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ASSOCIATION of POLISH ELECTRICIANS
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TESTING LABORATORY

AB 044

TEST REPORT
PN-EN 60529
Degrees of protection provided by enclosures (IP code)

Report Reference No. ..... :	LS-23.009/E
Date of issue ..... :	2023-04-13
Total number of pages ..... :	17
Tested by (name + position + signature) ..... :	Józef Stańczuk (specialist)
Authorized by (name + position + signature) ..... :	Jarosław Jesień (senior specialist)
Testing application number ..... :	B-S-23-009
Test item reference ..... :	B-S-23-009
Scope of test ..... :	☒ - type test ☐ - partial test ☐ - other test
Test specification:	
Standard/procedure ..... :	PN-EN 60529:2003+A2:2014-07
Non-standard test methods ..... :	N/A
Non-accredited test methods ..... :	N/A
Applicant's name ..... :	KRADEX Sp. z o.o.
Address ..... :	ul. Minerska 4, 04-506 Warszawa, Polska
Test item description ..... :	Surface-mounted enclosure
Trade Mark ..... :	KradeX
Manufacturer ..... :	KRADEX Sp. z o.o. ul. Minerska 4, 04-506 Warszawa, Polska
Model/Type reference ..... :	ZP105.105.75
Ratings ..... :	IP65

List of Attachments: *Annex A: Photographs (3 pages)*	
Summary of testing	
Tests performed (in the case of partial tests): Type tests for IP65 protection degree.	**Testing location / address:** Association of Polish Electricians Quality Testing Office Testing Laboratory Division of Installation Materials, Electronic Equipment and Lighting Equipment ul. M. Pożaryskiego 28; 04-703 Warszawa
Number of tests with F(Fail) verdict:	0
Summary conformity/non-conformity with standardization document (if apply):	The product fulfils the requirements of PN-EN 60529:2003+A2:2014-07 for IP65 protection degree
Summary of compliance with National Differences (if apply): Provide list of standards.	N/A
Opinions and interpretation, if needed:	N/A
Other additional information (e.g. additional information from the client, including information that may affect the validity of the results):	Tested enclosures were empty and were mounted on the wall. According to the Client order, the torque for the screws was 0,6 Nm. Sample for IP6X protection degree test was prepared by the Client with one additional hole for mounting the cable gland for the under pressure hose.

Use of uncertainty of measurement for decisions on conformity (decision rule):

☒ *No decision rule is specified by the standard, when comparing the measurement result with the applicable limit according to the specification in that standard. The decisions on conformity are made without applying the measurement uncertainty ("simple acceptance" decision rule, previously known as "accuracy method").*

☐ Other: …

Information on uncertainty of measurement:

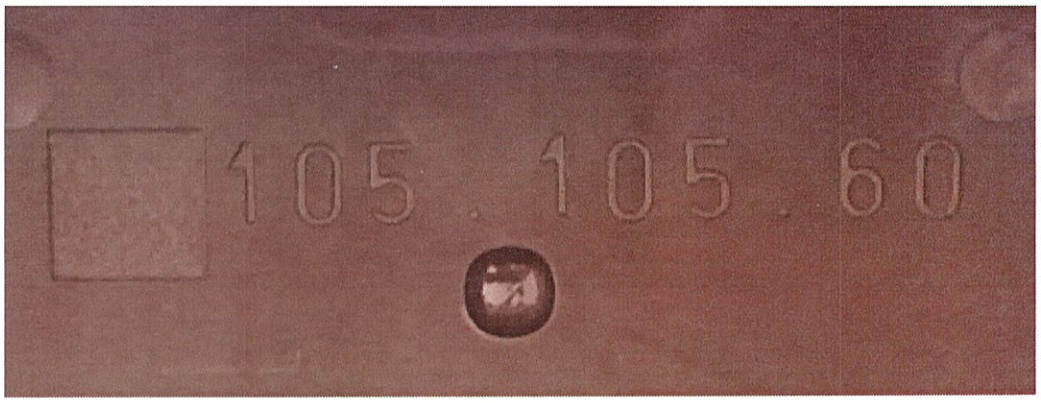
The uncertainties of measurement are calculated by the laboratory based on application of criteria given by IECEE OD-5014 for test equipment and application of test methods, decision sheets and operational procedures.

IEC Guide 115 or ILAC-G8 provides guidance on the application of measurement uncertainty principles and applying the decision rule when reporting test results within testing / certification scheme, noting that the reporting of the measurement uncertainty for measurements is not necessary unless required by the test standard or customer.

Calculations leading to the reported values are on file with the NCB and/or Testing Laboratory that conducted the testing.

Copy of marking plate:

The artwork below may be only a draft. The use of certification marks on a product must be authorized by SEP-BBJ Certification Body that own these marks.



Marking of the body of the enclosure

Test item particulars:
Date (s) of receipt of test item ..... : 2023-03-06
Tests start date ..... : 2023-04-05
Tests end date ..... : 2023-04-12
Possible test case verdicts:
- test case does not apply to the test object ..... : **N/A (Not Applicable)**
- test object does meet the requirement ..... : **P (Pass)**
- test object does not meet the requirement ..... : **F (Fail)**
Test report general remarks:
1. The test results presented in this report relate only to the object tested.
This report shall not be reproduced, except in full, without the written approval of SEP-BBJ Testing Laboratory.
2. "(See Enclosure #)" refers to additional information appended to the report.
3. "(See appended table)" refers to a table appended to the report.
4. Throughout this report a comma is used as the decimal separator.
5. Test Report Form is based on TRF No.: IEC 60529_A_2006, copyrighted by IECEE
Production place(s) .....:
KRADEX II Robert Radzikowski
ul. Naddnieprzańska 34, 04-205 Warszawa
General product information:
Surface-mounted enclosure. Tested samples: ZP105.105.75 – 2 samples. Sample for IP6X protection degree was prepared by the Client - in the enclosure was made one additional hole for mounting the cable gland for the under pressure hose.

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Clause	Requirement + Test	Result - Remark	Verdict

11	**GENERAL REQUIREMENTS FOR TESTS**		P
11.1	**Atmospheric conditions for water or dust tests**		---
	Unless otherwise specified in the relevant product standard, the tests should be carried out under the standard atmospheric conditions described in IEC 68-1.		P
	The recommended atmospheric conditions during the tests are as follows		---
	Temperature range: 15 to 35 °C Relative humidity: 25 to 75% Air pressure: 86 to 106 kPa (860 to 1060 mbar)	(21 ÷ 22) °C (30 ÷ 35) % 101 kPa	P
11.2	The tests specified in this standard are type tests.		P
	Unless otherwise specified in a relevant product standard, the test samples for each test shall be in a clean and new condition, with all parts in place and mounted in the manner stated by the manufacturer.	Tested samples were empty	P
	If it is impracticable to test the complete equipment, representative parts or smaller equipment having the same full-scale design details shall be tested		N/A
	The relevant product standard shall specify details such as:		P
	the number of samples to be tested;	2	P
	the conditions for mounting, assembling and positioning of the samples, for example by the use of an artificial surface (ceiling, floor or wall);	On the wall, vertical	P
	the pre-conditioning, if any, which is to be used;		N/A
	whether to be tested energized or not;		N/A
	whether to be tested with its parts in motion or not.		N/A
	In the absence of such specification, the manufacturer's instructions shall apply.		P
11.3	**Application of test requirements and interpretation of test results**		---
	The application of the general requirements for tests and the acceptance conditions for equipment containing drain-holes or ventilation openings is the responsibility of the relevant Technical Committee.		N/A
	In the absence of such specification the requirement of this standard shall apply.		P
	The interpretation of test results is the responsibility of the relevant Technical Committee. In the absence of a specification the acceptance of a specification the acceptance conditions of this standard shall at least apply		P

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Clause	Requirement + Test	Result - Remark	Verdict

11.4	**Combination of test conditions for the first characteristic numeral**		---
	Designation with a first characteristic numeral implies that all test conditions are met for this numeral:		P
	Tab. 6 **Test conditions for degrees of protection indicated by the first characteristic numeral**		---

First characteristic numeral	Test for protection against		
	access to hazardous parts	solid foreign objects	
0	*No test required*	*No test required*	N/A
1	*The sphere of 50 mm Ø shall not fully penetrate and adequate clearance shall be kept*		N/A
2	*The jointed test finger may penetrate up to its 80 mm length, but adequate clearance shall be kept*	*The sphere of 12,5 mm Ø shall not fully penetrate*	N/A
3	*The test rod of 2,5 mm Ø shall not penetrate and adequate clearance shall be kept*		N/A
4	*The test wire of 1,0 mm Ø shall not penetrate and adequate clearance shall be kept*		N/A
5	*The test wire of 1,0 mm Ø shall not penetrate and adequate clearance shall be kept*	*Dust-protected*	N/A
6	*The test wire of 1,0 mm Ø shall not penetrate and adequate clearance shall be kept*	*Dust-tight*	P

11.5	**Empty enclosures**		---
	If the enclosure is tested without equipment inside, detailed requirements shall be indicated by the enclosure manufacturer in his instructions for the arrangement and spacing of hazardous parts or parts which might be affected by the penetration of foreign objects or water.		P
	The manufacturer of the final assembly shall ensure that after the electrical equipment is enclosed the enclosure meets the declared degree of protection of the final product.		P

12	**TESTS FOR PROTECTION AGAINST ACCESS TO HAZARDOUS PARTS INDICATED BY THE FIRST CHARACTERISTIC NUMERAL**		P
12.1	**Access probes**		---
	Access probes to test the protection of persons against access to hazardous parts are given in Tab. 6.		P
12.2	**Test conditions**		---
	The access probe is pushed against or (in case of the test for first characteristic numeral 2) inserted through any openings of the enclosure with the force specified in Tab. 6.		P

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Clause	Requirement + Test	Result - Remark	Verdict
	For tests on low-voltage equipment, a low-voltage supply (of not less than 40 V and not more than 50 V) in series with a suitable lamp should be connected between the probe and the hazardous parts inside the enclosure. Hazardous live parts covered only with varnish or paint, or protected by oxidation or by a similar process, are covered by a metal foil electrically connected to those parts which are normally live in operation.	Empty enclosure	N/A
	The signal-circuit method should also be applied to the hazardous moving parts of high-voltage equipment.		N/A
	Internal moving parts may be operated slowly, where this is possibile.		N/A
12.3	**Acceptance conditions**		---
	The protection is satisfactory if adequate clearance is kept between the access probe and hazardous parts.		P
	For the test of first characteristic numeral 1, the access probe 50 mm diameter shall not completely pass through the opening.		N/A
	For the test of first characteristic numeral 2, the jointed test finger may penetrate to its 80 mm length, but the stop face (Ø 50 ´ 20 mm) shall not pass through the opening. Starting from the straight position, both joints of the test finger shall be successively bent through an angle of up to 90° with respect to the axis of the adjoining section of the finger and shall be placed in every possible position.		N/A
	See Annex A for further clarification. Adequate clearance means		P
12.3.1	**For low-voltage equipment** (rated voltages not exceeding 1000 V a.c. and 1500 V d.c.)		---
	The access probe shall not touch hazardous live parts.	Empty enclosure	N/A
	If adequate clearance is verified by a signal circuit between the probe and hazardous parts, the lamp shall not light.	Empty enclosure	N/A
12.3.2	**For high-voltage equipment** (rated voltages exceeding 1000 V a.c. and 1500 V d.c.)		---
	When the access probe is placed in the most unfavourable position(s), the equipment shall be capable of withstanding the dielectric tests as specified in the relevant product standard applicable to the equipment.		N/A
	Verification may be made either by dielectric test or by inspection of the specified clearance dimension in air which would ensure that the tests would be satisfactory under the most unfavourable electric field configuration (see IEC 71-2).		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	In the case where an enclosure includes sections at different voltage levels the appropriate acceptance conditions for adequate clearance shall be applied for each section.		N/A
12.3.3	**For equipment with hazardous mechanical parts**		---
	The access probe shall not touch hazardous mechanical parts.		N/A
	If adequate clearance is verified by a signal circuit between the probe and hazardous parts, the lamp shall not light.		N/A

13	**TESTS FOR PROTECTION AGAINST SOLID FOREIGN OBJECTS INDICATED BY THE FIRST CHARACTERISTIC NUMERAL**				P
13.1	**Test means**				---
	Test means and the main test conditions are given in Tab. 7.				P
	Tab. 7 **Test means for the tests for protection against solid foreign objects**				---
	First characteristic numeral	**Test means**	**Test force**	**Test conditions**	---
	0	*No test required*	—	—	N/A
	1	*Rigid sphere without handle or guard 50 mm diameter*	50 N ± 10%	13.2	N/A
	2	*Rigid sphere without handle or guard 12,5 mm diameter*	30 N ± 10%	13.2	N/A
	3	*Rigid steel rod2,5 mm diameter with edges free from burrs*	3 N ± 10%	13.2	N/A
	4	*Rigid steel wire 1 mm diameter with edges free from burrs*	1 N ± 10%	13.2	N/A
	5	*Dust chamber Fig. 2, with or without underpressure*	—	13.4 and 13.5	N/A
	6	*Dust chamber Fig. 2, with underpressure*	—	13.4 and 13.6	P
13.2	**Test conditions for first characteristic numerals 1, 2, 3, 4**				---
	The object probe is pushed against any openings of the enclosure with the force specified in Tab. 7.				N/A
13.3	**Acceptance conditions for first characteristic numerals 1, 2, 3, 4**				---
	The protection is satisfactory if the full diameter of the probe specified in Table 7 does not pass through any opening.				N/A
13.4	**Dust test for first characteristic numerals 5 and 6**				---

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Clause	Requirement + Test	Result - Remark	Verdict
	The test is made using a dust chamber incorporating the basic principles shown in Fig. 2 whereby the powder circulation pump may be replaced by other means suitable to maintain the talcum powder in suspension in a closed test chamber. The talcum powder used shall be able to pass through a square-meshed sieve the nominal wire diameter of which is 50 mm and the nominal width of a gap between wires 75 mm. The amount of talcum powder to be used is 2 kg per cubic metre of the test chamber volume. It shall not have been used for more than 20 tests.		P
	Enclosures are of necessity in one of two categories:		---
	Category 1: Enclosures where the normal working cycle of the equipment causes reductions in air pressure within the enclosure below that of the surrounding air, e.g., due to thermal cycling effects.		P
	Category 2: Enclosures where no pressure difference relative to the surrounding air is present		N/A
	Category 1 enclosures:		---
	The enclosure under test is supported inside the test chamber and the pressure inside the enclosure is maintained below the surrounding atmospheric pressure by a vacuum pump.		P
	The suction connection shall be made to a hole specially provided for this test.		P
	If not otherwise specified in the relevant product standard, this hole shall be in the vicinity of the vulnerable parts.		P
	If it is impracticable to make a special hole, the suction connection shall be made to the cable inlet hole.		N/A
	If there are other holes (e.g., more cable inlet holes or drain-holes) these shall be treated as intended for normal use on site.		N/A
	The object of the test is to draw into the enclosure, by means of depression, a volume of air 80 times the volume of the sample enclosure tested without exceeding the extraction rate of 60 volumes per hour.	80 x 0,575 dm^3 = 46 dm^3	P
	In no event shall the depression exceed 2 kPa (20 mbar) on the manometer shown in Fig. 2.	Max 11mbar	P
	If an extraction rate of 40 to 60 volumes per hour is obtained the duration of the test is 2 h.		N/A
	If, with a maximum depression of 2 kPa (20 mbar), the extraction rate is less than 40 volumes per hour, the test is continued until 80 volumes have been drawn through, or a period of 8 h has elapsed.	4h	P

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Clause	Requirement + Test	Result - Remark	Verdict
	or a period of 8 h has elapsed.		N/A
	Category 2 enclosures:		---
	The enclosure under test is supported in its normal operating position inside the test chamber, but is not connected to a vacuum pump.		N/A
	Any drain-hole normally open shall be left open for the duration of the test.		N/A
	The test shall be continued for a period of 8		N/A
	Category 1 and category 2 enclosures:		---
	If it is impracticable to test the complete enclosure in the test chamber, one of the following procedures shall be applied:		N/A
	testing of individually enclosed sections of the enclosure;.		N/A
	testing of representative parts of the enclosure, comprising components such as doors, ventilation openings, joints, shaft seals, etc., in position during test;		N/A
	testing of a smaller enclosure having the same full-scale design details.		N/A
	In the last two cases, the volume of air to be drawn through the enclosure under test shall be the same as for the whole enclosure in full scale		N/A
13.5	**Special conditions for first characteristic numeral 5**		---
13.5.1	**Test conditions for first characteristic numeral 5**		---
	The enclosure shall be deemed category 1 unless the relevant product standard for the equipment specifies that the enclosure is category 2.		N/A
13.5.2	**Acceptance conditions for first characteristic numeral 5**		---
	The protection is satisfactory if, on inspection, talcum powder has not accumulated in a quantity or location such that, as with any other kind of dust, it could interfere with the correct operation of the equipment or impair safety.		N/A
	Except for special cases to be clearly specified in the relevant product standard, no dust shall deposit where it could lead to tracking along the creepage distances.		N/A
13.6	**Special conditions for first characteristic numeral 6**		---
13.6.1	**Test conditions for first characteristic numeral 6**		---
	The enclosure shall be deemed category 1, whether reductions in pressure below the atmospheric pressure are present or not.		P
13.6.2	**Acceptance conditions for first characteristic numeral 6**		---

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Clause	Requirement + Test	Result - Remark	Verdict

	The protection is satisfactory if no deposit of dust is observable inside the enclosure at the end of the test.	no signs of dust inside the enclosure	P

14	**TESTS FOR PROTECTION AGAINST WATER INDICATED BY THE SECOND CHARACTERISTIC NUMERAL**					P
14.1	**Test means**					---
	The test means and the main test conditions are given in Tab. 8.					P
	Tab. 8 **Test means and main test conditions for the tests for protection against water**					---
	Second charact. numeral	**Test means**	**Water flow rate**	**Duration of test**	**Test conditions**	P
	0	*No test required*	—	—	—	N/A
	1	*Drip box Fig.3 Enclosure on turntable*	1 mm/min	10 min	14.2.1	N/A
	2	*Drip box Fig.3 Enclosure in 4 fixed positions of 15° tilt*	3 mm/min	2,5 min for each position of tilt	14.2.2	N/A
	3	*Oscillating tube Fig. 4 Spray ± 60° from vertical, distance max. 200 mm or Spray nozzle Fig. 5 Spray ± 60° from vertical*	0,07 l /min ± 5% *per hole, multiplied by number of holes* 10 l /min ± 5%	10 min 1 min/m² *at least 5 min*	14.2.3 a) 14.2.3 b)	N/A
	4	*As for numeral 3 Spray ± 180° from vertical*	*As for numeral 3*		14.2.4	N/A
	5	*Water jet hose nozzle Fig. 6 Nozzle 6,3 mm diameter, distance 2,5□m to 3 m*	12,5 l /min ± 5%	1 min/m² *at least 3 min*	14.2.5	P
	6	*Water jet hose nozzle Fig. 6 Nozzle 12,5 mm diameter, distance 2,5 m to 3 m*	100 l /min ± 5%	1 min/m² *at least 3 min*	14.2.6	N/A
	7	*Immersion tank Water-level on enclosure: 0,15 m above top 1 m above bottom*	—	30 min	14.2.7	N/A
	8	*Immersion tank Water-level: by agreement*	—	*by agreement*	14.2.8	N/A
14.2	**Test conditions**					---
	Test means and main test conditions are given in Tab. 8.					P
	Details concerning compliance of degrees of protection – in particular for second characteristic numerals 5/6 (water jets) and numerals 7/8 (immersion) – are given in Clause 6.					P
	The tests are conducted with fresh water.					P

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Clause	Requirement + Test	Result - Remark	Verdict
	During the tests for IPX1 to IPX6 the water temperature should not differ by more than 5 K from the temperature of the specimen under test.	4 K	P
	If the water temperature is more than 5 K below the temperature of the specimen a pressure balance shall be provided for the enclosure.		N/A
	For IPX7 details of the water temperature are given in 14.2.7.		N/A
	During the test, the moisture contained inside the enclosure may partly condense. The dew which may thus deposit shall not be mistaken for an ingress of water.		P
	For the purpose of the tests, the surface area of the enclosure is calculated with a tolerance of 10%.		P
	Adequate safety precautions should be taken when testing the equipment in the energized condition		N/A
14.2.1	**Test for second characteristic numeral 1 with the drip box**		N/A
14.2.2	**Test for second characteristic numeral 2 with the drip box**		N/A
14.2.3	**Test for second characteristic numeral 3 with oscillating tube or spray nozzle**		N/A
14.2.4	**Test for second characteristic numeral 4 with oscillating tube or spray nozzle**		N/A
14.2.5	**Test for second characteristic numeral 5 with the 6,3 mm nozzle**		---
	The test is made by spraying the enclosure from all practicable directions with a stream of water from a standard test nozzle as shown in Fig. 6.		P
	The conditions to be observed are as follows:.		---
	internal diameter of the nozzle: 6,3 mm;		P
	delivery rate: 12,5 l/min ± 5%;		P
	water pressure: to be adjusted to achieve the specified delivery rate;		P
	core of the substantial stream: circle of approximately 40 mm diameter at 2,5 m distance from nozzle;		P
	test duration per square metre of enclosure surface area likely to be sprayed: 1 min;		P
	minimum test duration: 3 min;	3 minutes	P
	distance from nozzle to enclosure surface: between 2,5 and 3 m		P

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Clause	Requirement + Test	Result - Remark	Verdict

14.2.6	**Test for second characteristic numeral 6 with the 12,5 mm nozzle**		N/A
14.2.7	**Test for second characteristic numeral 7: temporary immersion between 0,15 and 1 m**		N/A
14.2.8	**Test for second characteristic numeral 8: continuous immersion subject to agreement**		N/A
14.3	**Acceptance conditions**		---
	After testing in accordance with the appropriate requirements of 14.2.1 to 14.2.8 the enclosure shall be inspected for ingress of water.	no signs of water inside the enclosure	P
	It is the responsibility of the relevant Technical Committee to specify the amount of water which may be allowed to enter the enclosure and the details of a dieletric strength test, if any.		N/A
	In general, if any water has entered, it shall not:		---
	be sufficient to interfere with the correct operation of the equipment or impair safety;		N/A
	deposit on insulation parts where it could lead to tracking along the creepage distances;		N/A
	reach live parts or windings not designed to operate when wet;		N/A
	accumulate near the cable end or enter the cable if any.		N/A
	If the enclosure is provided with drain-holes, it should be proved by inspection that any water which enters does not accumulate and that it drains away without doing any harm to the equipment.		N/A
	For enclosures without drain-holes, the relevant product standard shall specify the acceptance conditions if water can accumulate to reach live parts		N/A

15	**TESTS FOR PROTECTION AGAINST ACCESS TO HAZARDOUS PARTS INDICATED BY THE ADDITIONAL LETTER**		**N/A**
15.1	**Access probes**		---
	Access probes to verify the protection of persons against access to hazardous parts are given in Tab. 6.		N/A
15.2	**Test conditions**		---
15.	The access probe is pushed against any openings of the enclosure with the force specified in Tab. 6.		N/A
	If it partly or fully penetrates, it is placed in every possible position, but in no case shall the stop face fully penetrate through the opening.		N/A
	Internal barriers are considered part of the enclosure as defined in 3.1.		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	For tests on low-voltage equipment, a low-voltage supply (of not less than 40 V and not more than 50 V) in series with a suitable lamp should be connected between the probe and the hazardous parts inside the enclosure.		N/A
	Hazardous live parts covered only with varnish or paint, or protected by oxidation or by a similar process, are covered by a metal foil electrically connected to those parts which are normally live in operation.		N/A
	The signal-circuit method should also be applied to the hazardous moving parts of high-voltage equipment.		N/A
	Internal moving parts may be operated slowly, where this is possible.		N/A
15.3	**Acceptance conditions**		---
	The protection is satisfactory if adequate clearance is kept between the access probe and hazardous parts.		N/A
	In the case of the test for the additional letter B, the jointed test finger may penetrate to its 80mm length, but the stop face (Ø 50 x20 mm)shall not pass through the opening.		N/A
	Starting from the straight position, both joints of the test finger shall be successively bent through an angle of up to 90° with respect to the axis of the adjoining section of the finger and shall be placed in every possible position.		N/A
	In case of the tests for the additional letters C and D, the access probe may penetrate to its full length, but the stop face shall not fully penetrate through the opening.		N/A
	See Annex A for further clarification.		N/A
	Conditions for verification of adequate clearance are identical with those given in 12.3.1, 12.3.2 and 12.3.3.		N/A
ZA	**ANNEX ZA (NORMATIVE)** **Other International Publications quoted in this standard with the references of the relevant European Publications**		P
	When the International Publication has been modified by CENELEC common modifications, indicated by (mod), the relevant EN/HD applies.	(**EN 60529**)	P

Annex A: Photographs