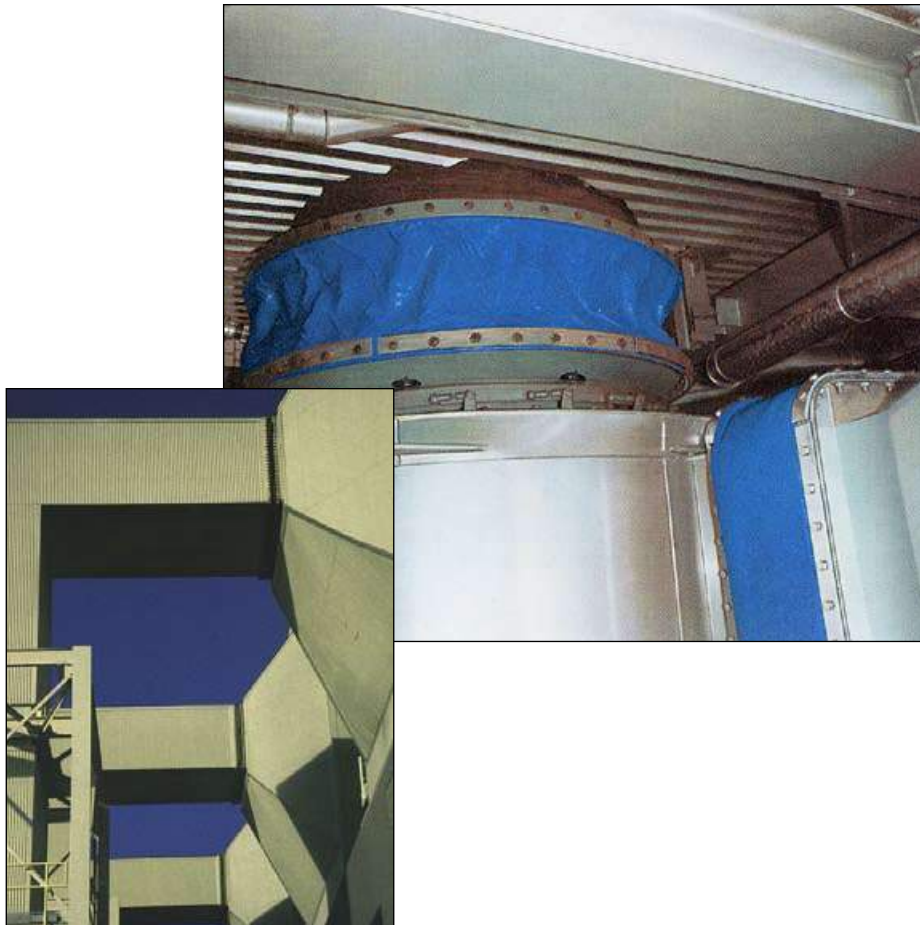

CUSTOM FLUE DUCT & FLEXIBLE BELLOW EXPANSION JOINTS

Installation and Maintenance Manual



Garlock
SEALING TECHNOLOGIES®

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Introduction

This manual describes how to install, inspect, and maintain Garlock flue duct style expansion joints. All the procedures must be followed for the Garlock warranty to be valid. It is therefore incumbent on the purchaser to be knowledgeable of these procedures and to ensure that they are faithfully followed during installation. This manual is arranged to cover the many designs and configurations of Garlock flue duct style expansion joints. The goal is to provide users with the procedures directly applicable to the equipment ordered. If any questions arise from reading or using this manual please contact Garlock technical support at 1-800-448-6688.

Garlock flue ducts are precision devices custom designed to meet our customer's performance specifications. To ensure flexibility of the expansion joints and to facilitate installation, Garlock typically uses multiple plies of high performance fabrics. These materials can tolerate design conditions but they cannot withstand abuse. The fabrics can be ripped and punctured by sharp objects or by contact with excessive force during storage and handling. The expansion joint installer needs to exercise normal and prudent care to avoid wrinkling the fabric and the user needs to avoid mechanical and thermal damage, such as weld spatter, to the expansion joint. Operating within the specified design conditions during system startup is also critical. Dampers should start in their normal positions and operating parameters, e.g., fan speeds, should be checked to ensure that the expansion joints are not subjected to excessive pressure or temperature.

The Garlock drawing accompanying each expansion joint shows the exact arrangement of the component parts. The expansion joint installer must have the drawing and these instructions at the installation site. Garlock provides our customers with this information and also attaches it to the joint before shipping. Despite our best efforts, the information packet may become separated from the joint. The customer should ensure that the information is available to the installer.

1.0 Shipping & Handing

Garlock fabric style expansion joints may be provided assembled to frames or unassembled for on-site installation. In either case, the expansion joints and/or their containers should be inspected immediately upon arrival at their destination before being unloaded. All expansion joints leave the factory without defects and are packed to withstand normal handling without damage. Any visible signs of damage such as torn or wrinkled fabric, abrasion on fabric surfaces, damaged pallets and holes in cartons indicate mishandling during shipping. Never install damaged parts. The customer must note any damage on the bill of lading before accepting delivery. Garlock technical support should be contacted immediately if damage is noted. In addition, the customer should check that all

materials itemized on the Garlock packing list are included with the shipment. Any exceptions or missing items should be noted before signing the bill of lading. Notify Garlock immediately if there are any concerns with the shipment.

1.1 Assembled Components

Assembled flue duct style expansion joints must be moved with the temporary shipping and bracing bars in place. The joints should always be lifted and should not be dragged over objects or on the ground. All lifting lugs must be used to distribute the weight of an assembled joint. Assembled joints must never hang from forklift forks. Joints with a short side dimension less than the length of the forks may be moved with a forklift only if the joint is lifted from wood supports around the perimeter of the joint and placed on similar support blocks. The supports should be placed at least every 6 feet. Joints wider than the forks should be suspended with fabric slings at least 2 inches wide secured around lifting lugs welded to the frames. The slings must not contact the expansion joint fabric to prevent rubbing holes in the fabric. Several slings may be required on large joints to stabilize movement. The shipping bars maintain an expansion joint flange-to-flange distance less than the breach opening so the joint can be lifted in place from any direction. When the shipping bars are removed it is critical that the expansion joint is supported so design movements are not exceeded. For example, an expansion joint designed for 3 inches of axial compression should not be compressed more than 3 inches otherwise there may be damage to the expansion joint that will impair its performance. Under no circumstances should the frames make contact with each other so that the fabric is totally compressed. All frame bracing provided with an assembled expansion joint must remain in place until installation to the ductwork.

1.1 Unassembled Components

Unassembled fabric style expansion joints should remain in their shipping crates and should not be unpacked until immediately prior to installation. The crates are on pallets to facilitate moving with a forklift. Never try to move a crate on a broken pallet; the expansion joints should be repacked in a secure container. The shipping crate and packing method protect the expansion joints during shipping and storage. If damage is noticed when the shipping crate is unpacked, Garlock technical support should be contacted. Deformation, wrinkles and folds in the expansion joints must be avoided when they are unpacked. Unpacked joints should always be supported when they are moved; the lifting device must not contact the fabric. The expansion joints can be moved on pallets or wood platforms. The expansion joints should never be moved using the bolting holes in the fabric. Some Garlock expansion joints have metal rings or metal scissor mechanisms on the inside and the outside. These expansion joints should never be moved by the rings or metal parts be-

cause they are not designed to support the weight of the expansion joint. The rings will bend and the expansion joint will be destroyed. If not equipped with metal moving devices supplied by Garlock, these joints are to be moved as described in Section 9.0.

2.0 Storage

Acceptable storage temperatures range from 20°F to 100°F. The components should not be stored in direct sunlight or in open weather. Storage in a dry location off the ground is required. Storage near electrical or heating equipment should be avoided. The components should be stored in a position approximating their installed position. Heavy objects should not be stored on top of expansion joints and they should be kept away from sharp objects. Duration of storage should not exceed one year. Assembled expansion joints of the same size may be stacked no more than 3 high and the frames of adjacent expansion joints must be separated by wood blocks at least 4 inches high around the perimeter so that the cuff fabric is not damaged. The expansion joints must be at least 50°F prior to installation to ensure the proper flexibility of the gas seal and avoid damage to the seal.

3.0 Belt Type Installation Overview

The nomenclature for belt type expansion joints is illustrated in Figure 1. Belt type expansion joints typically include metal frames, baffles that may or may not be integral with the frames, an insulation pillow, the fabric belt, and the clamp bars and bolting for attaching the fabric to

the frame flanges. The Garlock drawing accompanying each expansion joint shows the exact arrangement of the component parts. The expansion joint installer must have the drawing and these instructions at the installation site. The customer should ensure that the information is available to the installers. Factory assembled expansion joints are installed by lifting the joint into the breach and welding or bolting one frame to a duct. If the other duct can be brought up to the unattached frame, it can be welded before the shipping bars are removed. If the ducts are fixed, the shipping bars must be removed as one frame is welded to the duct. The unattached frame must be supported during this operation so that the expansion joint is not supporting the weight of the frame. The unattached frame can then be positioned and welded to the opposing duct. The first step for installing unassembled joints is welding the frames to the ducts. If baffles are integral with the frame, the fabric expansion joint must be open for field splicing. If baffles are to be welded or bolted to the duct, closed or endless expansion joints can be pulled through the breach and over the flanges of one frame. The Garlock name that is stenciled on the expansion joint fabric must face to the outside. Baffles can then be attached to the duct. Insulation pillows are installed after baffles are in place and installation of the fabric belt is completed by pulling the belt to the flange of the other frame. Care must be taken not to wrinkle the fabrics during installation to avoid damage to the gas sealing layers. The expansion joint bolting is tightened to specification and retightened within the first 24 hours of operation.

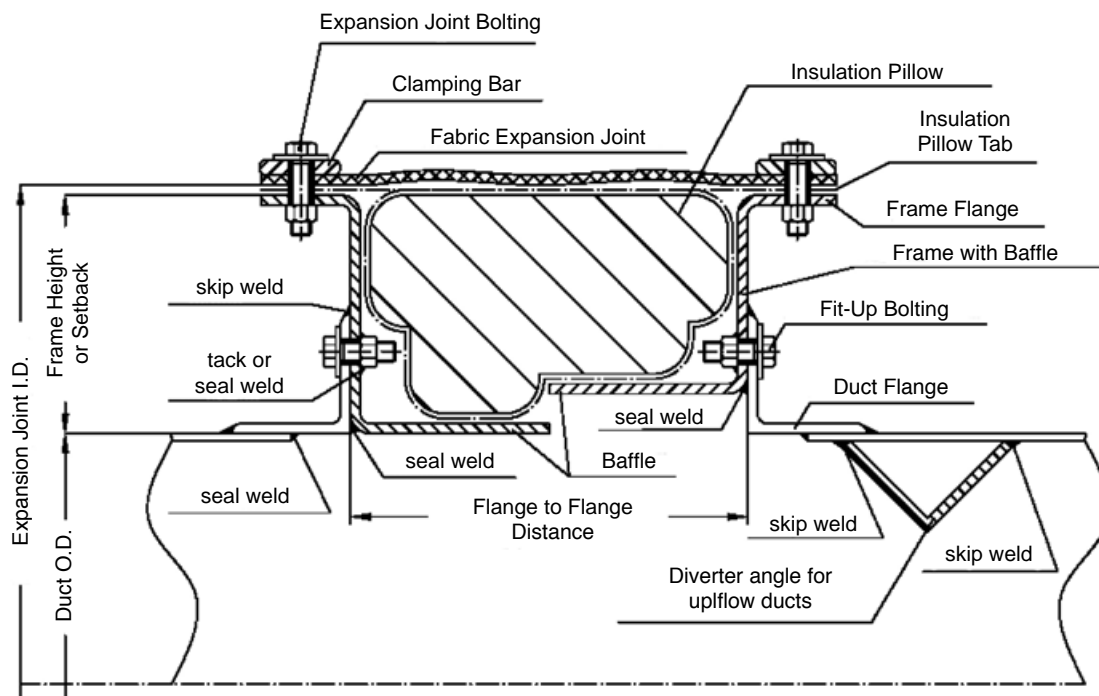


Figure 1. Belt Type Expansion Joint

4.0 U-Type Installation Overview

The nomenclature for U-type expansion joints is illustrated in Figure 2. The joints consist of fabric, backup bars, and bolting that connect to drilled duct flanges. The drawings accompanying the expansion joint show the arrangement of the assembled joint and detailed procedures for installation can be found later in this manual. The first step for installation is to clean the duct flanges and apply self-stick PTFE tape around the perimeter of the flange inside the expansion joint bolting pattern. Self-sealing fabrics will not require PTFE tape, so not all U-type joints require the PTFE tape. If bolt-in baffles are provided, they are attached using a minimal amount of bolting to temporarily hold them in place. In this type of configuration, PTFE tape is applied to the breach side of the baffle flange around the perimeter just inside the bolt pattern. The fabric joint can be installed into the breach with the Garlock logo facing out and then secured by the backup bars and bolting by first removing the bolting temporarily supporting the baffle and reinstalling it through the backup bars and fabric. The bolting must be tightened to specification and re-tightened within 24 hours of first being placed in service.

5.0 Erecting Expansion Joint Frames

This section provides guidance for assembling and installing expansion joint frames. Erecting both assembled and unassembled expansion joint frames is addressed.

5.1 Welding Frame Sections

Garlock can provide frames for very large ducts in sections so they can be transported by flatbed truck. Before the sections are welded together, the frame dimensions

should be checked against the measured duct dimensions to ensure a proper fit. Usually 4 frame sections are provided, including two C-sections with the corners welded to the short sides, and two straight sections for the long sides. The C-sections are shipped with bracing to prevent twisting and bending during shipping and moving. These braces should remain in place until the entire frame is assembled. Care should be taken to store and assemble the frames on level surfaces to prevent deformation. Frames or frame sections should never be moved using the bolt holes in the frames.

The frame sections should be joined using full penetration welds and the appropriate weld material in accordance with A.W.S. D1.1. The Garlock drawings supplied with the expansion joints identify the materials of construction in the material list. The material selection is based on information provided to Garlock by the customer. The installer should verify that the frame material is the same as the duct material. If dissimilar metals are welded, the weld may break when the joint reaches operating temperature because of the different coefficients of expansion. Frames with integral baffles require full penetration welds in all areas of the frame including the baffles. Backing or filler pieces can be used to weld complex shapes in compliance with A.S.W. D1.1. Welds in the flange area where the expansion joint is mounted must be ground flat so the expansion joint will form a gas-tight seal with the frame. Some frame sections are provided with the fabric and insulation assembled to the frame. When these frame sections are welded together, the fabric and insulation need to be protected with welding blankets. All metal edges in contact with expansion joint fabric must be radiused. Shipping braces can be removed when the frames are fully assembled and installed in the ductwork.

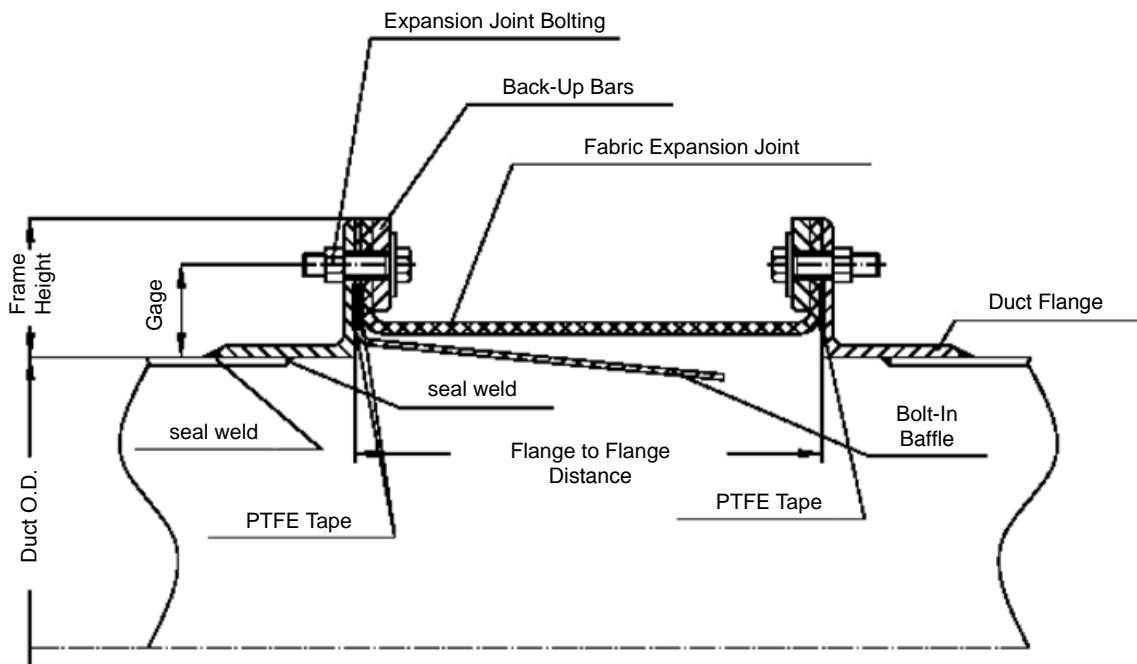


Figure 2. U-Type Expansion Joint

5.2 Installing Frames to Ducts

There are four requirements for proper installation of expansion joint frames to the ducts, specifically:

- 1) The outside frame dimensions, as indicated on the Garlock drawings, must be held for the fabric to fit correctly. Pay careful attention to any preset (designed offset) of the frames during installation. When specified, the preset indicated on the drawings must be maintained to accommodate large duct movements.
- 2) The frames must be square with the duct.
- 3) The flange-to-flange distance between the frames shown in the drawing must be maintained around the entire perimeter of the joint when the frames are installed in the “cold” position.
- 4) Do not attach the fabric of unassembled expansion joints to the frames before welding the frames to the ducts or placing the ducts in final position to avoid damage to the fabric. Proper frame alignment is often ensured using erection bolting. Bolts placed through holes in the duct flange are threaded into nuts welded onto the expansion joint frames. The torque applied to these bolts should not exceed 25 ft-lbs. All the erection bolts should be installed prior to welding the frame to the duct. Expansion joint frames require a continuous seal weld on the inside (gas side) contact area where they meet the duct member. Stitch welds (3 inch long welds spaced 6 inches apart) should be applied to the outside area of contact. Stitch weld spacing can be 12” for long runs. Stud bars that are welded to duct flanges should be installed the same way. The studs on each duct need to be directly opposite each other in the cold position.

6.0 Installing Baffles and Deflectors

This section addresses welding baffles and deflectors to the inside of duct walls and installing bolt-in baffles for U-type expansion joints. Weld-in baffles provided in piece-marked sections as identified on the Garlock drawing must be placed inside the ducts prior to expansion joint fabric installation. Weld the baffles to the duct after the fabric installation is complete. The baffle sections are stitch welded to the duct walls on both the upstream and downstream sides of the baffle. Before welding, the installer should ensure that the baffle is being installed in the proper direction. For ducts with horizontal or downward gas flow, the opening of the baffle should be located toward the downstream direction and the baffle must be welded to the upstream duct. For baffles installed in ducts with horizontal flow, there may be some baffle sections that are shorter (narrower than the breach dimension) than other sections. These smaller sections must be installed on the bottom of the duct. These shorter sections are ash deflectors that prevent ash accumulation on the expansion joint. For vertical ducts where the gas flow is upward, the

opening of the baffle is located in the upstream direction and the baffle is welded to the downstream (upper) duct. Additionally, for upflow ducts, diverter angles must be stitch welded to the upstream (lower) duct to prevent ash accumulation under the baffle. The proper clearances for welding the baffles and diverters are shown in the Garlock drawing. Always protect the expansion joint fabric with welding blankets while welding.

After the baffles are welded to the ducts, the baffle sections need to be stitch welded to each other and they also need to be welded in the corners where they form a mitered joint. Some belt type expansion joints have an internal bolt-in baffle to permit the installation of closed belts. The diverter angle used to attach the bolt-in baffles must be stitch welded to the upstream duct on both sides before the baffle is bolted to the angle.

Garlock provides some U-type expansion joints with bolt-in baffles. These baffles should always be installed on the upstream duct for horizontal and vertical flow. The duct flange must first be cleaned of dirt and grime and must have a smooth mounting surface for the joint. Then the gasket or self-stick PTFE tape is applied around the entire upstream flange perimeter just inside the bolting. This PTFE tape will create a gas seal between the metal parts when the bolting is tightened. The baffle is then installed temporarily by using a minimal number of bolts fastened very loosely. When the baffle is in place, additional PTFE tape should be applied to the entire perimeter of the baffle flange just inside the bolting to form an expansion joint gas seal if this tape is indicated on the Garlock drawing. Self-sealing fabric construction will not require the use of PTFE tape. The U-type joint can then be assembled. For baffles on upflow ducts or for double baffles, consult the Garlock drawing to position the baffles.

7.0 Installing Insulation Pillows

Insulation pillows may be provided in several configurations; the insulation may be totally enclosed in stainless steel wire mesh with or without tabs extending onto the clamping area, or the insulation pillow may be open on the side adjacent to the expansion joint fabric. The stainless steel wire mesh forms a U-shape in the frame cavity with the wire mesh being secured in the clamping area. All types of pillows require splicing and must be in place before installing the expansion joint fabric. Insulation must be kept dry during installation.

7.1 Enclosed Pillows with No Tabs

Totally enclosed pillows with no tabs should be placed in the frame cavity where they are supported by the baffle or by pins welded to the frames or baffles. The pillows should be forced onto the pins so the pins penetrate the wire mesh. Check that sufficient clearance exists between the pins and the expansion joint fabric throughout the entire movement of the joint. Pin clearance is checked at the factory but pins may be bent during shipping and handling.

7.2 Enclosed Pillows with Tabs

Totally enclosed pillows with tabs should be placed in the frame cavity so the tabs rest on the clamping areas (flanges) of the frame. The pillows may have one or two tabs, the pillows with single tabs are installed on joints experiencing large movements. The Garlock drawing indicates which frame flange receives the single tab. Tabbed pillows can be secured to the frame flanges using removable screw clamps while the fabric belt is being installed. Alternatively, the wire mesh can be attached to the flange by plug welding a ¼" washer on top of the wire mesh to the frame. The washers need to be located inside the bolting line between expansion joint mounting holes. Use a spacing of 2 feet between washers. Welds should be ground smooth to the tops of the washers and then self-sticking PTFE tape should be applied on top of the wire mesh before installing the fabric belt. All welds and taping should be complete before installing the fabric.

7.3 Open Pillows

Open pillows are assembled by first forming stainless steel wire mesh into a U-shape in the frame cavity. Sections of wire mesh must overlap 3 inches and they need

to be sewn together as described in Section 7.4. The wire mesh should line the bottom of the cavity created by the baffle(s). The mesh extends up the sides of the frame, fitting snugly at the junction of the frame and baffle, with 1 inch extending above the frame on each duct. This 1-inch section of mesh is bent over the flange and can be secured using screw clamps or welded washers as described in Section 7.2. After the mesh is secured around the entire frame, insulation is placed in the cavity to completely fill the area between the baffle and the top of the frame. The expansion joint fabric can then be installed.

7.4 Sewing Insulation Pillows

The wire mesh of insulation pillow sections is overlapped approximately 4 inches and sewn together using the stainless steel thread and curved needle supplied by Garlock. Instructions for sewing are shown in the following photographs. Colored thread rather than stainless steel wire is used to highlight the photographs. Always use the sewing material supplied by Garlock. The location of insulation splices must be at least 3 feet from the location of an expansion joint fabric splice.



1. Insulation Pillows as Supplied
Wire Mesh Approximately 4"



2. Fold Back Insulation and Overlap



3. Begin Cross-Stitching on One Side



4. Finish Cross-Stitch and Tie Ends



5. Stitch All Three Sides



6. Butt Insulation Over Splice

8.0 Installing Expansion Joint Fabric

Expansion joint fabric may be supplied as open or closed (endless) belts or as closed U-type expansion joints. Installation of each type is discussed in the following sections. The duct flanges must be straight and smooth for all installations. Field welds in the flange areas must be ground smooth and all edges contacting the fabric must be radiused. The working area should be clear of sharp objects and protrusions during installation. The expansion joint fabric must always be supported during installation and should be moved as described in Section 1.0. The fabric must be installed with the Garlock label facing to the outside; never to the gas side.

8.1 Open Belt-Type Expansion Joints

Open belts should be installed after frames are mounted on ducts, after the ducts are in their final position and after baffles and the insulation pillow have been installed. The fabric should be placed on the frame flanges over any wire mesh from the insulation pillow. The belt should be unrolled from the midpoint of the long side with the ends for splicing placed on the top of the duct at least 3 feet away from a corner area. The splicing area may be at the upper section of the sides but never on the bottom of the duct. The belt must be supported as it is being unrolled around the duct using bolting or temporary screw clamps. The expansion joint should never hang from clamps or bolts to prevent the fabric from tearing. The clamping bars can be installed starting in the corners nearest the splice without temporarily clamping the entire belt. Clamping bars on the lower flange should be installed last. Clamping bars should not be installed within 8 feet of the splicing area until the splice is finished. Garlock provides splicing instructions specific to the belt make-up with open belts as an addendum to this manual. Each layer of the expansion joint must be spliced according to the instructions that are provided with this manual. If the belts are not provided with bolting holes, they can be drilled as the belt is placed on the flanges. The clamping bars and drilled frame flanges can be used for the drilling pattern. The fabric must be secured on both sides of the hole during drilling to prevent fabric damage.

8.2 Installing Closed Belts

Closed belts may be secured with T-bolt clamps on small round or oval ducts, or with clamping bars and bolting as indicated by the Garlock drawing. Belts secured with T-bolt clamps are installed onto the ducts through the breach opening. The belts should slide onto the ducts and should fit snugly. This installation may be easier if a silicone spray or grease is first applied to the outside of the duct. The expansion joints should never be pulled with pliers or vise grips to avoid damage to the fabric. If the belt will not slip on the duct, contact Garlock for technical assistance. The correct T-bolt clamps are packed with the belts and the belts and clamps must be kept together. Multi-part

clamps used on larger ducts must be assembled by the customer. The bolt section of one multi-part clamp must be joined to the threaded section of the other clamp. All the clamps must be open prior to being joined. The clamp needs to be installed around the expansion joint prior to joining the final sections. The bolts should be tightened evenly around the belt so they are all hand tight. Then the final fastening is completed by applying 70 in.-lb. of torque to each carbon steel fastener and 50 in.-lb. to each stainless steel fastener.

Closed belts secured with clamping bars are pulled through the breach opening using fabric slings and pulled onto the frame flanges without wrinkling the fabric. This operation must occur before baffles are welded in place and before an insulation pillow is installed. If baffles and insulation pillows are to be installed, the belt must be pulled over the flanges on one duct so that no material is in the breach opening. After baffles and insulation pillows are installed, the belt can be slid over the one flange, across the breach opening, to the frame flange on the other duct. The belt can be temporarily secured with screw clamps to begin installation of the clamping bars as described in Section 10.0

8.3 U-Type Expansion Joints

U-type expansion joints are installed through the breach opening and bolted to the duct flanges using back-up bars. U-type expansion joints may be shipped partially assembled with shipping bars to maintain a flange-to-flange distance smaller than the breach opening. Please note the instructions in Section 1.0 for moving joints equipped with metal rings or scissor mechanisms. Other U-type joints can be lifted into position by fabric slings placed around the joints in the axial direction. Supports can be used as described below. The joints should not be lifted by the shipping bars because the weight of the joint would be supported by only a few bolts and the fabric could tear around these bolts. Duct flanges must be clean and, if supplied by Garlock, the self-stick PTFE tape supplied with the expansion joint must be applied continuously around the perimeter of the duct flange to the inside of the bolt hole circle. The PTFE tape compresses when the bolting is tightened to form a gas-tight seal with fabrics that are not self-sealing. When the expansion joint is in position, it may be loosely secured to the duct flange using bolting through the holes in the back-up bars and fabric not used for the shipping bars. After both sides of the expansion joint are loosely attached, the shipping bars can be removed and the remainder of the bolting is installed as described in Section 10.0.

Installation of unassembled U-type expansion joints is similar except for moving the joints into position. Large U-type joints on rectangular ducts with horizontal gas flow can be lifted into position by placing a board with a width less than the breach opening to the inside of the top of the joint and securing the joint to the board with ropes or tape as illustrated in Figure 3. Fabric slings wrapped around

the board and joint are used to lift the joint into position. The lower section of the joint can be tied to the top board on very large joints.

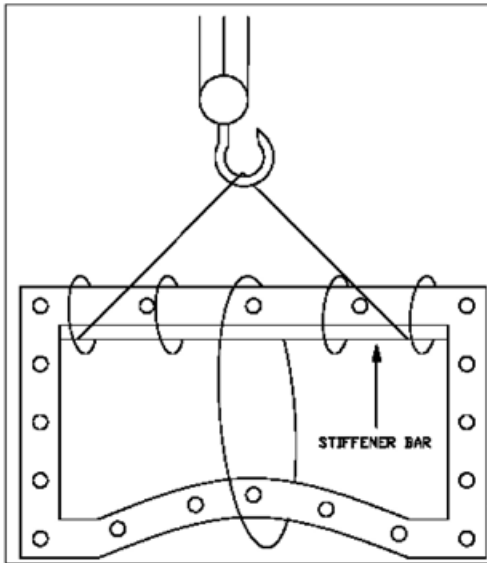
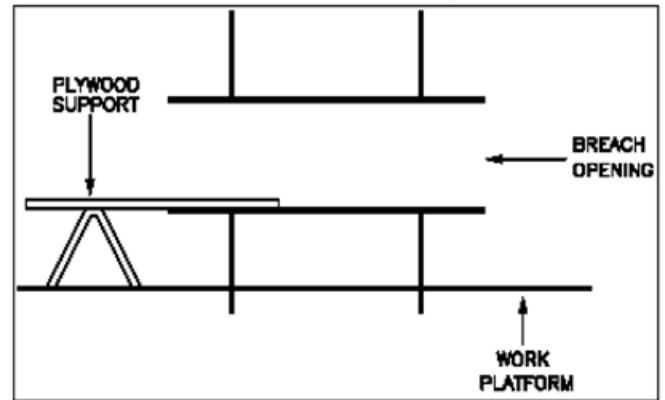


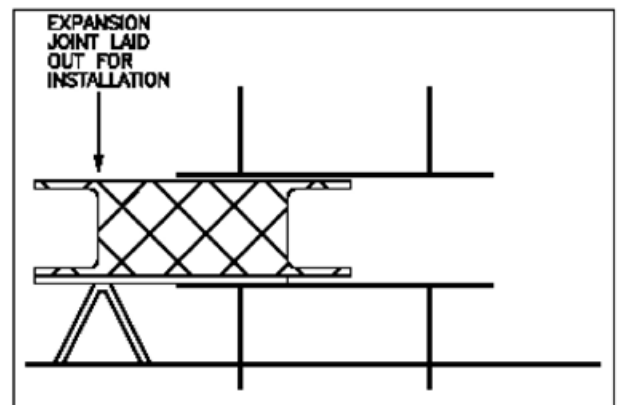
Figure 3. Expansion Joint Support

Plywood placed in the lower section of duct supports the bottom of the joint when the ropes are cut loose. Any PTFE self-stick tape needs to be applied to the duct flanges before installation. A section of the expansion joint flange and its back-up bar are temporarily secured to one duct flange with screw clamps and bolting is loosely installed. When the upper flange is secure the ropes can be cut and the board can be removed prior to installing the fabric on the lower flange. For ducts with vertical gas flow, plywood can be placed on the lower duct flange and supported to the outside of the duct as shown in Figure 4. The joint is placed on the plywood to approximate its installed shape. The plywood is then slid into the duct and the upper flange can be installed using clamping bars and bolting. After all the bolts in the upper flange are installed hand-tight, the plywood can be slid out of the duct and the lower flange can be installed. It is important to mount the expansion joint to opposing duct flanges symmetrically to prevent twisting the fabric. The bolt holes on each side of the breach opening should be directly opposite each other. Please contact Garlock technical assistance if they are not. After all back-up bars and bolting are installed hand tight, they may be secured as described in Section 10.0.

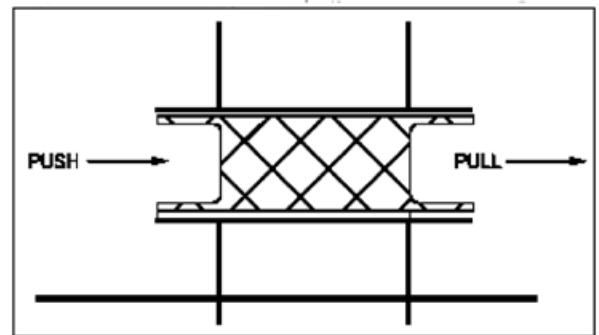
Figure 4. Installing Expansion Joints in Vertical Ducts



1. Set Up Platform



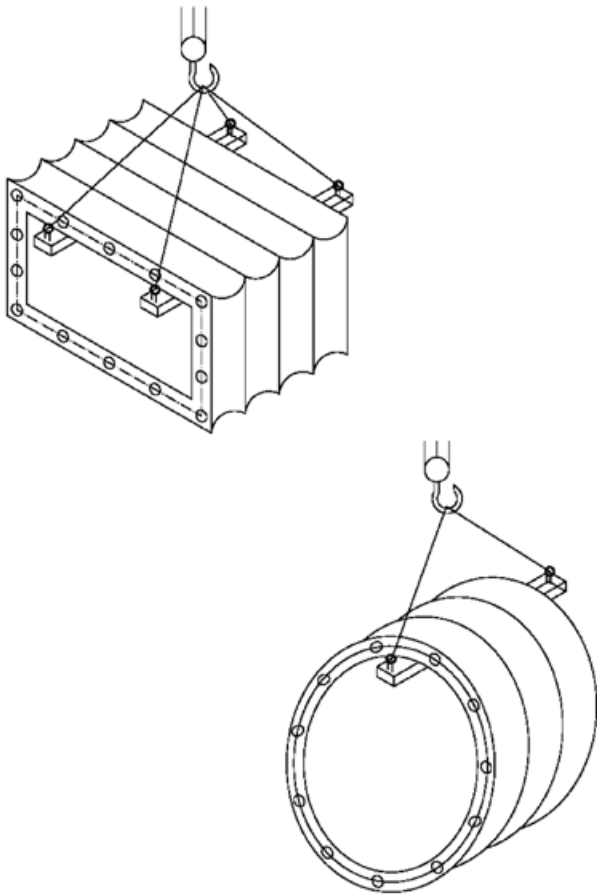
2. Place Expansion Joint in Breach Opening



3. Slide Expansion Joint into Breach Opening

9.0 Installing Convoluted Expansion Joints

Convoluted expansion joints have multiple folds supported by metal rings on the inside and the outside. This design is able to accommodate large movements when installed and the joint can be compressed to facilitate handling and installation. When compressed, the folds can touch but no force must be applied to the metal rings. Never lift or move convoluted joints by the metal rings. The rings are not designed to support the weight of the expansion joint and they will bend thereby destroying the expansion joint. Convoluted joints should be lifted and moved as shown in the diagrams below. Rectangular joints require at least two boards in each of the top corners placed through the compressed joint as shown. The boards can be lifted with slings through lifting lugs on the boards, being careful to avoid contact with the metal rings. The bottoms of the joints must be tied to the boards so they do not hang free. The rectangular shape of the joints must be maintained during movement and installation to prevent deformation of the rings. Round expansion joints can be moved the same way but only one board at the top as shown in the diagram is necessary. The bottom of round joints must be tied to the board so the weight of the joint does not hang on the metal rods.



Once the convoluted joint is properly lifted for installation, the remainder of the process is identical to that for standard U-type joints as described in Section 8.3. The duct flanges need to be clean and smooth. If Garlock provides PTFE self-stick tape with the joint, it needs to be installed on the duct flanges inside the bolting pattern. The convoluted joint can slide into a vertical duct using the plywood board placed across the lower duct. The convoluted joint can be lifted into the breach of a horizontal duct. After the joint is in the breach, one side can be attached using hand-tightened bolting in all flange and clamping bar holes. The bolts must be installed with their heads on the breach side and the threaded part toward the duct as shown in the Garlock drawing provided with the expansion joint. The lifting or supporting device can be removed after the free side of the joint is supported. The metal rings must not be used to support the free side. After bolting is placed in the free side, all bolting can be tightened as described in Section 11.0

10.0 Installing Assembled Expansion Joints

For ducts with vertical gas flow, installation is outlined in Figure 4. Plywood is placed on the lower duct flange and supported to the outside of the duct. The joint is placed on the plywood in its installed shape. Ensure the baffles connected to the expansion joint frames are oriented in the proper direction as indicated in the Garlock drawing. The plywood is then slid into the duct and the upper frame section can be installed after any shipping bars are removed. After the upper frame is installed, the plywood can be slid out of the duct and the lower frame can be installed. The expansion joint fabric must be protected with welding blankets while the frame is welded onto the duct. For ducts with horizontal gas flow, the assembled joints can be lifted into position using fabric slings secured to the lifting lugs on the frame. The slings should not chafe against the expansion joint fabric. Ensure that baffles are facing in the proper direction prior to lifting the joint. Shipping bars should remain in place to ensure that the joint will fit into the breach opening. The slings and shipping bars can be removed after the joint is in proper position for any fit-up bolting and adequately supported. The expansion joint fabric must be protected with welding blankets while the frame is welded onto the duct.

11.0 Installing Clamping Bars and Bolting

Clamping bars are typically 2" wide x 3/8" thick bars with 5/8" x 1" slotted holes to allow tolerance for bolt hole misalignment when using $\varnothing 1/2$ " bolting. At least one edge should have a chamfered 1/8" radius; typically all four edges have a radius. A single chamfered clamp bar must have the radius against the fabric at the edge nearest the duct or breach opening. The clamping bars are placed on top of the fabric material so the fabric is between the clamping bar and the duct or frame flange. Garlock expansion joints are self-sealing if not provided with grom-

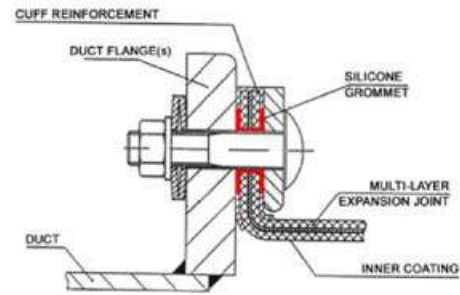
ments so no sealing material or caulk on the flange area is necessary other than the PTFE tape supplied with some joints. All bolting should be installed loosely before being tightened. The bolt heads must be installed on the same side as the clamping bar with a flat washer between the bolt head and the clamping bar. The bolts must pass through the hole in the fabric and the hole in the mounting flange. The nut is placed on the bolt and hand-tightened to the flange. When all bolting is installed and prior to setting the recommended bolt torque, the expansion joint fabric should be smoothed out to ensure no folds are present in the clamping area. The gap between the ends of adjacent clamping bars should not exceed 1/8". If a larger gap is observed, it must be filled with a metal shim prior to tightening the bolts. The shims must be placed behind the clamping bars and on top of the expansion joint fabric. The shims should be centered in the gap. They are held in place by the torque applied to the bolting. Silicone may be used to hold the shims until the bolting is tightened. The bars should not overlap and they must be trimmed if the overlap cannot be eliminated by repositioning the bars. Final tightening of the bolts should proceed from a single bolt and proceed in one or both directions away from that bolt. The torque applied to the expansion joint and frame bolting depends on the size and material of the bolting or studs according to the following specifications:

- ø1/2" carbon steel, galvanized, or zinc electroplated bolting – 45 ft.-lbs.
- ø1/2" stainless steel bolting – 40 ft.-lbs.
- ø1/2" stainless steel bolting with brass nuts – 35 ft.-lbs.
- ø1/2" stud bolts – 20 ft.-lbs.
- ø5/8" carbon steel bolting – 55 ft.-lbs.
- ø5/8" stainless steel bolting – 50 ft.-lbs.

Carbon steel bolting can be installed without lubrication; high temperature, anti-seize compound or paraffin wax should be applied to stainless steel bolting to minimize galling unless brass nuts are used. Button-head bolting and hex-head bolting are tightened to the same specifications.

NOTE: EXPANSION JOINT BOLTING MUST BE RE-TORQUED WITHIN THE FIRST 24 HOURS OF OPERATION.

If silicone inserts (grommets) are supplied with the expansion joints, each bolt hole should have a grommet as shown below. The flanges of the grommets should lay flat on the cuff of the expansion joint fabric and should not be twisted or deformed. The grommets will not bond with the cuff properly if they are not flat and they will not be gas tight. Damaged silicone inserts must be replaced before fabric installation. Do not install expansion joints with grommets missing. The proper size bolts as indicated on the Garlock drawing must be used with the grommets to prevent damage to the grommets.



12.0 Insulating and Covering Expansion Joints

In the absence of specific instructions from Garlock, our expansion joints should not be insulated from the outside. The insulation would cause excessive heat build-up in the joint which would ruin the joint materials and void the Garlock warranty. Garlock recommends external insulation for some low temperature joints to prevent joint temperatures from falling below the flue gas dew point and for some high temperature joints that contain no heat sensitive materials. If there is any question regarding external insulation, please contact Garlock Technical Assistance.

Garlock expansion joints can be fitted with rain covers or with expanded metal covers for worker protection or for expansion joint protection. The covers may be attached using the expansion joint mounting bolting, but they must never contact the fabric material. Covers should be mounted on clamping bars from the side opposite the fabric. Garlock recommends the use of additional nuts to secure cover; the expansion joint bolting would act as studs for the cover mounting. This method ensures that the proper torque can be applied to the expansion joint bolting without interference from the cover. All covers must be at least 4" from the fabric surface and they must be vented on the sides to permit air flow across the expansion joint. This cooling effect of ambient air is critical to proper expansion joint operation and warranty maintenance.

If grounding straps are used, they are secured in the same manner as a cover. The expansion joint bolting is used as a stud and the strap is attached using an additional nut. Grounding straps should never be in contact with the fabric. External duct insulation should be kept at least 2 inches from the expansion joint bolting flange. Air circulation around the bolting is necessary to cool the flange area and prevent expansion joint failure.

13.0 Inspecting and Maintaining Expansion Joints

Before a Garlock expansion joint is put into operation, check the frame and breach dimensions to ensure they are consistent with design conditions. All surface debris on the expansion joint must be removed and the shipping bars must be removed. Check that no obstructions to duct movement and that the ducts are correctly anchored. The torque on the bolting should be checked and the upstream and downstream damper positions should be checked to prevent overpressure or other potential damage to the expansion joint. The bolting must be re-torqued within 24 hours of the first system startup after joint installation.

During operation the expansion joint exterior should be kept free of dust deposits, particularly coal dust that could ignite and destroy the expansion joint fabric. Dust can be removed using compressed air or careful brushing. The joint should be inspected monthly at a minimum for any damage such as tears or burns. Discolored areas of the expansion joint fabric indicate thermal or chemical damage. Contact Garlock if any damage is observed. Minor damage can be repaired. Duct movements should be checked during operation. If they exceed the design conditions, please contact Garlock Technical Assistance. The monthly inspections should also check that external duct insulation is at least 2 inches from expansion joint bolting flanges, so that no signs of leakage are evident, that the joints are ventilated and that the bolting is tight.

The expansion joint fabric must be protected from any welding in the vicinity of the joint. Welding blankets must be removed when work is finished. The joint must also be protected from falling objects during overhead work and from puncture during nearby work.

During shutdowns the interior of the expansion joint should be checked to ensure that no ash deposits have hardened in the breach area. Such hardened deposits could damage or prevent proper operation of the expansion joint. If detected, solidified ash should be carefully removed to prevent fabric damage. Loose ash can be removed by brushing or vacuuming the area. If the ducts are water washed, the expansion joints must be protected from moisture. Moisture can ruin insulation pillows.

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WARNING:

Properties/applications shown throughout this brochure are typical. Your specific application should not be undertaken without independent study and evaluation for suitability. For specific application recommendations consult Garlock. Failure to select the proper sealing products could result in property damage and/or serious personal injury.

Performance data published in this brochure has been developed from field testing, customer field reports and/or in-house testing.

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