

## **Metal Flex Connectors**

A metal flex connector is a braided stainless steel hose fitting that is typically used to make the connection from the product line to the dispenser or submersible pump. It is designed to absorb line shock as the system operates, as well as to accommodate a slight offsetting of the product line as it enters the sump or man-way.

The braided steel mesh protects an interior plastic or steel hose that carries the petroleum. Some of the earlier designs of this fitting were only allowed for underground use by fire code. The installation had to be contained underground, and the flex connector needed adequate protection from corrosion.

Although the braided portion of the flex connector is made of stainless steel, the two ends of the fitting are typically not stainless steel. The “non-stainless” steel portion of the connector is susceptible to corrosion. Therefore, it is not rated or approved for direct burial. Constant exposure to backfill or liquid will accelerate corrosion. The same would be true for any metal fitting in the fuel supply system that is not properly protected.

There are two different ways to protect flex connectors from corrosion: isolation and cathodic protection. Both of these methods may be installed after the original installation, however, the connectors should be properly protected when originally installed.

Isolation boots are simply placed around the entire flex connector assembly to prevent corrosive agents from coming into contact with the metal. There are several different designs of isolation boots. One design includes adjustable ends that can be loosened to allow movement on the product line for correct placement. Another design is a boot that is heat shrunk directly to the flex connector once installed. Isolation boots are a relatively low maintenance means of protection. When the boots show signs of degradation, they must be replaced.

Cathodic protection is the only other option if isolation cannot be accomplished. Some flex connectors were manufactured with an anode already attached, so contact with backfill is not a problem. In fact, constant contact with backfill is required for the anode to work properly. If you don't have the factory designed anode already attached, cathodic protection can be added in the field. Sacrificial anodes can be connected to the flex connector at the submersible or under the dispenser. A spike/pencil anode is attached with a clamp, and then driven into the soil/backfill next to the piping. In addition, bracelet anodes can be attached with a U-bolt around the flex connector. In either case, it is required that they be buried below the surface.

We have documented several flex connector failures. In addition to corrosion, other factors contributing to the failures include flex connectors that have been twisted, kinked, or installed with too much bend. The bend is determined by the length of the flexible portion, but should never exceed 90 degrees.

PMMIC inspections indicated that 8.5% of the sites inspected in 2003 had deficiencies for metal in contact with backfill at the submersible pump or dispensers, most related to improperly protected flex connectors. This deficiency can be corrected with either isolation or field installed cathodic protection. Isolation is a simple process: remove the backfill in contact with the fitting, and install an isolation boot or barrier to keep the backfill away from the metal. If the fitting

cannot be completely accessed, installing a spike anode may be the preferred protection method. If you add cathodic protection, the system must be recertified every three years.

Contact your licensed petroleum equipment installer to determine the best method to protect your flex connectors.

Flex connectors have been viewed as a worry-free link in a fuel delivery system. However, these fittings are not immune to corrosion or wear and tear. Flex connectors must be inspected frequently. Have you inspected your flex connectors lately?