BULLETIN

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. Approx. 20% less metal is required than fully compressed.

Fully Compressed: The tubing in a fully compressed state and the convolutions are completely closed. Approx. 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.

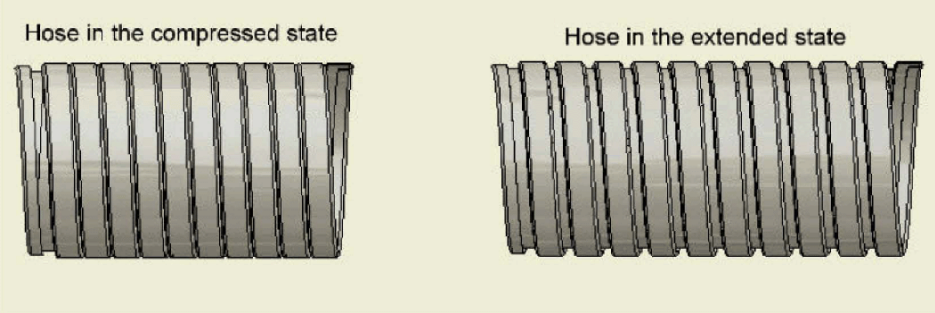


Figure 1. Fully Compressed and Fully Extended Flex Tubing

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.

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 it's fully extend 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. Figure 2 depicts 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.

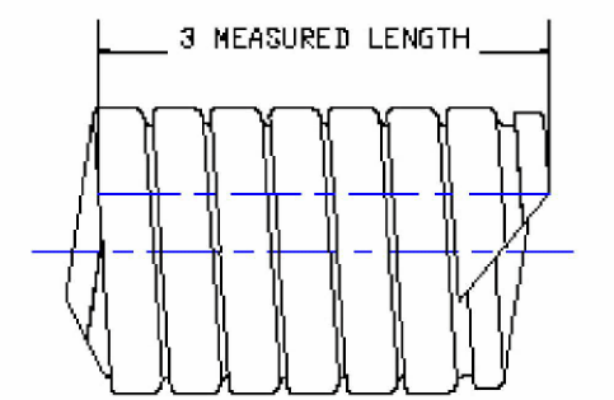


Figure 2. Measured Length and Open End to Right

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 Figure 3. When the inner radius of the flex pipe is fully compressed, the outer radius will be fully extended and the centerline of the tube will be at its natural lie length as depicted in the figure.

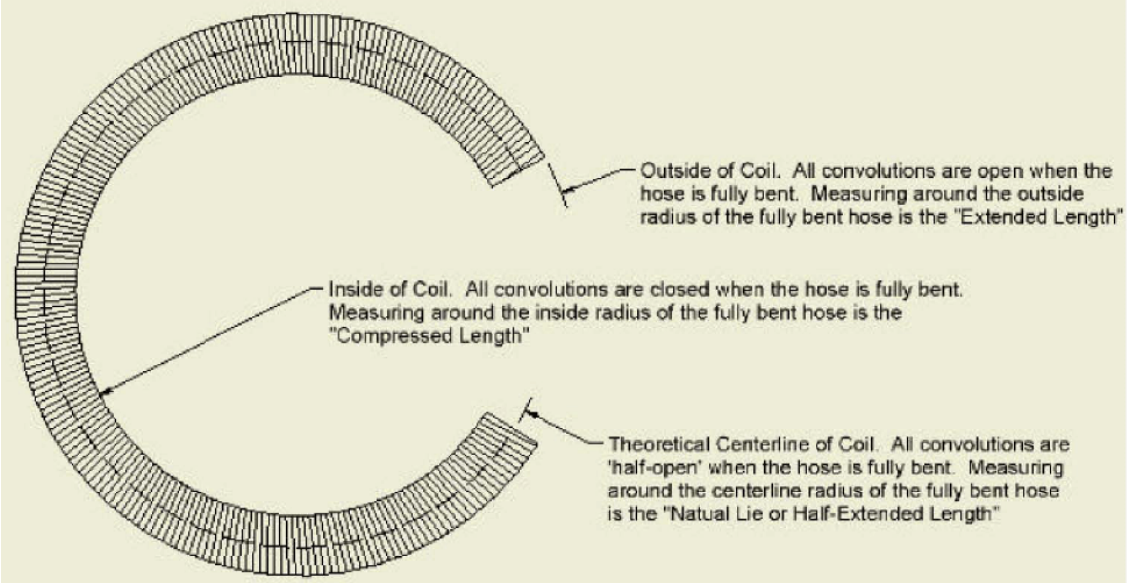


Figure 3 Measuring Flex Pipe Length

To measure in the extended state, the following procedure is used:

1. Orient the tube properly. Insure that the open end is on your right. The right will be the end to start measuring from.

2. Coil the tube in a tight radius as shown in Figure 3.

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 bulletin.

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

Cutting

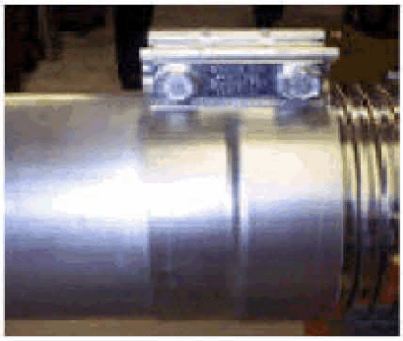
Insure tubing is straight and cut at fully extended mark using one of the approved methods below:

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 Torca "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.



*This information supersedes all other published information concerning Fleetguard Hoses prior to November 13, 2003.

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LT32551 rev.01
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