

ENGINEERING BULLETIN #140

Why Flexibility Doesn't Necessarily Mean Longer Service Life

Thin wall hoses at close corrugations are—on account of their geometry—highly flexible hoses and typically do show better results in cycle tests. Thus, one of the reasons flexibility is a key point of focus for many metal hose users is it is often equated with service life.

But to treat flexibility and service life synonymously misses the big picture.

In an earlier bulletin, we discussed the [numerous aspects of hose geometry, braid construction and material composition that impact flexibility](#) and touched on the tendency to oversimplify and point to a single factor.

Similarly, to say that a flexible hose will have a longer life in service is too easy.

In this bulletin, as we talk about flexibility, we are referring to how many cycles a hose can go at a certain pressure.

Additional variables: Operating conditions

Once in service, various operating conditions—like bend radius and internal pressure—can impact the flexibility of a metal hose assembly.

Bend radius is the radius of the bend measured at hose centerline. The smaller the bend radius, the more deflection and stress there will be at each corrugation, accelerating hose failure. Thus, the larger the bend radius, the longer the life of the hose will be.

There's little downside to increasing the bend radius, while decreasing it too much can overwhelm a hose's flexibility, and result in deformation. For this reason, a larger bend radius is recommended when repeated bending stress is anticipated.

In applications subject to flexing, whether it be static or dynamic flexing, it's important to calculate the Minimum Bend Radius and the Minimum Dynamic Bend Radius.

- **Minimum Bend Radius.** The smallest radius to which a hose can be bent without being deformed.
- **Minimum Dynamic Bend Radius.** The smallest allowable radius of a hose being used in an assembly in dynamic movement service.

To understand how long a hose must be to withstand a certain bend radius, use the [Min Live Length Calculator](#) within our Technical Tools section or reference the [Vibration and Minimum Hose Length Engineering Bulletin](#) to see the relationship between hoses with nominal OD from ¼” to 12” and the minimum live length for vibration required.

Furthermore, the pressure at which media is moved through the hose as well as any external pressure the hose may be subjected to can impact flexibility, or rather alter the flexibility required for a particular application.

The flow velocity in corrugated metal hose should never exceed 150 ft/sec for gas or 75 ft/sec for liquids, but when a hose is installed in a bent condition, the flow values should be reduced proportionally to the degree of the bend.

Where the flow velocity exceeds these rates, [an interlocked metal hose liner or larger hose ID is recommended](#).

Specific pressure ratings for each type of Penflex metal hose are found in [our catalog](#).

For any questions regarding metal hose flexibility, please [contact us](#).