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What is PVDF EN

PVDF

PVDF (polyvinylidene fluoride) – semi-crystalline high-performance fluoropolymer, high-purity and chemically resistant

PVDF (polyvinylidene fluoride) is a semi-crystalline fluoropolymer from the family of high-performance plastics. It combines outstanding chemical resistance – the best among plastics after PTFE – with high purity, good mechanical strength and excellent machinability and weldability. In addition, PVDF is inherently flame-retardant (UL 94 V-0) without the need for any flame-retardant additives.

Classification and basic character

PVDF belongs to the group of fluoropolymers – polymers whose carbon chain is partly occupied by fluorine atoms. These carbon-fluorine bonds are extremely stable and give PVDF its high chemical and thermal resistance. Unlike PTFE, which is even more resistant but cannot be machined or welded conventionally, PVDF machines, welds and thermoforms excellently. It is stiff, strong, dimensionally stable and absorbs virtually no moisture.

Chemical resistance and purity

The outstanding feature of PVDF is its chemical resistance: it withstands acids, halogens, aliphatic and aromatic hydrocarbons, alcohols and many solvents – surpassed only by PTFE among the technically processable plastics. In addition, it offers very high purity with low outgassing and minimal ion release. This makes PVDF a standard material of the semiconductor industry and cleanroom technology, where components must carry ultrapure media without contaminating them.

How PVDF is made and processed

PVDF is produced by polymerisation of vinylidene fluoride. From the raw polymer, semi-finished stock such as round bars, plates and tubes is extruded or pressed. From these we machine precision parts – turning, milling, drilling and sawing produce clean, dimensionally accurate results. PVDF can also be welded (e.g. for tank and apparatus construction) and thermoformed. As it absorbs virtually no moisture, components are highly dimensionally stable.

Mechanical, thermal and electrical properties

PVDF reaches a yield stress of about 55 MPa with a tensile modulus around 2,100 MPa and a density of about 1.78 g/cm^3 – it is stiff, strong and yet tough, with good low-temperature impact strength. The service temperature ranges from about -20 °C up to a continuous +140 °C, short-term to around 150 °C; the heat deflection temperature (HDT) is about 115 °C. Electrically, PVDF is a good insulator with high volume and surface resistivity. It is also weathering- and UV-resistant and inherently flame-retardant (UL 94 V-0 at 3 and 6 mm).

When PVDF is the right choice

PVDF is worthwhile whenever chemical resistance and purity must be combined with good machinability – for example:

- Components for chemical plant engineering (pumps, valves, fittings, pipes)
- Components for the semiconductor industry and cleanroom technology (wet bench, front-end)
- Parts in contact with aggressive media and ultrapure liquids
- Applications requiring weathering and UV resistance outdoors
- Components that must be flame-retardant without flame-retardant additives

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When PVDF is NOT the right choice

Equally important are the limits of the material:

- Contact with strong bases (alkalis) and amines – PVDF is attacked here
- Continuous service above about 140 °C – then PTFE or PEEK are options
- Applications with a very tight budget – standard plastics such as POM or PA are considerably cheaper
- When only the very highest chemical resistance is required without machining/welding – then PTFE

What does PVDF cost?

PVDF is a high-performance plastic and is priced considerably above standard engineering plastics such as POM or PA, but below PTFE and PEEK. As a rough guide, semi-finished stock prices are in the range of about 20–45 €/kg. The component price is determined mainly by the semi-finished shape and dimension, material utilisation (offcut), machining effort and lot size. We are happy to quote binding prices on request based on your drawing.

Machining at Liedtke

PVDF machines very well – turning, milling, drilling and sawing produce clean, dimensionally accurate results. As PVDF absorbs virtually no moisture, the components are dimensionally stable; we ensure sufficient cooling and adapted cutting parameters to avoid heat build-up. This is how we reliably produce precision parts for chemical, semiconductor and cleanroom applications – from single pieces to series production.

Advantages and disadvantages at a glance

An honest assessment – and how the disadvantages can be mitigated in practice:

Advantages

- Outstanding chemical resistance (the best after PTFE)
- High purity – ideal for semiconductor and cleanroom
- Inherently flame-retardant (UL 94 V-0), without additives
- Machines, welds and thermoforms well
- Weathering- and UV-resistant, high continuous service temperature

Disadvantages

- Not resistant to strong bases (alkalis) and amines
- Higher price than standard engineering plastics
- Continuous service limited to about 140 °C
- Combustion products contain hydrogen fluoride – observe fire safety

Practical tip: PVDF plays to its strengths wherever aggressive media and purity meet – for example in semiconductor manufacturing or chemical plant engineering. If even higher chemical or temperature resistance is required, we recommend PTFE or PEEK; for simple engineering parts without media attack, POM or PA are more economical.

Typical Properties

- Outstanding chemical resistance
- High purity
- Inherently flame-retardant (UL 94 V-0)
- Machines, welds and thermoforms well
- Good weathering and UV resistance
- High continuous service temperature (up to 140 °C)
- High low-temperature impact strength

Product Examples

- Pumps, valves, fittings and pipes
- Wet-bench and front-end components for semiconductors
- Cleanroom and ultrapure media components
- Sealing and guiding elements in chemical processing
- Tank and apparatus components (weldable)
- Weathering-resistant outdoor components

Typical Industries

- Chemical plant engineering
- Semiconductor industry
- Cleanroom technology
- Mechanical and plant engineering
- Electronics
- Food industry

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- Electrically insulating

	Test Method	Unit	Value
General Properties			
Density	DIN EN ISO 1183-1	g / cm^3	1.78
Moisture absorption	DIN EN ISO 62	%	0.0
Flammability (thickness 3 mm / 6 mm)	UL 94		V0 / V0
Mechanical Properties			
Yield stress	DIN EN ISO 527	MPa	55
Elongation at break	DIN EN ISO 527	%	30
Tensile modulus	DIN EN ISO 527	MPa	2100
Notched impact strength	DIN EN ISO 179	kJ / m^2	12
Shore hardness	DIN EN ISO 868	scale D	80
Thermal Properties			
Melting temperature	ISO 11357-3	°C	178
Service temperature, long-term	Average	°C	-20 ... 140
Service temperature, short-term (max.)	Average	°C	150
Heat deflection temperature	DIN EN ISO 75, method A, HDT	°C	115
Electrical Properties			
Volume resistivity	DIN EN 62631-3-1	Ω * cm	10^{14}
Surface resistivity	DIN EN 62631-3-2	Ω	10^{14}
Dielectric strength	IEC 60243	kV / mm	21

The values stated are typical average values for PVDF natural; they serve as an aid to material selection and are not a legally binding warranty of specific properties. PVDF is resistant to most chemicals but is attacked by strong bases (alkalis) and amines – media resistance must be verified case by case. Price information is a rough, non-binding guide and may vary depending on market situation, grade, dimension and quantity.

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