Maschinenfabrik Reinhausen GmbH
Testcenter
Falkensteinstraße 8
93059 Regensburg

PTTP/Wag
17.07.2025

Type test report

No. VI 1E 002e

Type test for types:	On-load tap-changers VACUTAP® VI with - three phase design - star-point (Y) or delta (D) application - number of contacts: 10, 12 or 14 - highest voltage for equipment: 40 kV, 76 kV or 123 kV - maximum rated through-current: 400 A - maximum rated step voltage: 1500 V - reversing, coarse or without change-over selector
Test standards:	IEC 60214-1:2014, sub-clause 5.2.2: “Temperature rise of contacts” IEEE C57.131-2024, sub-clause 5.2.2 “Temperature rise of contacts”
Test sample:	VACUTAP® VI III 400 D – 123/76 – 14 27 1W
Manufacturer:	Maschinenfabrik Reinhausen GmbH
Date of test:	December 2024
Tests performed:	The test was performed to verify that the temperature rise above the medium surrounding each type of contact which carries through-current continuously in service does not exceed 20 K when the contacts have reached a steady temperature when carrying 1.2 times the maximum rated through-current. Test current: 1.2 * 400 A = 480 A The temperature of the surrounding medium was measured at not less than 25 mm below the contacts.
Test results:	The requirements of IEC 60214-1:2014, sub-clause 5.2.2: “Temperature rise of contacts” and IEEE C57.131-2024, sub-clause 5.2.2 “Temperature rise of contacts” were met.

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i. V. Dr. Thomas Strof
[valid without signature]

Maschinenfabrik Reinhausen GmbH
- TAP-CHANGER TESTING -

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1. General

Applicant:

Name of applicant:	Maschinenfabrik Reinhausen GmbH
Street:	Falkensteinstraße 8
Post-code – Location:	93059 – Regensburg, Germany

Place of test:

Name of laboratory:	Maschinenfabrik Reinhausen GmbH, Testcenter
Street:	Falkensteinstraße 8
Post-code – Location:	93059 – Regensburg, Germany

2. Data of test sample

Type designation:	VACUTAP® VI III 400 D – 123/76 – 14 27 1W
Type characteristics:	On-load tap-changer
Serial numbers:	2773195 (OLTC unit)
IBASE:	1009650863
Year of manufacture:	2024
Manufacturer:	Maschinenfabrik Reinhausen GmbH

3. Test specification

Test standards:	IEC 60214-1:2014, sub-clause 5.2.2: “Temperature rise of contacts” IEEE C57.131-2024, sub-clause 5.2.2 “Temperature rise of contacts”

4. Scope of application

On-load tap-changers type VACUTAP® VI are available with highest voltage for equipment Um = 40 kV, 76 kV and 123 kV in star-point (Y) application or with highest voltage for equipment Um = 40 kV, 76 kV and 123/76 kV in delta (D) application.
Further, on-load tap-changers type VACUTAP® VI are available with 10, 12 or 14 contacts as well as with change-over selector (reversing or coarse) or without change-over selector.

The design of contacts that carry current continuously in service is identical for all types of VACUTAP® VI with reversing or coarse change-over selector. Further, the contacts of the tap-selector have the same design.

Thus, the temperature rise of contacts test was exemplary carried out on a test sample with reversing change-over selector (see sub-clause 2). Variants with coarse change-over selector or without change-over selector are covered by the performed test.

The temperature rise of contacts does not depend on the highest voltage for equipment, the application of the on-load tap-changer (star-point or delta) and the number of contacts.

Therefore, this type test report is valid for on-load tap-changers type VACUTAP® VI with following characteristics:

- Number of phases: 3
- Application: star-point (Y) or delta (D)
- Number of contacts: 10, 12 or 14
- Highest voltage for equipment: 40 kV, 76 kV or 123 kV
- Maximum rated through-current: 400 A
- Maximum rated step voltage: 1500 V
- Change-over selector: without change-over selector, coarse change-over selector or reversing change-over selector

5. Test setup

Test tank content:	Clean mineral oil mixture (e.g. Nynas Nytro Taurus, Shell Diala D).
Condition of test sample:	New as manufactured.
Test conditions:	The test was performed on phase "V" of the test sample. Tested contacts were those which carry current continuously in service and are opened and closed or being moved at some instant during service life or maintenance, except bolted connections.
Measurement:	The temperature was measured by thermocouples (NiCr-Ni, type K) positioned in a manner to accurately reflect the actual contact temperature as near the point of contact as possible. The thermocouples were caulked after drilling a hole in the contact material, so that the bulk temperature of the contact and not the temperature of the interface between contact and cooling medium was measured. The temperature of the surrounding medium was measured at not less than 25 mm below the contacts.
Starting liquid temperature:	Approx. 21 °C
Test circuit:	See figure 1
Position and connection of the test sample:	See figure 1
Measuring points:	See figures 2a and 2b

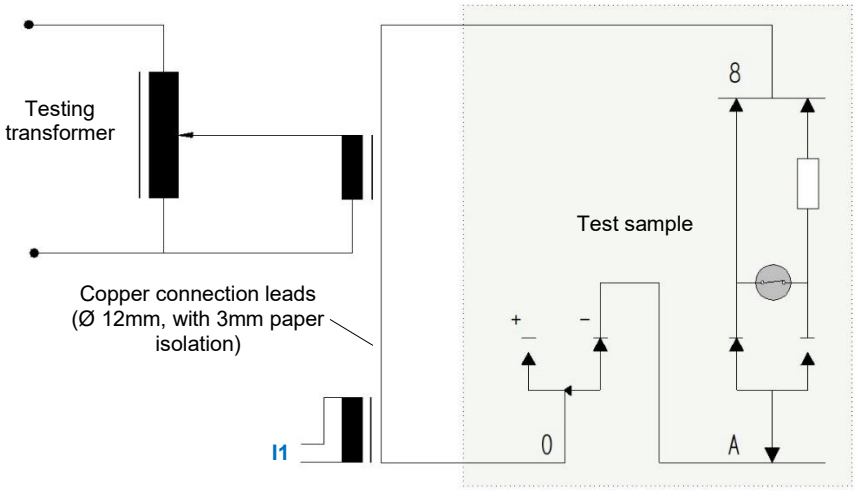

Figure 1: Test circuit (schematic sketch).

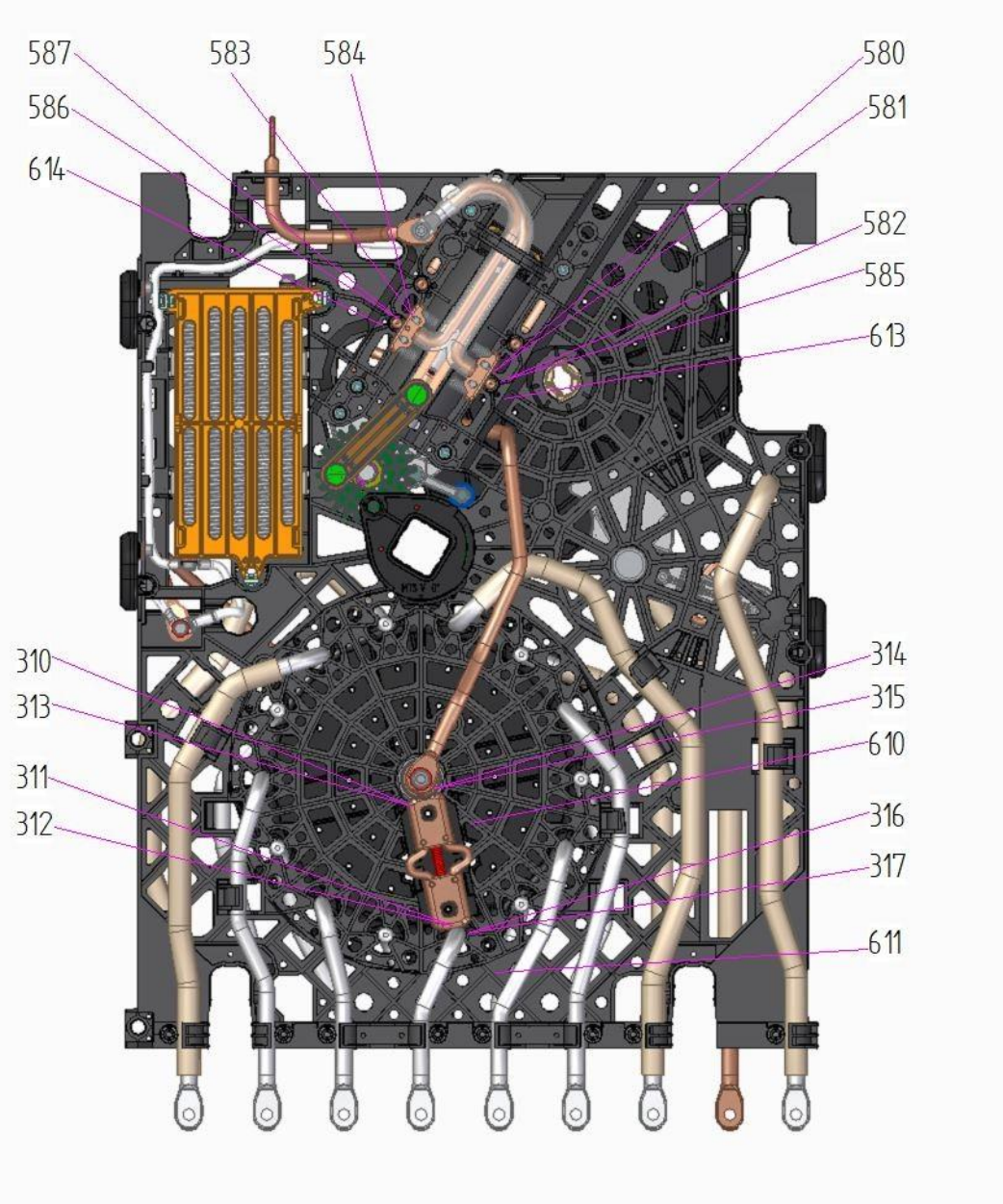

Figure 2a: Measuring points (OLTC unit, upper side).

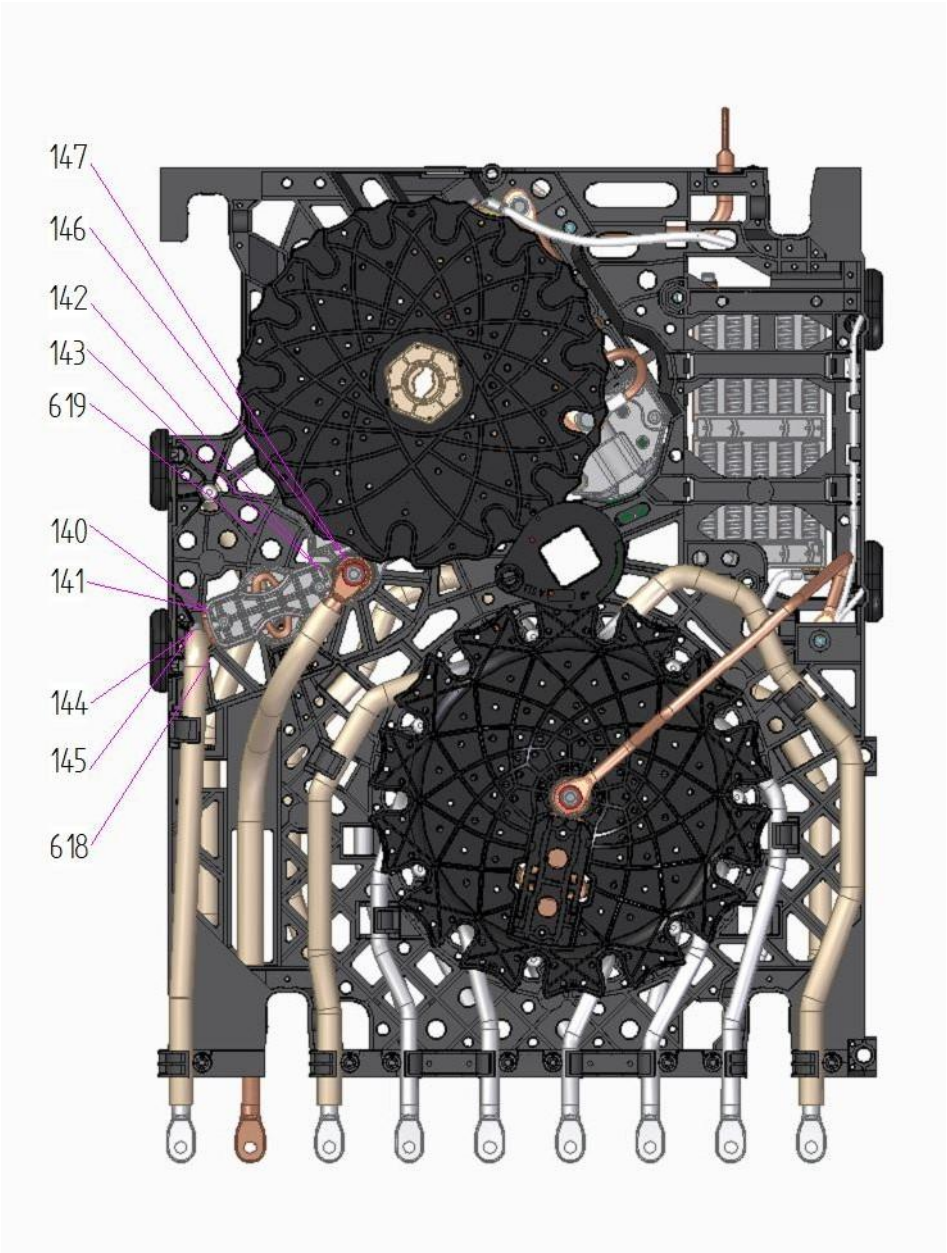

Figure 2b: Measuring points (OLTC unit, lower side).

6. Test performed

The test was performed to verify that the temperature rise above the medium surrounding of each type of contact which carries through-current continuously in service did not exceed 20 K when the contacts have reached a steady temperature when carrying 1.2 times the maximum rated through-current.

Note: The temperature condition is considered to be steady when the difference of the temperature between the contact and the surrounding medium did not change more than 1 K over an hour.

Test current: 1.2 * 400 A = 480 A

Table 1 shows the determined temperature rise of contacts. The highest temperature rise is always indicated for parallel or equivalent contacts.

Designation of contacts	Measuring points (see figs. 2a, 2b)	Temperature of reference point	Steady temperature rise
Tap selector			
Fixed MTS contact 8 (upper side)	316	-	11.3 K
Fixed MTS contact 8 (lower side)	317	-	10.4 K
Upper movable contact (MTS side)	311	-	13.9 K
Lower movable contact (MTS side)	312	-	12.4 K
Oil below contacts	611	22.2 °C	-
Current ring (upper side)	314	-	12.3 K
Current ring (lower side)	315	-	11.3 K
Upper movable contact (current ring side)	310	-	13.3 K
Lower movable contact (current ring side)	313	-	13.2 K
Oil below contacts	610	21.1 °C	-
Fixed MBS contact (upper side left)	587	-	12.3 K
Fixed MBS contact (lower side left)	586	-	10.6 K
Movable MBS contact (upper side left)	583	-	15.0 K
Movable MBS contact (lower side left)	584	-	15.0 K
Oil below contacts	614	21.2 °C	-
Fixed MBS contact (upper side right)	582	-	14.2 K
Fixed MBS contact (lower side right)	585	-	13.9 K
Movable MBS contact (upper side right)	580	-	17.3 K
Movable MBS contact (lower side right)	581	-	17.0 K
Oil below contacts	613	21.1 °C	-
Change-over selector			
Fixed contact (upper side)	144	-	18.0 K
Fixed contact (lower side)	145	-	18.2 K
Upper movable contact	140	-	13.7 K
Lower movable contact	141	-	12.7 K
Oil below contacts	618	21 °C	-
Current ring (upper side)	147	-	18.1 K
Current ring (lower side)	146	-	18.2 K
Upper movable contact (current ring side)	142	-	16.6 K
Lower movable contakt (current ring side)	143	-	17.3 K
Oil below contacts	619	20.9 °C	-

Table 1: Measurement of steady temperature rise of contacts.

7. Test results

The requirements of IEC 60214-1:2014, sub-clause 5.2.2: “Temperature rise of contacts” and IEEE C57.131-2022, sub-clause 5.2.2 “Temperature rise of contacts” were met.

The test sample withstood the test without any restrictions. The temperature rise of contacts when carrying 1.2 times the maximum rated through-current was below the maximum permissible limit of 20 K.

8. List of amendments

Version	Date	Author	Amendment
01	17.07.2025	R. Wagner	---

End of document.