



Type test report no. VR 1E 001e

Temperature rise of contacts of diverter switch

Product Approval
CTTP/Wag
10.02.2017

Type test for types:	Diverter switches VACUTAP® VRS / VRM / VRH / VRX with maximum rated through-current up to 1000 A.
Test specification:	IEC 60214-1:2014, sub-clause 5.2.2: "Temperature rise of contacts".
Test sample:	VACUTAP® VRS III 1000 Y – 72.5, S/N: 1782303.
Manufacturer:	Maschinenfabrik Reinhausen GmbH, Regensburg, Germany.
Date of test:	January 2017.
Place of test:	Maschinenfabrik Reinhausen GmbH, Regensburg, Germany.
Tests performed:	Measurement of temperature rise of contacts with a test current of 1.2 times the maximum rated through-current. The test was performed on a single phase (sector) of the diverter switch. Test current: $1.2 \times 1000 \text{ A} = 1200 \text{ A}$.
Test results:	The requirements of IEC 60214-1:2014 were met. All steady temperature rises of contacts were below the maximum admissible value of 20 K.

This report contains 4 pages.

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- PRODUCT APPROVAL -

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1. Test specification

The type tests were performed in accordance with IEC 60214-1:2014 "Tap-changers - Part 1: Performance requirements and test methods", sub-clause 5.2.2 "Temperature rise of contacts".

2. Data of test sample

Type designation: VACUTAP® VRS III 1000 Y – 72.5
Type characteristics: Diverter switch
Serial number / IBASE: 1782303 / 576668179
Year of manufacture: 2016
Manufacturer: Maschinenfabrik Reinhausen GmbH, Regensburg, Germany.

3. Scope of application

Diverter switches type VACUTAP® VR are available in the basic design variants VACUTAP® VRS, VACUTAP® VRM, VACUTAP® VRL, VACUTAP® VRH and VACUTAP® VRX.

The design of sectors (current paths) and contacts that carry current continuously is the same for all diverter switches type VACUTAP® VRS, VACUTAP® VRM, VACUTAP® VRH and VACUTAP® VRX with maximum rated through-current up to 1000 A.

According to IEC 60214-1:2014 the type test was performed on a single phase (single current path) of diverter switch type VACUTAP® VRS III 1000 Y – 72.5 with a test current of 1.2 times of the maximum rated through-current ($1.2 \times 1000 \text{ A} = 1200 \text{ A}$).

The temperature rise of contacts does not depend on the insulation levels of the diverter switch.

Therefore this type test report is valid for diverter switches type VACUTAP® VR with following characteristics:

- Design variants: VRS, VRM, VRH or VRX
- Number of phases: 1, 2 or 3
- Number sectors (per phase): 1 or 2¹
- Maximum rated through-current: up to 1000 A

¹ Single phase design with two sectors for applications with variable shunt reactors with maximum rated step voltage $2 \times 6000 \text{ V}$ (VACUTAP® VRX).

4. Test conditions / Test arrangement

Mounting: The test sample was mounted in a test tank.
Surrounding medium: Transformer oil according to the requirements of IEC 60296.
The oil temperature was less than 40 °C.
Condition of the test sample: New, as manufactured.
Connection of the test sample: Test circuit connected to the take-off terminal "Y" and the diverter switch terminal "B" of the test sample (see figure 1).
Connection leads: Copper bars with dimensions 50 x 10 mm (cross-section of 500 mm²).
Measurement: By means of thermocouples (NiCr-Ni, type K) welded onto the contacts and reference points 25 mm below the contacts.
Measuring points: See figure 2.

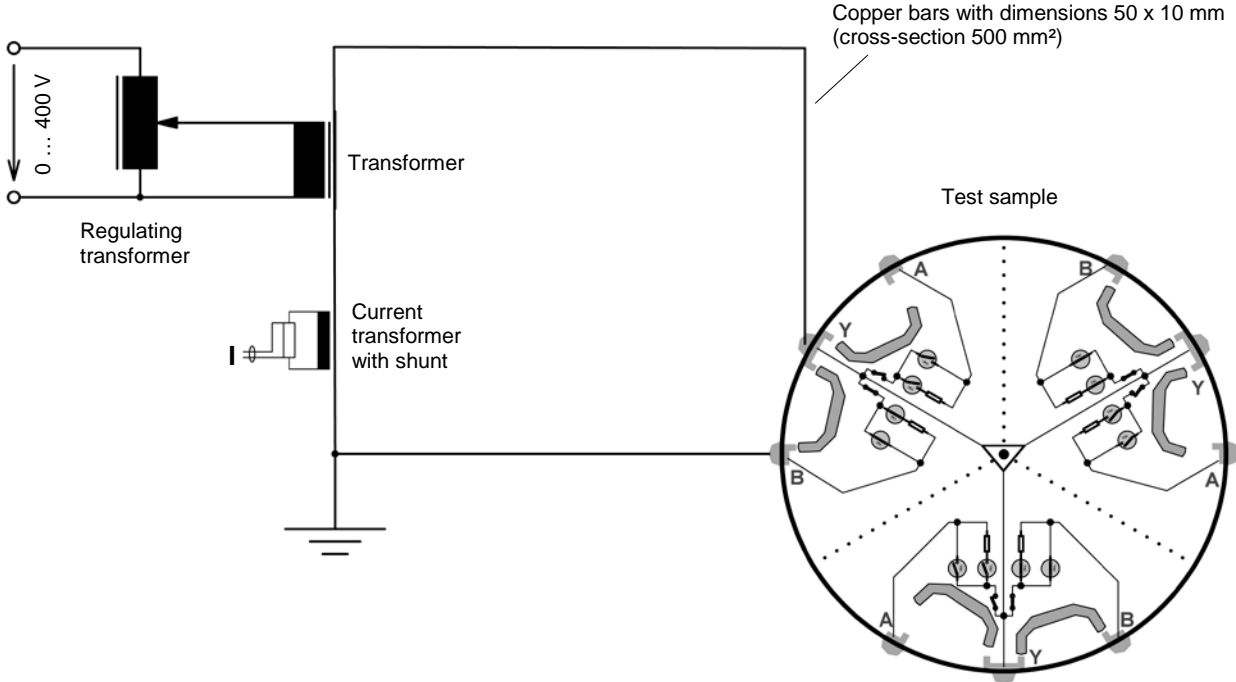
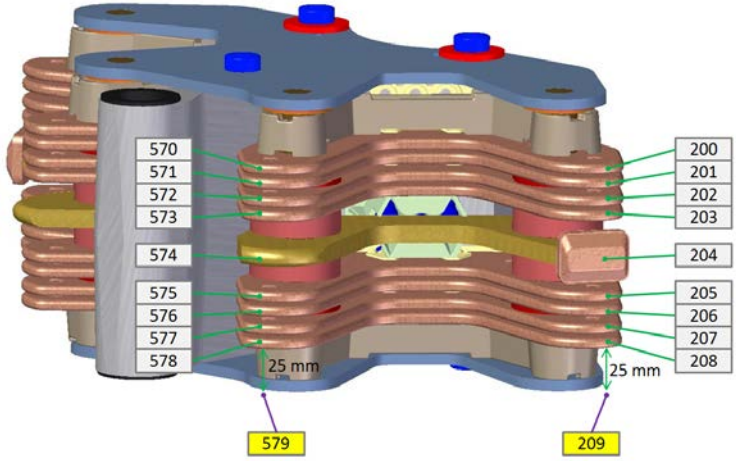


Figure 1: Test circuit and position of the test sample during the test.

Movable contacts (diverter switch insert):



Stationary contacts (oil compartment):

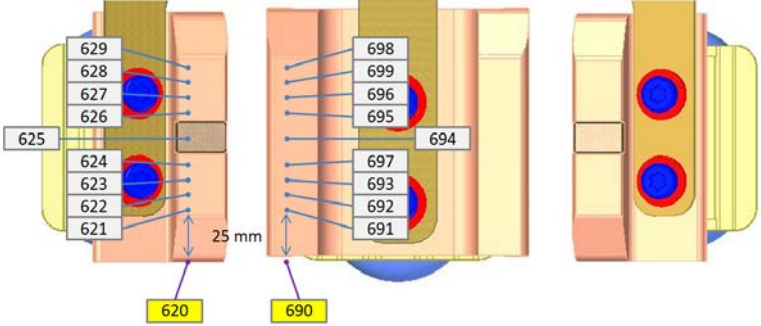


Figure 2: Measuring points.

5. Tests performed

Test current: 1.2 x 1000 A = 1200 A.

Test duration: Measurement at steady temperature rise, i.e. the change of temperature was less than 1 K for more than one hour.

Table 1 shows the determined temperature rise of contacts. The highest temperature rise is always indicated for parallel or equivalent contacts. Table 2 shows diverter switches type VACUTAP® VRS, VACUTAP® VRM, VACUTAP® VRH and VACUTAP® VRX covered by this type test.

All steady temperature rises of contacts were below the admissible value of 20 K.

Designation of contacts	Measuring points (see fig. 2)	Steady temperature rise
Main contact connected to take-off terminal		
Stationary contacts	691...693, 695...699	10.7 K
Stationary arcing contact	694	8.5 K
Oil below stationary contacts	690	-
Movable contacts	570...573, 575...578	10.7 K
Movable arcing contact	574	8.4 K
Oil below movable contacts	579	-
Main contact connected to diverter switch terminal		
Stationary contacts	621...624, 626...629	10.2 K
Stationary arcing contact	625	8.8 K
Oil below stationary contacts	620	-
Movable contacts	200...203, 205...208	11.3 K
Movable arcing contact	204	8.6 K
Oil below movable contacts	209	-

Table 1: Steady temperature rises of measuring points.

Maximum rated through-current of diverter switch VACUTAP® VR	Basic design variants	Number of phases	Number of sectors per phase
650 A	VRX	1	2
	VRH	1, 2 or 3	1
700 A	VRS, VRM	1, 2 or 3	1
1000 A	VRS, VRM	1, 2 or 3	1

Table 2: Diverter switches covered by this type test.

6. Test results

The requirements of IEC 60214-1:2014 "Tap-changers – Part 1: Performance requirements and test methods", sub-clause 5.2.2 "Temperature rise of contacts" were met.

All steady temperature rises of contacts were below the admissible value of 20 K.