

High Voltage Warning Device for cranes - General definitions, test methods and acceptance criteria.

TABLE OF CONTENTS

1	Scope	5
2	Normative references.....	5
3	Definitions	5
3.1	High voltage warning device.....	5
3.2	PWD warning feature	5
3.3	Alarm	5
4	Abbreviations	5
4.1	Electrical abbreviations.....	5
4.2	Mechanical abbreviations	5
5	General	6
6	Materials.....	6
6.1	Control box	6
6.2	Antenna	6
6.3	Metal parts.....	6
7	Dimensions	6
7.1	Dimension and characteristics.....	6
7.2	Units.....	6
8	Marking	6
9	Classification of tests, sampling and procedures.....	6
9.1	Performance test	6
9.2	Manufacturer's production test	7
9.3	Follow up service test	7
10	Performance tests	7
10.1	Accelerated weather test	7
10.2	Weatherproof test	7
10.3	Thermal test.....	7
10.4	Impact test	7
10.5	Alternating Voltage test	8
10.6	Direct Voltage test	9
10.7	PWD warning feature test.....	10
11	Manufacturer's production tests.....	10
11.1	Dimensional test	10
11.2	Visual examination.....	10
11.3	Galvanising test	10
11.4	PWD Warning feature test.....	10
11.5	Alternating Voltage test	10
11.6	Direct Voltage test	10
12	Follow up service tests.....	11
12.1	Alternating Voltage test	11
12.2	Direct Voltage test	11
	ANNEX A	12
	ANNEX A	13
1	Preferred installation.	13
2	Preferred operation.	13

3 Risk assessment..... 14

High voltage warning device for cranes, general definitions, test methods and acceptance criteria

1 Scope

This Standard is applicable to high voltage warning devices for crane PWDs, not limited to but including as example, for use by the broadcasting, mining, farming and construction industry including Proximity Warning Devices, (PWD). This Standard specifies the characteristic mechanical and electrical performance levels required for these devices.

2 Normative references

- IEC 60060: High-voltage test techniques – Part 1: general definitions and test requirements
- ISO 1463: Metallic and oxide coatings – Measurement of coating thickness – Microscopical method
- ISO 4892-2: Plastics Methods of exposure to laboratory light sources: Xenon-arc lamps
- ISO 4892-3: Plastics Methods of exposure to laboratory light sources: Fluorescent UV lamps
- IEC 60529: Degrees of Protection provided by enclosures – (IP code)

3 Definitions

For the purpose of this document, definitions of terms in Sections 3 of the IEC 62217 and IEC 60815-1 and the following apply.

3.1 High voltage warning device

High voltage warning device is an alarm that senses an energized conductor or object. In this standard it is called a PWD.

3.2 PWD warning feature

PWD warning feature is the daily self diagnostic warning system.

3.3 Alarm

Alarm is the sounder operated by the PWD. The alarm:

- a) cannot be reset without a special key.
- b) and operation of key is data logged with the time, date and GPS position of Control box.
- c) automatically resets if daily self test is performed satisfactorily.

4 Abbreviations

4.1 Electrical abbreviations

- a) Routine proof test field (R.T.F.) is the test field strength at the antenna for ac.
- b) Routine proof test field (R.T.M.) is the test field strength at the antenna for dc.

4.2 Mechanical abbreviations

- a) Safe Working Distance (S.W.D) is the design operating distance between antenna and power line.
- b) Maximum sustained operating temperature (M.O.T)
- c) Minimum sustained operating temperature (M.I.T)

5 General

PWDs shall conform in all respects to the requirements of this standard. The text, tables and figures supplement each other and shall be considered part of this standard. All tests to be carried out at ambient conditions unless specified.

6 Materials

6.1 Control box

The control box of the PWD shall consist of an impact resistant material. The material shall be sound and free of defects that might adversely affect the PWDs electrical and mechanical properties.

6.2 Antenna

The Antenna shall be covered with impact resistant polymer materials. They may contain inorganic fillers and organic compounding agents. The shapes of the antenna and spacing between them, if multiple, are not part of this standard.

6.3 Metal parts

Metal parts shall be made of a good commercial grade of malleable iron, ductile iron, steel or aluminium. All external ferrous parts, other than stainless steel, shall be galvanized in accordance with specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware ASTM A 153-82.

7 Dimensions

7.1 Dimension and characteristics

Dimensions and characteristics of the PWDs shall be in accordance with manufacturers' drawings. General tolerances shall be according to IEC 62217 clause 8. Manufacturer's drawings shall show the outline of the PWDs, together with all pertinent dimensions, mechanical and electrical values. Any variations in these dimensions due to manufacturing tolerances shall be indicated.

7.2 Units

All dimensions and other numerical values are given in customary metric units except as otherwise stated.

8 Marking

All markings shall be legible, indelible and their fixings (if any) weather proof and corrosion proof. Each PWD shall be clearly and indelibly marked with the name or trademark of the manufacturer, simplified operating instructions, the year of manufacture, design, unique serial number, the safe working distance (S.W.D.), and the routine proof test fields (R.T.F) and (R.T.M) identified by the word 'TEST'. The maximum sustained operating temperature (M.O.T). The minimum sustained operating temperature (M.I.T).

9 Classification of tests, sampling and procedures

The tests are divided into three groups as follows:

9.1 Performance test

Performance tests are intended to verify the main characteristics of a PWD which depend mainly on its design and only performed once for a new design or manufacturing process of PWD and then subsequently repeated only when the design or manufacturing process is changed. The results of performance tests are certified by test certificates confirmed by a qualified organisation. There is no time limit for the validity of certificates for performance tests. When a PWD is submitted to the performance tests, the results shall be considered valid for the whole design of PWDs represented. A design of PWDs is defined as being the "same" with those having the:

- a) same control box, same antenna of the same materials and method of manufacture materials, and method of attachment to the control box.
- b) same printed circuit boards and software.
- c) same, or more gain, antenna
- d) same, or larger, Alarm.

The performance test report shall include a drawing of the PWD tested, with dimensions. These dimensions shall at a minimum include those dimensions that define a design. To allow for subsequent manufacturing or design variations, the term "same" in clauses 9.1(a) and 9.1(d) may vary up to 15% before the performance tests must be repeated. (See Section 7.1 for tolerances on dimensions.)

9.2 Manufacturer's production test

Routine test are intended to eliminate defective units and are carried out during the manufacturing process and are carried out on every PWD.

9.3 Follow up service test

Performance tests are performed on a PWD to characterise it under operating conditions and are carried out by manufacturer or their approved agents.

10 Performance tests

Performance tests are to be performed only once for each design of PWD as follows; four identical test specimens will be provided and the tests carried out as specified in sequence from 10.1 to 10.7. Failure to complete all the performance tests shall constitute failure to meet the requirements of this standard. The results shall be recorded in a test report which may constitute the evidence of successful completion of the performance tests.

10.1 Accelerated weather test

Three test samples shall be subjected to 1000 hours by one of the following test methods. Tests without water are not permitted and markings must be directly exposed to UV light.

- a) Xenon-Arc Methods: ISO 4892-2
- b) Fluorescent UV Method: ISO 4892-3

Examination of the PWDs with normal, or corrected vision without magnification, shall reveal no signs of deterioration when compared with the fourth test sample. Surface defects such as cracks and blisters or illegible markings shall constitute failure to meet the requirements of this standard.

10.2 Weatherproof test

The four test specimens selected shall tested to IEC 60529

- a) The Control Box shall pass IP67
- b) The Antenna and connecting wire shall pass IP68

Failure of any specimens to pass this test shall constitute failure to meet the requirements of this standard.

10.3 Thermal test

The four test specimens selected shall be uniformly heated to $(M.O.T + 10) \text{ }^{\circ}\text{C} \pm 3 \text{ }^{\circ}\text{C}$ and maintained at that temperature for a minimum of 8 h. The samples shall then be placed in a cold room having a temperature of $(M.I.T-10) \text{ }^{\circ}\text{C} \pm 3 \text{ }^{\circ}\text{C}$. for a minimum of 8 h. The transfer time between the hot and cold media shall be no more than 5 min. The test cycle shall be performed 10 times. The lower temperature shall be maintained up to 5 minutes prior to the impact test commencing.

10.4 Impact test

The four test specimens selected shall be dropped a clear distance of 2.0 m. onto a concrete floor.

10.5 Alternating Voltage test

The four test specimens selected shall be tested as shown in Fig 1, Fig 2, Fig 3 and Fig 4 where:

- a) Voltage 1 = 2kV ac, conductors at 30ft.
- b) Voltage 2 = 2kV ac, conductors at 30ft.
- c) Voltage 3 = 2kV ac, conductors at 60ft.
- d) Voltage 4 = 2kV ac
- e) Voltage 5 = 2kV ac
- f) Voltage 6 = 22kV ac
- g) Voltage 7 = 2kV ac
- h) Voltage 8 = 2kV ac
- i) H1 = 30ft
- j) H2 = 60ft
- k) H3 = 30ft
- l) H4 = 60ft
- m) Pole pitch is 100 ft.
- n) ac is 60Hz

Failure of the Alarm to sound when the fully extended boom crosses the S.W.D, in both directions, shall constitute failure to meet the requirements of this standard. Failure of the Alarm to stay on as boom moves to within 10ft of power line shall constitute failure to meet the requirements of this standard. The field strength on crossing the S.W.D line shall be recorded as R.T.F.

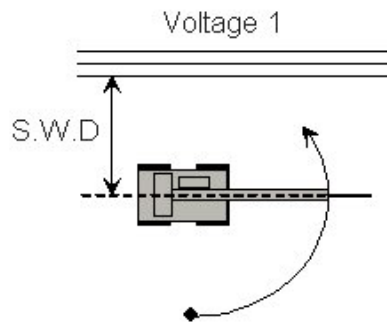


Figure 1 – Single voltage test

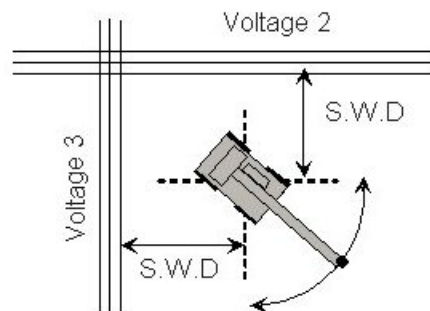


Figure 2 – Double voltage test

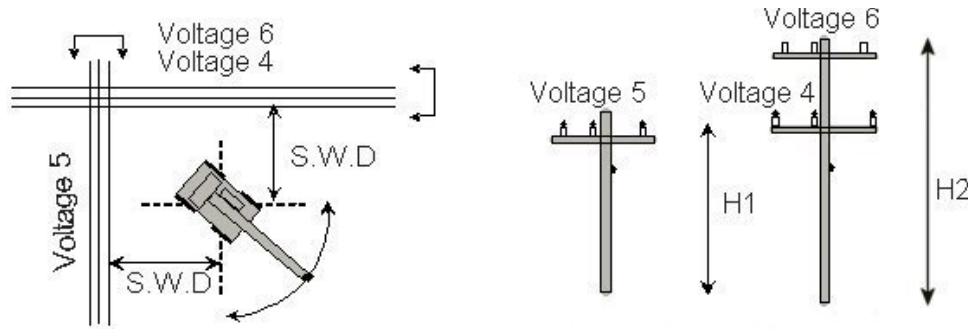


Figure 3 –Right angle interference voltage test

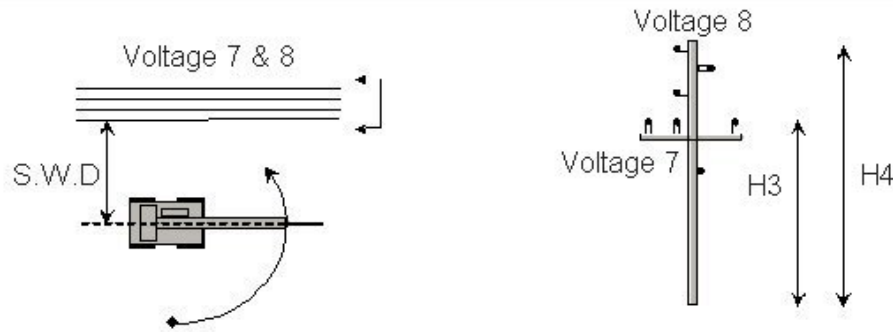


Figure 4 – Vertical interference voltage test

10.6 Direct Voltage test

The four test specimens selected shall be tested as shown in Fig 1, Fig 2, Fig 3 and Fig 4 where:

- a) Voltage 1 = 350kV DC, conductors at 60ft.
- b) Voltage 2 = 350kV DC, conductors at 60ft.
- c) Voltage 3 = 350kV DC, conductors at 80ft.
- d) Voltage 4 = 350kV DC
- e) Voltage 5 = 350kV DC
- f) Voltage 6 = 500kV DC
- g) Voltage 7 = 350kV DC
- h) Voltage 8 = 350kV DC
- i) H1 = 60ft
- j) H2 = 80ft
- k) H3 = 60ft
- l) H4 = 80ft
- m) Pole pitch is 100ft

Failure of the Alarm to sound when the fully extended boom crosses the S.W.D, in both directions, shall constitute failure to meet the requirements of this standard. Failure of the Alarm to stay on as boom moves to within 50ft of power line shall constitute failure to meet the requirements of this standard. The field strength on crossing the S.W.D line shall be recorded as R.T.M.

10.7 PWD warning feature test

The four test specimens selected shall be tested. The PWDs shall be provided with built in self diagnostics which warn if the PWD could not detect a power line at its S.W.D. Failure of PWD, during its self test, to detect a genuine R.T.F and R.T.M shall constitute failure to meet the requirements of this standard. The alarm may be reset prior to test. After the daily self test:

- a) No alarm shall constitute failure to meet the requirements of this standard.
- b) Failure of the sounder to produce 85dB, peak, at 200 mm shall constitute failure to meet the requirements of this standard. (Ambient noise may not to exceed 45dB, peak.)
- c) Failure of any PWD to data log time, date and GPS position shall constitute failure to meet the requirements of this standard.

11 Manufacturer's production tests

Every PWD shall be tested and must conform to section 11.1 through 11.6. All PWDs that fail do not meet the requirements of this standard.

11.1 Dimensional test

The PWD shall be checked against the dimensions on the manufacturer's drawing. Clause 7.1 shall apply to all dimensions without tolerances specified by the manufacturer. Failure to conform within tolerance to the dimensions on this drawing shall constitute failure to meet the requirements of this standard.

11.2 Visual examination

The mounting of the metallic parts shall be in conformance with the manufacturer's drawing. The colour of the PWD shall be approximately as specified on the drawing. The following imperfections shall be acceptable on the PWD surface: Superficial defects of area less than 25 square centimetres (the total defective area not to exceed 5% of the total PWD surface) and depth less than 10 mm. All PWDs not in conformance with this section do not meet the requirements of this standard.

11.3 Galvanising test

Each type of galvanized hardware used with the PWDs shall be tested in accordance with ISO 1463. Five to ten measurements shall be randomly distributed over the entire surface. Both the average thickness value for each individual specimen and the average of the entire sample shall equal or exceed the following:

Hardware (except nuts/bolts)	3.4 mil (Average)
Nuts/Bolts	2.1 mil (Average)

If the average of one specimen fails to comply with the minimum thickness criteria, in the table above, shall constitute failure to meet the requirements of this standard.

11.4 PWD Warning feature test

The High Voltage Warning feature will be operated at least daily in the normal operating use of the PWD. No daily testing of the PWD shall constitute failure to meet the requirements of this standard.

11.5 Alternating Voltage test

The PWD shall alarm when the field strength exceeds R.T.F. Failure of the PWD to meet the test shall constitute failure to meet the requirements of this standard.

11.6 Direct Voltage test

The PWD shall alarm when the field strength exceeds R.T.M. Failure of the PWD to meet the test shall constitute failure to meet the requirements of this standard.

12 Follow up service tests

Every PWD shall be tested and must conform to section 12.1 and 12.2 no less than every 12 months. All PWDs that fail do not meet the requirements of this standard.

12.1 Alternating Voltage test

The PWD shall alarm when the field strength exceeds R.T.F. Failure of the PWD to meet the test shall constitute failure to meet the requirements of this standard.

12.2 Direct Voltage test

The PWD shall alarm when the field strength exceeds R.T.M. Failure of the PWD to meet the test shall constitute failure to meet the requirements of this standard.

ANNEX A

Table 1 - Summary of tests

10.1 Accelerated weather	1000 hours
10.2 Weatherproof	IP67 and IP68
10.3 Thermal	(M.O.T + 10) ° C and (M.I.T - 10) ° C for 160 hours
10.4 Impact resistance	Drop 2.0m onto concrete
10.5 Alternating Voltage test	2kV
10.6 Direct Voltage test	350kV
10.7 PWD warning feature	
The following are Routine Tests	
11.3 Galvanizing	2.1 & 3.4 mil
11.5 Alternating Voltage test	2kV
11.6 Direct Voltage test	350kV

ANNEX A*(Informative)***Guidance on selection of preferred position to install PWDs on a crane including a risk assessment.****1 Preferred installation.**

The PWD Control box and alarm should be fitted in the crane operator's cab.

2 Preferred operation.

The special reset key should not be in the control of the operator but the site supervisor as the PWD should not be reset without the site supervisor being aware of the situation.

3 Risk assessment

In all situations when the PWD is being used near a known power line a risk analysis should be performed. A typical example is shown in Table 2.

Table 2 – Risk Assessment

PART A	RISK ASSESSMENT 09/1
Customer: Street City State, ZIP	
How close to the power lines are you working?	
Where is Proximity Warning Device, (PWD) Control box installed?	
What is the maximum length of the crane boom?	
Is the Safe Working Distance, (S.W.D) of the Proximity Warning Device greater than maximum length of the crane boom? If your answer is "No" then fill in Part B of form.	
Are you authorised to answer these questions?	
Email or fax this form to Manufacturer	
Name	
Phone number	
PART B	PART B
If the SWD is less than crane boom length have you got a "Clearance Note" from Manufacturer?	
Will the PWD only be used as instructed in "Clearance Note" by Manufacturer?	