

Flame Retardancy: Which Standard Applies to Which Part

A plain-language comparison of cable flame tests and plastics flammability ratings, and how to specify each one correctly.

Issued 14 September 2026 Rev. 1 Applies to: cable assemblies, overmolded assemblies, connector housings

Flame ratings are not interchangeable. A finished cable is tested one way; a plastic material is tested another. Asking for “UL94 V-0” on a cable — or “VW-1” on a molded connector body — is one of the most common specification errors we see. It can delay approval, or worse, pass a part that was never actually tested for what it will face in service.

This sheet sets out which test belongs to which object, what each one actually measures, and how to read a rating so that it means something.

1 Two families, two objects

	Cable assemblies — finished product	Molded parts & housings — raw material
What is tested	The complete cable, as built and as it will be installed	A standard 125 × 13 mm bar moulded from the polymer
Standards	UL 1581 (VW-1, FT1, FT2) · UL 1685 / UL 444 (CM, CMR, CMP) · IEC 60332-1-2 · IEC 60332-3 · EN 50575 (CPR)	UL 94 — V-0 / V-1 / V-2, 5VA / 5VB, VTM-0-2 (film), HBF / HF-1 / HF-2 (foam)
Question it answers	Will flame travel along this cable once installed? Does it drip burning material?	How quickly does this plastic stop burning after a defined flame is removed?
Result issued as	A cable marking or listing, or a test report tied to one construction	A UL Yellow Card, valid for one grade, one colour range and specific thicknesses

Both can apply to one part. An overmolded cable assembly has a cable *and* a moulded strain relief. The cable is rated to a cable standard; the overmold material is rated to UL 94. A complete specification names both.

2 Cable assemblies

North America — UL 1581 and UL 444

Rating	Standard	Test in one line	Pass criteria
VW-1	UL 1581 §1080	Vertical cable, ~500 W flame (125 mm), 15 s on / 15 s off, five cycles	Afterflame ≤60 s; paper indicator flag less than 25 % burned; surgical cotton below not ignited
FT1	UL 1581 §1060	Same burner cycle, but drips and cotton ignition are not counted	Afterflame ≤60 s; indicator flag less than 25 % burned
FT2	UL 1581 §1090	Horizontal specimen, 30 s flame application	Flame speed ≤25 mm/min; adjacent cotton not ignited
CM / CMG	UL 1685 (UL 444)	8 ft vertical tray, bundled samples, 20 kW for 20 min	Flame must not reach the top of the tray and must self-extinguish
CMX	UL 1581, limited use	Vertical wire, small flame, 15 s on / 15 s off ×5	Afterflame ≤60 s; charred portion ≤25 %
CMR	UL 1666	Vertical shaft, 154.5 kW for 30 min	Flame spread ≤12 ft beyond the ignition point. No smoke or toxicity limit
CMP	NFPA 262 (formerly UL 910)	Steiner tunnel, horizontal, 87.9 kW for 20 min	Flame spread ≤1.5 m; smoke density peak ≤0.5, average ≤0.15

Installation hierarchy, lowest to highest: CMX → CM / CMG → CMR → CMP. Only CMP carries a smoke requirement.

International — IEC

Standard	Test in one line	Pass criteria
IEC 60332-1-2	One 600 mm vertical cable, propane burner at 45°. Duration by diameter: ≤25 mm → 60 s; 25–50 mm → 120 s; 50–75 mm → 240 s; >75 mm → 480 s	Charring starts more than 50 mm below the top clamp, and does not extend past 540 mm below it

Standard	Test in one line	Pass criteria
IEC 60332-3	Bundled cables, 3.5 m on a steel ladder. Category sets the non-metallic volume per metre and burn time: A = 7 L/m, 40 min · B = 3.5 L/m, 40 min · C = 1.5 L/m, 20 min · D = 0.5 L/m, 20 min	Charred height ≤ 2.5 m above the bottom edge of the burner
IEC 61034-2	Smoke density of cables burning under defined conditions	Minimum light transmittance, typically 60 %
IEC 60754-2	Acidity and corrosivity of combustion gases	pH and conductivity limits — the basis of “halogen free” claims

IEC 60332-1-2 tests a single cable; IEC 60332-3 tests a bundle. Passing the single-cable test does not imply the bundle test — they are separate requirements.

European Union — CPR

Under the Construction Products Regulation, cables placed on the EU market for building use carry a class under EN 50575, assessed with EN 50399 (heat release, flame spread, smoke, flaming droplets). Classes run A_{ca} , $B1_{ca}$, $B2_{ca}$, C_{ca} , D_{ca} , E_{ca} , F_{ca} , with additional suffixes for smoke (s1a/s1b/s1/s2/s3), flaming droplets (d0/d1/d2) and acidity (a1/a2/a3). If your project is in the EU and the cable is installed in a building, this — not UL — is the legal requirement.

3 Molded parts, overmolds and connector housings — UL 94

UL 94 classifies *plastics*, not products. The most used method is the 50 W vertical burn: a 125 × 13 mm bar is held vertically, a 20 mm methane flame is applied to the lower end for 10 s and removed; as soon as flaming stops it is applied a second time for 10 s. Surgical cotton sits 300 mm below the specimen to catch burning drips.

Criterion	V-0	V-1	V-2
Afterflame after either application (t1, t2)	≤ 10 s	≤ 30 s	≤ 30 s
Total afterflame, 5 specimens × 2 applications	≤ 50 s	≤ 250 s	≤ 250 s
Afterflame + afterglow after 2nd application (t2 + t3)	≤ 30 s	≤ 60 s	≤ 60 s
Burns up to the holding clamp (125 mm mark)	No	No	No

Criterion	V-0	V-1	V-2
Flaming drips ignite the cotton indicator	No	No	Yes

The only difference between V-1 and V-2 is the drips. Their time limits are identical. V-2 means the material self-extinguishes within 30 s but drops burning particles that set fire to the cotton below — in a vertically mounted assembly, that is the difference between a fire that stops and one that travels downwards.

The more severe ratings

Rating	Test	Distinguishing requirement
5VA	500 W, 125 mm flame, five 5 s applications with 5 s gaps, on bars and on 150 × 150 mm plaques	Afterflame + afterglow ≤60 s after the fifth application, no cotton ignition, and the plaque must not burn through
5VB	Same test	Same time and cotton limits, but burn-through of the plaque is permitted
VTM-0/1/2	Films too thin to self-support; wrapped on a 13 mm mandrel, 20 mm flame, 2 × 3 s	Same criteria as V-0/V-1/V-2 — used for thin-wall and flexible films
HBF / HF-1 / HF-2	Foamed materials, horizontal, 38 mm flame for 60 s	HF-1 and HF-2 differ again by whether drips may ignite the cotton

5VA is the highest classification in UL 94. A material must already hold V-0 or V-1 before a 5V rating is pursued.

4 What a flame rating does *not* tell you

It is not “will not burn”

Every one of these tests begins by holding a flame on the sample. A rating describes what happens next, not whether ignition occurs.

It is not a product certification

UL 94 grades a material. Whether the finished part is acceptable still depends on the end-product standard, wall thickness, and where the part sits in the assembly.

It is tied to thickness

A grade rated V-0 at 3.0 mm may only reach V-2 at 0.8 mm. A rating without a thickness is incomplete — always quote both.

It is tied to grade and colour

Resin grade, colourant, regrind content and filler all change the outcome. The rating belongs to one specific formulation.

It says nothing about smoke or toxicity

Smoke density (IEC 61034-2), gas acidity (IEC 60754-2) and heat release (EN 50399) are separate tests. “V-0” and “low smoke halogen free” are independent claims.

It does not predict a real fire

These are small-scale laboratory comparisons used for material screening and specification. They do not model a fully developed fire.

5 How to specify it

Six questions resolve almost every flame requirement. Answer them in the RFQ and the correct standard usually follows directly:

1. **Where is it installed?** Inside a machine, in a wall, in a vertical shaft, in an air plenum, or bundled in a tray — each maps to a different test.
2. **Which market?** North America generally expects UL; most of the rest of the world expects IEC; building installations in the EU legally require a CPR class.
3. **Single cable or bundle?** IEC 60332-1-2 and IEC 60332-3 are separate requirements; passing one does not cover the other.
4. **Is it a cable or a moulded part?** Cable → a cable standard. Overmold, housing, strain relief → UL 94, quoted with thickness.
5. **Do you need smoke, acidity or heat release limits?** If yes, name IEC 61034-2, IEC 60754-2 or the CPR sub-classes explicitly.

6. **What documentation must be supplied?** Material Yellow Card, third-party test report, or a listing mark — and for which part number.

6 How we state flame performance

- **By object.** We quote a cable rating for the cable and a material rating for the moulded part. We do not use a single blanket “flame retardant” claim across both.
- **With the parameters that make it meaningful.** Material grade, tested thickness, and the source — UL Yellow Card file number or third-party test report number.
- **Without overstating.** If a specific construction has not been tested to a standard you ask for, we say so and either propose the closest tested alternative or arrange the test. We do not assume a rating carries over from a similar part.
- **With documentation on request.** Material Yellow Cards, third-party flame test reports, and material declarations (RoHS, REACH) can be provided per part number.

EXAMPLE OF A COMPLETE SPECIFICATION

Cable: UL 1581 VW-1 – or IEC 60332-1-2 where required

Overmold: PVC, UL 94 V-0 @ 3.0 mm, Yellow Card EXXXXXX

Housing: PA66, UL 94 V-2 @ 1.5 mm, Yellow Card EXXXXXX

Note the thickness after each UL 94 rating. Without it the line is not a specification.

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The values in this sheet are the published pass/fail criteria of the standards named, summarised to help you specify correctly; they are not a substitute for the standards themselves, which are available from UL, IEC and CEN. Flame performance for any specific part number is as stated in that part's datasheet and supporting test report. Where no test has been performed we state that explicitly rather than infer a rating. This document is not a certificate of compliance.

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