H.V. CIRCUIT BREAKERS: RESISTANCE AS SEEN FROM THE TERMINALS. WHY THIS EASY and IMPORTANT INFORMATION IS RARELY INCLUDED IN THE MANUFACTURERS CATALOGUES

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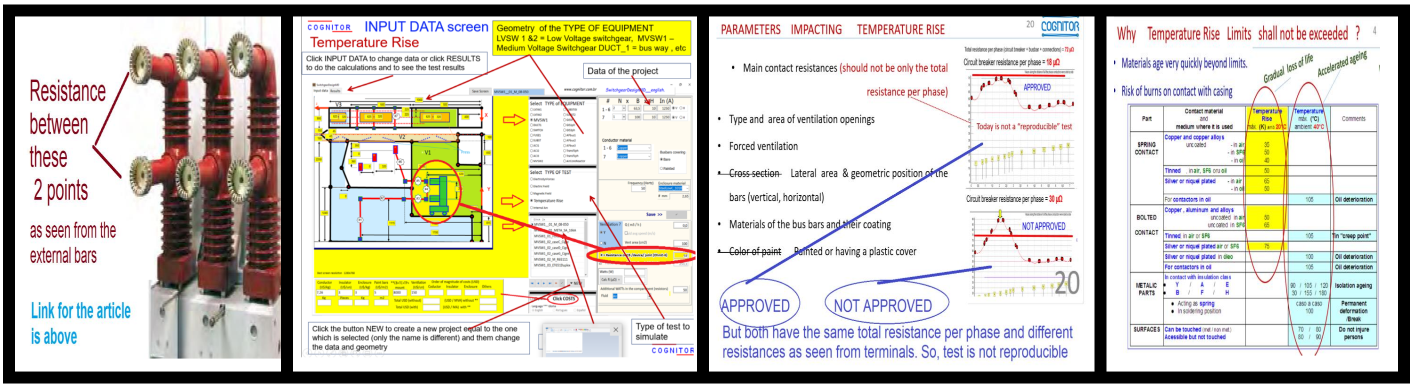


1. WHY I NEED THE VALUES

In the last 20 years I have been doing testing simulations to demonstrate to manufacturers and certifiers what is the performance expected during the real test. I use this to – sometimes – suggest modifications in the design to assure with more tan 95% of probability if the equipment will be approved in the real expensive test un the lab. Before this I worked 25 years as a researcher, test engineer and manager of the main testing labs of South America.

Usually, the mentioned testing simulations are done for internal arc tests, short time current tests (short circuit forces) and, our focus in this article, temperature rise tests.

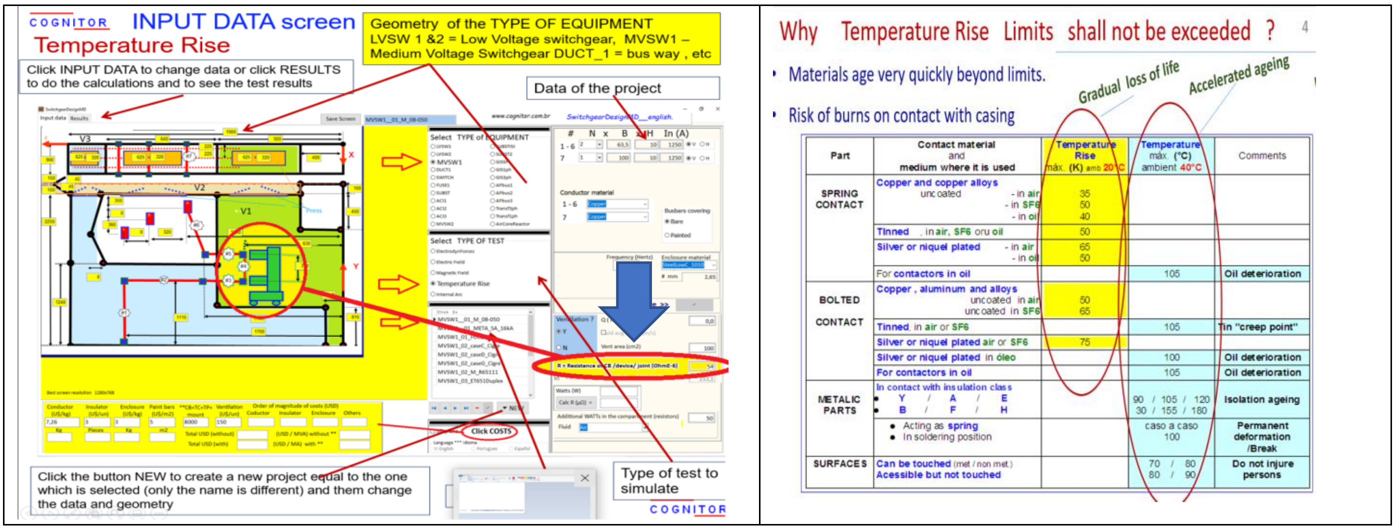
A strange thing, which happens almost every time, like now, when I am doing a study for a manufacturer, is that the resistance values of MV/HV breakers are necessary, but very difficult to find in the manufacturers catalogues. When you call the manufacturer, the salespeople have to consult the "engineering" because they, too, have no idea of the importance of this data or where to find it. This has happened to me dozens of times.

It's kind of disappointing to see how manufacturers have difficulty in informing and the IEC technical standards themselves don't seem to understand their importance.

First of all, this information is important because, after receiving the supplied the circuit breaker, the resistance will be the main reference to follow up on predictive maintenance. I got experience with this because the testing staff of the high-power labs I worked and managed were responsible for the maintenance of the testing equipment. In a high-power testing lab, the maintenance is a key factor because the equipment operates with very high frequency at extreme conditions.

I also learned about the importance of the values of the resistance for predictive maintenance when I represented an important company expert on these matters.

I need to find these values because they are the more impacting factor in a temperature rise test of switchgear / controlgear of IEC 62271-200. I learned this when I became an expert in testing simulations but never precepted when I was a testing engineer.



2. THE IMPACT OF THE CIRCUIT BREAKER RESISTACE IN THE RESULTS OF TEMPERATURE RISE TEST

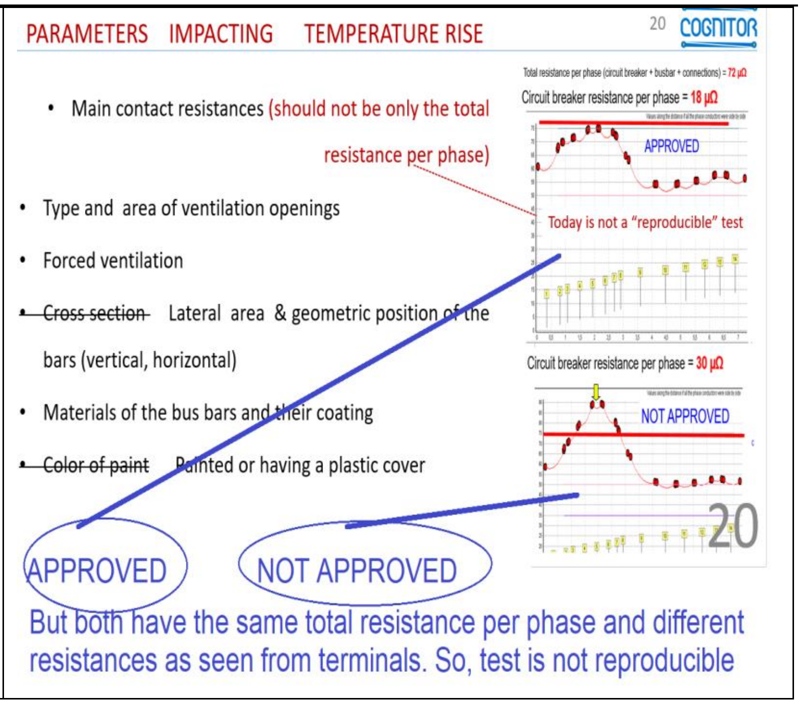
If you wish to understand the impacting factors start reading IEC 62271-307 (I am coauthor). It is very well explained there. In general, the higher the resistance, closer to the temperature rise limits of the IEC62271-100 (circuit-breaker) you will be. When installing the circuit breaker inside a switchgear / controlgear (IEC 62271-200) the hottest point is usually in the connections from the circuit breaker to the busbar.

IF you use a breaker with a "tighter" setting in the temperature rise tests you will have a lower temperature rise in the test because the resistance is lower than in the normal use. Do the right thing and don't do it

The reason is because, this will not correspond to the regulation recommended by the manufacturer to be used in everyday life. If, on a daily basis, you use a tighter adjustment than recommended by the manufacturer, you will quickly have to redo the adjustments. I learned this by doing maintenance on many circuit breakers in the laboratories where I worked.

> For this reason, it should be mandatory in the IEC 62271-1 temperature rise test to measure both the total resistance of the circuit and that of the circuit breaker alone.
>
> For the same total resistance value, you can pass or fail the test, depending on the setting. In other words, the temperature-rise test of IEC 62271-1 is not reproducible without the two measurements.

That's why I need the values to use in simulations of temperature rise tests on products of IEC 62271-200.
I need to complete this table with many values of many manufacturers and types , for my own use.



3. **CAN ANYONE HELP ME TO FIND THE DATA ? THE TABLE I NEED TO COMPLETE**

Since yesterday when I posted in Linkedin a a request for values of the resistance, 800+ people clicked the post. Many of them are the main worldwide manufacturers of circuit breakers (ABB, Schneider, Eaton, Siemens, GE Hitachi, Tavrida, Alstom and others). Many clicks but I did not receive any data.

So, could any of you spend some minutes of your time, helping me to get the values ?

Test reports of the temperature rise test of the circuit breaker are also welcome but not essential . If you send me the report it will not be disclosed in any way.

NON CONFIRMED VALUES INCLUDED ONLY TO EXEMPLIFY, AS ORDERS OF MAGNITUDE

Manufacturer of circuit breaker / Rated voltage / Rated current	Resistance as seen from the terminals of the circuit breaker (as seen from external bars) μΩ	
	Installation Fixed	Extractable (Plug In)
Schneider Evolis 17,5 KV * 185/145 mm	35 μΩ	68 μΩ
Schneider Evolis 17,5 KV * 240 mm	18 μΩ	30 μΩ
AREVA VAA (vacuum) 36 kV	42 μΩ	90 μΩ
AREVA HVX (vacuum) 17-30-20E	19 μΩ	25 μΩ
TAVRIDA 17,5 kV	18 μΩ	
ABB VD4 40kA and 50 kA	??? 70 μΩ ?????	??? 70 μΩ ?????
EATON		
SIEMENS		
Etc		

I thank you all in advance.

To send data please use preferably my e-mail instead of Linkedin

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The author of this article is Eng. Sergio Feitoza Costa. Sergio is an electrical engineer, M.Sc. in power systems and director of COGNITOR. It has 40+ years of experience in the design, operation and management of high power, high voltage, and other testing laboratories. After leaving CEPEL's testing labs, Sergio gained considerable experience using test simulations to support manufacturers and certification companies in substation equipment projects. He is co-author of several IEC and ABNT standards. Sergio is the author of SwitchgearDesign simulation software and DECIDIX.

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