

# 1 • Muffler Guide



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Introduction . . . . .	1-3
Troubleshooting and Repairing the Exhaust System	1-3
How to Reduce Exhaust-Related Noise Levels. . . . .	1-4
Applications. . . . .	1-4
Welding Aluminized Steel . . . . .	1-5
Flexible Metal Tubing (Flex)	
Measurement and Cutting . . . . .	1-5
TorcTite™ – The “Seal of Strength™” . . . . .	1-7
Cleaning Chrome . . . . .	1-7

## Introduction

For 50 years, we have been working worldwide with leading vehicle OEM's to design and manufacture exhaust systems for their equipment. Our engineering is the best in the industry and employs the latest design and manufacturing techniques. We are the largest OEM supplier of exhaust systems and a leader in engine exhaust noise technology. Customers can count on our exhaust system products for OE quality.

### Top Quality Construction

Our mufflers are constructed of heavy gauge aluminized and stainless steel to:

- Resist hot, corrosive exhaust gases
- Deter rust
- Extend service life

**Note:** Aluminized steel tubes are not recommended for 2007 emission compliant engines. As the industry leader, we have the ability to manufacture stainless steel tubes and other accessories to meet the stringent 2007 emission regulations. Please call (800) 223-4583 to speak to an OEM account manager for details.

### Objectives of This Guide

- Provide a basic understanding of the exhaust system to assist in identifying replacement part needs
- Provide an understanding of how exhaust components effect overall vehicle performance and fuel efficiency

## Troubleshooting and Repairing the Exhaust System

The following guidelines are intended to help locate and identify problem areas in the vehicle's exhaust system:

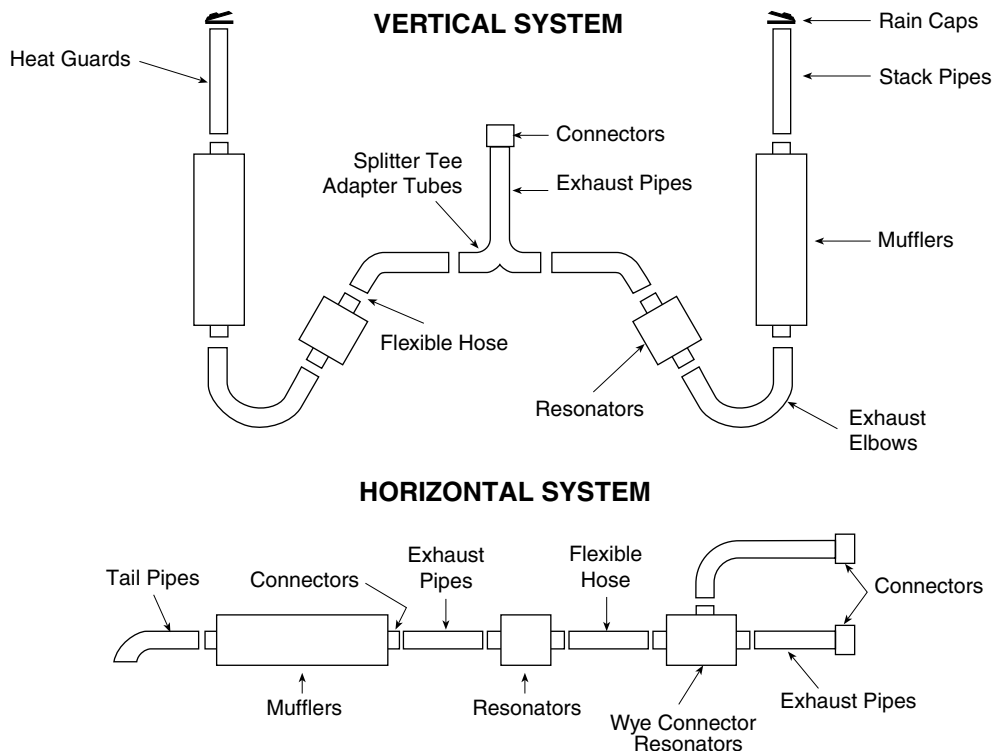
- Leak check the entire exhaust system from the manifold pipe connector before and after repairs are made.
- **Mufflers** - Inspect the area around clamps for breakage, cracks and rust-through. A leaking muffler represents a potential safety hazard as it may allow exhaust gases to be discharged near, or under, the operator's compartment creating the potential for carbon monoxide to enter the compartment. Carbon monoxide is a colorless, odorless, but toxic gas. On vertical systems, check to ensure that the heat guard around the muffler is secure and in place. If there is no heat shield you may want to consider adding one.
- **Elbows, Stacks and Exhaust Pipes** - Dents or crushed portions of any tubing create exhaust flow restriction and increase back pressure significantly. Even relatively small dents will cause decreased fuel economy and increased turbo wear. Always check for dented pipes and do not over-torque clamps as this can lead to pipe crimping.
- **Rain Caps** - Our mufflers are designed to prevent water and snow from passing beyond the muffler to the engine. Water entering the muffler will create a slurry of soot and be blown on the trailer later causing significant cleanup expense. A curved exhaust stack is an acceptable alternative to a rain cap but may not be 100 percent effective in all conditions. Make sure an existing rain cap is in place and still in good condition.
- **Clamps** - New clamps should be installed anytime a muffler or pipe is replaced. Check the general condition of all clamps and joints in the exhaust system. Reuse of any clamps is not recommended.
- **Flexible Tubing** - Do not patch flexible hose (flex), always replace the entire section. Stainless steel flex is recommended as the best value due to its superior high temperature strength and oxidation resistance as compared to other materials. Examine any flex pipe to make sure it's in good condition and will perform properly.
- **Mounting** - The exhaust system must be secured to eliminate vibration. The muffler brackets should fit securely to the muffler and to the mast or truck frame.

## How to Reduce Exhaust-Related Noise Levels

1. Worn or leaking flexible tubing is a common noise source. Replace the part, if necessary. The service life of flexible tubing can be improved if it is installed in a relaxed position. Bending, stretching and compressing all reduce life because they limit the tubing's ability to "flex."
2. The entire exhaust system should be well-supported. This will reduce the noise generated by the exhaust pipes and the muffler shell. Care must be taken to isolate engine vibration from the exhaust system and to provide for expansion when the system is hot.
3. The addition of a universal resonator, silenced "wye" or splitter muffler in the system will generally reduce the exhaust noise level from 3 to 6 dBA. Packed stacks will reduce the noise level 3 to 4 dBA. Both items have a minimal effect on engine backpressure.
4. Change from a single to a dual system. For maximum benefit, special "dual only" mufflers are usually recommended. Lower system backpressure is generally an additional benefit of dual systems.
5. On horizontal systems, the tail spouts should be pointed towards the center of the roadway. This reduces the noise reflected off of the road surface and perceived by curbside observers.
6. On vertical systems, straight stacks will yield lower sound levels than will curved stacks. Straight stacks direct the noise upward, where curved stacks direct noise towards the observer.

## Applications

There are two basic exhaust system configurations - vertical and horizontal. Comparison of the illustrations of these two systems shows there is little difference in the components used. In most vertical installations the muffler is bolted to a mast structure in order to reduce the amount of muffler noise transferred into the cab or tractor. Vertical stacks help to get any objectionable odor up in the air - away from ground level. Vertical installations are also perceived as being quieter because sound is directed upward by the stacks. The need for improved aerodynamics has led to the increased usage of horizontal exhaust systems. The schematics show the overall layout of the components used in both vertical and horizontal installations. It is possible to find a vertical and a horizontal application in any truck class. School bus applications must meet some very stringent local regulations for school bus exhaust systems that may include a horizontal system, a rear discharge, and a totally leak free system.



## Welding Aluminized Steel

Aluminized steel can be welded using appropriate techniques which are described below

### Oxyacetylene Welding Filler Metal

Use a mild steel filler metal, 3/32" diameter, free of rust (American Welding Society classification A5.2). Do **not** use copper coated filler material.

**Welding Equipment:** Use a number 3 or 4 tip. Observe instructions of the equipment manufacturer when adjusting the operating pressures at the gas regulators.

**Procedure:** Clean the parts to be welded thoroughly. Incline the torch at a 45° angle from the direction of travel. Use the forehand welding technique. Keep the torch flame on the tip of the filler rod, not in the center of the puddle.

### Shielded Metal-Arc (Stick Electrode)

Any one of the following rods are recommended:

- E-6011
- Low Hydrogen: E-7108.
- Stainless: 309 or 310

### Gas Metal-Arc (MIG)

- Wire: ER70S-3 or ER70S-6
- Shield gas: Carbon Dioxide or 75% Argon/25% CO<sub>2</sub>

## Flexible Metal Tubing (Flex) Measurement and Cutting

Strip-wound flexible metal hose is a typically round conduit, three to six inches inner diameter, and is flexible in nature due to the design of the strip. It is commonly used to absorb relative motion and vibration, typically between a vehicle's engine and frame or between the frame and cab. Often strip-wound flexible metal hose is used as a means to account for dimensional differences and tolerance stack-up in the exhaust system. Using strip-wound flexible metal hose to account for misalignments in the exhaust piping can compromise the flexibility to the extent that early failures occur. It is necessary that the hose is installed so that its maximum flexibility is preserved. This document provides detailed information to install flex hose properly so as to minimize failures.

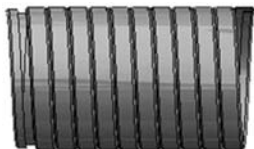
Measurement and cutting of flex tubing must be performed using the correct procedures. The following definitions are used to describe the various states that flex can be measured in:

**Fully Extended:** The tubing is in a fully expanded state and the convolutions are completely open. Approximately 20% less metal is required than fully compressed.

**Fully Compressed:** The tubing in a fully compressed state and the convolutions are completely closed. Approximately 20% more metal is required than fully extended.

**Natural Lie:** The average of fully compressed and fully extended lengths. Approximately 10% more metal is required than fully extended and 10% less metal is required than fully compressed. This is also referred to as the partially compressed state.

- Fleetguard's **bulk flex tubing** is sold in 10' and 25' rolls measured in the **natural lie state**.
- Fleetguard's **cut to length flex** is measured in the **fully extended state**.



Hose in the Compressed State



Hose in the Extended State

Fleetguard provides bulk flex in over length rolls to assure that the correct amount of natural lie tubing is provided to the customer. In many cases, these rolls of bulk flex tubing are subsequently cut to length for the end user. Inconsistent measurement and cutting procedures can result in apparent shortages of bulk tubing. It is important to insure that the customer is following the procedures described in the next section.

# Muffler Guide

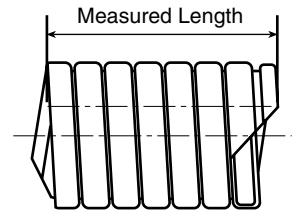
## Measuring Length of Flexible Metal Tubing

Shipping will cause the tubing to compress beyond the natural lie state. Before cutting flex tubing, one end of the tube must be anchored and the other end pulled to its fully extended state and quickly released so that it snaps back into its natural lie condition.

Whenever flex tubing is measured or cut, it must be properly oriented. The piece being cut from the tube must come off of the **open end** of the bulk length of tube. The open end is the end at which the wraps appear to be on top of each other as they move away from the end of the tube. When measuring or cutting flex tubing, keep the **open side** of the tube to your right. The figure to the right shows how to measure length along with the proper orientation – open end on the right. Note how wraps are on top of one another when looking right to left and underneath one another when looking left to right.

### To measure in the compressed state:

Measurement of flex should be done by laying out the tube on a level surface and curving the entire tube or section into a tight radius such that the inner side of the curved tube has its convolutions touching as shown in the figure to the right. When the inner radius of the flex pipe is fully compressed, the outer radius will be fully extended and the center line of the tube will be at its natural lie length as depicted in the figure.



### To measure in the extended state:

1. Orient the tube properly. Insure that the open end is on your right. This will be the end to start measuring from.
2. Coil the tube in a tight radius as shown above.
3. Measure along the outside of the radius where the convolutions are all open.
4. Mark point on outer radius where cut is to be made. Cut using one of the methods described later in this section.

If selling in the natural lie state, the length should be measured off the bulk flex roll after restoring it to its pre-shipping state. Cutting methods are same as below.

## Cutting

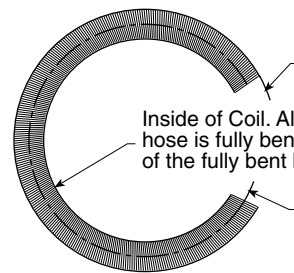
Non PolyLock™ flex hose must be tack welded prior to cutting. Ensure tubing is straight and cut at fully extended mark using one of the approved methods below:

- **For Chop Saw Cuts:** Use 1/16" wide blade for best results
- **For Band Saw Cuts:** Use a no-set blade with 24-32 teeth / inch
- **For Hack Saw Cuts:** Use a no-set blade with 24-32 teeth / inch

**Cutting and measuring flex tubing in any other way can cause an apparent shortage.**

## Joining Flex to Straight Pipe

It is important to use the proper type of clamp to hold and seal the tube-to-flex joint. It is required to use a TorcTite™ clamp, or equivalent, at both ends of the flex hose. This style of clamp is preformed to fit properly on the outer diameters of the flex hose and mating tubes. This clamp fits generally one half on the flex hose and one half on the mating tube.

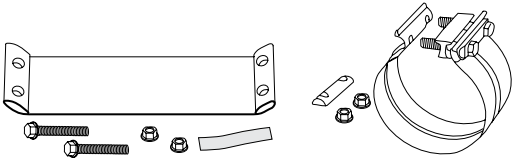
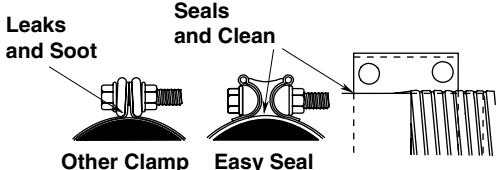
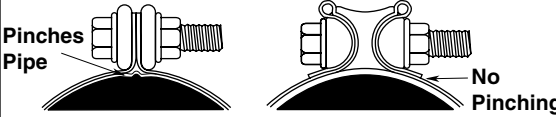
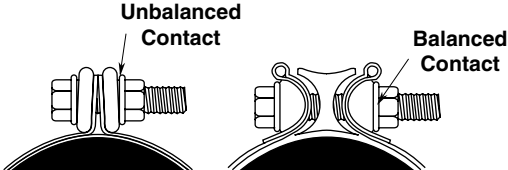


Outside of Coil. All convolutions are open when the hose is fully bent. Measuring around the outside radius of the fully bent hose is the "Extended Length"

Inside of Coil. All convolutions are closed when the hose is fully bent. Measuring around the inside radius of the fully bent hose is the "Compressed Length"

Theoretical Centerline of Coil. All convolutions are "half-open" when the hose is fully bent. Measuring around the centerline radius of the fully bent hose is the "Natural Lie or Half-Extended Length"

## TorcTite™ – The “Seal of Strength™”

Feature		Benefit
	<p>TorcTite™ is the only clamp with fastener hardware pre-attached to a bright-finish band.</p>	<p>Installation is fast, easy and accurate. Simply wrap the clamp band with its pre-attached hardware around pipes; insert the extra-long bolts through the opposite clamp end, force bars and nuts, and torque. No dropping or fumbling with loose or excessive parts. The pre-formed band makes an accurate I.D. - O.D. installation even easier, and causes no damaging distortion to pipe or flex hose. This high-tensile steel with TorcTite's exclusive reaction block has greater stretching capability than other band clamps.</p>
	<p>TorcTite's™ exclusive, pliable aluminum reaction block conforms tightly to exhaust components providing a superior seal.</p>	<p>During installation, the block conforms to the I.D. - O.D. step between pipes, creating a unique seal. The block actually digs into flex hose spirals. Other clamps leave leaky gaps between the clamp band ends and pipes; TorcTite's patented reaction block, specially-formed band and fasteners all work together to seal these leaks. And it seals without loose gaskets or sealant additives.</p>
	<p>TorcTite's™ reaction block will not pinch flex hose and pipes, which means TorcTite will not cause leak paths or damage expensive exhaust components.</p>	<p>Other inferior clamps pinch exhaust pipes and flex hose during installation, creating exhaust leak paths. TorcTite's reaction block completes a full 360-degree compressive seal without damage – eliminating pinching, distortion and damage to pipes. Expensive flex hose, pipes and muffler inlets remain unharmed.</p>
	<p>TorcTite's™ reaction block and independent force bars prevent bolt bending and clamp binding which makes installation time fast and easy.</p>	<p>A balanced transfer of forces among TorcTite's specially formed band, reaction block and independent-force-bars eliminates bending forces on bolts, which keeps installation torque very low. Clamp binding is eliminated, too. The unique balanced design results in a strong, tightly-sealed exhaust joint that assembles quickly and reliably.</p>

### Cleaning Chrome

The following are general tips and procedures to use when cleaning chrome exhaust components.

1. Always wash your chrome with a mild, nonabrasive, alkaline detergent (like most truck and automotive detergents) and a soft, nonabrasive cloth.
2. Rinse thoroughly.
3. Quickly dry your chrome with a soft, nonabrasive cloth before water spots have a chance to form.
4. When polishing chrome, a good quality chrome polish provides the best results. Read and follow all instructions for the polish you use. Use a nonabrasive, non-colored (not dyed) cloth to apply and remove polish.
5. It is not recommended that you use wax on chrome exhaust products. The sustained high temperatures associated with exhaust can adversely affect a waxed chrome finish.

