TEMPERATURE RISE *LIMITS* USED IN IEC STANDARDS: is there anyone studying if they can be increased to save materials and other Earth resources? Energy efficiency starts here.

Here is my suggestion to change the values of silvered connections from 75K to 85K

Extracted from table 14 of IEC62271-1 (2021) – medium / high voltage switchgear (these are also the values of well-based IEC 60943)	Suggestion by Sergio Feitoza Costa for AIS MV & LV switchgear	Low voltage circuit breaker catalogue of an important manufacturer world leader in IEC61439-1/2 products
Connections, bolted or the equivalent Bare-copper or bare-copper alloy or bare-aluminium alloy - in OG 60 - in NOG 75 - in Oil 60 Silver-coated or nickel-coated - in OG 75 - in NOG 75 - in Oil 60 Tin-coated - in OG 65 - in NOG 65 - in Oil 60 Temperature rise in K (or Celsius) OG is like Air	Maintain 60 Increase from 75K to 85K Maintain 65	Figure 7.1 Connection with busbar 85K  If experience shows that this value works well for LV panels, why not apply it for any switchgear?

All electrical products are tested to verify that working temperatures are not higher than certain temperature rise limits specified in technical standards. Working above these limits implies that the connections and contacts will age faster, reducing the expected useful life. IEC 60943 "Guidance concerning the permissible temperature rise for parts of electrical equipment, in particular for terminals", explains why working just 6,5 K degrees above limits means a reduction of life around 50%. An increase of 10 K in these limits represents savings of more than 20% in bars weight.

The expected useful life of a product is a concept little covered in standards for substations equipment. Producing an item to last 90 years involve more materials and higher costs than making to last 30 years. The expected lifetime of 30 years is frequently mentioned in publications. We see several well-maintained electric panels in use for 40-50 years.

Temperature rise limits and related lifetime are the main keys to a lower cost electrical product that will be subjected to temperature rise tests. This applies from low voltage to ultra-high voltage products because temperatures are not related to voltages. A good reading is Brochure Cigrè 740 (2018) - Contemporary Solutions for Low-Cost Substations.

The temperature rise limits used in IEC standards have not been discussed for over 50 years and little research has been carried out and published in this area. The higher is the allowable temperature rise limit; the less copper and aluminum will be spent to produce an equipment approved in the temperature rise test.

It is necessary that the main thinking heads of the global electrical industry such as IEC, IEEE and Cigré reassess whether these limits can be increased. It seems that this topic has become a forgotten old paradigm.

A good starting point is in IEC61439-1 (low voltage switchgear). It permits temperature rises higher than other IEC standards like IEC62271-1. The document, instead of mentioning values like in the table above says, "according to components manufacturer's instructions". **A typical value is 85K in the connection to circuit breakers**. In all other IEC standards, the limits go from 60 (bare) to 75K (silvered). As most of the LV switchgear uses 85K this may mean that the 75K limit possibly could be changed to 85K without any problem.

Standards used for electronics equipment like notebooks are also something to understand. The temperatures inside are high and involve strong ventilation. The expected time life is much lower than switchgear. In standards such as IEC 60950, it can be seen that the focus is on safety issues like avoiding touching components that are hot. It is not possible to perceive the concern with contact and connection temperatures, perhaps because the values in focus are lower.

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