



Most surges never make the news.

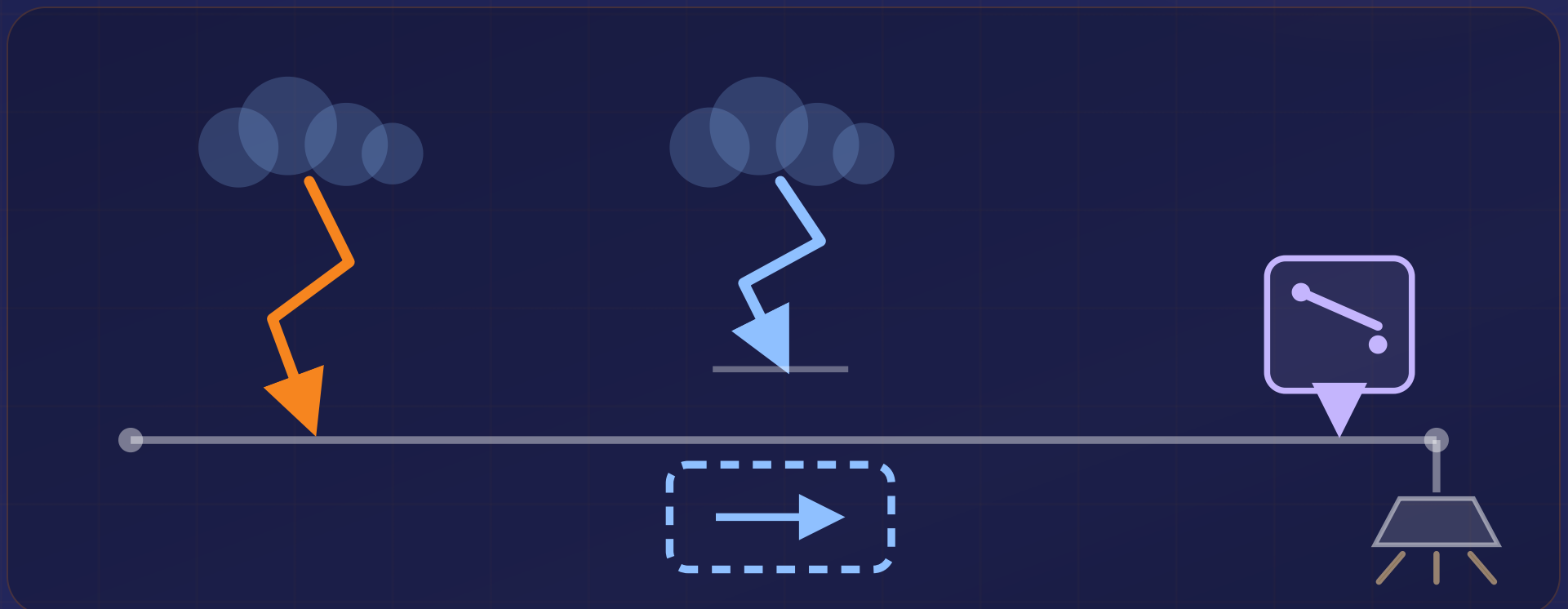
NLC Academy | Episode 18

The datasheet says 40 kA. That is not the number that saves the driver.

The number that actually decides whether a driver survives is a voltage, and the connecting leads can add substantially to it. This episode: what the ratings mean, what your own datasheet row says, and what to write into the spec.

The origins

Three ways a surge reaches the driver.



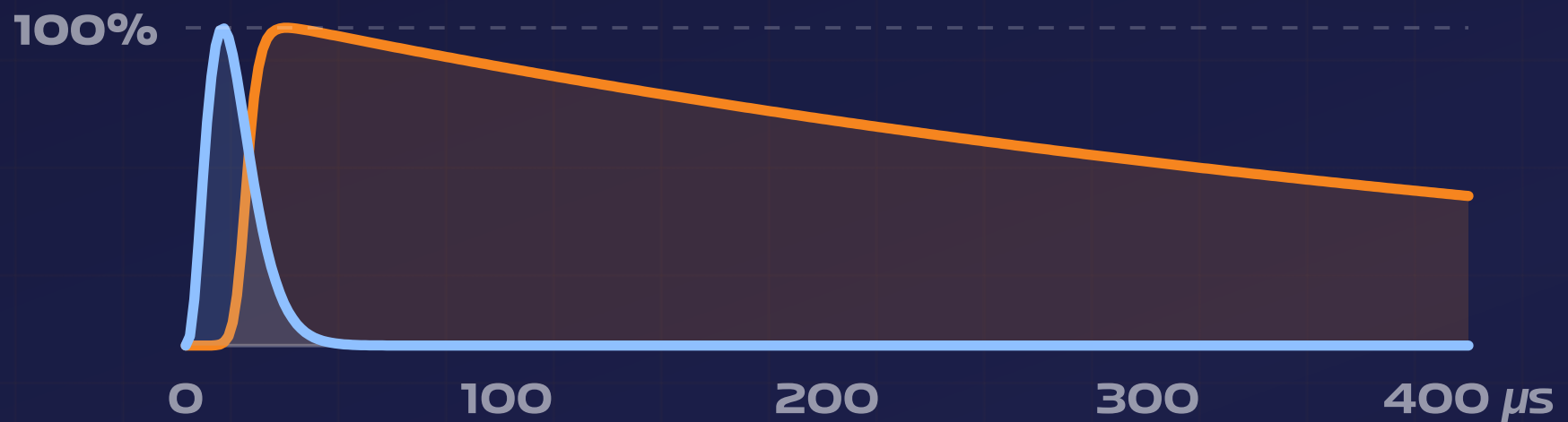
- 1** A direct or partial lightning current conducted into the line. Rare, and the only case that needs the full lightning waveshape. [3][9]
- 2** A nearby strike inducing current in the wiring loop between line and earth. Far more common than a direct hit. [3][9]
- 3** Switching: motors, transformers, capacitor banks, and the lighting circuit's own contactor. No storm required, and it happens all year. [11]

IEC 60364-4-44 names both origins in one clause title:
atmospheric origin OR due to switching.

The waveshape

Same peak, **very different surge.**

 Drawn to the standard front and half-value times



- 1 The 10/350 μs lightning waveshape: a 10 μs CONVENTIONAL front time and a 350 μs time to half value. Its current actually peaks near 31 μs . [3]
- 2 The 8/20 μs induced waveshape. The 8 is not time to peak either: it is $1.25 \times (t_{90} - t_{10})$, and the current peaks near 11.5 μs . [1][4]

Curves drawn from published constants: IEC 61000-4-5 Annex E.3 for the 8/20, IEC 62305-1 Annex B for the 10/350. Integrating those, at equal peak the 10/350 carries about 29 times the charge and about 21 times the specific energy. The frame stops at 400 μs , so its tail runs past the right edge. [3][4]

A kA number without its waveshape is not a rating. **Ask which waveshape it was tested to.**

The vocabulary

T1, T2, T3: three types, three quantities.

Rated with charge and energy

T1

limp is a crest value "with specified charge transfer Q and specified energy W/R ", so peak alone does not describe it. A T1 device declares I_n as well. [1]

Rated by peak on the 8/20

T2

The nominal discharge current I_n is the crest value "having a current waveshape of 8/20". A peak, on a short wave. [1]

Rated by a generator setting

T3

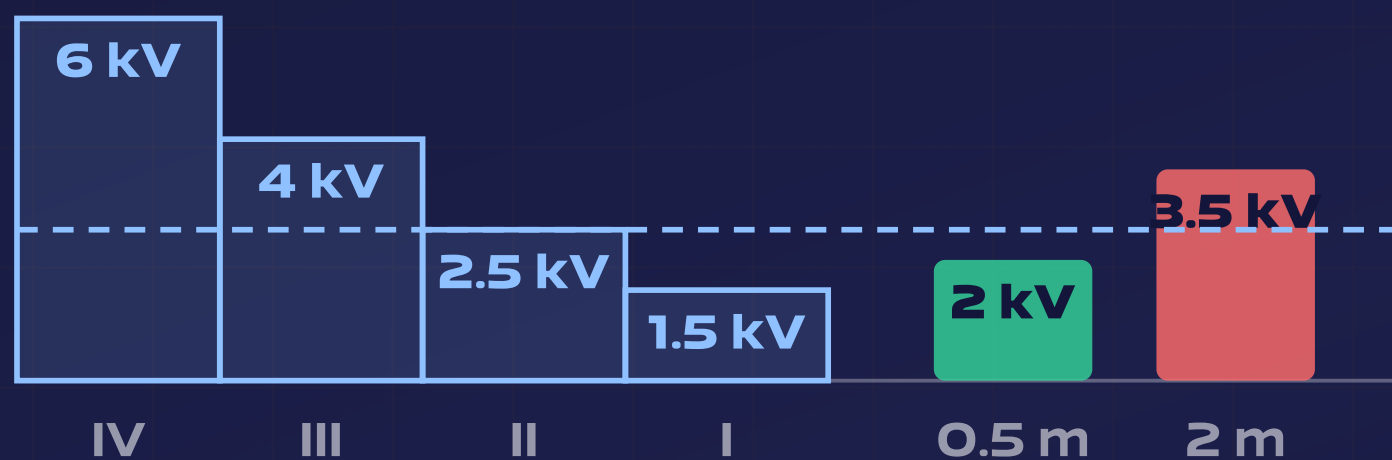
Characterised by U_{oc} , the open-circuit voltage of a combination wave generator. That fixes a current too, but it is a test setting, not a discharge current the device diverts. [1]

Why datasheets say both: IEC 61643-11:2011 called these three CLASSES OF TEST, and IEC 61643-01:2024 with IEC 61643-11:2025 renamed them SPD Types T1, T2 and T3, the names the installation standards already used. The names moved; the quantities did not. [1] [2][12]

Lining up 25 kA, 40 kA and 6 kA as if they were the same scale **compares three different quantities.**

The number that protects

It is **Up against Uw**, not kA against kA.



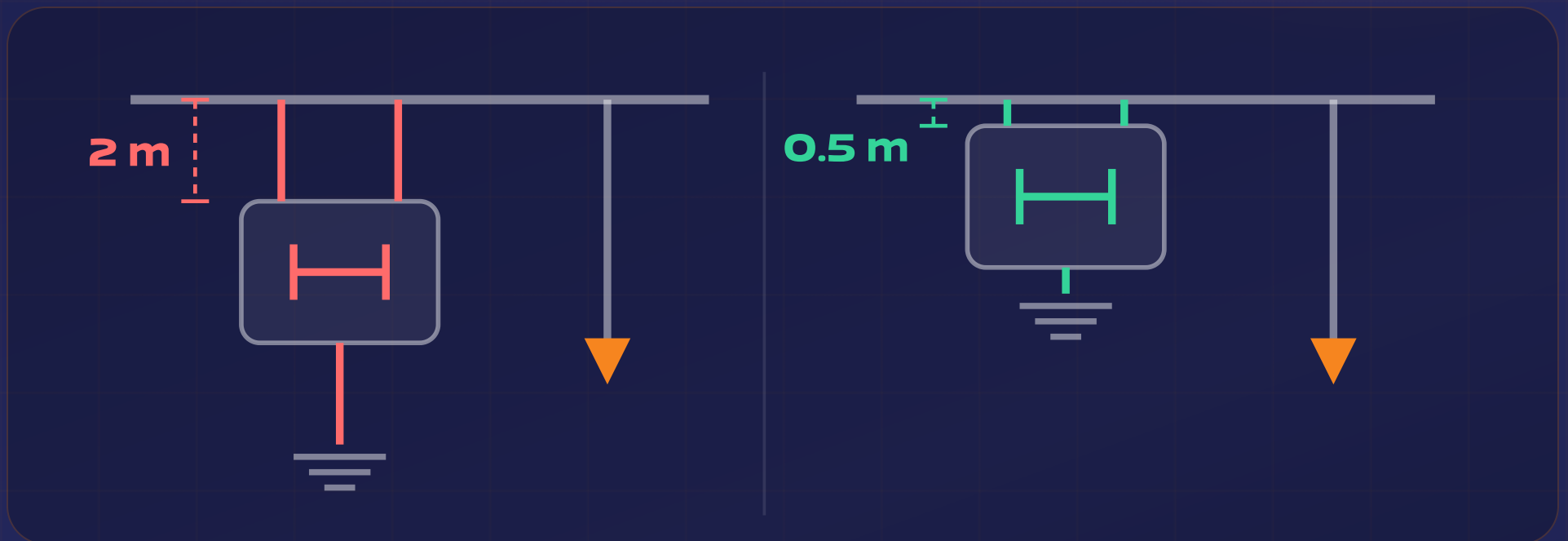
- 1 Equipment carries a rated impulse withstand voltage U_w set by its overvoltage category. For a 230/400 V system the published ladder runs 6, 4, 2.5 and 1.5 kV. [8][11]
- 2 The device carries a voltage protection level U_p . What the equipment actually sees is U_p PLUS whatever the connecting leads add. That total is what has to stay under U_w . [1][7]

Bars: a $U_p = 1.5$ kV device, once on 0.5 m of connecting lead and once on 2 m, against the overvoltage category II line. Withstand ladder shown for a 230/400 V system; other system voltages have their own. [7][8]

The same device passes or fails **depending on a metre and a half of wire.**

The wiring

At 8 kA on an 8/20 μ s wave, every metre can add about 1 kV.



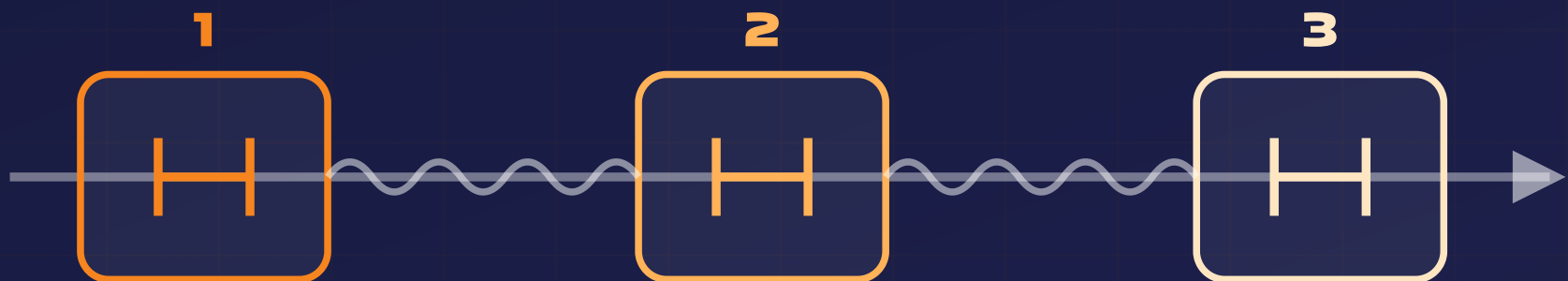
- 1** Long leads. Connecting conductors run about 1 μ H per metre, and an 8/20 wave at 8 kA rises at 1 kA/ μ s, so each metre adds roughly 1 kV. [7]
- 2** Short leads. IEC 60364-5-53 cl. 534 puts the connecting conductors, live side plus the run to the earthing terminal, at preferably 0.5 m and never above 1 m; Schneider takes 0.5 m as the design target. At 0.5 m the added voltage is about 0.5 kV, roughly 2 kV here. [2][7]

Totals computed as $U_p + L \times di/dt$ for a $U_p = 1.5$ kV device: 2 m gives 3.5 kV, 0.5 m gives 2 kV. The earth path counts in the total. [7]

This is the cheapest kilovolt you will ever buy back: shorten the leads.

The cascade

Coordination is energy sharing, not ordering by kA.



1

Service entrance

At the origin of an installation with an external lightning-protection system, this device takes the lightning waveshape itself. [1][9]

2

Distribution board

Takes what passes stage 1 and brings the let-through toward what the final circuit stands. [9]

3

At the luminaire

The last stage, where what remains has to land below the equipment's withstand. [9]

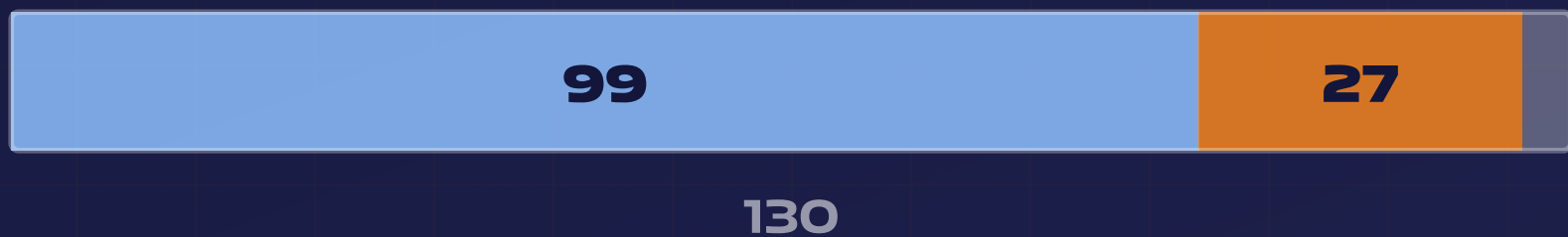
Each stage should discharge only the energy it was designed for: decoupling impedance, a stated cable length, or a maker-coordinated set. Mixing brands with no coordination statement is where cascades can fail without warning. [9]

Ask the supplier for the coordination statement, not three separate datasheets.

Your own datasheet

What that "surge protection" row is telling you.

☰ Counted from the live catalogue



99 99 of them publish 1 kV (L-N) and 2 kV (L/N-PE). These amplitudes correspond to IEC 61000-4-5 Level 3 setpoints, if that is the declared test method. Confirm the test report. [4][5][10]

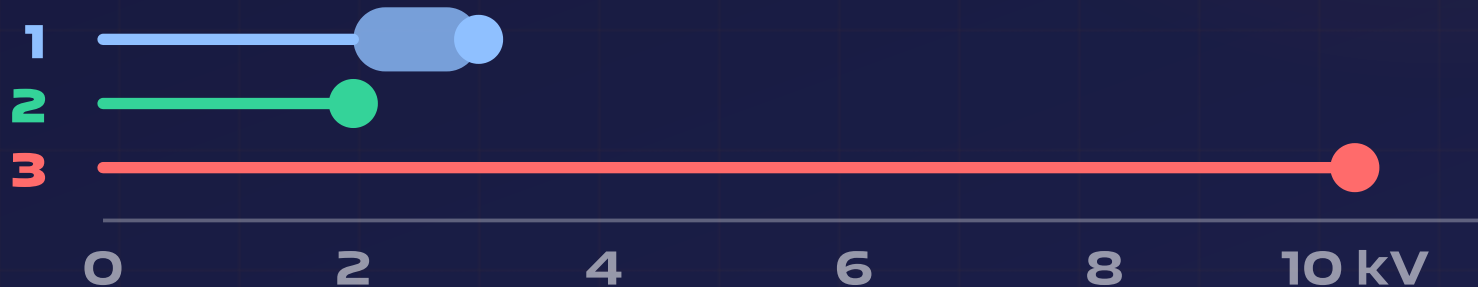
27 27 of them publish an elevated figure instead, 6, 10 or 20 kV, usually splitting an internal driver figure from an external device. Different quantity, different question. [10]

99 + 27 + 4 = 130 pages in a 2026-08-24 snapshot; a live spot-check on 2026-09-02 found 2 of 7 sampled pages had changed since, so treat this as a snapshot, not a live tally. IEC 61000-4-5 Table 1 levels: 2 = 0.5/1 kV, 3 = 1/2 kV, 4 = 2/4 kV. [4][10]

An immunity level describes **a bench test the product is declared against**. An SPD rating describes what a device diverts on site.

The driver

What a driver survives on its own.



■ 1 · stated capability
 ■ 2 · clamp below this
 ■ 3 · exposure to survive



2 to 3 kV, one 2011 example

One driver maker states its unprotected drivers handle "surges in the 2-3 kV range" on the 1.2/50 μ s pulse, 2 Ω . [6]

Clamp below 2 kV, same source

Same guideline: LED-to-heatsink breakdown "in the order of 2 kV", so clamping stays below it. [6]

Bars 1 and 2 are ONE maker's 2011 figures, not a requirement: 27 NLC pages publish higher. Bar 3 is a C62.41.2 category C scenario per [6], on its 2002 edition. [6][10][15][16]

The gap between bar 2 and bar 3 **is the whole job of the SPD.**

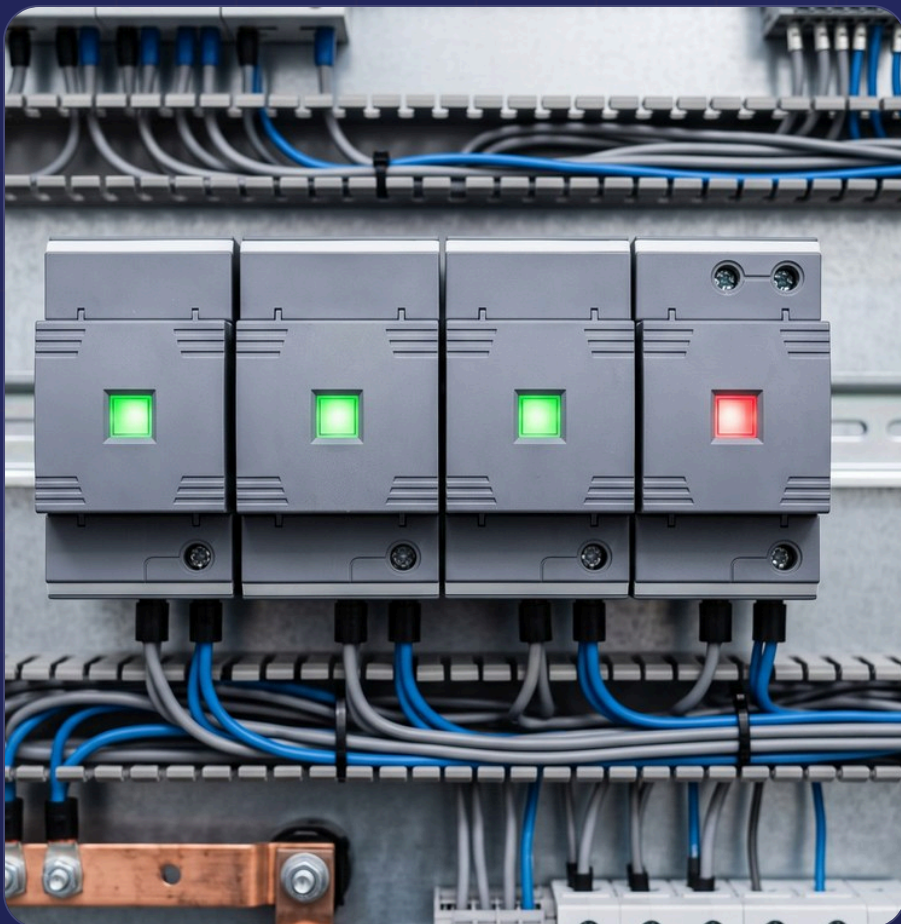
The consumable

A varistor spends itself protecting you.

⚠ Illustrative trend, not measured data



Vertical: leakage at operating voltage. Horizontal: surges diverted over the life of the device.



It degrades

Diverted surges can leave a varistor progressively more conductive at operating voltage, at a rate that depends on their energy. Nothing outside shows it.

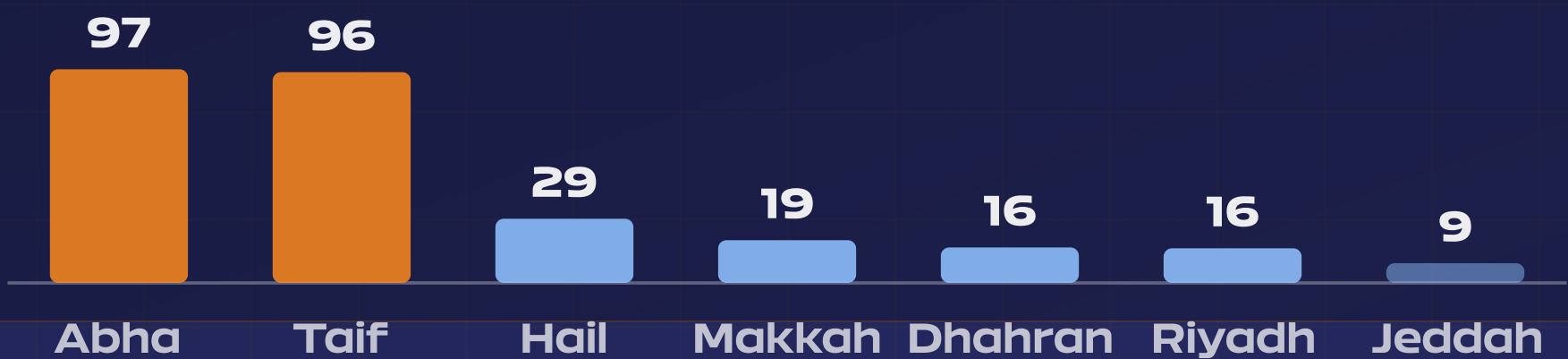
It has to announce itself

A thermal disconnecter takes a failing varistor out of circuit; a status window or remote contact is how the site finds out. [9]

An SPD with no indication and no inspection route **is a component you will find out about later.**

The exposure

Recorded thunderstorm frequency varies sharply across Saudi Arabia.



Thunderstorm days per year at seven selected stations, of the 28 in the published national survey, PME records for 1985 to 2003 [13]. Thunderstorm days are not ground flash density, and on their own they cannot determine SPD selection: that is a risk calculation [11][14], not a climate statistic.

-  IEC 60364-4-44 clause 443.4 names when protection is required outright, and gives a calculated risk level for the rest. It excludes direct strikes to the structure, which are IEC 62305-2 territory. [11][14]
-  SBC 401 carries the same structure for Saudi work: chapter 44 for the need and the risk level, chapter 53-4.4 for selecting and erecting the device. [12]

Abha and Jeddah are the same country and **nowhere near the same risk case.**

From the NLC range

Four products, four different answers.

STONY

High bay luminaire



DM 6 kV int.

10 kV ext.

Two figures, two roles.

COMET

Street light



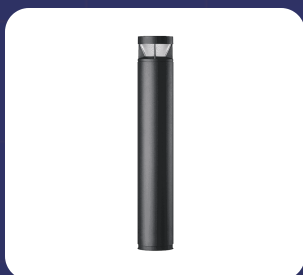
10 kV

20 kV opt.

A bare voltage, standard and optional.

DAWN

Bollard light



DM 4 kV

CM 6 kV

A DM/CM pair: driver immunity.

LUXO

Recessed downlight



1 kV L-N

2 kV L/N-PE

Level 3 amplitudes, if that is the method.

Rows quoted from each page and re-checked live on 2026-09-02.
Four different quantities, not four points on one scale. [4][10]

One heading, four quantities. **Ask what each was measured with** before comparing any two.

Before you sign

Five lines that make **surge protection** real.

- ☐ Ask for the **class of test and the waveshape** behind every kA figure, and for limp with its Q and W/R where a T1 SPD is offered. [1]
- ☐ Write the **voltage protection level Up** into the spec against the equipment's rated impulse withstand Uw, naming the system voltage. [1][8]
- ☐ Put the **connecting-conductor length** into the drawings, live side plus the earthing run: 0.5 m preferred per IEC 60364-5-53 cl. 534, 1 m never exceeded. [2][7]
- ☐ Demand a written **coordination statement** for the stages together, not three datasheets that never mention each other. [9]
- ☐ Specify the **end-of-life indication and inspection route**, and read the fixture's own surge row for what it is. [4][9][10]

The sources

Every number on these slides, sourced.

- [1] IEC 61643-01:2024 + 61643-11:2025 (defs. from 61643-11:2011)
- [2] IEC 60364-5-53:2019 +A1:2020 +A2:2024, cl. 534
- [3] IEC 62305-1:2024, lightning current parameters
- [4] IEC 61000-4-5:2014 +A1:2017, Table 1 and Annex E
- [5] IEC 61547:2020, lighting EMC immunity
- [6] Signify OEM, Protecting LED systems, rel. 2011
- [7] Schneider Electrical Installation Guide, SPD connection
- [8] IEC 60664-1:2020 +A1:2025, overvoltage categories
- [9] DEHN Lightning Protection Guide, 3rd ed., 2015
- [10] NLC catalogue, surge rows, snapshot 2026-08-24
- [11] IEC 60364-4-44:2024, cl. 443 and the risk level
- [12] SBC 401-CR-2024, Saudi Electrical Code, ch. 44, 53-4
- [13] Shwehdi 2005, Saudi thunderstorm survey, Table 1, 28 stations 198
- [14] IEC 62305-2:2024/COR1:2024, risk management
- [15] IEEE C62.41.2-2025, surge location categories
- [16] IEEE C62.41.2-2002 (inactive), the edition [6] uses

Full citations, URLs and access dates ship in the episode reference documents with the claim-to-evidence matrix. One exception to current editions: the category C levels on slide 9 come from [6], a 2011 guideline written against C62.41.2-2002 [16], inactive since 2021, and are not revalidated against [15].

PRACTICAL LIGHTING ENGINEERING

**Save this. Send it to a
colleague.**



Read the full episode article

<https://nlc.com.sa/academy/surge-protectors.html>



Next episode
Why a Driver?