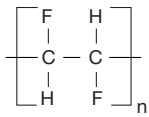
POLYVINYLIDENE FLUORIDE (PVDF)

PVDF is a thermoplastic fluorocarbon polymer with wide thermal stability from -62° C (-80° F) to 148° C (300° F) and crystalline melting point of 171° C (340° F). In terms of piping systems, PVDF has a usage range of up to 121° C (250° F).

Material Grade

Purad PVDF pipe, valves, and fittings are manufactured of natural polyvinylidene fluoride resin. PVDF is part of the fluorocarbon family and has the following molecular structure.



PVDF resin is partially crystalline and has a high molecular weight. Purad is 100% PVDF with absolutely no antioxidants, anti-static agents, colorants, fillers, flame retardants, heat stabilizers, lubricants, plasticizers, preservatives, processing aids, UV stabilizers, or any other additives. Purad is also resistant to the effects of gamma radiation and has a V-O rating according to the UL-94 vertical flame test.

Purad PVDF has been tested for its inherent purity through extensive testing performed by internationally recognized independent laboratories. The outstanding performance of Purad material, with respect to extreme conditions, is well documented and available upon request. Therefore, it is well suited to handle such aggressive media as ultra pure water and ultra pure, electronic grade acids. Just as importantly, it conforms to FDA regulations as outlined in Title 21, Chapter 1, Part 177-2510 (contact with food).

Corrosion Resistance

Purad PVDF systems offer the broadest protection for the chemical process industries, pulp mill bleaching, bromine processing, and electronic product manufacturing in both etching operations and ultra pure deionized water lines. Purad-PVDF resins resist most corrosive chemicals and many organic solvents. It is particularly good against strong oxidants, strong acids, all salts, and solvents such as chlorinated, aromatic, and aliphatic. Strong base amines and ketones such as hexamethylene diamine and propyldimethylformamide, and methylethyl ketone are not recommended for use with PVDF. A comprehensive table is available in Section E, *Chemical Resistance*.

Solvay Solef Resin

Purad PVDF is exclusively produced from Solvay Solef 1000 Series high-purity resin. Solef 1000 Series resins use a suspension production process according to ASTM D 3222, Type II PVDF resin.

The suspension process, as opposed to emulsion or Type I PVDF, allows the manufacture of polymers with fewer structural defects in the molecular chain. In other words, the PVDF polymers are more crystalline. Thus, the melting temperature and the mechanical characteristics are higher than homopolymers with the same average molecular weights obtained by emulsion polymerization.

Solef PVDF is thus manufactured by suspension polymerization of vinylidene fluoride. The process uses a recipe where the monomer is first introduced in an aqueous suspension and then polymerized by means of a special organic peroxide-type polymerization initiator at low dosage. The polymerization is performed in a heated autoclave under high pressure.

The polymer powder form is then subjected to extensive washing and rinsing operations, and then, after drying, is stored in homogenizing silos. All the while, strict inspections are performed on line in order to ensure optimal quality control.

When complete, Solef PVDF contains a high percentage of fluorine. The bond between the highly electronegative fluorine and carbon atom is extremely strong with a dissociation energy of 460 kj/mol. Thus, the importance of exclusively using Solef PVDF high-purity resin is two fold:

1. Provides for a cleaner, mechanically superior system.
2. Allows the closest melt flow indices between system components, which in turn, provides superior welding/joining capabilities.

Table B-4. Polyvinylidene Fluoride Physical Properties

Characteristic	Standard	Units	Value
Specific Gravity	ASTM D 792	g/cm^3	1.78
Tensile Strength	ASTM D 638	psi	7975
Ultimate Tensile Strength	ASTM D 638	psi	6960
Elongation at Break	ASTM D 638	%	50
Flexural Strength	ASTM D 790	psi	12,180
E-Modulus	ASTM D 790	psi	435,000
Impact Strength	ASTM D 256	ft-lb/in	2.80
Hardness–Shore D	ASTM D 2240	—	80
Abrasion Resistance	DIN 53 754	mg/100 cycle	0.5–1
Friction Coefficient	DIN 375	—	0.4–5
Dynamic Friction Coefficient	—	—	0.34
Crystalline Melting Point	DIN 53 736	° C ° F	350 177
Vicat Point	ASTM D 3418	° C ° F	293 144
Brittleness Temperature	ASTM D 746	° C ° F	-40 -40
Thermal Conductance	ASTM D 177	Btu–in/hr ft^2•°F	1.32
Coefficient of Thermal Expansion	DIN 53 453	° F^{-1}	6.7 x 10^{-5}
Specific Volume Resistivity	ASTM D 257	Ohm•cm	5 x 10^{14}
Surface Resistivity	DIN 53 482	Ohm	>10^{13}
Dielectric Strength	ASTM D 149	kv/mm	40
Burning Rate	UL94	—	V-O
Limiting Oxygen Index	ASTM D 2863	%	44

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