

# How to use IEC 62271-307 (HV) for extension of the validity of test reports of LV IEC61439 products? .... *Understand why IEC\_62271-307 is applicable to extending validity of test reports of IEC61439-1/2*

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- Are the test results from a tested product that is similar but not identical valid for the product you bought? How can I make sure?
- How to use IEC 62271-307 (MT) to extend the validity of test reports?
- Because "PROJECT RULES" did not apply to every test, it was an excellent concept that was misapplied.
- I can say with confidence that IEC\_62271-307, of which I am a co-author, is entirely suitable to extending the validity of the products test reports for IEC61439-1/2.

## **HAVE THE HUMILITY TO RECOGNIZE FAILURES AND WORK TO REWRITE THEM AT NATIONAL (ABNT) AND INTERNATIONAL (IEC) LEVELS**

Firstly, it should be clear to those who sell, buy and test electrical panels that, regardless of the nominal voltages, low voltage and high voltage panels use the same materials, design principles, the same tests and have the same basic functions. The higher the voltages, the greater the dielectric and internal arc requirements and for this reason it can be said that low voltage panels are a little simpler to design, for currents below about 4000 A.

Secondly, it is worth mentioning that contrary to what many people think, the technical standards for substation equipment such as panels, busbars, transformers, circuit breakers, disconnectors, etc. are voluntary documents, generally used to support commercial matters, occupational safety, etc. If nothing has changed, the only mandatory standards are those for products that, in order to be marketed, must have undergone some formal certification process by a Certification Body. In Brazil formal certification is linked to the activities of Inmetro. Before the certificates are issued, the certification processes are submitted to external certification committees, which act technically and are made up of representatives of the parties involved in society. This may concern domestic sockets and plugs, and explosion-proof equipment (Ex), but it certainly does not apply to electrical panels used in substations.

When a large purchasing company is going to purchase its switchgear like electrical panels, it can choose which technical standard to use, which will be stated in the contract between the parties. I assume that this standard prevails for legal purposes.

Here is a question for you to think about. If you are in Brazil and you have entered into a contract based on a Brazilian ABNT technical standard, which is a formal translation of an IEC standard published 4 years earlier by IEC, which has now been modified, which one prevails in the event of a legal dispute over an accident with material damage or even victims?

**I give this example to show that using an IEC technical standard developed by a high voltage working group is perfectly acceptable to a LV equipment. This is particularly true when it comes to low voltage switchgear of IEC61439 series for which there is not a standard text available for this purpose. Recall my earlier statement regarding the similarities between MV and LV switchgear.**

For over 10 years I have been publishing constructive articles on the poor quality of the IEC 61439-1/2 text. I explain the criticisms of the standard in detail in the articles in References [1] and [5] whose links are at the end of this text.

I have even written to the IEC, but I have never received any response. I understand that the text is poor and confusing. It has a technical error in the issue of temperature rise limits, in addition to omissions that harm local manufacturers who seek to develop more efficient products than the designs created over 50 years ago by large international manufacturers. As I explain in Reference [9], at that time climate issues and excessive use of materials were not priority issues.

Now these aspects are very important and to design more efficient products which use less materials should be a good example given by these big manufacturers that produce and sell all over the World. Having only a beautiful environmental speech is not enough.

I helped write some IEC standards work, including IEC 62271-307 (2015) and IEC 60282-2 (1990). Despite the apparently “democratic” way in which they are prepared, they are in fact done by large international manufacturers. They have the merit of being there in working groups. The participation of users and large buyers is almost non-existent.

I have always defended at Brazilian Standards ABNT that national standards should be faithful copies of IEC Standards. Today I think differently and understand that in cases such as IEC 61439-1/2 it would be better for Brazil to modify some parts rather than spend years translating something that modern translators do very well. It is very unlikely that the large international manufacturers who sit at the IEC table to prepare the revisions will make these revisions. They would be leaving their comfort zone because they sell these same projects all over the world. Spending extra copper and insulators are not a priority, in this scenario.

### **HOW TO USE IEC 62271-307 (MT) TO EXTEND THE VALIDITY OF TEST REPORTS?**

The concept of “DESIGN RULES” included in the replacement of the IEC 60439 series (TTA/PTTA) by the IEC 61439 series, from 2009 onwards, was very welcome and useful to avoid the repetition of costly tests. However, the confusing text, also in this part, does not even allow us to understand whether the intention is to apply the rules only to short-circuit and temperature rise tests, as in the previous standard, or to all tests, as does IEC 62271-307 (2015) - Extension of the validity of type tests to avoid repetition of tests.

To find out if a test report is valid for the LV panel you purchased, the only current way is to use IEC 62271-307, which was made for medium voltage panels. Remember that regardless of voltage, panels use the same materials, design principles, same tests and have the same basic functionality. IEC 62271-307 was made based on the same idea and concepts as the LV “Design Rules”. The difference is that it was produced in the form of a clear, complete and transparent text. I am a co-author of this IEC document and explain its scope and how to use it in the Reference article [2]. When I show these details in the training I apply, designers

understand perfectly what could have been done in the IEC61439-1 design rules table. A good opportunity to do something complete was missed.

For this and other reasons listed below, the text supporting Table 13 of IEC 61439-1 should be rewritten based on IEC\_62271-307 to allow the extension of the validity of test reports carried out on the “original tested equipment” to other equipment in the same family. If there were more rationality in IEC in avoiding separating LV and HV standards, it would be possible to simply reference the various tables of IEC 62271-307 to replace Table 13 of IEC 61439-1. The difficult thing is to overcome vanities and recognize mistakes.

The specialists working, just now, at the Brazilian ABNT to translate/revise the NBR IEC 61439 series have in hands an opportunity to do something remarkable by reviewing the Brazilian standard to improve the text and then making a proposal to the IEC for the same modifications. It is not difficult as it seems. I did this in the past when I coordinated the review of IEC60282-2 at IEC and it worked.

### THE MAIN POINTS TO REVIEW IN IEC 61439-1 ARE:

- A) Replace Table 13 (Design Rules) and related texts with reference to IEC62271-307
- B) Replace Table 6 of IEC61439-1 (temperature rise limits) with the transparent Table 14 of IEC62271-1. Certifiers and laboratories use these limit values to approve and certify. The limits for connections, the hottest point, are not written in IEC 61439 and allow very different interpretations (60 to 105K). The phrase “In accordance with the requirements of the component or manufacturer” is not an objective or verifiable statement (ISO9000). Limits on connections depend solely on the materials. If the terminal of a circuit breaker supports 85K rise, but the silvered terminal of the bar that touches it supports 75K, the limit to prevail is the lowest and not, as stated in IEC61439-1, that of the circuit breaker. In other words, the temperature rise limit of a connection shall be the lowest value of the 2 parts that are touching because will age faster. If you join a circuit breaker (85K) and a busbar (60/75K), the limit is the lower of the 2 values – and not the value of the circuit breaker/component. IEC 60943 explains. The concept of Note (b) for terminals should also be applied here. The mention of 105 K leads people to mistakenly think that this is the limit value for connections. I think the origin of the error is that, in the past, the term “temperature (40+75=115K) was confused with “temperature rise” and became the “truth”.
- C) Another deficiency to correct is the unbelievable change in the temperature rise test method of section 10.10 of IEC 61439-1 (2022). In IEC 60439-1 (TTA/PTTA) it was allowed to use 1 current source plus resistors to simulate other power dissipations. IEC 61439-1 is different and requires, without technical advantages, the use of at least two current sources plus resistors. What motivated the change in test method?
- D) The change in the testing method has increased the cost and duration of tests and decreased the number of laboratories that can perform them. E.g. Brazilian laboratories that performed the IEC 60439 test without problems now say that they cannot perform it according to IEC61439-1. I think most of the lab experts simply do not understand the confusing text. Read my interpretation of the text of the standard in the Reference article [1].
- E) By the way, if the method change were truly necessary, and not an academic refinement, a statement should be included in IEC61439-1 to specify that, “for new products derived from old

already tested designs (original and derived product) it is necessary to retest using the new method". This would demonstrate coherence with the testing change that has caused difficulties for many testing laboratories, small and medium-sized manufacturers. There is a paragraph in section 10.1 that says "If tests were done to IEC 60439, prior to publication of the IEC 61439 series product standard and the results met the requirements of IEC 61439, the tests do not need to be repeated".

- F) By this sentence, as the test method changed, the previous temperature rise test must be repeated. To fix this test method error, IEC61439-1 should - at least - include a statement specifying that the "new" test method is preferred, but the old one may be used. Furthermore, it must be included an explanatory figure making it clear what the circuit to be used in the IEC61439-1 temperature rise test is. Reading this figure, some laboratories will probably realize that they can carry out the test.
- G) To recognize and highlight in the text of IEC\_61439-1 that test reports without a statement "passed or failed" are not safe for the buyer because it is almost impossible to know whether it passed or not with all this confusion

## FINAL COMMENTS

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The necessary changes to the IEC 61439 series of standards and national standards like the ABNT NBR IEC 61439 series, derived from it, always remind me of a story I read as a child. It was the fable "The Emperor's New Clothes", by Hans Christian Andersen. In it, the king hired a tailor to make new clothes that deceived him with almost invisible clothes. When the king walked through the streets, most of his subjects didn't see his clothes, but, in order not to compromise, they praised him and accepted the invisible clothes without questioning.

Errors should not be turned into unquestioned truths. In a way, this is what we have been doing for decades on the issue of climate change for which we are now starting to pay the bill.

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## REFERENCES

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[1] **Article "TEMPERATURE RISE LIMITS OF IEC 61439-1** : unclear values distort the LV switchgear market. (May,12, 2023) - <http://www.cognitor.com.br/IEC614391Table6.pdf>

[1] Portuguese version "LIMITES DE ELEVAÇÃO DE TEMPERATURA DA IEC 61439-1: valores indefinidos distorcem o mercado de painéis de baixa tensão <http://www.cognitor.com.br/IEC61439Tabela6.pdf>

[2] **LV CIRCUIT BREAKERS DEVELOPMENT. WHY HAVING A LOWER POWER DISSIPATION IS BETTER.** <https://www.cognitor.com.br/LVcircuitBreakerDevelopment.pdf>

[3] **IEC 62271-307 – Extension of the validity of type tests to avoid tests repetitions.** <https://www.cognitor.com.br/IEC62271307ENG.pdf>

[3] Portuguese version - IEC 62271-307 – Extensão da validade de ensaios de tipo para evitar repetição de testes <https://www.cognitor.com.br/IEC62271307POR.pdf>

[4] **IEC62271-307 (2015)** - High-voltage switchgear and controlgear - Part 307: Guidance for the extension of validity of type tests of AC metal and solid-insulation enclosed switchgear and controlgear for rated voltages above 1 kV and up to and including 52 kV.

[5] **IEC TR 60943:1998** - Guidance concerning the permissible temperature rise for parts of electrical equipment, in particular for terminals. Issued by IEC Technical Committee TC 32.

[6] **CIGRÈ BROCHURE 830 (2021)** – “SIMULATIONS FOR TEMPERATURE RISE CALCULATION”.

[7] **CIGRÈ BROCHURE 740 (2018)** Contemporary design of **low-cost** substations in developing countries.

[8] **CIGRÈ BROCHURE 602 (2014)** Tools for Simulation of The Effects of the Internal Arc in T&D Switchgear,

[9] **Free book by Sergio “SWITCHGEAR, BUSWAYS & ISOLATORS & SUBSTATIONS & LINES EQUIPMENT”**  
[https://www.cognitor.com.br/Book\\_SE\\_SW\\_2013\\_ENG.pdf](https://www.cognitor.com.br/Book_SE_SW_2013_ENG.pdf)

[10] Other reference articles free downloads <https://www.cognitor.com.br/Downloads1.html>

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