can be easily identified by its lack of stiffness. The uniformly distributed alloy coating is more compliant than PTFE, filling the voids and impregnating the woven structure. This pliable matrix maintains consistent physical and chemical properties over a wide range of temperatures and corrosive conditions experienced in flue gas ductwork.

CONSISTENT COATING PROCESS

The DARLYN series of products are coated and cured over a dozen times in the patented process. The multilayer alloy coating of PTFE and FKM completely surrounds the fiberglass foundation, and then is multi-coated with PTFE. This unique procedure is a characteristic of the detailed quality and consistency which guarantees the longevity of the DARLYN products.

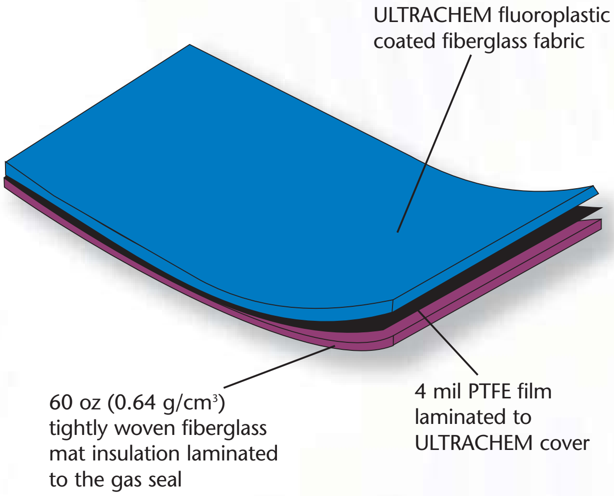
DARLYN material is manufactured with 100% defect free, continuous, twisted multiple filament fiberglass. This means that for the entire length of your DARLYN belting material the strands are uncut, homogeneous and guaranteed the strongest fiberglass fibers possible. Numerous strands are than grouped and twisted together maximizing the flex, tensile, shear and tear characteristics of thousands of filaments. These glass yarns are then bathed with a protectant PTFE coating to resist self-abrasion and friction during flexing, and chemical attack preventing acid from wicking in service, which destroys conventional woven glass.

DARLYN 1100 CB & ULTRACHEM

CB or Chemical Barrier was developed for superior corrosion resistance. A multilayer PTFE cast film is thermally and chemically welded to DARLYN 1100 and ULTRACHEM assuring an even greater protection from corrosion due to exposure in the most extreme conditions. This isotropic film (identical physical properties in all directions) is built up through multiple operations assuring a uniform thickness, nonporous, chemically inert barrier. Further, when combined with the DARLYN and ULTRACHEM isotropic fabric, the result is a uniform membrane which can flex without stress concentrations, distributing the load equally throughout the belt.

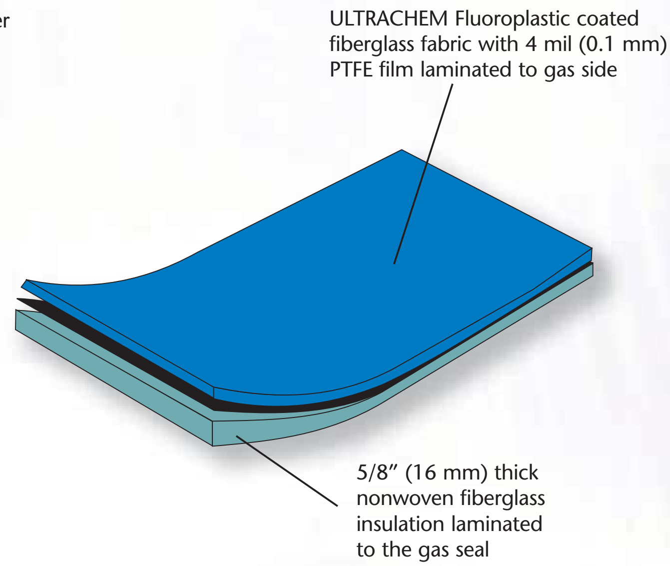
HIGH TEMPERATURE APPLICATIONS

- Superior strength retention, even after repeated flexing.
- Fast, easy field splicing
- Outstanding corrosion resistance
- Less than 1/4 the weight of 100% fluoroelastomer fabrics, resulting in lower installed costs

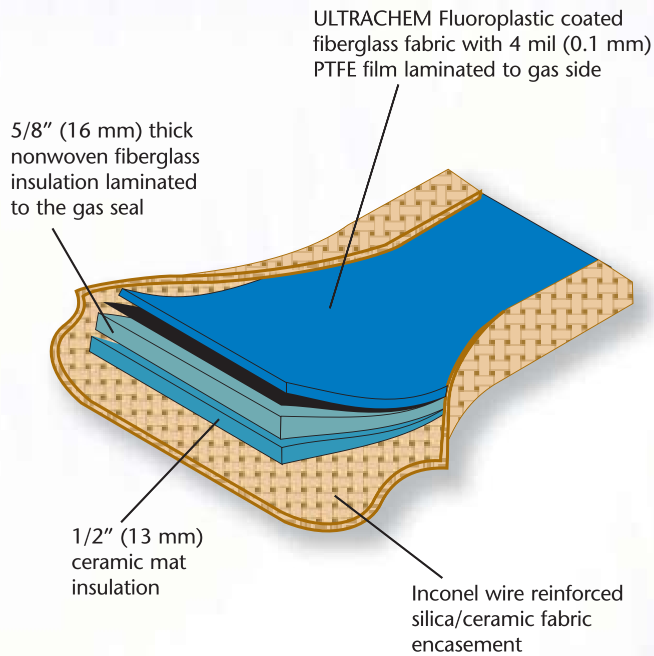


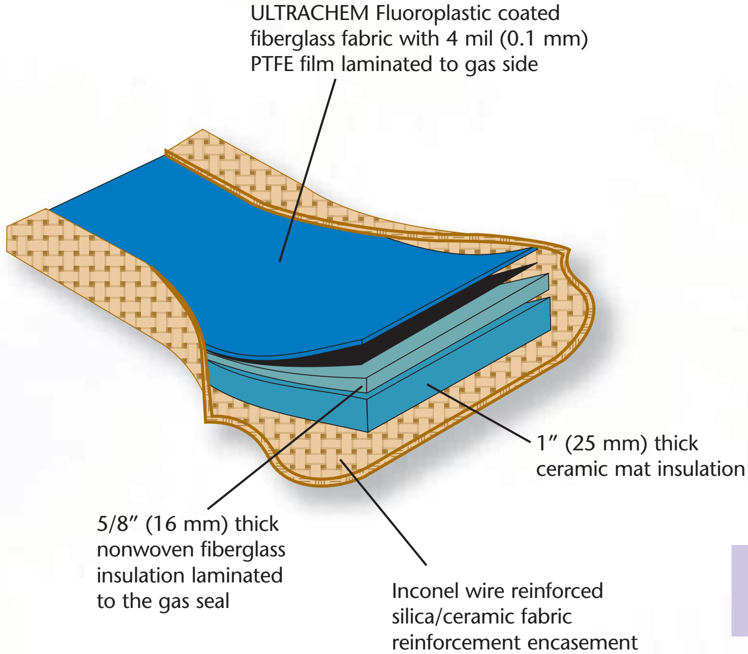
FLEXON-700 A composite belt designed to provide continuous reliable service at 700°F (371°C). A tightly woven fiberglass insulation is thermally bonded to the FLEXON material. This composite design provides insulating properties at elevated temperatures and prevents separation of the insulation.

FLEXON-1000 A composite belt designed to provide continuous reliable service at 1000°F (538°C). A non-woven fiberglass needle-mat insulation is bonded to the ULTRACHEM material and encased in aluminized coated fiberglass cloth.



FLEXON-1200 A composite belt designed to provide continuous service at 1200°F (649°C), by the addition of a 1/2" (13 mm) of ceramic mat insulation to the FLEXON 1000. Inconel® wire inserted silica cloth is used as the encasement to replace fiberglass in applications above 1000°F (538°C).





FLEXON-1500 A composite belt designed to provide continuous service at elevated continuous temperatures to 1500°F (816°C).

Note: Designs are available to 2000°F (1090°C).

HOW TO SPECIFY A

SPECIAL NOTE

The following instructions will help determine the correct part number. Completion of the ducting expansion joint specification sheet is also helpful and enables Senior Flexonics Pathway's engineering staff to verify that the correct design has been selected. Factory holes, back-up bars, nuts, and bolts must be specified if required.

STEP 1

Expansion joints can be manufactured and shipped either assembly or unassembled select the option which best meets your requirements.

A - Assembled – Ready for immediate installation

U – Unassembled – Match marked and packaged to minimize assembly at the jobsite. Complete assembly instructions and manufacturing drawings included.

BA - Belt, Assembled - Fabric belt elements are provided as a factory-spliced, endless loop, to fit existing frames.

BU - Belt, Unassembled - Fabric elements are prepared for field splicing at the jobsite.

STEP 2

Maximum Continuous System Operating Temperature (MCSOT°F) - This is the highest temperature at which the system normally operates. Excursion (upset) temperatures and durations should be specified on the Ducting Expansion Joint Specification Sheet. For applications exceeding 1200°F, please consult Senior Flexonics Pathway's engineering department.

	Assembly	MCSOT	Operating Pressure	Frame Style
English	U	450	12	SR2400
Metric	U	232	305	SR2400

STEP 5

Gas Seal Material - Leave this section of the part number blank and Senior Flexonics Pathway will make the material selection.

See material descriptions on Pages 17-20

STEP 6

Select the letter code for the options and accessories (CAP for Cavity Accumulation Pillow, CIP for Cavity Insulation Pillow, BH for Braided Hose Seal, TG for Tadpole Gasket Tape, FD for Flow Deflector, FWL for Field welded Liner, SWL for Shop Welded Liner, BFL for Bolted Flange Liner)

See pages 11-12 for various pillow styles.

FABRIC EXPANSION JOINT

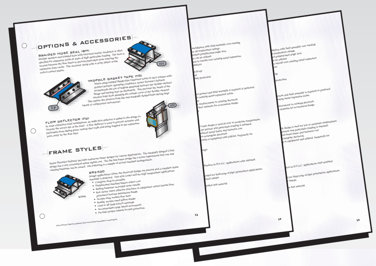
STEP 3

List the system operating pressure in inches water column, the pressure will be assumed to be positive unless a negative number is listed. The maximum rated operating pressure: ±83" wc (3 PSIG) for teflon belt ±139" wc (5 PSIG) for elastomer. For higher pressures please consult Senior Flexonics Pathway's engineering department.

STEP 4

Frame Style - Select the appropriate frame style (SR2400, SR2500, SR2550, SR2600, SR2650, SR2700, SR2750, SR2800, SR2900, U1000, etc.)

For isometric view and detailed description see pages 12-14



Belt Material	Options Accessories	Span F - F	Duct Size Inside Dimension
Flexon 1000	CAP - FD	14	120 x 96
Flexon 1000	CAP - FD	356	3048 x 2438

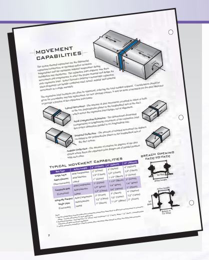
STEP 8

The basic part number is now complete.
For a unassembled Flexon 1000CB material on a SR2400 frame with a cavity accumulation pillow and a flow deflector 120 inches wide by 96 inches high with 14 inches active length for maximum continuous operating conditions of 450°F and 12 inches water column.

STEP 7

List the Face to Face Dimension (distance between the mating duct flanges) in which the expansion joint is to be installed. This dimension should not be confused with the active length.

See page 7 for technical data.



NOTES:

Torsion and angular movement capabilities may be obtained by consulting Senior Flexonics Pathway's engineering department. Larger spans are possible, depending on system pressures and movements, and require consultation of Senior Flexonics Pathway's engineering department. Non-standard face to face dimensions are available. Movements must be specified in the description accompanying the part number. A significant difference exists between the movement capabilities of round expansion joints and large rectangular joints (sides exceeding 3' length). This difference is due to the folding characteristics of the fabric element, which vary depending on whether it is attached to straight or curved flanges.

CAUTION

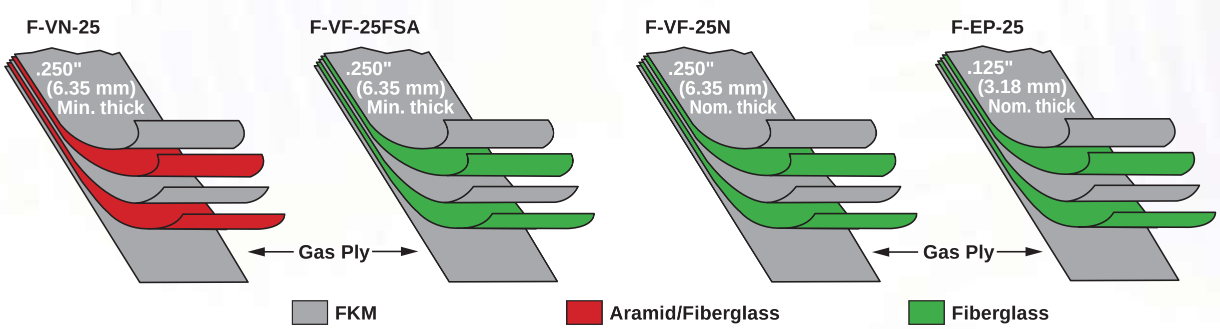
Installation temperature and duct tolerances must be considered in determining installed face to face dimensions and movements.

ELASTOMER MATERIAL DESCRIPTIONS

Ultraflex EV4® Fluoroelastomer and Elastomer Design Data

BELT CONSTRUCTION

- Fluoroelastomer terpolymer material, ASTM FKM (Viton® B with a C Cure or Fluorel® FT2350) per FSA-DSJ-401-94, Para. 3.1 (virgin FKM 68% by weight Flourine / 70% by weight FKM, balance 30% by weight thermal type carbon black with calcium hydroxide. Magnesium oxide and less than 5% by weight process aids).
- Aramid / fiberglass reinforcing material treated to ensure a minimum 24 lbs. / lineal inch Adhesion per ASTM D-413
- Heavier FKM ply on gas slide providing optimum "unbalanced ply" design
- Computer controlled belt press that guarantees optimum uniform pressure and heat distribution over the entire material surface



THERMAL EXPANSION

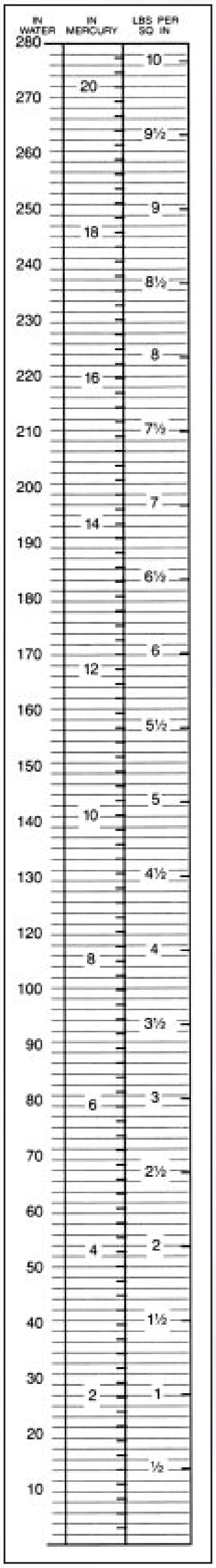
In the selection of an expansion joint, one of the critical design factors is the thermal expansion. To compute the linear expansion of a straight run of pipe or ducting, the designer must select the material and determine the linear distance of the ductwork. The linear expansion of the ductwork can be determined from the thermal growth chart using the temperature change between ambient and the design temperature.

THERMAL GROWTH CHART

Temp. Degrees F.	Temp. Degrees C.	Carbon, C MO, 3CR MO Steel	5 Cr Mo thru 9 Cr Mo 18	Austen, Stainless Steel	Ferritic Stainless Steel	Monel 400	Inconel 600	25CR 20NI
-325	-198	-2.37 (-1.97)	-2.22 (-1.85)	-3.85 (-3.21)	-2.04 (-1.70)	-2.62 (-2.18)		-3.00 (-2.50)
-300	-184	-2.24 (-1.87)	-2.10 (-1.75)	-3.62 (-3.02)	-1.93 (-1.61)	-2.50 (-2.08)		-2.83 (-2.36)
-275	-171	-2.11 (-1.76)	-1.98 (-1.65)	-3.40 (-2.83)	-1.81 (-1.51)	-2.38 (-1.98)		-2.66 (-2.22)
-250	-157	-1.98 (-1.65)	-1.86 (-1.55)	-3.17 (-2.64)	-1.70 (-1.42)	-2.26 (-1.88)	-2.30 (-1.92)	-2.49 (-2.07)
-225	-143	-1.84 (-1.53)	-1.74 (-1.45)	-2.95 (-2.46)	-1.58 (-1.32)	-2.14 (-1.78)	-2.17 (-1.81)	-2.32 (-1.93)
-200	-129	-1.71 (-1.42)	-1.62 (-1.35)	-2.72 (-2.27)	-1.47 (-1.22)	-2.03 (-1.69)	-2.04 (-1.70)	-2.15 (-1.79)
-175	-115	-1.58 (-1.32)	-1.50 (-1.25)	-2.49 (-2.07)	-1.35 (-1.12)	-1.91 (-1.59)	-1.87 (-1.56)	-1.98 (-1.65)
-150	-101	-1.45 (-1.21)	-1.37 (-1.14)	-2.27 (-1.89)	-1.24 (-1.03)	-1.79 (-1.49)	-1.70 (-1.42)	-1.81 (-1.51)
-125	-87	-1.30 (-1.08)	-1.23 (-1.02)	-2.01 (-1.67)	-1.12 (-0.93)	-1.59 (-1.32)	-1.54 (-1.28)	-1.60 (-1.33)
-100	-73	-1.15 (-0.96)	-1.08 (-0.90)	-1.75 (-1.46)	-0.99 (-0.82)	-1.38 (-1.15)	-1.37 (-1.14)	-1.39 (-1.16)
-75	-59	-1.00 (-0.83)	-0.94 (-0.78)	-1.50 (-1.25)	-0.86 (-0.72)	-1.18 (-0.98)	-1.17 (-0.97)	-1.19 (-0.99)
-50	-46	-0.84 (-0.70)	-0.79 (-0.66)	-1.24 (-1.03)	-0.72 (-0.60)	-0.98 (-0.82)	-0.97 (-0.81)	-0.98 (-0.82)
-25	-32	-0.67 (-0.56)	-0.63 (-0.52)	-0.98 (-0.82)	-0.58 (-0.48)	-0.77 (-0.64)	-0.76 (-0.63)	-0.76 (-0.63)
0	-18	-0.50 (-0.42)	-0.46 (-0.38)	-0.72 (-0.60)	-0.43 (-0.36)	-0.57 (-0.47)	-0.56 (-0.47)	-0.57 (-0.47)
25	-4	-0.32 (-0.27)	-0.30 (-0.25)	-0.46 (-0.38)	-0.27 (-0.22)	-0.37 (-0.31)	-0.36 (-0.30)	-0.37 (-0.31)
50	10	-0.14 (-0.12)	-0.13 (-0.11)	-0.21 (-0.17)	-0.12 (-0.10)	-0.16 (-0.13)	-0.16 (-0.13)	-0.16 (-0.13)
70	24	0.00 (0.00)	0 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
100	38	0.22 (0.18)	0.22 (0.18)	0.33 (0.27)	0.19 (0.16)	0.27 (0.22)	0.26 (0.22)	0.27 (0.22)
125	52	0.41 (0.34)	0.40 (0.33)	0.61 (0.51)	0.35 (0.29)	0.50 (0.42)	0.48 (0.40)	0.50 (0.42)
150	66	0.60 (0.50)	0.58 (0.48)	0.89 (0.74)	0.52 (0.43)	0.74 (0.62)	0.70 (0.58)	0.73 (0.61)
175	79	0.80 (0.67)	0.76 (0.63)	1.17 (0.97)	0.69 (0.57)	0.98 (0.82)	0.93 (0.77)	0.97 (0.81)
200	93	1.00 (0.83)	0.94 (0.78)	1.46 (1.22)	0.86 (0.72)	1.22 (1.02)	1.15 (0.96)	1.21 (1.01)
225	107	1.20 (1.00)	1.13 (0.94)	1.74 (1.45)	1.03 (0.86)	1.47 (1.22)	1.39 (1.16)	1.45 (1.21)
250	121	1.40 (1.17)	1.33 (1.11)	2.03 (1.69)	1.21 (1.01)	1.71 (1.42)	1.63 (1.36)	1.69 (1.41)
275	135	1.61 (1.34)	1.52 (1.27)	2.32 (1.93)	1.38 (1.15)	1.96 (1.63)	1.86 (1.55)	1.94 (1.62)
300	149	1.82 (1.52)	1.71 (1.42)	2.61 (2.17)	1.56 (1.30)	2.21 (1.84)	2.10 (1.75)	2.19 (1.82)
325	163	2.04 (1.70)	1.90 (1.58)	2.91 (2.42)	1.74 (1.45)	2.47 (2.06)	2.34 (1.95)	2.44 (2.03)
350	177	2.25 (1.87)	2.10 (1.75)	3.20 (2.67)	1.93 (1.61)	2.72 (2.27)	2.57 (2.14)	2.69 (2.24)
375	191	2.48 (2.07)	2.30 (1.92)	3.50 (2.92)	2.11 (1.76)	2.98 (2.48)	2.81 (2.34)	2.94 (2.45)
400	204	2.70 (2.25)	2.50 (2.08)	3.80 (3.17)	2.30 (1.92)	3.25 (2.71)	3.05 (2.54)	3.20 (2.67)
425	218	2.93 (2.44)	2.72 (2.27)	4.10 (3.42)	2.49 (2.07)	3.51 (2.92)	3.30 (2.75)	3.46 (2.88)
450	232	3.16 (2.63)	2.93 (2.44)	4.40 (3.67)	2.68 (2.23)	3.78 (3.15)	3.54 (2.95)	3.72 (3.10)
475	246	3.39 (2.82)	3.14 (2.62)	4.70 (3.92)	2.88 (2.40)	4.06 (3.38)	3.79 (3.16)	3.98 (3.32)
500	260	3.62 (3.02)	3.35 (2.79)	5.01 (4.17)	3.08 (2.57)	4.33 (3.61)	4.03 (3.36)	4.24 (3.53)
525	274	3.86 (3.22)	3.58 (2.98)	5.31 (4.42)	3.28 (2.73)	4.61 (3.84)	4.28 (3.57)	4.51 (3.76)
550	288	4.10 (3.42)	3.80 (3.17)	5.62 (4.68)	3.48 (2.90)	4.89 (4.07)	4.53 (3.77)	4.78 (3.98)
575	302	4.35 (3.62)	4.02 (3.35)	5.93 (4.94)	3.69 (3.07)	5.17 (4.31)	4.77 (3.97)	5.05 (4.21)
600	316	4.60 (3.83)	4.24 (3.53)	6.24 (5.20)	3.90 (3.25)	5.46 (4.55)	5.02 (4.18)	5.33 (4.44)
625	329	4.85 (4.04)	4.47 (3.72)	6.56 (5.46)	4.10 (3.42)	5.75 (4.79)	5.29 (4.41)	5.60 (4.66)
650	343	5.11 (4.26)	4.69 (3.91)	6.87 (5.72)	4.31 (3.59)	6.04 (5.03)	5.54 (4.61)	5.88 (4.90)
675	357	5.36 (4.46)	4.92 (4.10)	7.18 (5.98)	4.52 (3.77)	6.34 (5.28)	5.80 (4.83)	6.16 (5.13)
700	371	5.62 (4.68)	5.14 (4.28)	7.50 (6.25)	4.73 (3.94)	6.64 (5.53)	6.06 (5.05)	6.44 (5.36)
725	385	5.89 (4.91)	5.38 (4.48)	7.82 (6.51)	4.95 (4.12)	6.94 (5.78)	6.32 (5.26)	6.73 (5.61)
750	399	6.16 (5.13)	5.62 (4.68)	8.15 (6.79)	5.16 (4.30)	7.24 (6.03)	6.58 (5.48)	7.02 (5.85)
775	413	6.43 (5.36)	5.86 (4.88)	8.47 (7.06)	5.38 (4.48)	7.54 (6.28)	6.84 (5.70)	7.31 (6.09)
800	427	6.70 (5.58)	6.10 (5.08)	8.80 (7.33)	5.60 (4.66)	7.85 (6.54)	7.10 (5.91)	7.60 (6.33)
825	441	6.97 (5.81)	6.34 (5.28)	9.13 (7.61)	5.82 (4.85)	8.16 (6.80)	7.38 (6.15)	7.89 (6.57)
850	454	7.25 (6.04)	6.59 (5.49)	9.46 (7.88)	6.04 (5.03)	8.48 (7.06)	7.67 (6.39)	8.19 (6.82)
875	468	7.53 (6.27)	6.83 (5.69)	9.79 (8.16)	6.27 (5.22)	8.80 (7.33)	7.95 (6.62)	8.48 (7.06)
900	482	7.81 (6.51)	7.07 (5.89)	10.12 (8.43)	6.49 (5.41)	9.12 (7.60)	8.23 (6.86)	8.78 (7.31)
925	496	8.08 (6.73)	7.31 (6.09)	10.46 (8.71)	6.72 (5.60)	9.44 (7.86)	8.52 (7.10)	9.07 (7.56)
950	510	8.35 (6.96)	7.56 (6.30)	10.80 (9.00)	6.94 (5.78)	9.77 (8.14)	8.80 (7.33)	9.36 (7.80)
975	524	8.62 (7.18)	7.81 (6.51)	11.14 (9.28)	7.17 (5.97)	10.09 (8.40)	9.09 (7.57)	9.66 (8.05)
1000	538	8.89 (7.41)	8.06 (6.71)	11.48 (9.56)	7.40 (6.16)	10.42 (8.68)	9.37 (7.81)	9.95 (8.29)
1025	552	9.18 (7.65)	8.30 (6.91)	11.82 (9.85)	7.62 (6.35)	10.76 (8.96)	9.66 (8.05)	10.25 (8.54)
1050	566	9.46 (7.88)	8.55 (7.12)	12.16 (10.13)	7.85 (6.54)	11.09 (9.24)	9.94 (8.28)	10.54 (8.78)
1075	579	9.75 (8.12)	8.80 (7.33)	12.50 (10.41)	8.08 (6.73)	11.43 (9.52)	10.23 (8.52)	10.83 (9.02)
1100	593	10.04 (8.36)	9.05 (7.54)	12.84 (10.70)	8.31 (6.92)	11.77 (9.80)	10.51 (8.75)	11.12 (9.26)
1125	607	10.30 (8.58)	9.28 (7.73)	13.18 (10.98)	8.53 (7.11)	12.11 (10.09)	10.80 (9.00)	11.42 (9.51)
1150	621	10.57 (8.80)	9.52 (7.93)	13.52 (11.26)	8.75 (7.29)	12.45 (10.37)	11.09 (9.24)	11.72 (9.76)
1175	635	10.84 (9.03)	9.76 (8.13)	13.87 (11.55)	8.97 (7.47)	12.80 (10.66)	11.37 (9.47)	12.01 (10.00)
1200	649	11.10 (9.25)	10.00 (8.33)	14.20 (11.83)	9.19 (7.66)	13.15 (10.95)	11.66 (9.71)	12.31 (10.25)
1225	663	11.38 (9.48)	10.26 (8.55)	14.55 (12.12)	9.42 (7.85)	13.51 (11.25)	11.98 (9.98)	12.60 (10.50)
1250	677	11.66 (9.71)	10.53 (8.77)	14.88 (12.40)	9.65 (8.04)	13.86 (11.55)	12.29 (10.24)	12.89 (10.74)
1275	691	11.94 (9.95)	10.79 (8.99)	15.22 (12.68)	9.88 (8.23)	14.22 (11.85)	12.61 (10.50)	13.17 (10.97)
1300	704	12.22 (10.18)	11.06 (9.21)	15.56 (12.96)	10.11 (8.42)	14.58 (12.15)	12.93 (10.77)	13.46 (11.21)
1325	718	12.50 (10.41)	11.30 (9.41)	15.90 (13.24)	10.33 (8.60)	14.94 (12.45)	13.25 (11.04)	13.76 (11.46)
1350	732	12.78 (10.65)	11.55 (9.62)	16.24 (13.53)	10.56 (8.80)	15.30 (12.74)	13.56 (11.30)	14.05 (11.70)
1375	746	13.06 (10.88)	11.80 (9.83)	16.58 (13.81)	10.79 (8.99)	15.66 (13.04)	13.88 (11.56)	14.35 (11.95)
1400	760	13.34 (11.11)	12.05 (10.04)	16.92 (14.09)	11.01 (9.17)	16.02 (13.34)	14.20 (11.83)	14.65 (12.20)

The linear thermal growth or contraction between 70°F (24°C) and indicated temperature is in inches/100 feet (mm/m) of duct work.

PRESSURE EQUIVALENTS CHART



GLOSSARY OF TERMS

Accumulation Pillow: A pillow fabricated using insulation material, wrapped in a woven fabric, then placed in an expansion joint cavity. The purpose is to either retard the intrusion of particulate, thermal protection, or to resist pressure pulsation.

Active Length (Live Length): The portion of the flexible seal that is free to move.

Back-Up Bars: Metal bars used for the purpose of clamping the fabric expansion joint to mating ductwork flanges.

Baffle (Liner): A metal shield that is designed to protect the expansion joint from the abrasive particles in the gas stream and to reduce the flutter caused by air turbulence in the gas stream and in some cases may be part of the overall thermal protection system.

Belt Type (Flat Belt): An expansion joint in which the flexible fabric portion of the joint is flat and is bolted or clamped to metal flanges or frame.

Bolt-In Flow Liner: A baffle that is designed to be bolted to the breach flange. This design can be either single or telescoping and requires the use of a gasket seal. Typically used on integrally flanged expansion joints.

Belt: The flexible element of a nonmetallic expansion joint.

Breach Opening: The distance between the mating duct flanges in which the joint is to be installed.

Cavity Pillow (Insulation Bag): Same as accumulation pillow, except used for thermal barrier.

Clamping Bars: See back-up bars.

Composite Belt: An expansion joint in which the various plies are constructed of different materials that are not integrally bonded together. Normally made up of an inside liner, thermal insulating barrier and an outer cover. Other special plies may be included.

Concurrent Movement: Combination of two or more types (axial and lateral) of movements.

Corners: Molded, formed, or radial belt corners of rectangular expansion joints.

Design Pressure: The maximum pressure, both positive or negative that is expected during normal operation, not including periods of abnormal operation (see excursion pressure).

Design Temperature: The maximum or most severe temperature expected during normal operation, not including periods of abnormal operation caused by equipment failure. (See excursion temperature)

Excursion Pressure: The maximum pressure, both positive and negative, the system could reach during abnormal conditions or equipment failure.

Excursion Temperature: The maximum temperature the system could reach. Excursion temperature should be defined by maximum temperatures and time duration.

Face-To-Face: See breach opening.

Field Assembly: A joint that is assembled at the job site due to its size (too large to ship) or the location of the breach opening makes it more practical to install in sections. On-site assembly is required for certain frame styles.

Field Splice: See splice

Flanges: That part of an expansion joint used for fastening the joint into the system ductwork.

Flow Direction: Direction of gas movement through the system.

Flow Liner: See baffle

Flutter: The repetitive oscillating movement of the expansion joint material due to fluctuation between positive pressure and negative pressure or due to flow induced pulsations. This phenomenon is detrimental to expansion joints.

Frame: The complete angle iron or plate frame to which belt or bellows portion of the expansion joint is attached.

Flow Deflector: A metal baffle installed in the ductwork adjacent to the expansion joint, that diverts the gas stream over the flow liner for the purpose of preventing the particulate in the flow stream for entering the expansion joint cavity. It also can be used to prevent condensation from entering the expansion joint cavity.

Gas Seal: The layer or specific ply of the expansion joint material that is designed to minimize or contain the flue gas.

Lateral Movement: The relating displacement of the two ends or the expansion joint perpendicular to its longitudinal axis. The displacement movement usually caused by the thermal expansion of the ducting system and measured in inches or millimeters.

Lateral Offset: The offset distance between two adjacent duct flanges or faces. Can be due to misalignment or, by design, to compensate for excessive displacement in the opposite direction during cycling. (Cold lateral offset)

Lifting Lugs: A lifting device that is attached to the metal portion of the expansion joint for field handling and erection.

Manufactured F/F (Face to Face): The manufactured width of the joint measured between joint flange faces. The joint may be set into a breach opening that is less than the manufactured F/F of the joint to allow for axial extension.

Misalignment (Offset): The out of line condition that exists between the adjacent faces of the breach or duct flanges during ductwork assembly.

Molded Corner Expansion Joint: A rectangular integrally flanged expansion joint in which the corner is molded to form a continuous unspliced section.

Movements: The dimensional changes which the expansion joint is required to absorb, such as those resulting from thermal expansion or contraction.

Operating Pressure: The pressure or vacuum condition which occurs during normal performance.

Operating Temperature: The gas temperature at which the system generally will operate during normal conditions.

Pre-Compression: Compressing the expansion joint (shortening the manufactured F/F) so that in the cold position the joint has a given amount of compression set into the joint. The purpose of pre-compression is to allow for unexpected or additional axial extension and/or lateral movement.

Pre-Set: Dimension that joints are deflected to insure that desired movements will take place. See lateral offset and manufactured F/F.

Resultant Movement: The net effect of concurrent movements.

Set Back (Stand Off Height): The distance the expansion joint is set back from gas stream to allow for lateral movement and to prevent the joint from protruding into the gas flow.

Shipping Bars: Braces that are located between the two expansion joint flanges to prevent over-compression or distortion during shipment and joint assembly or installation. These braces must be removed after installation.

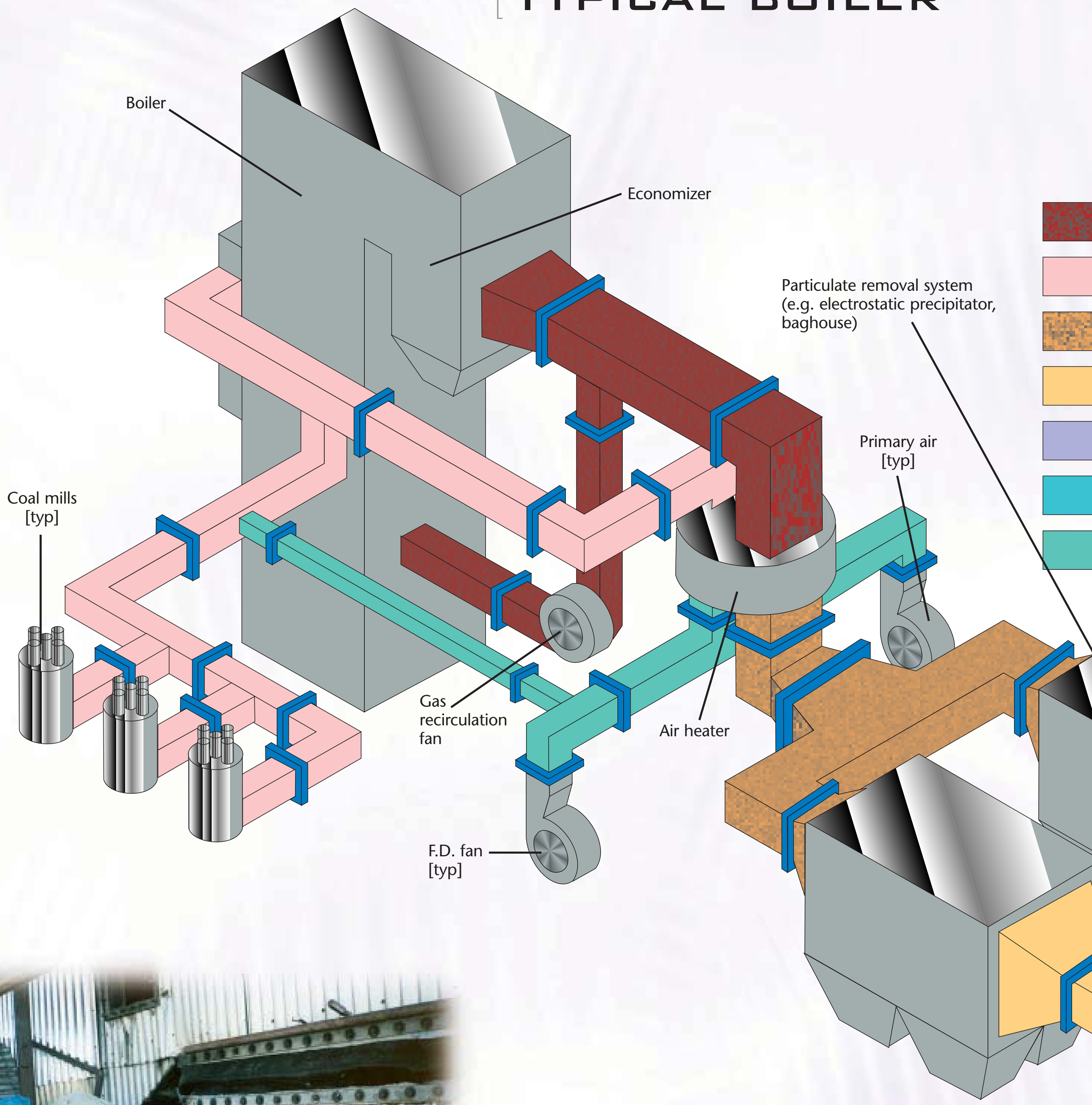
Splice: Procedure for making endless boot or bellows from open ended material. Splicing may be accomplished by one or more of the following: cementing, bonding, heat sealing, stitching, vulcanizing or mechanical fastening.

Telescoping Liners (Overlapping Liners): Metal shields attached to each side of the expansion joint, that overlap or telescope together under thermal movements.

Thermal Barrier: A layer of insulating material designed to reduce the surface temperature at the gas sealing layer to a level compatible with its heat resistance capability.

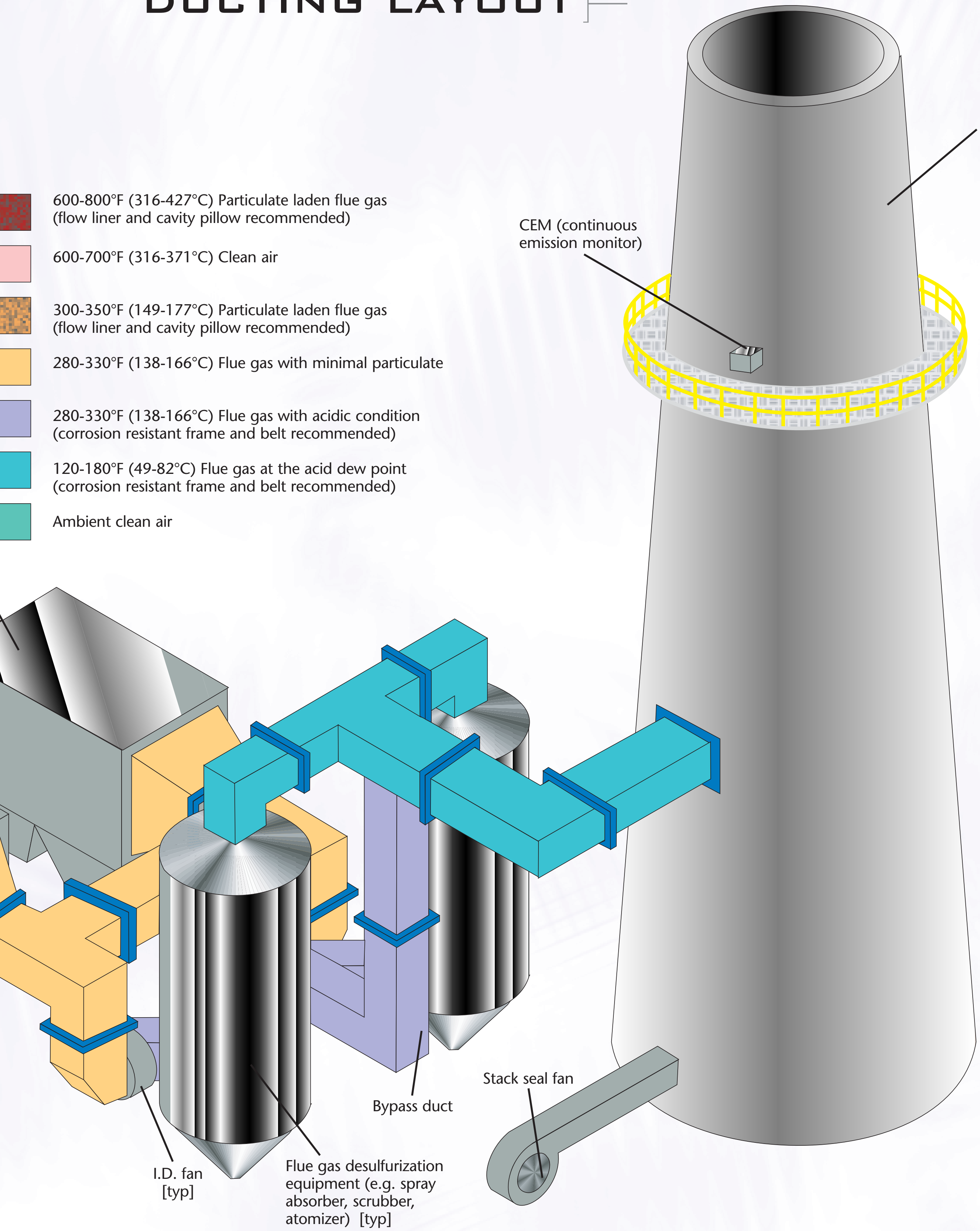
Weld-In Liner: A liner that is designed to be welded to the existing duct wall. This design can be either single or telescoping type.

TYPICAL BOILER



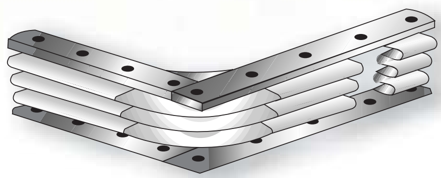
Field survey technicians perform comprehensive inspection of all expansion joints and provide a written and photograph document to plan replacement based on existing and projected life expectancy. Infrared analysis determines leaks even if the expansion joints are lagged over. This methodical approach reduces/eliminates the potential of unplanned forced outages and accurately projects the scope and cost of outage work required.

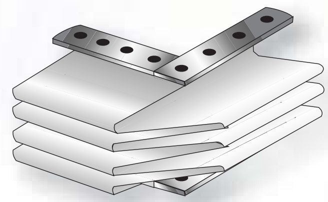
DUCTING LAYOUT



RECTANGULAR METAL DUCT EXPANSION JOINTS

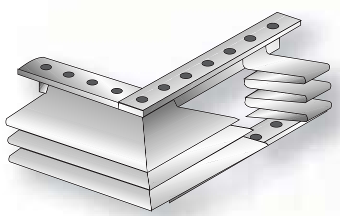
Corspan





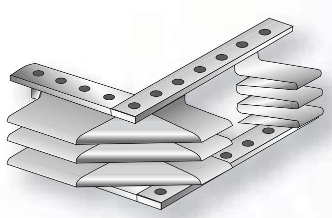
ROUND CORNER-FOR BEST FATIGUE PERFORMANCE AND BEST VALUE

Corspan recommends the round corner design for all applications. This design results in the lowest corner stress if fit up and welding of the corner seams are carefully controlled.



SINGLE MITER CORNER – CONVENTIONAL DESIGN

Corspan also recommends the single miter design for corner construction. If a corner preference is not specified, Corspan will use the single miter design for all convolution profiles for lowest cost. This design allows for maximum amount of motion possible for a given convolution profile. The corner is a simple “picture frame” construction.



DOUBLE MITER CORNER – VALUE ADDED – LOW CORNER FATIGUE

The double miter corner design offers lower corner fatigue than the conventional single miter corner or camera corner designs. Welds are positioned away from the centerline of the corner and the highest stressed area of the bellows.

CAMERA CORNER – NOT RECOMMENDED

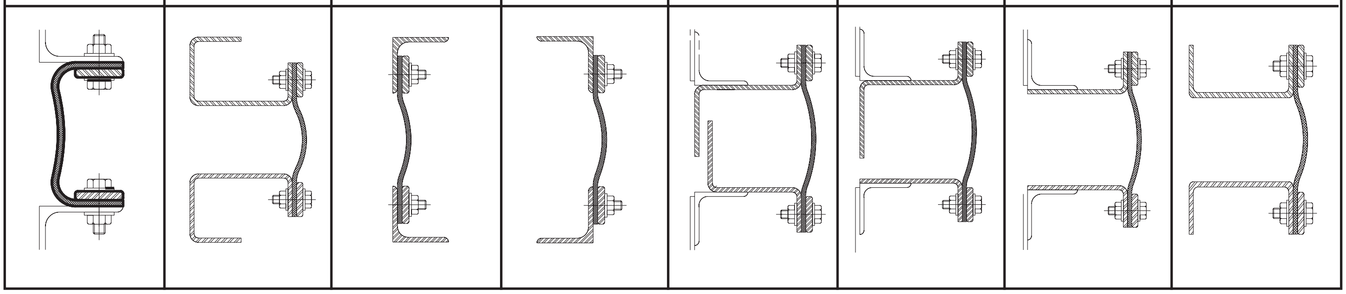
Corspan does not recommend the use of camera corner construction for rectangular metal expansion joints of any convolution profile. This is a method of assembly that allows all corner seam welding to be performed on the outside of the corner in a very accessible area with welders of lower skill level than would be required for a single miter corner. However, this style corner results in deep crevices at the corner that are corrosion initiators in certain flue gas conditions. The design also results in a reduction in movement capability.

DUCTING EXPANSION JOINT SPECIFICATION SHEET

CUSTOMER NAME		INQUIRY NO.	DATE
MAILING ADDRESS CITY STATE ZIP		PROJECT NAME	
NAME OF PERSON SUBMITTING DATA	PHONE	FAX NO.	DELIVERY REQUIRED BY
TYPE OF PLANT		FUEL	SULFUR CONTENT
NO. OF PLANT CYCLES PER YEAR	BASE LOAD	PEAK LOAD	DUCT SYSTEM ☐ NEW ☐ EXISTING

EXPANSION JOINT GEOMETRIES

U1000 SERIES	2400 SERIES	2500 SERIES	2600 SERIES	2700 SERIES	2750 SERIES	2800 SERIES	2900 SERIES



	ITEM OR TAG NUMBER					
	QUANTITY REQUIRED					
	EXPANSION JOINT LOCATION (FAN OUTLET, STACK, ETC.)					
	EXPANSION JOINT STYLE/SERIES					
SIZE	DUCT SIZE (INSIDE DIMENSION OR DIAMETER)		IN	IN	MM	MM
SIZE	BREACH OPENING (FACE TO FACE, SPAN)		IN	IN	MM	MM
GAS	FLOWING MEDIA (AIR, FLUE GAS, ETC.)					
GAS	FLOW DIRECTION (UP, DOWN, HORIZONTAL, ANG. UP, ANG. DOWN)					
GAS	FLOW VELOCITY		FPS	FPS	M/S	M/S
GAS	DUST LOAD		PSF	PSF	Mg/M^3	Mg/M^3
PRESS	DESIGN PRESSURE	NORMAL OPERATING	"WC	"WC		
PRESS	DESIGN PRESSURE	MAXIMUM OPERATING	"WC	"WC	MM H_2O	MM H_2O
TEMPERATURE	GAS TEMPERATURE	NORMAL OPERATING	°F	°F	°C	°C
TEMPERATURE	GAS TEMPERATURE	DESIGN	°F	°F	°C	°C
TEMPERATURE	GAS TEMPERATURE	MAXIMUM UPSET EXCURSION	°F	°F	°C	°C
TEMPERATURE	GAS TEMPERATURE	DURATION PER UPSET	MIN	MIN	MIN	MIN
TEMPERATURE	AMBIENT (MINIMUM/MAXIMUM)		°F / °F	°F / °F	°C / °C	°C / °C
MOVEMENTS	AXIAL COMPRESSION					
MOVEMENTS	AXIAL EXTENSION					
MOVEMENTS	LATERAL OFFSET (PERPENDICULAR TO LONG SIDE)					
MOVEMENTS	LATERAL OFFSET (PERPENDICULAR TO SHORT SIDE)					
MOVEMENTS	OTHER (ANGULAR OR TORSIONAL)		A/T DEG	A/T DEG	A/T DEG	A/T DEG
DUCT	DUCT MATERIAL (GAUGE OR THICKNESS)					
DUCT	INTERNAL LINER MATERIAL (GAUGE OR THICKNESS)					
DUCT	LINER ATTACHMENT	FWL - FIELD WELDED				
DUCT	LINER ATTACHMENT	SWL - SHOP WELDED				
DUCT	LINER ATTACHMENT	BFL - BOLTED FLANGED				
	CAVITY INSULATION PILLOW REQUIRED (YES OR NO)					
DESIGN	RADIUS OR SQUARE CORNER		R/S IN	R/S IN	R/S MM	R/S MM
DESIGN	DUCT MATERIAL / THICKNESS		MAT'L / IN.	MAT'L / IN.	MAT'L / MM	MAT'L / MM
DESIGN	STAND OFF HEIGHT		INCH	INCH	MM	MM

NOTES:

AVAILABLE ON CD-ROM

SENIOR FLEXONICS PATHWAY

www.flexonics.com
1 800 854 2553

Senior Flexonics Pathway
2400 Longhorn Industrial Dr.
New Braunfels, Texas 78130
Tel Int: 1 830 629 8080
Fax Int: 1 830 629 6899
E-mail: sales@pathway.flexonics.com

ISO 9001 : 1994 REGISTERED COMPANY
CERT. NO. 97-1091