Application References

Electrostatic Discharge

Most applications of Flexible Components Chemfluor® fluoropolymer hoses do not require the use of a conductive inner tube. Under certain applications, however, the potential for static discharge must be considered. Static electricity can be a hazard. Under those conditions where static discharge can occur, the use of conductive Flexible Components Chemfluor® PTFE hose is recommended.

When two different materials contact each other, electrons from one material can move across its boundary and associate with the other. These electrons align themselves with the material contacted. If the two materials are good conductors of electricity, the positive and negative electrons flow back and forth between them, keeping them in balance. If one or both are insulators, the flow will not occur. A charge will then build up on the surface of one of the materials. When the charge exceeds the electric strength of the material, dielectric breakdown results.

In applying this to Chemfluor® PTFE hose, we have to consider fluids and gases, which are poor conductors of electricity, and the flow rates of those fluids and gases. In order for a liquid or gas to be a poor electrical conductor it will generally satisfy one or both of the following conditions:

1. Be nonpolar; that is, an imbalance between protons and electrons, and/or
2. Contain a nonmixable component or a suspended solid; such as water in kerosene.

So when a liquid contacts a PTFE tube that isn't a good conductor (white PTFE innercore), the result is phase separation, and the electric charge starts to build. The rate at which static electricity builds up now becomes a function of the fluid flow rate. When the dielectric strength of the PTFE tube is exceeded, the electric charge will puncture the tube wall and ground itself on the stainless steel braid of the hose. In hydraulics, high pressures generally mean high velocities. Historically, fluids were filtered upstream of the hoses using metallic filter elements. The metallic element helped to ground the charge. But, today, most filtration is done with paper type and glass-fiber elements that have a tendency to inject an electrostatic charge into the fluid they are filtering.

Fuels and steam are two specific areas of concern.

Fuels are, for the most part, "nonconductive" liquids and have a resistivity greater than 108 ohm; i.e., gasoline and white spirits, hydrazine, benzene, diesel oils, etc. These fluids usually are transferred at fairly low velocities, but there still is a potential for an electrostatic discharge due to external factors, such as humidity and, to some extent, temperature. You should take all of these factors into account even at fluid velocities at or below 1 meter per second.

When using PTFE hose, you can offset the potential hazard of electrostatic discharge by using a conductive PTFE hose. Carbon is added to the Chemfluor® PTFE inner wall during manufacture. The carbon layer directs the electrostatic charge down the inner diameter of the hose to the metal end fittings. This prevents the charge from building up on the inner tube wall.

It's important to examine any application where nonconductive fluids are used and any of the above conditions exist. This section is not meant to cover all conditions or situations involving fuels, steam or other media which may cause electrostatic buildup or potential discharge.

Following is a list of some of the chemicals which meet at least one of the criteria necessary to create electrostatic discharge:

Cyclohexane
Decalin
Diacetone
Dibutyl Ether
Dibutyl Phthalate
Dibutyl Sebacate
Dimethyl Phthalate
Dioctyl Phthalate
Dipentene
Freon
Fuel Oil
Gasoline
Hexane
Hezene
Hydraulic Oil
Hydrazine
Kerosene
Lacquer Solvents
Lacquers
Lacquers Decalin
Mineral Oil
n-Octane
Naphtha
Naphthalene
Paint
Petroleum
Phosphate Ester
Pinene
Silicone Oils
Skydrol 500 & 700
Steam
Transformer Oil
Toluene
Turpentine
Varnish
Versilube