

Illustrative photo: cables on a tray in a hot plant room, installed in air.

NLC ACADEMY · EPISODE 38

In 50 °C air, a cable keeps 71% or 82% of its rating.

IEC 60364-5-52:2009, Table B.52.14, cables in air, one circuit at a 50 °C ambient: PVC (70 °C) keeps 71% of its 30 °C rating and XLPE/EPR (90 °C) keeps 82%. Buried cables use other tables.

The heat problem

Catalogue ratings assume 30 °C air. Saudi design ambients are hotter.

Every factor starts from a reference condition

30 °C in air
Ambient reference
PVC 1.00 · XLPE 1.00

20 °C in ground
Ground reference
buried cables

2.5 K·m/W soil
Soil reference
factor 1.00

Saudi design ambients sit well above 30 °C

Reference conditions in IEC 60364-5-52:2009: 30 °C in air, 20 °C in ground, soil 2.5 K·m/W, one circuit with no grouping. Every correction factor is 1.00 there, and falls as the conditions get harsher.

Takeaway 1

In 50 °C air, PVC keeps 71% and XLPE keeps 82%.

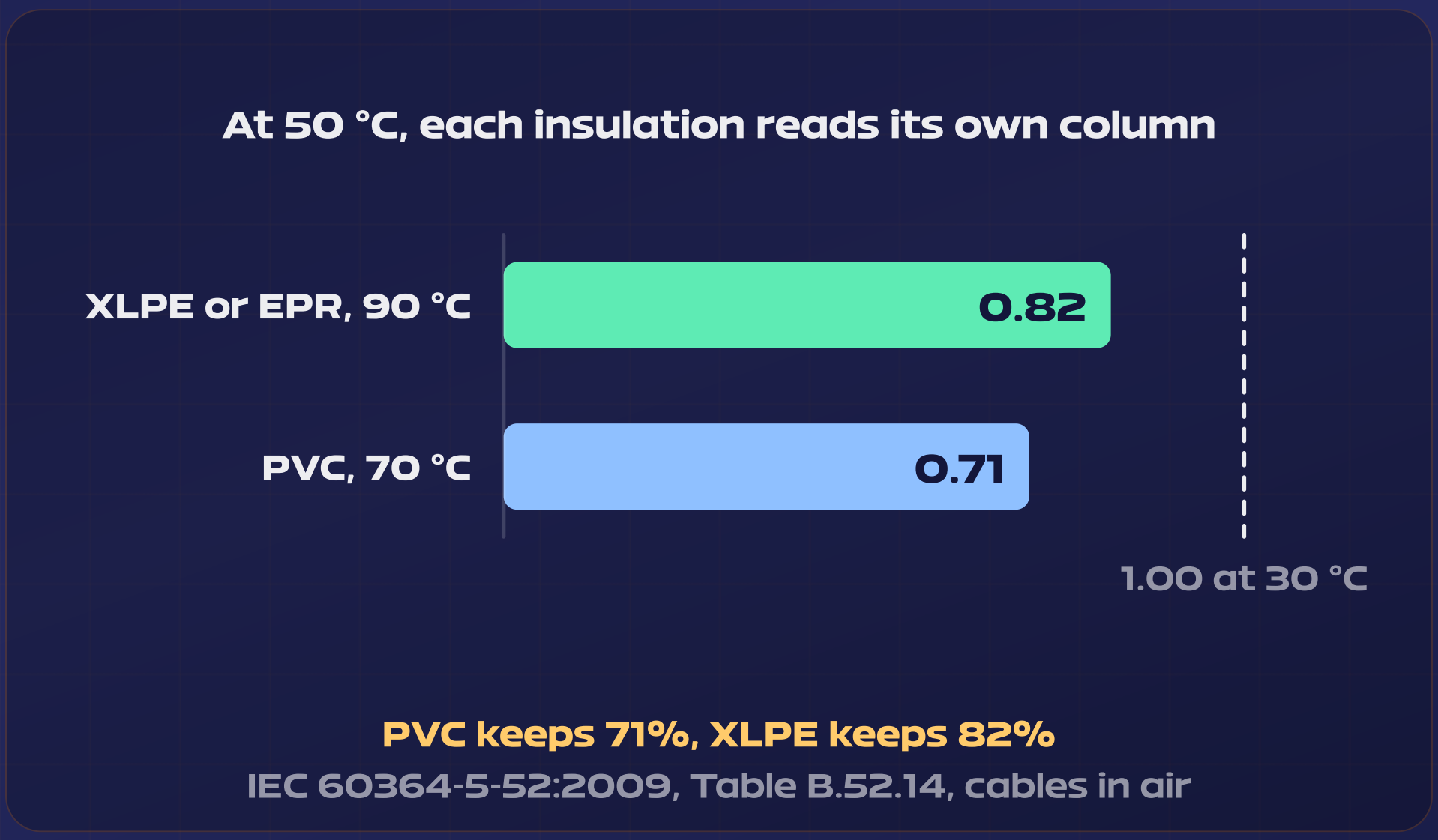
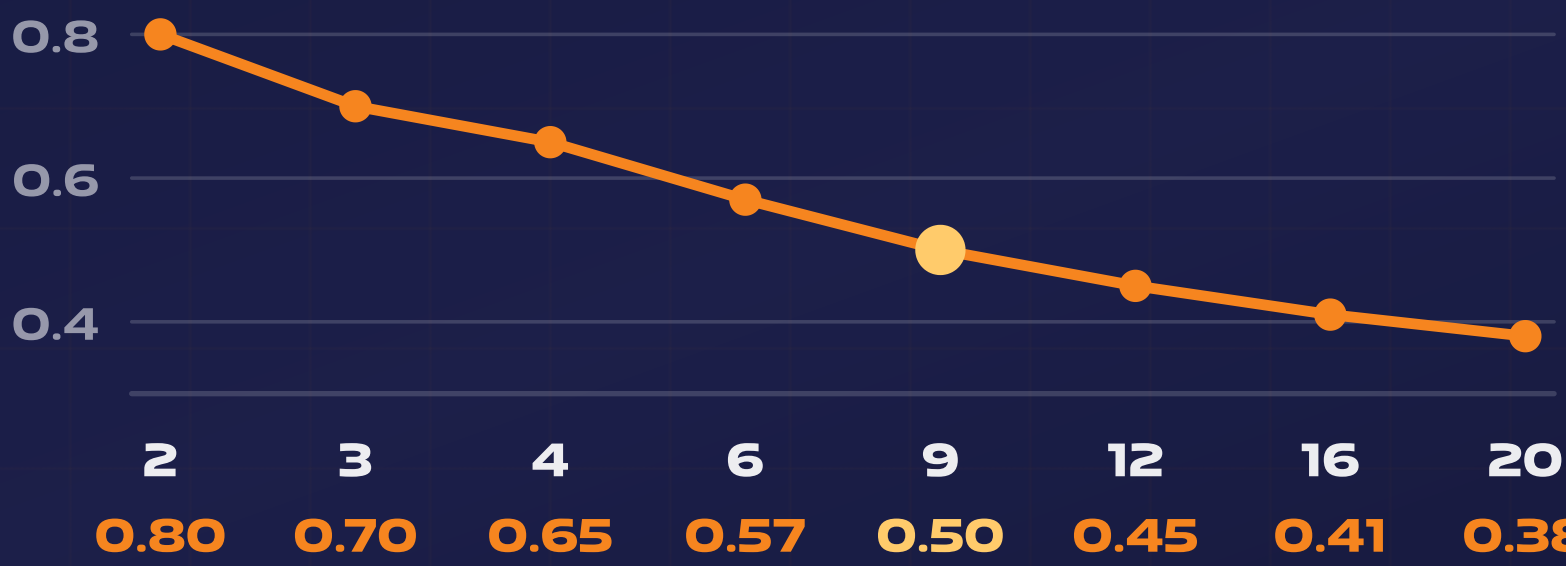


Table B.52.14 factors for cables in air, one circuit, 50 °C ambient: 0.71 for PVC (70 °C conductor) and 0.82 for XLPE/EPR (90 °C conductor). They do not apply to buried cables.

Takeaway 2

Nine bunched circuits take the rating to 0.50.



IEC 60364-5-52:2009, Table B.52.17

Table B.52.17, item 1, cables in air (bunched, on a surface, embedded or enclosed), one insulation type: 0.80 for 2 circuits, 0.65 for 4, 0.50 for 9, 0.38 for 20. It multiplies the ambient factor.

Takeaway 3

Buried cables read ground temperature and soil, not the air table.

Buried cables: ground and soil factors

Ground temperature

Table B.52.15, reference 20 °C

ground	PVC	XLPE/EPR
25 °C	0.95	0.96
30 °C	0.89	0.93
35 °C	0.84	0.89
40 °C	0.77	0.85
45 °C	0.71	0.80
50 °C	0.63	0.76

Soil resistivity

Table B.52.16, buried ducts



not Table B.52.14, which is for cables in air

IEC 60364-5-52:2009, Tables B.52.15 and B.52.16

Buried cables use Tables B.52.15 and B.52.16, not B.52.14 (BS 7671 Table 4B2 has the same ground values). One buried circuit, no grouping. Measure the soil, or state the value assumed.

Reference methods

The installation method sets the table and its reference.

Ten reference methods, in three groups

Enclosed or on a wall
30 °C air
A1 A2 B1 B2 C

Buried
20 °C ground
D1 D2

Free air
30 °C air
E F G

the method picks the base table and its reference

30 °C air for methods A1 to C and E to G. 20 °C ground for the buried methods D1 and D2.

Reference table

Table B.52.14: cables in air, by ambient.

Table B.52.14, ambient air

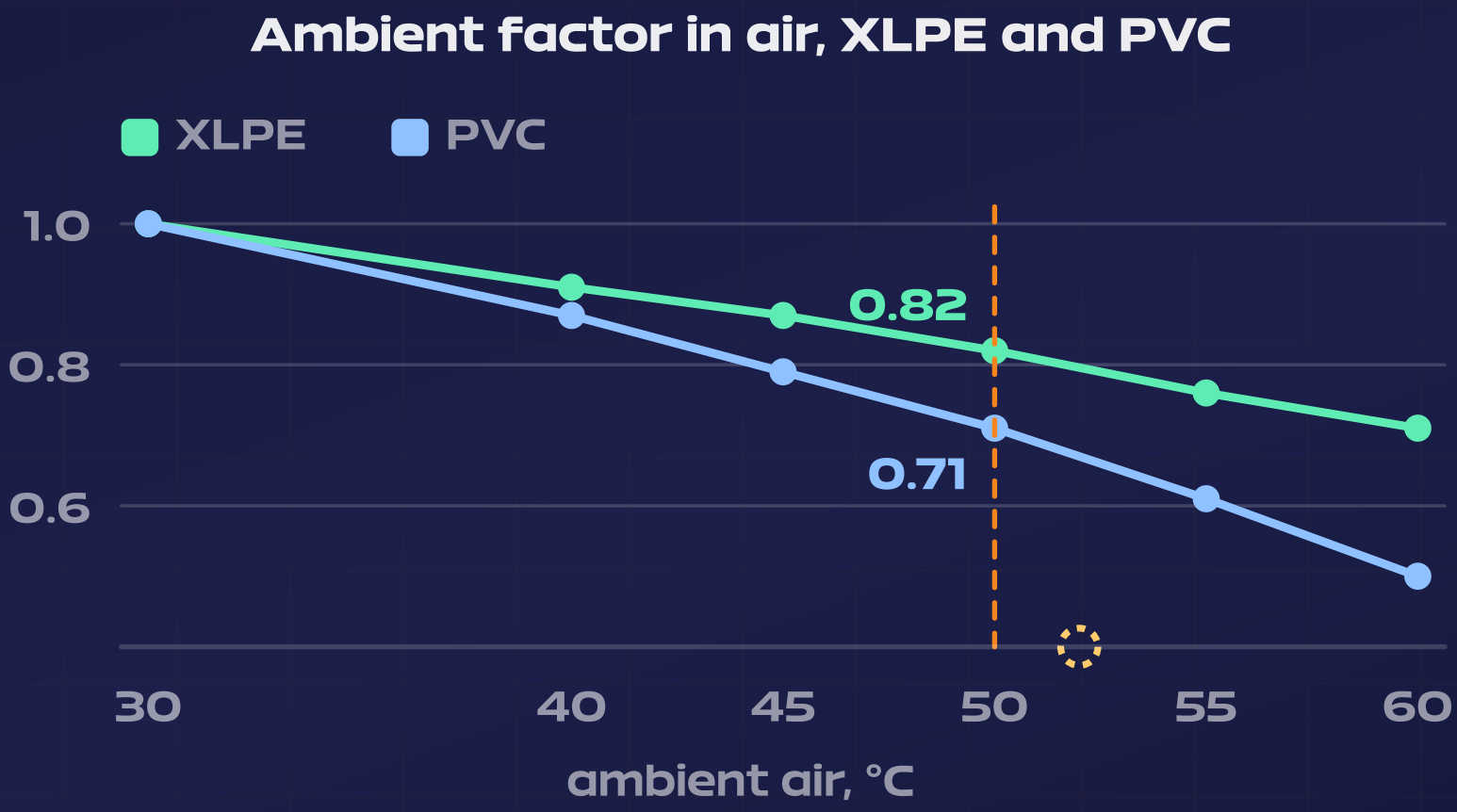
ambient		PVC	XLPE/EPR
30 °C		1.00	1.00
40 °C		0.87	0.91
45 °C		0.79	0.87
50 °C	example used here	0.71	0.82
55 °C		0.61	0.76
60 °C		0.50	0.71

IEC 60364-5-52:2009, cables in air, one circuit

IEC 60364-5-52:2009, Table B.52.14, cables in air, one circuit; BS 7671 Table 4B1 gives the same values. The design ambient follows the site conditions, the project requirements and any applicable Saudi code; there is no single Saudi value. 50 °C is the example used here.

Design ambient

Choose the design ambient, then read its row.



a 52 °C design ambient reads the 55 °C row
the hotter row is the conservative choice

Cables in air. Between two rows, the hotter row is the conservative choice: a 52 °C design ambient reads the 55 °C row (0.76 for XLPE). This is design practice, not a clause of the standard.

Which code

Each source supplies a different part.

Which source supplies what

SBC 401-CR-2024	**Annex B.52** based on IEC 60364-5-52
IEC 60364-5-52	**Tables B.52.14 to B.52.17** 2009 edition
IEC 60364-4-43	**clause 431.4.2, coordination** 2023 edition
NFPA 70	**its own rules, such as 125%** separate code

SBC 401-CR-2024 (Saudi Building Code, electrical) includes Annex B.52, based on IEC 60364-5-52. IEC 60364-4-43 sets the coordination with the protective device. NFPA 70 is a separate code.

The mismatch

A count of cables is not a count of circuits.

Count circuits, not cables

By cables

9 single-core cables
read as 9 circuits: 0.50

By circuits

3 three-phase circuits
read as 3 circuits: 0.70

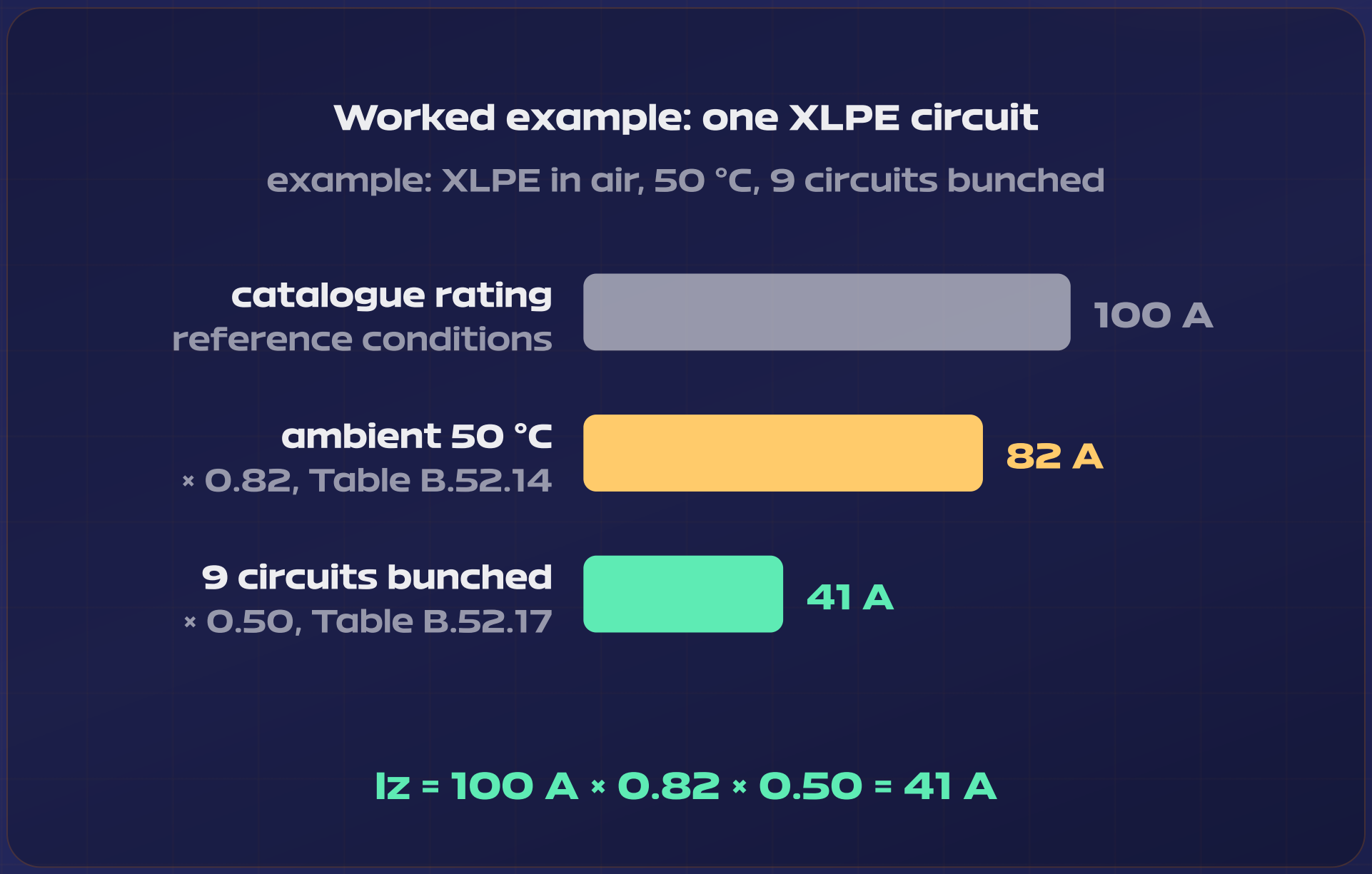
a count of cables is not a count of circuits

IEC 60364-5-52:2009, Table B.52.17

Cables bunched in air (item 1): nine single-core cables in three three-phase circuits read the 3-circuit row of Table B.52.17 (0.70), not the 9-circuit row (0.50).

Worked example

Example: 100 A × 0.82 × 0.50 = 41 A.



Apply each factor to the catalogue rating, in turn. Iz is 41 A.

Example only: one XLPE circuit in air, catalogue rating 100 A at the reference conditions, a 50 °C ambient (Table B.52.14) and 9 circuits bunched (Table B.52.17, item 1).

Takeaway 4

Ib ≤ Iz is necessary and not sufficient.

Ib ≤ Iz alone is not the test

Ib	35 A	assumed for this example
In	40 A	assumed for this example
Iz	41 A	from the worked example
I2	58 A	1.45 × In, assumed

Ib ≤ In ≤ Iz	35 ≤ 40 ≤ 41 A	met
I2 ≤ 1.45 × Iz	58 ≤ 1.45 × 41 = 59.45 A	met

IEC 60364-4-43:2023, clause 431.4.2

IEC 60364-4-43:2023, clause 431.4.2 (433.1 in the 2008 edition): Ib ≤ In ≤ Iz, and I2 ≤ 1.45 × Iz. With the assumed Ib = 35 A, In = 40 A and I2 = 1.45 × In = 58 A, both are met against Iz = 41 A from the worked example. The device maker supplies the real I2.

Buried cables

Buried cables read the ground tables.



Illustrative photo: cables laid in a trench. Buried cables read the ground and soil tables.

20 °C	2.5	B.52.14
Ground reference	**Soil reference, K·m/W**	**Air table**
Table B.52.15	Table B.52.16	not for buried cables

Example, one buried circuit in 35 °C ground: 0.84 for PVC and 0.89 for XLPE/EPR (Table B.52.15).

Checklist

Before the cable size is final.

Six checks, in this order

1. **Name the reference method**
   A1 to G. D1 and D2 are buried.
2. **Take the insulation's own column**
   PVC 70 °C and XLPE/EPR 90 °C, never one column.
3. **Read the design ambient row**
   Table B.52.14, in air. Between rows, take the hotter.
4. **Count circuits, not cables**
   Table B.52.17, for the arrangement used.
5. **Buried: ground and soil tables**
   Tables B.52.15 and B.52.16, not B.52.14.
6. **Check both coordination conditions**
   $I_b \le I_n \le I_z$, and $I_2 \le 1.45 \times I_z$.

Six checks, in this order. Skip none.

NLC schedule

What a cable schedule has to show.

The fields a cable schedule needs

field	entry
Method	reference method letter
Insulation	PVC or XLPE/EPR
Ambient row	B.52.14 air, or B.52.15 ground
Circuits	count, as Table B.52.17 defines it
Grouping factor	value and row, Table B.52.17
Iz	rating after every factor
Coordination	both conditions shown
Voltage drop	method and source stated

A final ampere figure alone cannot be checked.

Not IEC

NFPA 70 rules are not IEC values.

NFPA 70 is a separate code

NFPA 70
125% continuous-load and motor rules

IEC 60364
correction factors and clause 431.4.2

the two codes are not interchangeable
do not mix them in one calculation

NFPA 70 is a separate code with its own rules, for example 125% for continuous loads and for motor circuits. They are not IEC values. Size a circuit to one code, and do not mix the codes in one calculation.

Sources

The sources behind each number.

Sources in this episode

IEC 60364-5-52:2009
Tables B.52.14 to B.52.17

IEC 60364-4-43:2023
clause 431.4.2 (433.1 in the 2008 edition)

SBC 401-CR-2024
Annex B.52, based on IEC 60364-5-52

NFPA 70
a separate code, kept out of the calculation

Full references, with editions, are on the article page.

Practical electrical engineering

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Read the full episode article

https://nlc.com.sa/academy/cable-sizing-saudi-heat.html

Next episode
UPS sizing