Hose Routing and Installation

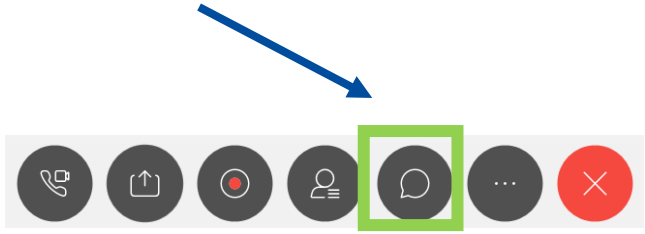
January 20, 2021

Welcome to the Hose Routing and Installation Tech Talk

Presented by Brian Misutka, Services & Engineering Manager

- Please ensure your phone or computer is on ***mute*** to prevent background noises.

- If you have questions throughout the webinar, please utilize the ***chat function*** located in the tool bar at the bottom of your screen.



- Thank you for attending!

Swagelok North Carolina | East Tennessee

Agenda

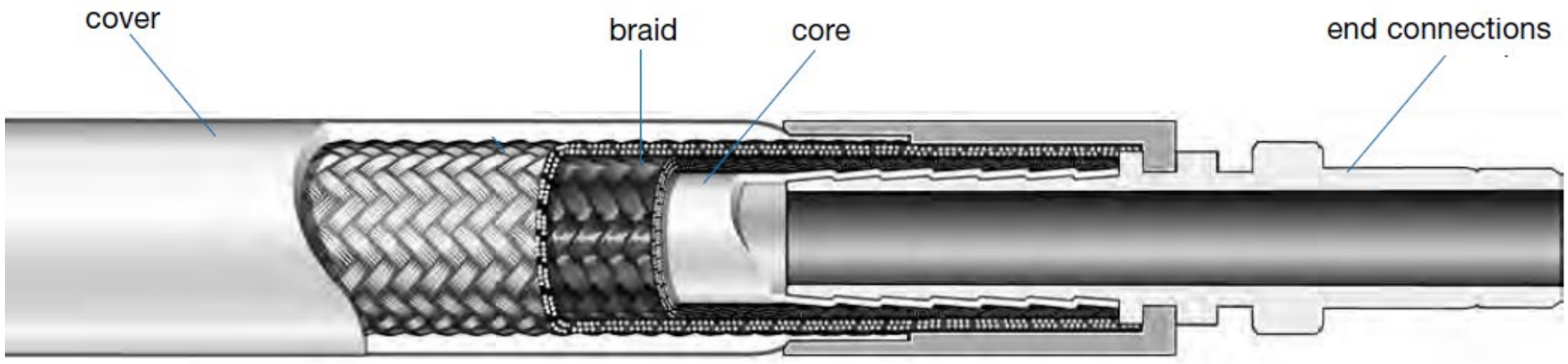
- Hose Basics
- Hose Selection
- Hose Installation
- Static Dissipation

HOSE BASICS

Hose construction impacts performance

Typically a hose assembly will consist of four components:

1. Core tube
2. Reinforcement (braid)
3. Cover
4. End connections

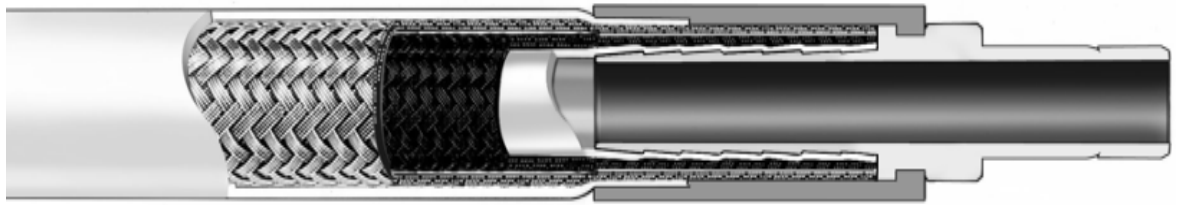


All hoses are NOT created equal

Types of hose products available

Metal

Fluoropolymer



Thermoplastic

Rubber

Hose construction greatly impacts performance

Application parameters impact on hose types

	Metal Core	PTFE	Thermo-plastic	Rubber
Temperature	🟢	🟡	🔴	🔴
Pressure	🟢	🟢	🟡	🔴
Impulse	🔴	🟡	🟢	🟢
Dynamic Bend	🔴	🟢	🟢	🟡
Permeation	🟢	🟡	🔴	🔴
Cleanliness	🔴	🟢	🟡	🟡
Compatibility	🟡	🟢	🔴	🔴

Other factors include correct routing, vibration, burst rating, and many others.

HOSE SELECTION

How long will a hose last?

- Hoses begin wearing out as soon as they are put to use. Let's compare hose to tires. The tire's life depends on a number of variables:

- quality of the tire
- miles traveled
- frequency of tire rotation
- pressures maintained
- weight of vehicle
- driving conditions.

Are your hoses S.T.A.M.P.E.D?

Selecting proper hose will impact overall efficiencies

Biopharm application

- Hoses are wear items (similar to tires on a car) and need preventative maintenance programs
- Selecting a “cleanable” hose and starting a PM program saved over $500k annually

Selecting proper hose will impact overall efficiencies

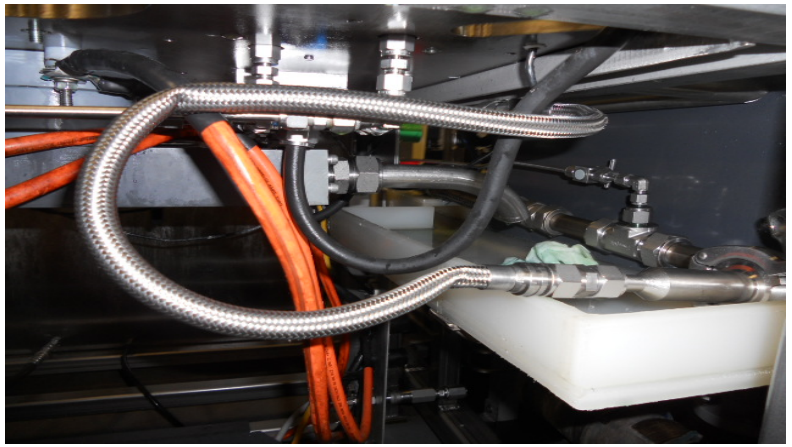
Steam hoses can be a safety concern

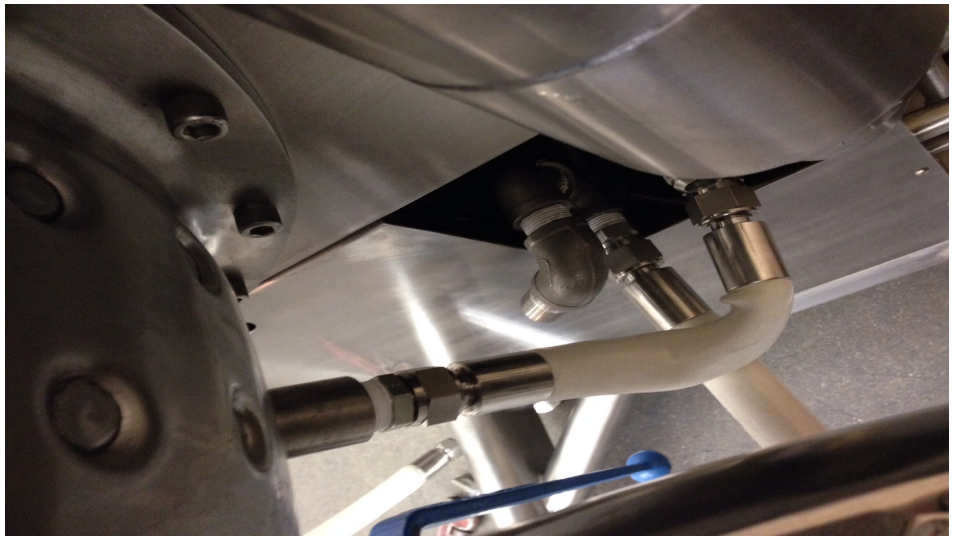
- The movement of hoses can cause safety hazard, especially when transferring hot media
- Properly insulating a hose will greatly reduce external temperatures and improve safety

HOSE INSTALLATION

Proper routing is key in overall lifecycle of a hose

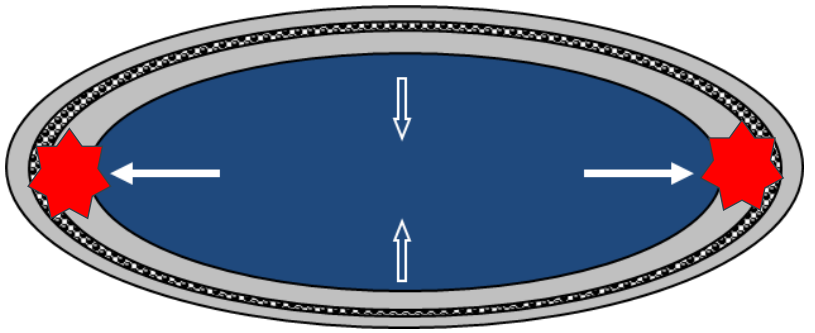
Examples of unsuccessful installations





Hose “kinking” is the top cause of failure in hose

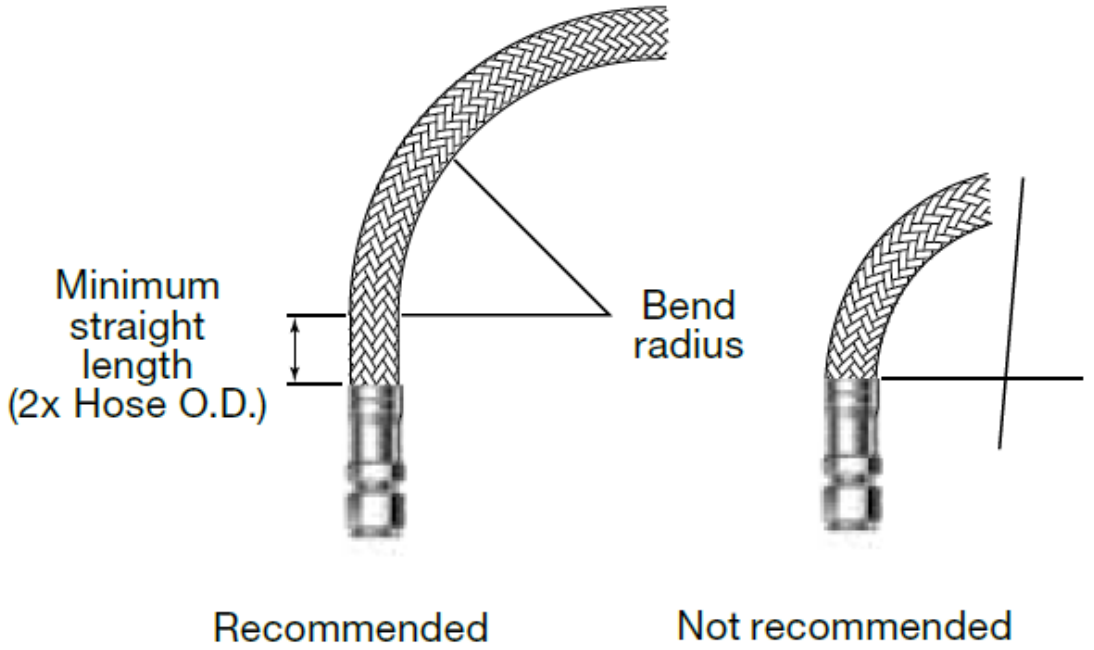
- Kinking is the result of a hose being bent beyond the minimum bend radius
- The over-bending causes the hoop strength of a hose to collapse, resulting in permanent damage to a hose core
- A hose that has been kinked will never withstand full burst pressure again in its life
- Kinking is almost always due to incorrect length or routing of a hose



Permanent damage

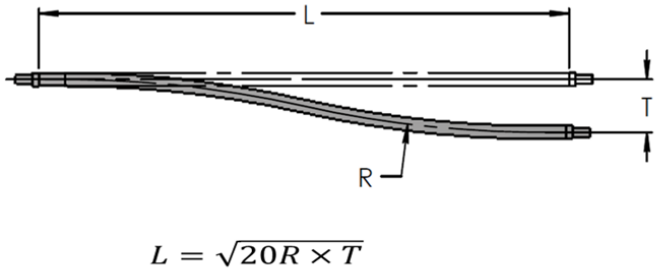
Minimum Bend Radius (MBR) determines when a hose is kinked

- Follow minimum bend radius requirements for your hose. Installing hose with smaller bends may kink hose and reduce hose life
- Allow for a straight length at the end connection to eliminate strain

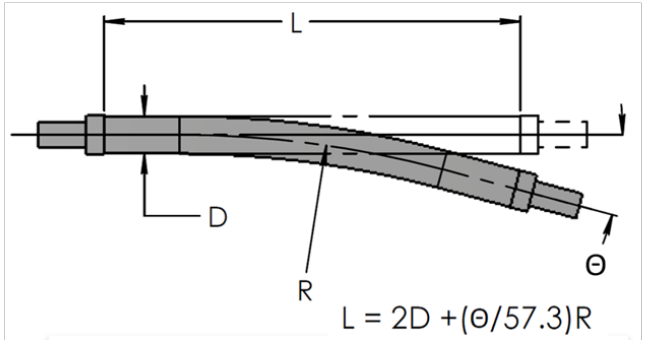


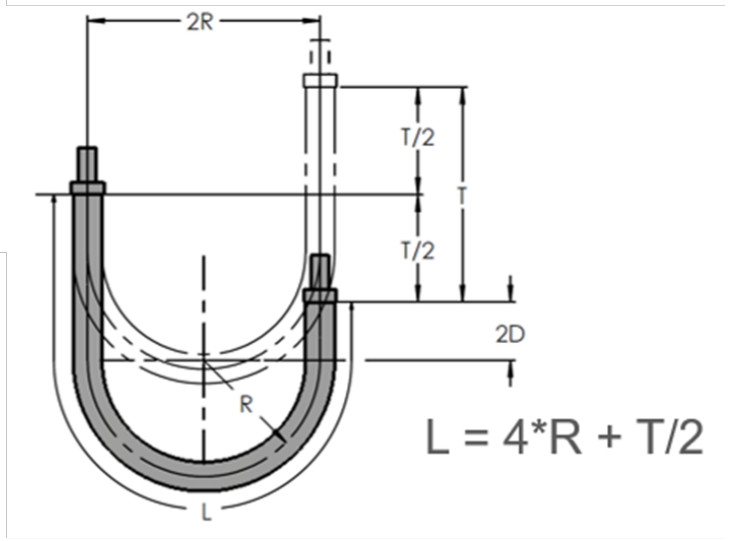
MBR in dynamic applications is larger than static applications

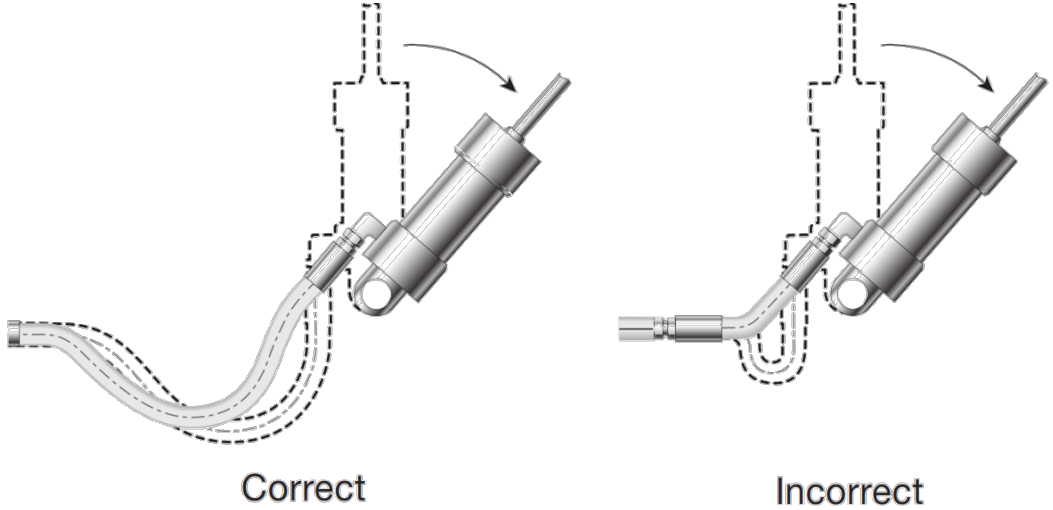
- Hose motion can cause a hose to kink if not properly sized.
- Understand the motion is critical to selecting a hose that is right for the application



$$L = \sqrt{20R \times T}$$





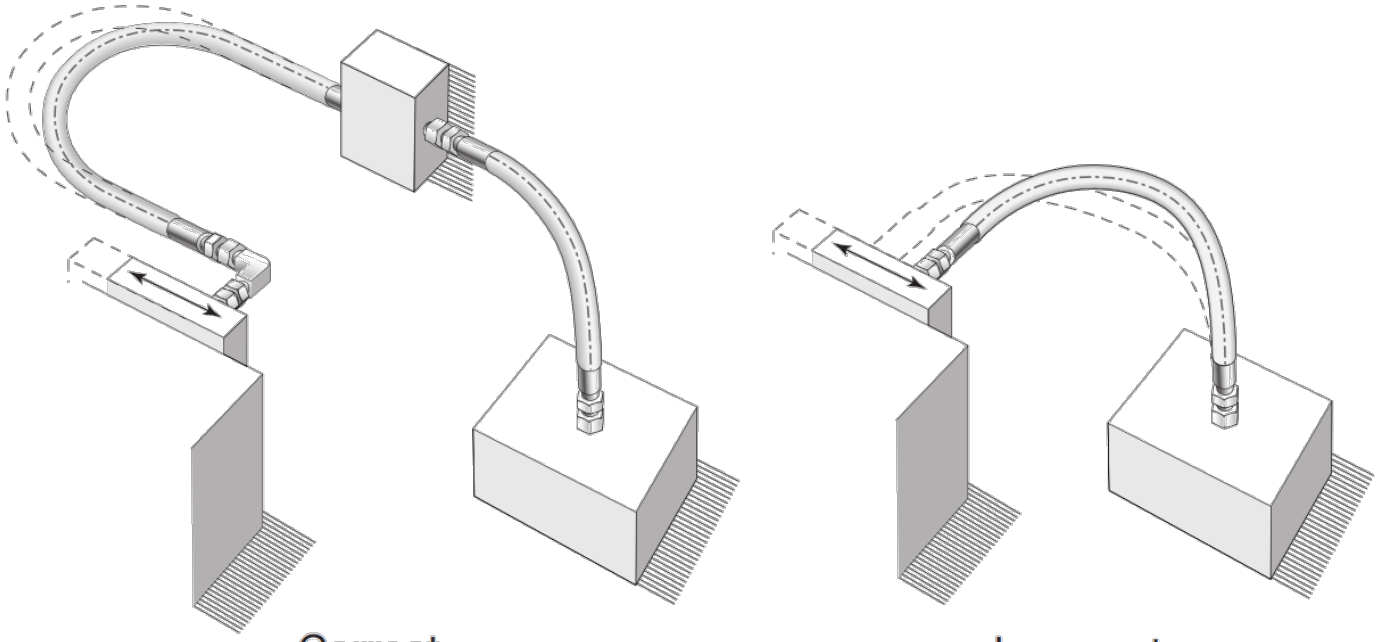


Hose Strain

- The weight of a hose can cause it to kink if not properly installed
- Elbows and adapters can be used to relieve hose strain

Bending in multiple planes will twist and damage a hose

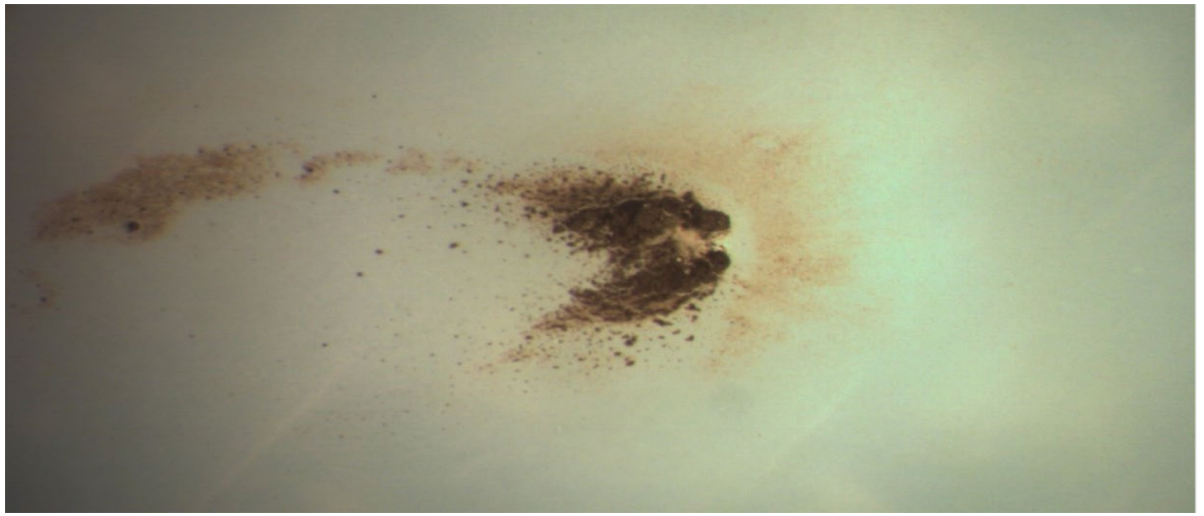
- Avoid twisting the hose in multiple planes.
- Assure that bending occurs in one plane only by using elbows, adaptors, and other methods of securing the hose.



STATIC DISSIPATION

Background on Static Dissipation

- Static electricity can be generated by media passing through the hose
- Discharge of static electricity can create severe hazards where a small electrical spark might ignite explosive mixtures
- Static discharge can puncture the core tube



Various media will cause this more often than others

Factors

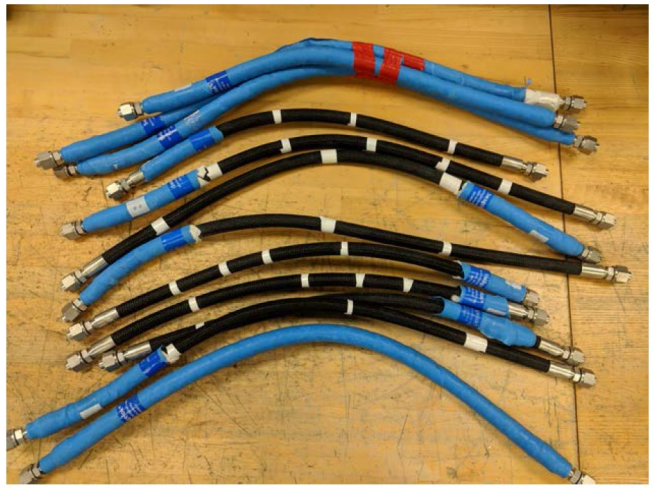
- Conductivity of core material
- Conductivity of media
- Velocity
- Filter (Metal vs Paper)
- External
  - Humidity
  - Temperature

Following is a list of some of the chemicals that 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
> Fuel Oil
> Gasoline
> Hexane
> Hexene
> Hydrazine
> Kerosene
> Lacquers
> Lacquer Solvents
> Naphtha
> Naphthalene
> Octane
> Paint
> Petroleum
> Pinene
> Silicone Oils
> Skydrol 500 & 700
> Steam
> Toluene
> Transformer Oil
> Turpentine
> Varnish
> Versilube

Some hoses can dissipate static

- *Static Dissipative* hose is the ability to safely discharge static build up on the CORE TUBE
  - Metal core hoses
  - PTFE hoses with carbon infused core



Product return at Swagelok for “pin hole” leaks at the yellow tape marks

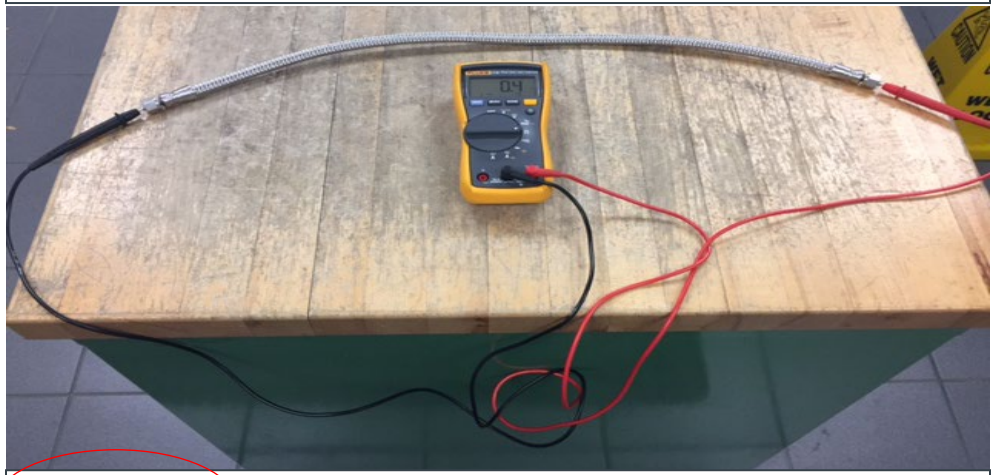
Static dissipation and conductivity are very different features

PTFE Carbon Core Hose

80.1 Mohms (80,100,000 ohms)
V/R=I= .006 mA

- Static dissipative
- NOT conductive

Metal Core Hose



0.4 ohm
V/R = I = 22.5A

- Static dissipative
- Conductive

200 MILLION times less resistance!!!

A PTFE core without carbon will have infinite Resistance

- Not static dissipative

Static Dissipation versus Conductivity Summary

1. Understand the media's likeliness of causing static charge. When in doubt, use a carbon core PTFE hose.
2. Just because a hose dissipates static, it does NOT make it conductive – metal core vs PTFE carbon core. The electrical resistance in our example is 200 MILLION times higher in a non-conductive hose with a carbon core.

Thank You!

1. Understand which hose type is best for your application
2. Plan for safe and efficient routing of the hose, especially in dynamic applications
3. Know when a hose needs to dissipate static charge

Any questions?

Join Us for Our Next Tech Talk

- Regulator Basics
- Wednesday, February 17th
- 11:30 am to 12:00 pm