

A Teflon® Fluoropolymers Hose Primer

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The attributes that make Teflon® an ideal hose material for hundreds of critical applications—thermal stability, strength, and compatibility with a wide variety of different media—also make it well suited for many mobile and industrial applications.

What Is Teflon®?

DuPont scientist Dr. Roy Plunkett discovered polytetrafluoroethylene (PTFE) in 1938. This “super plastic,” patented in 1941, is extremely resistant to chemical corrosion and heat, in addition to possessing the world’s most slippery surface. Teflon is the DuPont registered trademark for its family of fluoropolymer products.

These properties are widely used in applications ranging from non-stick cookware, to semiconductor manufacturing, medical devices, breathable waterproof fabrics, fire-resistant cables, automotive components, and numerous industrial processes.

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It is important to note that across the extensive family of DuPont fluoropolymers, not all have the same properties. Some, for example, are engineered to be melt-extrudable, which requires a lower melting temperature than higher-performance paste-extrudable formulations. Melt-extrudable fluoropolymers also exhibit lower flex-fatigue resistance than premium paste-extrudable materials like the Teflon grade T 62.

When fabricated into hose, the Teflon T 62 grade used by some manufacturers is typically married to a metallic braid of stainless steel or, in some cases, bronze or Monel. The metal braid provides both strength and abrasion resistance, while the core made of Teflon contains the fluid in a thermally stable, highly impermeable, and chemically inert environment. For some applications, the hose will be covered with silicone rubber, thermoplastic, or textiles to meet specific performance requirements.

Because Teflon PTFE is not a thermoplastic, it cannot be continuously extruded, which limits the length of hose that can be produced. The latest generation of paste extrusion equipment has the capacity to produce longer lengths of hose. For example a one inch hose can be made in lengths up to 400 feet, a 400 percent increase compared to older equipment. That means fewer joints and less waste in large-scale applications.

Application Indicators

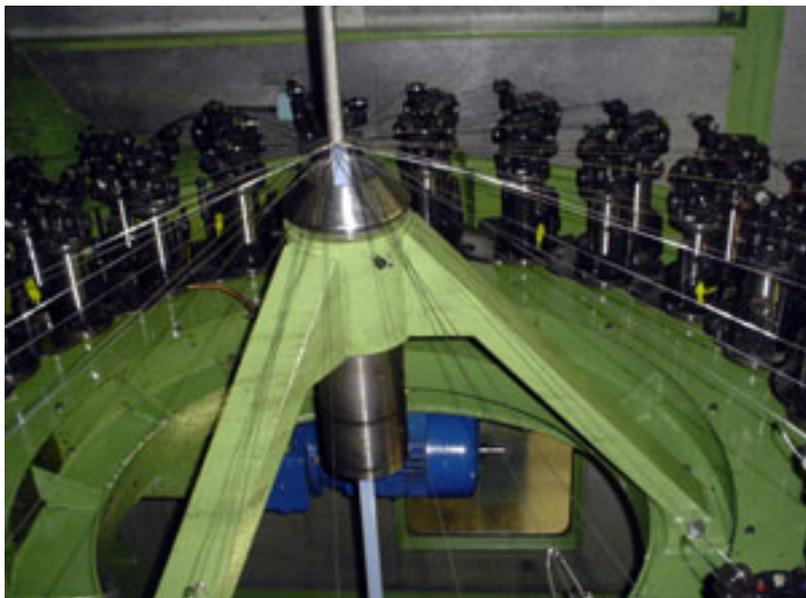
Hose made from Teflon PTFE can be a good choice for applications where the following characteristics are desirable or required by specification:

1. Heat and cold resistance
2. Corrosion resistance
3. Non-toxicity
4. Extremely low permeability
5. Light weight
6. Flex/fatigue resistance
7. Ease of cleaning/sanitizing
8. UV/ozone resistance

Typical Applications

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Mobile Compressor Discharge: Hose with Teflon is used in engine to dryer compressor discharge lines which are subjected to high temperatures.

Process Steam Lines: In the tire industry, hose made with Teflon can handle steam, water, and air without cross-contamination or thermal fatigue.

Food Processing: Hoses made with Teflon are widely used in food processing equipment to handle both hot oils and grease. The fact that Teflon is in contact with the food ingredients and since it is non-toxic, tasteless, and odorless, it is a good choice. In addition, hose with Teflon can be cleaned and sanitized with ease, which is another advantage for food processing.

Pharmaceutical Manufacturing: Hoses made with Teflon are non-absorbent, chemically inert, and easily sanitized with high-temperature steam or other materials, making them a good choice for handling biological materials and chemicals.

Paint Systems: Hoses made with Teflon are inert and have no extractables to contaminate paints. They are also easily cleaned to facilitate color changes.

Energy Production & Distribution: Hoses made with Teflon are used in production, distribution, and vehicle fuel, of Liquefied Petroleum Gas (LPG) and Compresses Natural Gas (CNG) hoses for the alternative fuels industry.

Selection Criteria

Hoses made with Teflon PTFE are for the most part universal, making selection fairly easy. This means that a hose with Teflon PTFE can be utilized for many applications, thus eliminating the need to stock numerous rubber hoses that are application-specific.

However, Because hoses made with Teflon are used in such a wide variety of applications, there are many variables to be considered in selecting the appropriate

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product. Just as there are important differences between the various Teflon PTFE-fluoropolymers used in hoses, there are also significant differences between hoses using the same base material.

Here are some of the basic characteristics to consider in selecting a hose for a specific application:

Smooth vs. Convuluted Bore: The primary issues here are size and bend radius. Smooth bore hoses are generally only available in bore sizes of 1-inch or less and have much larger minimum bend radii. For example, a -16 (1-inch) convoluted bore hose has a minimum bend radius of 3-inches, while a comparable smooth bore hose has a minimum bend radius of 12-inches.

Convuluted bore hose is also somewhat more resistant to collapse in vacuum applications. Smooth bore hose tends to have a lower price in sizes where both are offered.

Conductive vs. Non-Conductive Teflon: Hoses, typically fuel lines carrying low-viscosity hydrocarbons at high flow rates, tend to build-up static electrical charges that can arc through the Teflon to the braid. This creates a pin-hole in the Teflon. Specifying conductive Teflon will allow the static charge to bleed off harmlessly to the fitting.

Wall Thickness: Thicker walls are better for applications where the hose is flexed severely as they are more resistant to buckling. Thick wall hoses also have less permeability to gasses.

Thin wall hoses tend to have a lower price because they contain less material. Most hoses made with PTFE are broadly classified as .030" or .040" wall hoses.

Braid Material: 304 Stainless is the baseline braid material for most hoses made with Teflon. 316 Stainless is the recommended material for marine hose applications.

Monel is available for hoses exposed to severe marine corrosion environments, and bronze is used in marine applications and also where hoses may rub together or against other pieces of equipment. In the latter case, the excellent lubricity of bronze often can deliver longer wear life than stainless steel.

Braid material is also a major factor in the pressure rating for a given hose. Special braid materials and configurations are available to handle pressures up to 5,000 psi. Bronze and Monel braided hoses are typically only offered with lower pressure-ratings.

Fittings: Hoses made with Teflon are suitable for use as crimp, swage, or reusable fittings. The choice is largely one of personal preference, since there are no significant performance differences between the two systems.

Interior & Exterior Treatments: Hoses exposed to severe environmental

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conditions can be fitted with several different forms of external protection. Options include extruded thermoplastic and silicone sleeves, slip-over or integral fire-resistant sleeves, and a variety of metallic protective enclosures.

Hoses used in vacuum applications, particularly at high temperatures, are often fitted with internal coils or sleeves to prevent collapse.

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