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RESEARCH INSTITUTE

HIGH VOLTAGE LABORATORY

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TEST REPORT

No. EWN.4032.067.2023.EN1

Test object	Fire extinguisher type MBK17-060PA-VR
Manufacturer	MOBIAK S.A. Akrotiri Chania Crete P.C.73100
Customer	MOBIAK S.A. Akrotiri Chania Crete P.C.73100
Number and Date of the order	from 26.04.2023
Type of test	Power-frequency 50 Hz withstand voltage test
Date of receipt of the test object	09.05.2023
Test date	11.05.2023
Test location	High Voltage Laboratory IEN
Test report issue date	02.06.2023
Test result	Presented in point 5 Test result applies only to the tested object.

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Signature

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Signature

TABLE OF CONTENTS

1 COMPETENCE OF THE LABORATORY 3

2 TEST OBJECT DESCRIPTION 4

3 TESTING PROCEDURE 5

3.1 POWDER TEST IN ACCORDANCE WITH P. 11 OF THE INTERNATIONAL STANDARD ISO 7202: 2018 5

3.2 TEST OF ELECTRICAL PROPERTIES FOR A FLASHOVER IN A SPRAY CLOUD OF EXTINGUISHING POWDER 5

3.3 LEAKAGE CURRENT MEASUREMENT IN A CLOUD OF EXTINGUISHING POWDER 6

4 TEST SYSTEM 6

5 TEST RESULT 7

5.1 POWDER TEST IN ACCORDANCE WITH P. 11 OF THE INTERNATIONAL STANDARD ISO 7202: 2018 7

5.2 TEST OF ELECTRICAL PROPERTIES FOR A FLASHOVER IN A SPRAY CLOUD OF EXTINGUISHING POWDER 7

5.3 LEAKAGE CURRENT MEASUREMENT IN A CLOUD OF EXTINGUISHING POWDER 8

6 CONCLUSIONS 8

Test report contains:

8 numbered pages;

1 numbered figure;

1 numbered photograph;

3 numbered tables.

Attached to the report:

Annex 1: Technical drawings (21 pages);

Annex 2: Powder certificate (9 pages).

1 COMPETENCE OF THE LABORATORY

High Voltage Laboratory is in possession of accreditation issued by the Polish Centre for Accreditation (Accreditation Certificate of Testing Laboratory No AB 272) in scope of following tests:

Insulators and insulator strings	• lightning and switching impulse tests • power-frequency voltage 50 Hz tests • radio interference and partial discharges measurements • tracking and erosion test – salt fog method • mechanical test – tensile and bending • thermal-mechanical test – tensile and bending
Distribution substations	• lightning and switching impulse tests • power-frequency voltage 50 Hz tests • radio interference and partial discharges measurements
Circuit breakers, switches	• lightning and switching impulse tests • power-frequency voltage 50 Hz tests • radio interference and partial discharges measurements
Disconnectors	• lightning and switching impulse tests • power-frequency voltage 50 Hz tests • radio interference and partial discharges measurements
Current and voltage transformers	• lightning and switching impulse tests • power-frequency voltage 50 Hz tests • radio interference and partial discharges measurements
Power transformers	• lightning and switching impulse tests • power-frequency voltage 50 Hz tests
Lightning arresters and limiters	• lightning and switching impulse tests • power-frequency voltage 50 Hz tests • radio interference and partial discharges measurements • tracking and erosion test – salt fog method
Cables and cable fittings	• lightning and switching impulse tests • power-frequency voltage 50 Hz tests
Line and station fittings	• radio interference and partial discharges measurements
Personal protective equipment	• industrial frequency voltage 50 Hz tests

Full scope of High Voltage Laboratory accreditation available at http://www.pca.gov.pl

2 TEST OBJECT DESCRIPTION

At the request of MOBIAK S.A. of April 26, 2023, tests were carried out at the High Voltage Laboratory of the Institute of Power Engineering on the extinguisher type MBK17-060PA-VR (Photo 1), containing the ZX PD standard N extinguishing powder. The test object was provided by the customer ready for testing.

Phot. 1: Powder extinguisher type MBK17-060PA-VR

The purpose of the test was to determine whether the fire extinguisher mentioned above, can be used to extinguish power devices and equipment with a rated operating voltages of up to 400 kV.

In Poland, there are no standards for testing the electrical properties of fire extinguishing devices for voltages above 1 kV; it was necessary to develop a test procedure that would take into account the specify of hazards associated with the presence of high voltage. Its development was based on international standards, as well as on own experience gained while performing similar tests carried out in the High Voltage Laboratory.

3 TESTING PROCEDURE

The basic hazards can occur when extinguishing energized electrical devices. Are the possibility of a electrical flashover between the live electrical device and the person operating the fire extinguisher (extinguishing nozzle), and the flow of current (leakage current) between this electrical device and the person operating the fire extinguisher, through a cloud of sprayed powder. In order to increase the certainty of the measurement, several voltage tests were performed. Taking into account the listed hazards, the following test program has been established.

3.1 Powder test in accordance with p. 11 of the international standard ISO 7202: 2018

Preliminary tests allowing the powder to extinguish live electrical equipment.

3.2 Test of electrical properties for a flashover in a spray cloud of extinguishing powder

This test determines whether a cloud of sprayed extinguishing powder does not reduce the electrical insulating properties of the air gap between the fire extinguisher nozzle and the object. Reducing this insulating properties may cause the risk of flashover and, as a result, electrocution of the person extinguishing the fire.

The following test conditions were established:

- distance between the electrode and the fire extinguisher nozzle d = 267 cm
- test voltage Up = 610 kV ±11 kV (k = 2, p = 95%) (this is the value of the test voltage of the safe distance for devices with the highest operating voltage up to and including 400 kV, specified in the standards).

The test carried out for a higher test voltage level imposes stricter requirements, therefore it is assumed that a positive test result for higher voltage levels (e.g. 400 kV) will also meet the requirements for lower test voltage levels (e.g. 1 kV, 36 kV, 123 kV and 220 kV).

3.3 Leakage current measurement in a cloud of extinguishing powder

This measurement determines whether the person putting out the fire will not be exposed to electric shock and other negative effects during the firefighting operation as a result of the current flow from the live extinguished object (being under voltage) through the cloud of sprayed extinguishing powder and the operator to the ground. The maximum value of this current was determined based on p.9.2 of the PN-EN 3-7+A1:2008 standard.

The following test conditions were established:

- distance between the electrode and the extinguisher nozzle d = 4 m;
- test voltage Up = 610 kV ± 11 kV (k = 2, p = 95%);
- the maximum value of the leakage current Imax = 0.5 mA.

4 TEST SYSTEM

A simplified diagram of the test system is shown in figure 1. A description of the test system is given in table 1.

Tab. 1: Test system description

Equipment	Manufacturer	Type	Number
Transformer	Zwar	TP 1000	EWNL 0012
Voltmeter	Haefely	Type 51	EWNL 0014
Voltage divider	Zwar	DUC 1000	EWNL 0012

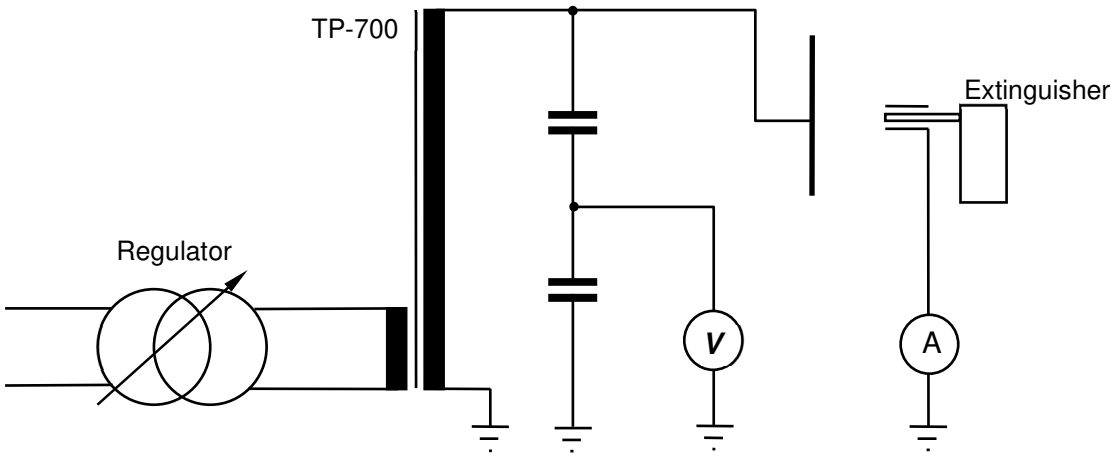

Fig. 1: Simplified diagram of the AC voltage measurement system

5 TEST RESULT

5.1 Powder test in accordance with p. 11 of the international standard ISO 7202: 2018

In 10 tests, the following flashover voltages of the extinguishing powder layer were obtained:

Tab. 2: Test result for ZX PD standard N powder

Extinguishing powder type ZX PD standard N	
Test No.	Flashover voltage [kV]
1	7,4
2	6,8
3	6,9
4	7,0
5	6,7
6	6,8
7	6,8
8	6,9
9	6,7
10	7,1
Average:	6,9

All obtained flashover voltage values exceed 5 kV, it means that they meet the requirements of ISO 7202: 2018 (Fire protection - Fire extinguishing media - Powder).

5.2 Test of electrical properties for a flashover in a spray cloud of extinguishing powder

During the tests for the highest voltage of 400 kV (d = 267 cm, Up = 610 kV), there were no flash-overs between the test plate - fire extinguisher nozzle system, therefore the requirement from the point 3.2 has been fulfilled.

TEST RESULT: POSITIVE

5.3 Leakage current measurement in a cloud of extinguishing powder

In all tests, the value of the leakage current did not exceed 500 μA, the requirement from point 3.3 has been fulfilled.

TEST RESULT: POSITIVE

6 CONCLUSIONS

Based on the carried out tests, it is concluded that: MBK17-060PA-VR powder extinguishers filled with ZX PD standard N extinguishing powder can be used to extinguish fires of electrical equipment with the highest operating voltage up to and including 400 kV, which are energized.
When extinguishing, it is absolutely necessary to keep the distance between fire extinguisher nozzle and extinguished object according to the following table:

Tab. 3: Allowed safe distances

Rated device voltage	Minimum safe distance between fire extinguisher nozzle and extinguished object
From 1 to 6 kV inclusive	1,12 meters
over 6 to 10 kV inclusive	1,15 meters
over 10 to 15 kV inclusive	1,16 meters
over 15 to 20 kV inclusive	1,22 meters
over 20 to 30 kV inclusive	1,32 meters
over 30 to 110 kV inclusive	2,00 meters
over 110 to 220 kV inclusive	3,00 meters
over 220 to 400 kV inclusive	4,00 meters

These distances should be understood in such a way that no part of the extinguishing person's body or any part of the extinguishing device (especially the extinguisher nozzle, etc.) may be closer to the extinguished object than the above-mentioned. The distances have been determined on the basis of the Regulation of the Polish Minister of Energy of august 28, 2019 - on occupational health and safety at energy equipment and installations, Journal of Laws of the Republic of Poland of April 23, 2013, item 492.

End of the report