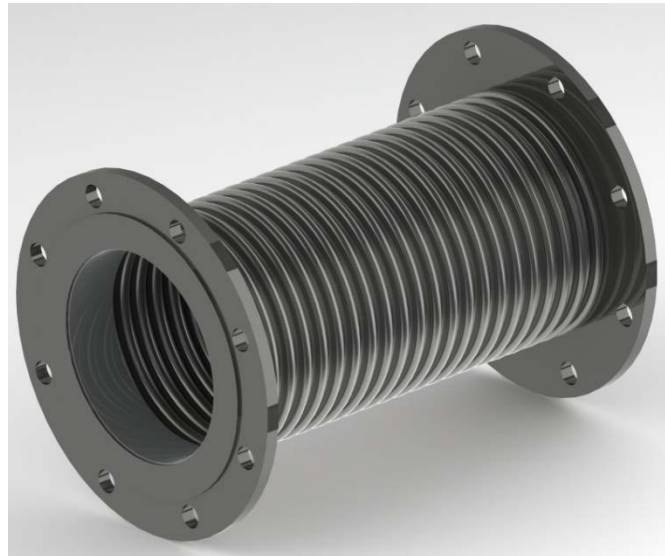




a clear direction for the future



Flex Connector GT Exhaust Accessories Installation and Operation Manual



Rev. B

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NOTICE

The instructions herein must be expressly carried out in order to preserve **WARRANTY COVERAGE**. Ensure that all periodic checks and maintenance schedules are adhered to as directed.

IMPORTANT SAFETY WARNINGS



IF THERE IS ANY CONCERN ABOUT THE SAFETY OF THIS OR ANY SYSTEM, CLEAR THE AREA IMMEDIATELY OF ALL PERSONNEL AND CONTACT THE APPROPRIATE PERSON FOR FURTHER INSTRUCTIONS.

WARNING: ANYONE WORKING AROUND OR NEAR THE INSTALLATION SHOULD BE TRAINED IN THE PROPER SAFETY PRECAUTIONS AND PROCEDURES INCLUDING EMERGENCY SHUTDOWN. THESE PRECAUTIONS AND PROCEDURES MUST BE FOLLOWED.

WARNING: WORK ON THE INSTALLATION IS TO BE DONE ONLY BY TRAINED, QUALIFIED INDIVIDUALS. THIS INCLUDES ALL ELECTRICAL AND MECHANICAL WORK. ALL WORKERS MUST BE TRAINED IN THE PROPER SAFETY PRECAUTIONS AND PROPER ATTIRE MUST BE WORN AT ALL TIMES INCLUDING HARD HATS, SAFETY GLASSES, PROTECTIVE OUTERWEAR, EAR PROTECTION, AND STEEL-TOED BOOTS.

Introduction

Congratulations on your decision to partner with GT Exhaust through your recent purchase of GT Exhaust Accessories. Whether your purchase will be installed within an enclosure for backup power generation or in the harsh environments of off-shore, you can be sure that your purchase will be manufactured to the highest quality and will perform as specified. This guide will walk you through the necessary steps to successfully install and maintain your GT Exhaust product and will provide all other relevant information to ensure optimal effectiveness of your exhaust system's operation.

READ THROUGH THE ENTIRE MANUAL BEFORE PROCEEDING WITH ACTUAL INSTALLATION.

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ERRORS and OMISSIONS EXCEPTED

Selection and Description

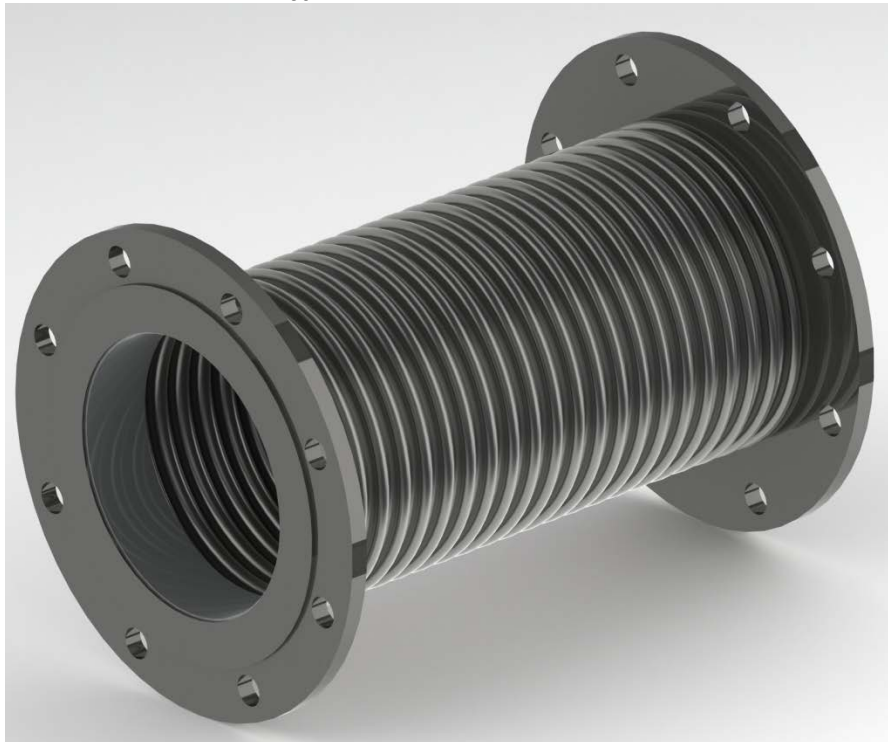
A full list of specification and application sheets for the full line of GT Exhaust Silencers, Emissions Products, and Accessories can be found at www.gtexhaust.com.

Flex Connector Overview

Flex Connectors are intended for applications where the movement of exhaust system components along the axis of the system due to the thermal expansion from intermittent engine operation produces limited movement. Flex connectors must not be installed in locations where they will be subjected to destructive vibration. When selecting an expansion joint, the following considerations should be reviewed for maximum life and effectiveness of the exhaust system:

- Exhaust size
- Maximum Pressure
- Maximum Temperature
- Type of Movement (Axial, Lateral, Angular, or a combination)
- Rate of exhaust flow (CFM) through the joint
- Type of end fittings or connections
- Extreme Service Conditions
- Thermal Insulation Type

IMAGE 1: Picture of a Typical GT Exhaust Flex Connector



Receiving Inspection

- Upon receipt of the system, check the nameplate against the packing list to verify the correct part numbers are received. Verify all items on the packing list are present.
- Keep the shipping container to protect the unit until installation has been completed.
- Prior to unpacking, check all components for shipping damage.
- Advise care@gtexhaust.com of shipping damage within three days of receipt of the product.

Storage

- Leave any cardboard boxing, plywood covering, crating, and/or plastic covering intact until ready to install.
- Be sure that all openings are closed so that no debris, vermin, rain, snow and/or ice can get into the unit.
- Store the product on blocks, a minimum of 4" high, so that air can freely circulate around the unit.
- Do not store the product in contact with the ground or in a wet, humid or flooded area.
- Inspect the product's body and mounting surfaces prior to installation. If there are any areas of significant damage, i.e. large dents, deep scratches, contact the factory before proceeding with installation.
- Clean and remove any minor corrosion and refinish per GT Exhaust recommendations. If major corrosion has occurred such that the integrity of the unit is in question, contact GT Exhaust.

Installations and Specifications

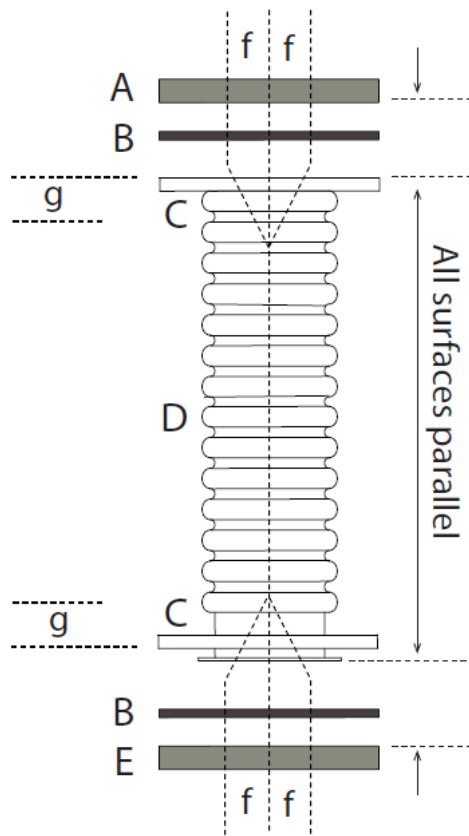
Refer to Table 1 for standard bolt torque specifications.

Note: For maximum durability, allow the flex connector to operate as closely as possible to a free state.

Caution: Pre-loading flange connections due to misalignment will result in premature failure and will void the Warranty.

Note: Flex Connectors are not designed to absorb any torque. Do not force-rotate one end of the expansion joint for alignment of the bolt holes.

1. Place the flange of the connector (floating flange, if used) over the exhaust outlet of the engine, with the gasket between the two facing surfaces and bolt holes properly mated, so that the axial lines of the connector and mating orifice are concentrically aligned.
2. Secure the flange over the mating face of the outlet using **Grade 2** bolts and nuts or appropriate Nut-Bolt-Gasket (NBG) kit, in order to maintain joint tightness over time. High grade fasteners will loosen as the system settles, causing failure. Do not use spring lock washers, as operating temperatures and pressures will cause them to degrade or disintegrate.
3. Secure the opposite flange of the connector to the mating face of the receiving system, with the gasket between the two facing surfaces and bolt holes properly mated. Use the same grade of fasteners as previously described, ensuring that the axial lines of the engine outlet, connector, and mating orifice remain concentrically aligned.



A - Silencer Inlet	f - Maximum Lateral Offset
B - Gasket	g - Maximum Axial Movement (expansion/compression)
C - Flange	
D - Flex Connector	
E - Engine Outlet	

Thermal Growth

Thermal growth of exhaust piping, away from the engine, must be planned to avoid excessive load on supporting structures. Steel exhaust pipe expands 0.0076 inches per foot for each 100°F rise of exhaust temperature. This amounts to 0.65 inches of expansion for each 10 foot run of pipe during a temperature increase of 100°F to 950°F. Add expansion joints to long pipe runs to accommodate for this growth and to prevent excessive structural stress which would lead to premature and potentially catastrophic failure. It is recommended that exhaust system supports are located to allow expansion away from engine, avoid strains or distortions to connected equipment, and to allow equipment removal without additional support. A restraint member is often used to keep the ends of a long pipe run fixed in place, forcing all thermal growth towards the expansion joints. Flex Connectors, when insulated, must expand and contract freely within the insulation, which requires a, chloride and halide free, soft material or insulated sleeve to encase the connection.

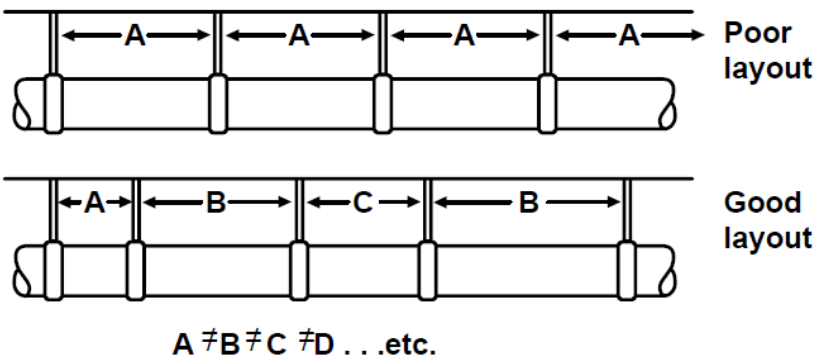
Anchors / Pipe Supports

Pipeline failures involving corrugated flex hose connectors and expansion joints can be caused by under designed anchors. Main anchors are required at each point where the pipeline has a directional change, blind end, valve, major branch connection or change in pipe diameter. The purpose of the intermediate anchor is to divide the pipeline into individual expanding sections.

Hanger Guides

Hanger systems which contain expansion joints tend to buckle under the compressive pressure forces in the system. Due to flexibility of the expansion joint and internal pressure loading, the pipe acts as a column that must be properly guided to prevent buckling. Also, the misalignments of adjoining pipe can cause lateral or rotational motion in the corrugated flex hose connector and/or expansion joint, which will negatively affect service life. Therefore proper alignment and guiding are essential to proper functioning and life of the expansion joint and piping. To prevent a buildup of resonant pipe vibrations, support long piping runs at unequal distances. See Image 2 to see a proper hanger layout.

IMAGE 2: Illustration of Poor and Good Exhaust Pipe Layouts



Pipe Hanger Location

In order to optimize the number of pipe hangers used in an exhaust system, locate the expansion joint adjacent to one of the anchors - pipe hangers are then required on one side only. An expansion joint located in the center of the pipe requires guides on both sides. It is suggested that the first guide be located within a distance of four (4) pipe diameters from the expansion joint, and the second guide be located within a distance of fourteen (14) pipe diameters from the first guide.

General Installation Considerations

Installation of GT Exhaust Accessories requires that the user ensure the entire exhaust system is properly designed before installing parts. Exhaust components such as expansion joints, rain caps, elbows, supports, etc. are critical installation pieces which, if they fail, may compromise the integrity of the system as well as damage other components and, possibly the engine and surrounding components.

The installation of GT Exhaust Flex Connectors must be performed by trained and qualified personnel and approved by local building inspectors, where applicable. It is the responsibility of the Owner/Operator to arrange for these procedures to be performed according to all applicable codes including local codes for your Municipality/City/County and State.

- Verify that the flex connector and gaskets are of proper size for the mating surface openings.
- **Note:** No part of the exhaust system should be in the vicinity of flammable materials. Exhaust system components inside the building should be covered with suitable insulation wrap to protect personnel and reduce room temperature. Standard and custom insulation wraps are available through GT Exhaust.
- Observe all OSHA mandated regulations for the safe rigging of exhaust equipment.
- Review Image 4 and 5 of typical Silencer Installations.
- Do not use chains or any lifting device directly on the flex connector. Protect the flex connector element.
- Ensure that all mating surfaces are clean and free of foreign material before installation. When cleaning the surfaces, **do not** use abrasive materials such as steel wool or wire brushes. Use only isopropyl alcohol and clean, soft rags – **Note:** Do not use Chloride or Halide based cleaners
- The connector's outer flange faces must be parallel with each other (see figure on previous page). As such, mating surfaces must also be parallel.
- The installation must be pre-aligned so that bolts for all mating surfaces can drop into place with no force, offsetting, bending, twisting or other form of distortion.
 - **Caution: Pre-loading flange connections due to misalignment will result in premature failure and will void the Warranty.**
- The installation must produce no downward force or loads exerted on the engine exhaust outlet.
- To avoid eminent failure, do not handle or install this product in a manner or position such that torqueing or twisting can occur along its axial line. Do not force-rotate one end of the expansion joint for alignment of the bolt holes. **Caution: Flex Connectors are not designed to absorb any torque.**
- Ensure that the installation complies with maximum allowable lateral offset and axial movement in inches per foot as specified in Table 1 above for your connector dimensions.
- Maximum operating temperature for this product is 1000°F (575°C).
- This product is rated at 5 PSIG (0.34bar). Hydrostatic test pressure shall not exceed 1.5 times the rated pressure.
- Only use chloride and halide free insulation.

Flanged Connections

- Apply high temperature anti-seize to bolts – use Loctite® 34517 or equivalent.
- To ensure uniform flange pressure, tighten bolts in a star-shaped pattern until all are snug. Following the same star-shaped pattern, torque the bolts to the specified torque. Never torque bolts directly to the left or right of the previously torqued bolt.
- When tightening fittings, torque to specifications listed below in Table 1. Re-check torque prior to and subsequent to initial engine start and system commissioning.

Cuffed Connections

- **Note:** Ensure the clamp is loosely attached to either the cuff or the exhaust piping prior to fitting the exhaust piping to the cuff.
- Insert the exhaust piping securely into the cuffed portion of the connection, ensuring that the exhaust piping is uniformly bottomed out and the alignment meets the criteria of Table 1.
- Position the clamp towards the edge of the cuff, allowing a min. of 0.5” from the edge of the clamp to the edge of the pipe.
- Torque the clamp bolts until tight. Re-check tightness prior to and subsequent to initial engine start and system commissioning.
- Complete the post installation check list to verify the connection does not leak exhaust gas.

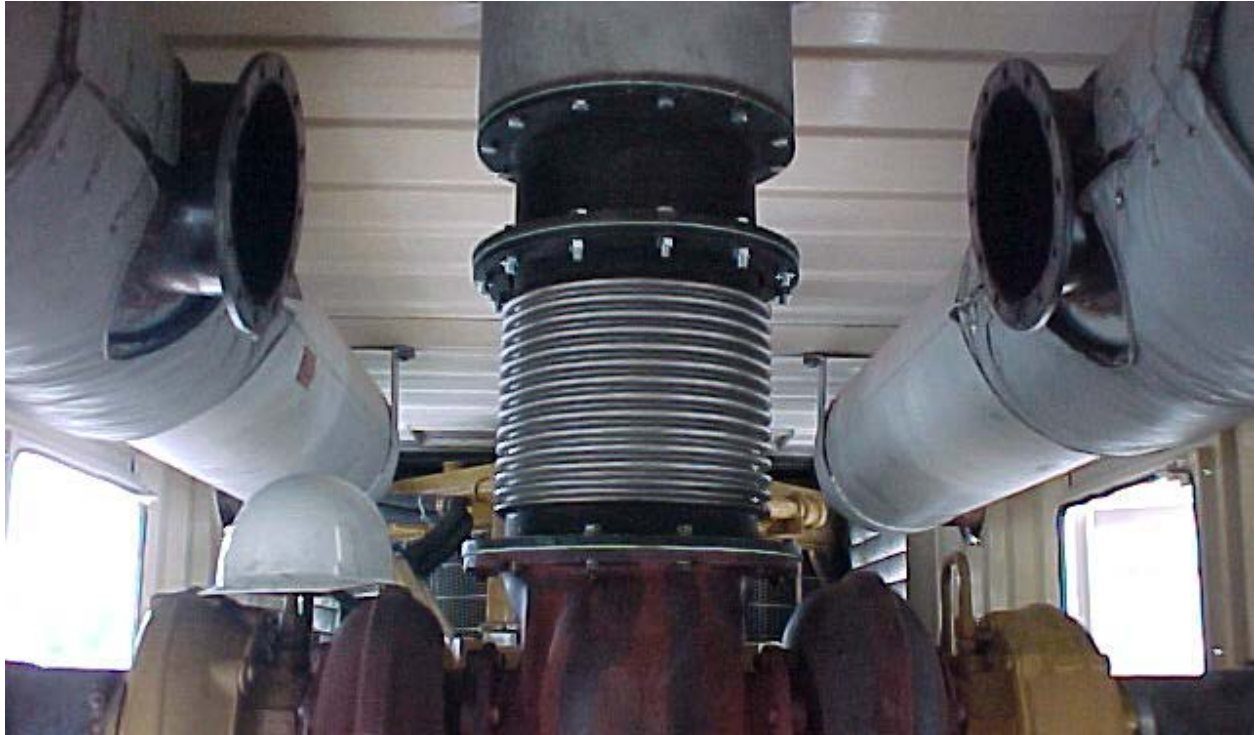
TABLE 1: Table showing Standard Bolt Torque Specifications

Nominal Bolt Diameter (in.)	Dry Torque (Ft-Lbs)
0.375	20
0.50	47
0.625	96
0.75	155
0.875	206
1.00	310
1.125	480
1.25	375
1.5	1100

IMAGE 3: Picture of a typical GT Exhaust Nut-Bolt-Gasket Kit with Fiber Gasket



IMAGE 4: Picture of a GT Exhaust System Installation

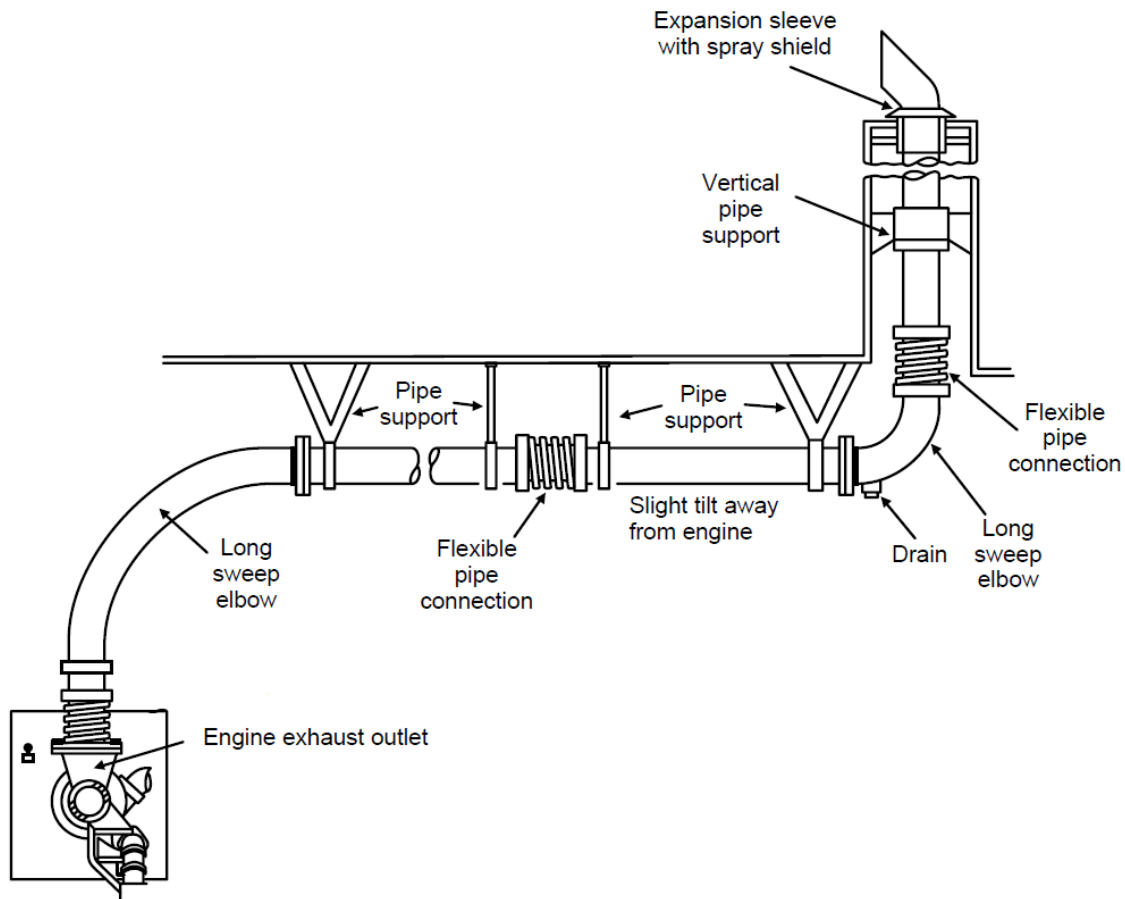


Post Installation Checklist

Subsequent to following the above procedure, review the following check list to ensure that all components of your exhaust system are properly installed and ready for operation:

- If your exhaust system has an insulation wrap installed over any fittings or connections, pull the insulation back, and check the tightness of the bolted connections and torque to the specifications provided in Table 1. Ensure there is no debris in the joint that would prevent a secure and tight fit. Re-install the insulation.
- Verify that the type and amount of movement generated by the system are identical with movements the expansion joint is designed for.
- After the initial engine run and cool down, re-check all bolts for tightness and torque as required in Table 1.
- Exhaust backpressure must not exceed the allowable backpressure specified by the engine manufacturer. Excessive exhaust backpressure reduces engine power and engine life and may lead to high exhaust temperatures and smoke. Engine exhaust backpressure should be estimated before the layout of the exhaust system is finalized, and is recommended to be measured at the exhaust outlet under full-load operation, as needed. Consult GT Exhaust Technical Support if actual backpressure exceeds manufacturers limits.

IMAGE 5: Illustration of a typical Exhaust System Installation



Maintenance

Note: Ensure exhaust components are cool prior to inspection and maintenance activities.

The maintenance schedule for a typical exhaust system installation will consist of:

1. **Weekly:** Physically examine exhaust system for any sign of gas leakage, cracks, or significant areas of damage. If there is any indication of leaks or damage, cease operation immediately and conduct a broader inspection to determine the cause and resolve.
2. **Quarterly:** Examine the exhaust system for corrosion. Clean and remove any minor corrosion and refinish per GT Exhaust recommendations. If major corrosion has occurred such that the integrity of the exhaust system is in question, contact GT Exhaust for recommendation and resolution. Examine connecting flanges and support bolting – retighten any loose bolts as required.

Note: If the flex connector or bolts are removed for any reason, all gaskets should be replaced to ensure no exhaust system leakage will occur.

Product Registration / Warranty

To register your GT Exhaust product and claim your warranty, please visit www.gtexhaust.com.

Sourcing of Spare or Replacement Parts

For spare or replacement parts, a full-line of accessories, warranty details, and other questions about the GT Exhaust Products, contact:



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