

What is PF CP 204 (Hp 2063)

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Flame-retardant phenolic paper laminate (phenolic resin/paper) per DIN 7735 / EN 60893

PF CP 204 (Hp 2063) is the flame-retardant grade within Liedtke's range of phenolic paper laminates ("Hartpapier"). Internationally this material type is best known as "FR-2" – the paper-based counterpart to the glass-fibre-reinforced "FR-4" – and has for decades formed the economical basis for flame-retardant printed circuit boards in the electronics industry.

Classification and basic character

PF CP 204 (Hp 2063) belongs to the phenolic paper laminate family per DIN 7735 / EN 60893: thermoset laminates made from several layers of cellulose paper, impregnated with phenol-formaldehyde resin and pressed under heat and pressure into a solid, homogeneous sheet. The result is a brown, electrically well-insulating, mechanically stable and economical construction material.

Within the PF-CP-201-to-206 family, PF CP 204 (Hp 2063) occupies a special position: it is the only grade whose phenolic resin is fitted with a flame-retardant system, giving the material a UL 94 V-0 classification – i.e. self-extinguishing.

FR-2 – the flame-retardant phenolic paper grade

In international electronics manufacturing, this material type is known by the NEMA designation "FR-2" (in Europe designated EP GC 202 per DIN 7735 / EN 60893). FR-2 is historically the classic base material for single-sided copper-clad printed circuit boards in consumer electronics, household appliances and simple control technology – wherever a cost-effective, flame-retardant PCB base is needed without the higher mechanical and thermal requirements met by glass-fibre-reinforced laminates such as FR-4.

The trade-off for the flame-retardant system lies in the limiting temperature: for PF CP 204 (Hp 2063) it is 90 °C, lower than the other, non-flame-retardant grades in the phenolic paper family (120 °C). Where a higher continuous-use temperature is required and flame retardancy is not needed, the other PF-CP grades are therefore the more suitable choice.

How PF CP 204 (Hp 2063) is manufactured and processed

Cellulose paper webs are impregnated with the flame-retardant phenol-formaldehyde resin, dried, and then pressed in multiple layers under high pressure and temperature into sheets or round bars. Cross-linking of the thermoset resin produces a dimensionally stable material that no longer melts.

At Liedtke, PF CP 204 (Hp 2063) is subsequently machined to customer specification: sawing, milling, drilling and punching are readily possible with carbide-tipped tools. As with all phenolic paper laminates, good dust extraction is recommended, since fine, fibre-containing dust is generated during machining.

Mechanical, electrical and thermal properties

With a flexural strength of 80 MPa, a tensile strength of 60 MPa and a compressive strength perpendicular to the laminations of 250 MPa, PF CP 204 (Hp 2063) sits in the solid range typical of phenolic paper laminates. Electrically, the material impresses with an insulation resistance of $10^{10} \Omega$, electric strength values of 20 kV (parallel) and 25 kV (perpendicular to the laminations), and a comparative tracking index (CTI) of 100.

Thermally, PF CP 204 (Hp 2063) is rated to a limiting temperature of 90 °C and thermal class E. Decisive for many applications is the UL 94 V-0 flammability rating – the material is self-extinguishing and achieves resistance-to-glowing grade 2a per DIN 53459.

When PF CP 204 (Hp 2063) is the right choice

PF CP 204 (Hp 2063) is well suited whenever an economical, easily machinable electrical insulation material with proven flame retardancy is required.

- PCB base material for simple applications requiring flame retardancy (FR-2 construction)
- Components in electrical and switchgear engineering requiring UL 94 V-0 fire protection
- Insulating parts where a limiting temperature of up to 90 °C is sufficient
- Economical alternative to higher-grade, glass-fibre-reinforced flame-retardant laminates
- Applications where electrical insulation and fire protection matter more than high continuous-use temperature

When PF CP 204 (Hp 2063) is NOT the right choice

In the following cases, a different material is better suited:

- Direct food contact – PF CP 204 (Hp 2063) is not declared suitable for this
- Applications with continuous-use temperatures above 90 °C – the non-flame-retardant PF-CP grades (limiting temperature 120 °C) are better suited here
- Applications with no flame-retardancy requirement, where the more economical standard grade PF CP 201/Hp 2061 is sufficient
- Highest electrical stress with increased test-voltage requirements – the electrically improved grade PF CP 202/Hp 2061.5 (up to 40 kV) is preferable here
- Applications with very high mechanical requirements – glass-fibre-reinforced laminates (e.g. glass fabric or epoxy glass fabric) are the better choice

What does PF CP 204 (Hp 2063) cost?

PF CP 204 (Hp 2063) ranks among the economical standard materials within the phenolic paper laminate family. The flame-retardant resin system results in a moderate price premium over the plain standard grade PF CP 201/Hp 2061, but the material remains significantly less expensive than glass-fibre-reinforced flame-retardant laminates such as FR-4. Exact pricing depends on sheet thickness, dimensions and order quantity – we are happy to provide an individual quotation.

Machining at Liedtke

Liedtke Kunststofftechnik machines PF CP 204 (Hp 2063) sheets into precision blanks and formed parts to customer drawings – sawn, milled, drilled or punched. Our quality management system, certified to DIN EN ISO 9001 (since 2015), ensures consistent manufacturing quality.

Advantages and disadvantages at a glance

Advantages

- Flame retardant per UL 94 V-0 (self-extinguishing)
- Good electrical insulating properties
- Economical standard material – the classic "FR-2"
- Good machinability (sawing, milling, drilling, punching)
- Proven, widely used PCB base material

Disadvantages

- Not declared suitable for direct food contact
- Lower limiting temperature (90 °C) than the other grades in the family (120 °C)
- Some moisture absorption possible, causing slight changes in electrical properties
- Not designed for the highest mechanical stresses
- Inferior to the electrically improved grade at very high electrical test voltages

Practical tip: If only UL 94 V-0 flame retardancy is required and the operating temperature stays safely below 90 °C, PF CP 204 (Hp 2063) is usually the most economical solution. For higher operating temperatures without a fire-protection requirement, it is worth considering the standard grade PF CP 201/Hp 2061 with its 120 °C limiting temperature.

Typical Properties

- Flame retardant per UL 94 V-0
- Good electrical insulating properties
- Economical standard material
- Good machinability
- Brown colour

Product Examples

- Single-sided copper-clad PCBs (FR-2)
- Insulating components in switchgear
- Base plates for terminal blocks

Typical Industries

- Printed circuit board manufacturing (PCB base material)
- Electrical and switchgear engineering
- Electrical industry
- Equipment manufacturing

	Test Method	Unit	Value
Mechanical			
Density	DIN 53479	g/cm ³	1.4
Flexural strength 23°C	DIN 53452	MPa	80
Tensile strength	DIN 53455	MPa	60
Compressive strength $\perp$ to laminations	DIN EN 60893	MPa	250
Modulus of elasticity	DIN 53457	MPa	5000
Electrical			
Insulation resistance 24h/23°C	DIN 53482	Ω	10 ¹⁰
Electric strength $\parallel$ to laminations	DIN 53481	kV	20
Electric strength $\perp$ to laminations	DIN 53481	kV	25
Dissipation factor	DIN 53483	–	max. 0.06
Permittivity	DIN 53483	–	5
Comparative tracking index CTI	IEC 112	–	100
Limiting temperature	VDE 0304/2	°C	90
Flammability	UL 94	–	V-0
General			
Water absorption (4mm thickness)	DIN 53495	mg	120
Colour			brown

PF CP 204 (Hp 2063) (also internationally known as "FR-2") is a flame-retardant phenolic paper laminate (phenolic resin/paper) per DIN 7735 / EN 60893. The values stated are typical properties researched from commonly published, publicly available data sheet information for this product type; they serve as an aid for material selection and do not constitute a legally binding guarantee of specific properties. Actual values may vary slightly depending on manufacturer and sheet thickness. PF CP 204 (Hp 2063) is not declared suitable for direct food contact.