

Cable selection in NEC project (for IEC practiced engineers)

When you select a LV cable in a project which uses NEC as the wiring code, the following must be observed.

I referred NEC 2008 and IEE 1992.

1 125% rule (or may be 80% rule)

Your cable must have 125% current carrying capacity against continuous load. This is not a 25% design margin nor for future load, simply you can not use this 25% forever.

In NEC and UL, MCCB, MCC and panel board rating is three hours rating, but not continuous. For continuous load, or load which is continuous for more than 3 hours, MCCB rating must be greater than 1.25 times the load current. For instance, continuous load of 100A requires 125AT MCCB at least. If you select 100A MCCB for 100A load, it may trip if the current of 100A continues more than three hours. The power cable connecting this load is protected by this 125A MCCB, thus the current carrying capacity of the cable is 125A minimum, which means you need a 125A cable for 100A load.

Cable current carrying capacity \geq MCCB rating \geq 1.25 times continuous load current

Refer to NEC 210.19(A)(1), 210.20(A), 240.4

IEE Note

Cable current carrying capacity \geq MCCB rating \geq Continuous load current
Refer to IEE 433-02-01 (1) and (2)

2 Many ACBs and some MCCBs are 100% continuous rating.

If your ACB or MCCB together with the enclosure is 100% continuous rating, the item 1, above 125% rule does not apply. Such equipment or device has normally large rating current such as 500A or larger.

Cable current carrying capacity \geq MCCB rating \geq Load current

However, as far as I know, most of LV loads are fed from 3 hours rating panels. Practically, 100% continuous rating is only for ACB.

Refer to NEC 210.19(A)(1) Exception No.1, 210.20(A) Exception

3 For cable protection, the next higher standard over-current device permitted.

NEC permits a cable is protected with next higher OC device.

for instance cable with 100A current carrying capacity must be protected by 100A MCCB, however, 101A current carrying capacity cable can be protected by 110A MCCB which is next higher standard of 101A.

The rule shown in item 1 above needs to change to this way.

Cable current carrying capacity \geq 1.25 times continuous load current

And

MCCB rating \geq 1.25 times continuous load current.

And

Cable current carrying capacity \geq next higher MCCB rating

Refer to NEC 210.19 (A)(1), 210.20(A), 240.4 (B)

For standard ampere rating, refer to NEC 240.6(A).

4 Conductor temperature in a panel board is 60 or 75 deg C.

Your XLPE cable has maximum conductor temperature of 90 deg.C. However, you must keep the conductor temperature in the panel 60 or 75 deg C depending on the panel. If you can specify the conductor temperature of a panel, specify 75 deg C. There is no LV panel with 90 deg C available. In a panel, there is no need to apply group factor to reduce current carrying capacity.

Current carrying capacity of a cable =

Current carrying capacity of the cable at 60 or 75 deg. C **without applying** a group factor

Or

Current carrying capacity of the cable at 90 deg. C **with applying** a group factor. whatever smaller one.

Refer to NEC 110.14(C)(1)

Refer to IEE 512-02-01

5 2.5 mm² 16A, 4 mm² 20A, 6mm² 32A

NEC requires small cables must be protected by the following OC protection.

14AWG (= 2.08mm²): 15A

12AWG (=3.31mm²): 20A

10AWG (=5.261mm²): 30A

IEC interpretation.

2.5mm²: 16A

4mm²: 20A

6mm²: 30A

You must apply 80% rule here.

Refer to NEC 240.4(D)(3), (5) and (7)

- 6 All power and control cables must include PE. Even though you can purchase IEC standard cables without PE, you should not do it. An NEC oriented client will never accept the explanation of IEC or interpretation of NEC with PE-less cables.**

Another important thing you should never forget is all HV, MV, LV power and control cable must have PE within each cable. Single core cables are the only exception to this rule. PE is called as EGC (Equipment Grounding Conductor) in NEC and the function is exactly same as PE. EGC insulation color is either green or green/yellow. Un-insulated EGC in a cable is also acceptable. Metal cable armour can be treated as EGC.

Refer to NEC 250.134(B) and 300.3(B)