Maschinenfabrik Reinhausen GmbH
Testcenter
Falkensteinstraße 8
93059 Regensburg

PTTP/Wag
17.07.2025

Type test report

No. VI 3E 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 5.2.4 “Short-circuit current test”
IEEE C57.131-2024, sub-clause 5.2.4 “Short-circuit current test”

Test sample:

VACUTAP® VI III 400 D – 123/76 – 14 27 1W

Manufacturer:

Maschinenfabrik Reinhausen GmbH

Date of test:

January 2025

Tests performed:

The test was performed on one phase, on all contacts of different design carrying current continuously in service.

Three applications were carried out with an initial peak current of 2.5 times the r.m.s. value of the rated short-circuit test current. The contacts were not moved between these applications.

	Normative requirements	Manufacturer specification (Rated values)	Nominal test values
Initial peak current	10.0 kA	12.5 kA	12.5 kA
Short-circuit current (r.m.s)	4.0 kA	5.0 kA	5.0 kA
Test duration	2 s	3 s	3 s

Test results:

The requirements of IEC 60214-1:2014, sub-clause 5.2.4: “Short-circuit current test” and IEEE C57.131-2024, sub-clause 5.2.4 “Short-circuit current test” 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:	2806672 (motor drive unit & sealing module) 2859007 (motor control unit) 2773195 (OLTC unit)
IBASE:	1009650863
Year of manufacture:	2024
Manufacturer:	Maschinenfabrik Reinhausen GmbH

3. Test specification

Test standards:	IEC 60214-1:2014, sub-clause 5.2.4 “Short-circuit current test” IEEE C57.131-2024, sub-clause 5.2.4 “Short-circuit current test”

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

Thus, the short-circuit current 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 short-circuit current capability 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).
Test conditions:	The test was performed on phase “W” on all contacts of different design carrying current continuously in service.
Condition of test sample:	Temperature rise of contacts test carried out before (phase “V”).
Test circuit:	Test circuit see figure 1a (incl. connection of the test sample).
Measurement circuit for switching sequence.	See figure 1b
Testing transformer:	4000 kVA, 20 kV.
Adjustment and measurement:	Short-circuit current was adjusted by air-core reactor and measured by Rogowski current probe. The testing current was switched by means of a time-controlled circuit breaker.

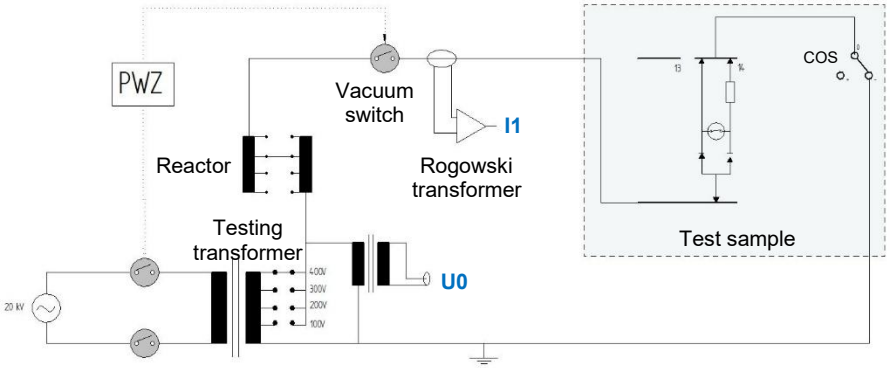

Figure 1a: Test circuit short of circuit current test (schematic sketch).

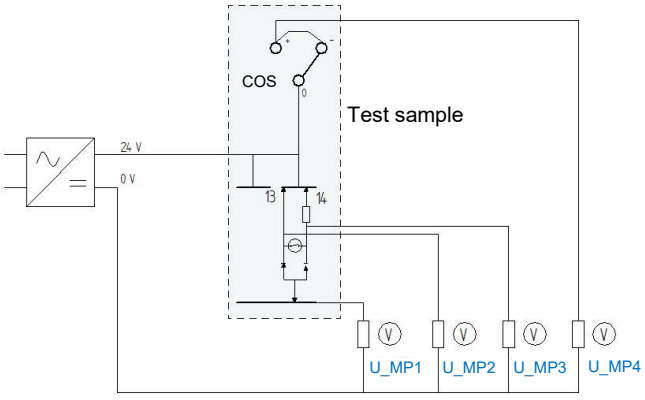

Figure 1b: Measurement circuit for switching sequence (schematic sketch).

6. Test performed

The test was performed on phase “W”. According to IEC 60214-1:2014 resp. IEEE C57.131-2024, three applications were carried out with an initial peak current of 2.5 times the r.m.s. value of the rated short-circuit test current. The contacts were not moved between these applications.

	Normative requirements	Manufacturer specification (Rated values)	Nominal test values
Initial peak current	10.0 kA	12.5 kA	12.5 kA
Short-circuit current (r.m.s)	4.0 kA	5.0 kA	5.0 kA
Test duration	2 s	3 s	3 s

Table 1 shows the tested short-circuit values. Table 2 shows the switching time measurements before and after the test and table 3 the measured initial driving torques before and after the test.

Open-circuit voltage of the testing transformer: $U0_{\text{r.m.s}} \geq 422$ V

Application no.	Peak current $I1_{\text{peak}}$ in kA	Short-time current $I1_{\text{r.m.s}}$ in kA	Short-circuit duration $t1$ in s
1	12.7	5.09	3.01
2	12.5	5.04	3.01
3	12.6	5.04	3.01

Table 1: Measurement of short circuit values.

Measurement timing of switching times	$MSV_{open} – MSV_{close}$ t_{MSV} in ms	$MTS_{open} – MTS_{close}$ t_{MTS} in ms	$COS_{open} – COS_{close}$ t_{COS} in ms	Result
Before the test	77.5	32.4	41.8	passed
After the test	77.4	32.5	40.8	

Table 2: Measurement of switching times.

Measurement timing of initial operation torque	Initial operation torque M in Nm	Result
Before the test	22.4	passed
After the test	22.6	

Table 3: Measurement of the initial driving torques.

Figures 2…4 show recordings of the performed three applications. Figures 5 and 6 show oscillograms of switching sequences and torque measurements, obtained by no load operations before and after the performed short-circuit current test.

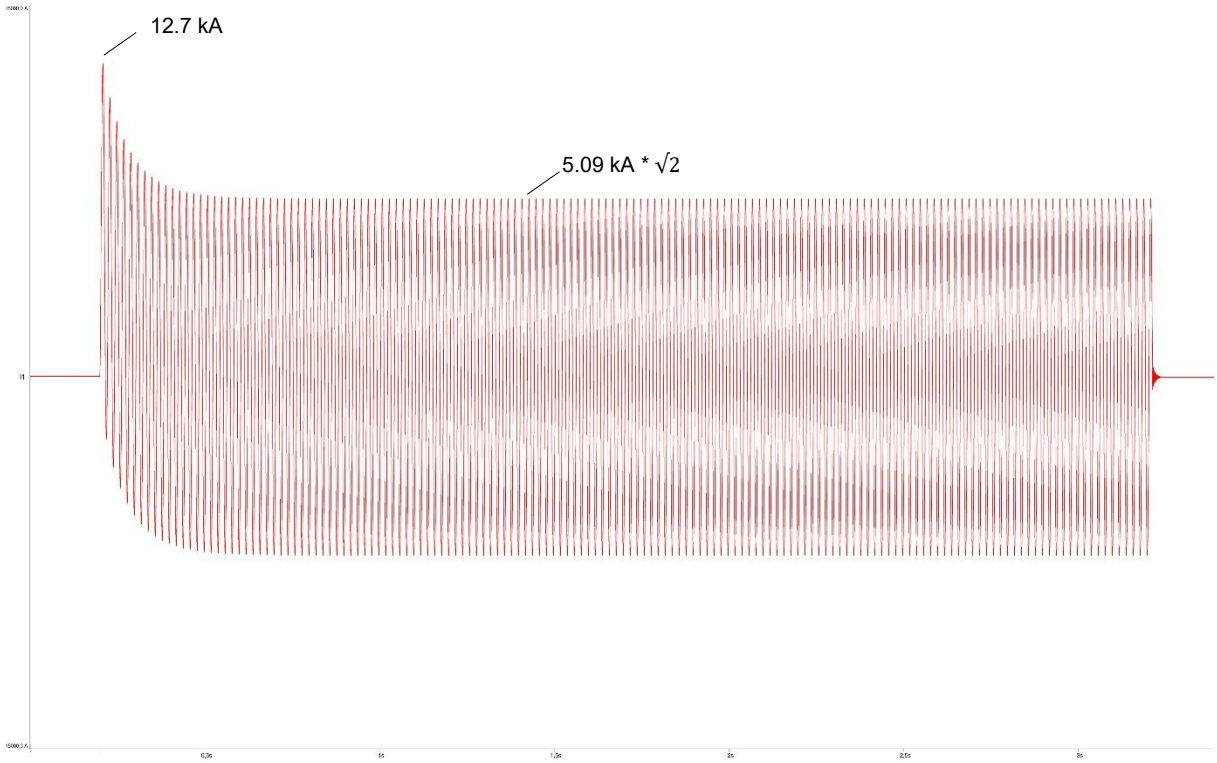

Figure 2: Recording of application no. 1.

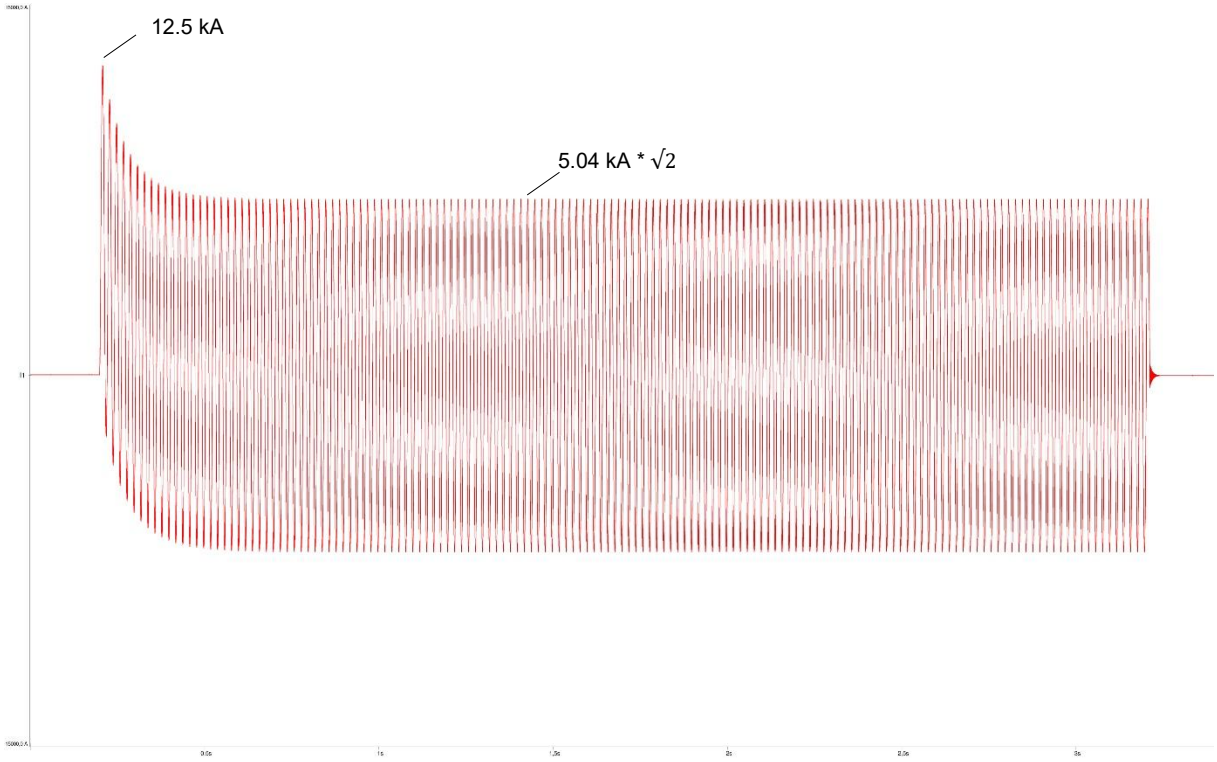

Figure 3: Recording of application no. 2.

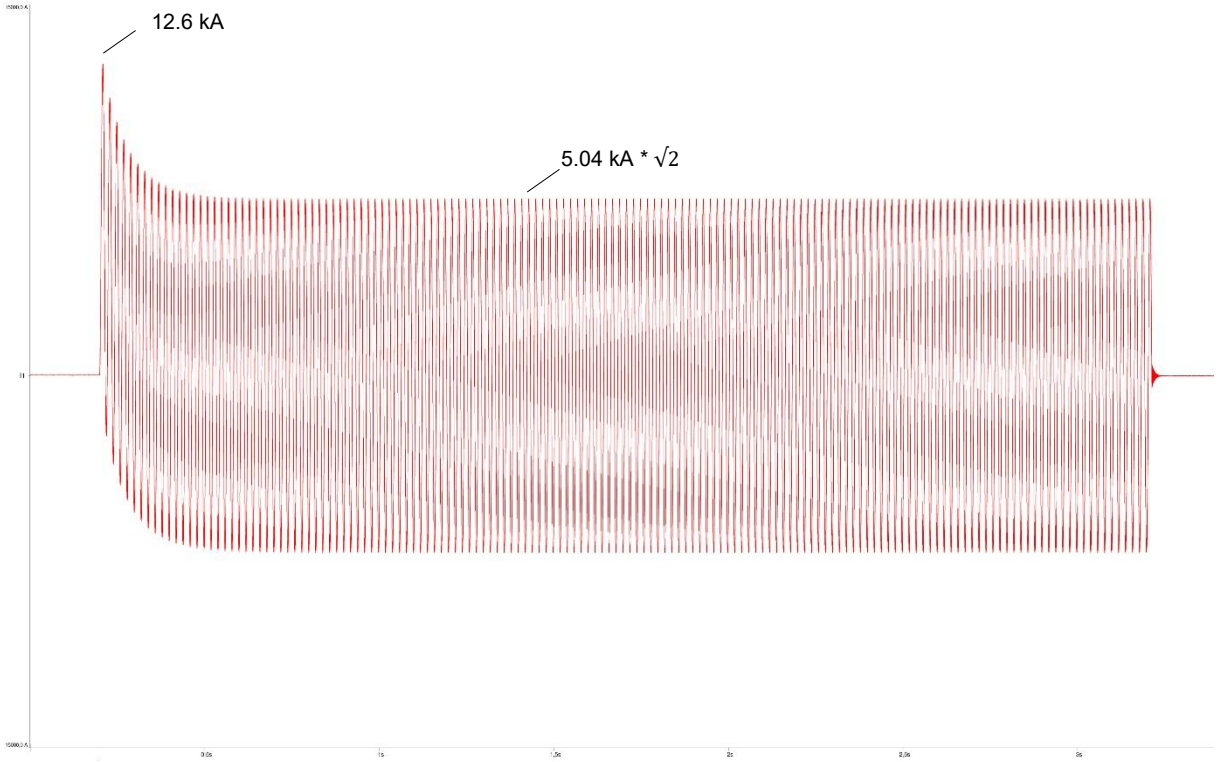

Figure 4: Recording of application no. 3.

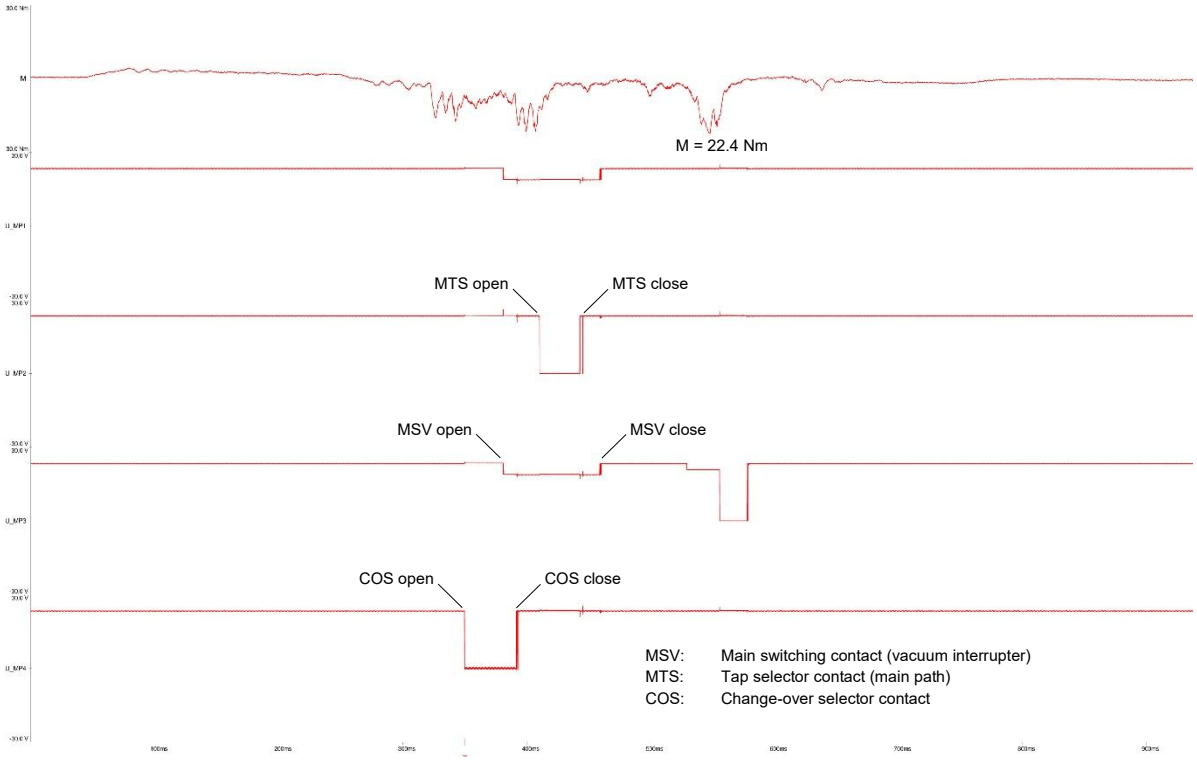

Figure 5: Recording of the switching sequence and initial driving torque before the short-circuit current test.

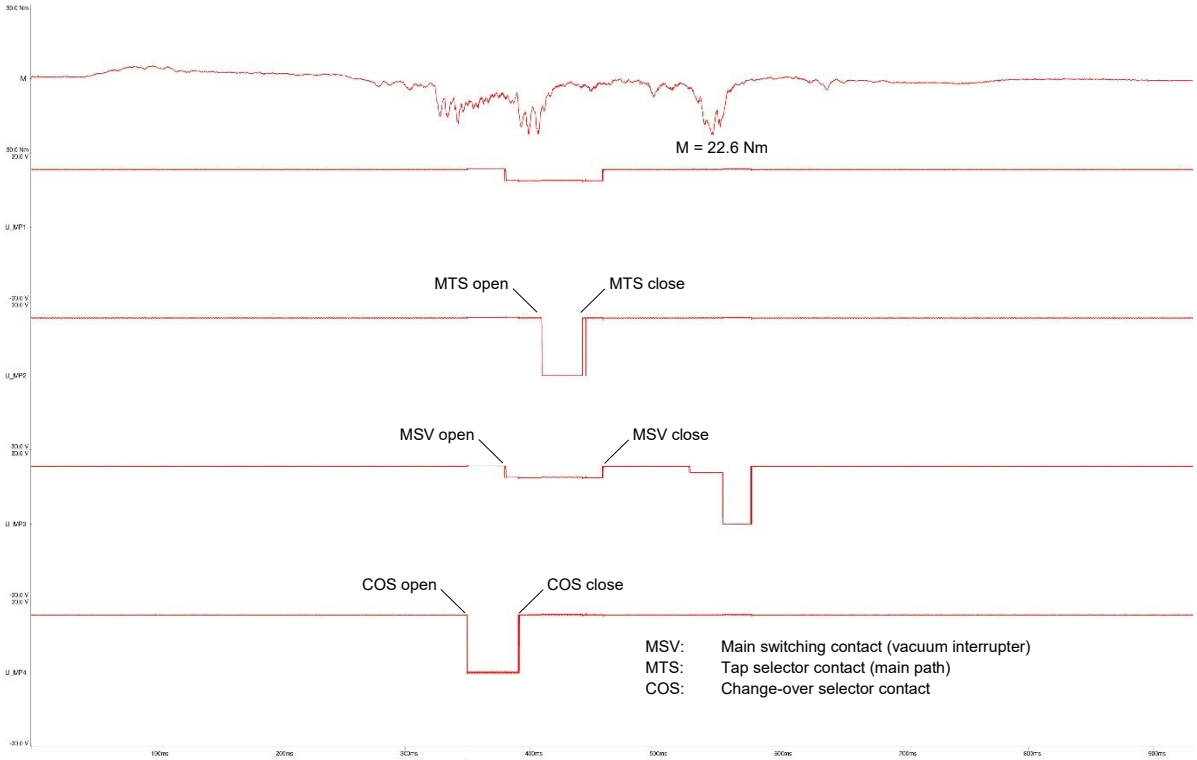

Figure 6: Recording of the switching sequence and initial driving torque after the short-circuit current test.

7. Test results

The requirements of IEC 60214-1:2014, sub-clause 5.2.4: “Short-circuit current test” and IEEE C57.131-2024, sub-clause 5.2.4 “Short-circuit current test” were met.

The test sample withstood the test without any restrictions. The recordings of the performed three applications did not show something unusual (see figures 2, 3 and 4).

At the conclusion of the test, the contacts were not damaged, so the capability of carrying the maximum rated through-current continuously was not reduced. This was proved by no load operations with recordings and measurements of switching times and the initial operation torques of the on-load tap-changer. Comparison of these recordings with those obtained before the test showed suitability for service (see figures 5 and 6 as well as tables 2 and 3).

Other current-carrying parts did show no signs of permanent mechanical distortion, which could influence the normal operation of the test sample.

8. List of amendments

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

End of document.