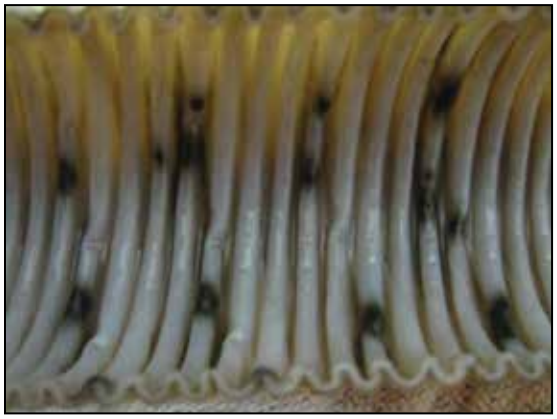
Electro Static Discharge in PTFE Hose

The Information provided within this document is as outlined by the manufacturer.

In many industrial plants, there is awareness that static electricity can be a hazard. Engineers are knowledgeable in the effects of static electricity upon the chemicals produced or transferred within their facilities. This Technical Bulletin is intended to explain the phenomenon of how static charges build and how that static electricity can be minimized or dissipated.



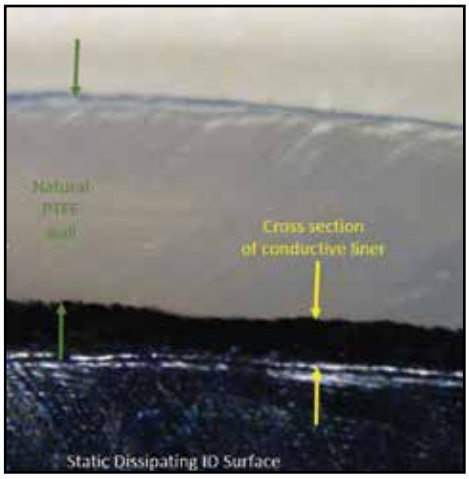
When two different materials are in contact, electrons from one material can move across its boundary and associate with the other. If the two materials in contact with each other are good conductors of electricity, the electrons will flow freely back and forth between the materials, keeping the electrical charge in balance at a low potential. However, if one or both of them are insulators, the flow of electrons is impeded and an electrical charge can build up on the surface. When the charge exceeds the dielectric strength of the material, dielectric breakdown or arcing occurs.

To apply this principle to PTFE hose, we must consider those fluids or gasses which are poor conductors of electricity, and the results of having those materials transferred at a high velocity through a PTFE hose. The effect of velocity can be amplified if the construction of the hose is convoluted. The convolutions act to mix the material causing turbulent flow which increases the transfer of electrons.

It is important to note that liquids and gasses are the culprits here, and when such poor conducting materials (see list following) are being transferred between storage tanks and/or processing equipment or machinery, etc., they often build up extremely high charges in the manner previously stated.

These strong static charges give rise to massive electrical fields that may discharge an arc of sufficient energy to pierce the wall of the PTFE. This condition (sometimes called ‘pinholing’) is where the static charge exceeds the dielectric strength of the PTFE and arcs or burns it way to the external stainless steel braid often creating a leak path.

Non-Conductive Hose With ESD



Static Dissipating Liner

To be a poor conductor of electricity, a liquid or gas will satisfy one or more of the following conditions. It must be non-polar; that is, an imbalance between protons and electrons, or relatively free from moisture. When this liquid comes in contact with a PTFE tube that is not a good conductor (such as a white or natural PTFE inner core), the electric charge starts to build up. In hydraulics, high pressures usually mean high velocities. Historically, hydraulic fluids were filtered upstream of the hoses using metallic filter elements. This metallic element helped ground the charge. Today however, hydraulic filtration is usually accomplished by using paper type and glass - fibre filter elements that have a tendency to put an electrostatic charge in the fluid that they are filtering.

Two specific materials to watch out for are fuels and steam. When dealing with fuels, i.e. gasoline, hydrazine, Jet JP-4 etc, quite often these fuels are transferred at fairly low velocities but the potential exists for an electrostatic discharge. Steam always has the potential to cause electrostatic problems in PTFE hose assemblies. The means of controlling, or safely dissipating this electrostatic energy usually fall into three classes:

1. Modification of Transfer Medium - In the case of PTFE hose, a carbon liner is added to the inner 15% of the PTFE wall. This black carbon liner conducts the electrostatic charge down the inner diameter of the hose, to the metal fittings, thereby preventing the charge from 'pinholing' or static burning. This static burning is caused by the charge arcing between the PTFE inner core and wire braid. It is important to note that the remaining 85% of the inner core remains the white PTFE which will act as an insulator to prevent any grounding to the braid. Our NL530 or NL540 PTFE with a black static conductive liner should be used with fuels, flammables & steam.

2. Modification of the Fluid - This may be accomplished by the introduction of additives to charge the physical and chemical properties so that intermolecular friction is reduced or so that conductivity is increased.

3. Adjustment of Fluid Velocity - Although not generally economical electrostatic generation may be corrected by reducing the fluid velocity to the point where electrostatic generation is no longer a consequence. There is no absolute rule as to how much reduction is enough due to the other factors involved, a reduction in the speed of the flow may allow the use of white PTFE hose, such as; our NL525. However it is highly recommended for all fuels, flammables, and steam that a conductive liner be used, such as' our NL530 or NL540 with black tube.

NOTE: The amount of electrostatic charge stored in a system is often controlled by the natural environment. Humidity or lack of it, and to some extent temperature, affects the rate of electrostatic dissipation to the surrounding atmosphere. The following is a list of chemicals which meet at least one of the criteria necessary to create electrostatic discharge at rapid flow rates, that is non-polarity or relatively free from moisture. It is important to examine each application individually and if any questions arise, please contact the manufacturer.

Cutting Oil
Hexane
Paint
Cyclohexane (C2H12)
Hexene
Petroleum
Decalin
Hydraulic Oil
Phosphate Ester Hydraulic Oil
Diacetone
Hydrazine
Pinene (C10H16)
Dibutyl Ether
Kerosene
Silicone Oils
Dibutyl Phthalate (DOP)
Lacquer Solvents
Skydrol 500 & 7000
Dibutyl Sebacate
Lacquers
Steam
Dimethyl Phthalate
Mineral Oil
Toluene
Dioctyl Phthalate
Motor Oil
Transformer Oil
Dipentene
Naphtha
Transmission Fluid
Freon
Naphthalene
Turpentine
Fuel Oil
N-Octane
Varnish
Gasoline

For more Information on Care & Maintenance of Hose Products go to NEW-LINE.com/resources

800-661-2208
sales@NEW-LINE.COM