



Bontek Compliance Laboratory

EN 62013-1: 2002

general requirements ---
construction and testing in relation to the risk of explosion

MEASUREMENT AND TEST REPORT

For

NEW WISDOM INVESTMENT LIMITED

4-306, Xianglixincun, Hongli West Road, Shenzhen, China

Model: KL5M

November 1, 2006

This Report Concerns: <input checked="" type="checkbox"/> Original Report	Equipment Type: Miner's cap lamp
Test Engineer:	Victor Feng / <i>Victor Feng</i>
Report Number:	BCT06KR070S
Test Date:	October 2-28, 2006
Reviewed By:	Bain Ye / <i>Bain Ye</i>
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**TEST REPORT
EN62013-1: 2002**

**Caplights for use in miners susceptible to firedamp
Part 1: general requirements ---
construction and testing in relation to the risk of explosion**

Report

Report reference No. : BCT06KR070S
Tested by (+signature) : Victor Feng / test engineer
Approved by (+ signature) : Bain Ye / project engineer
Date of issue : Nov. 1, 2006

Victor Feng
Bain Ye

Testing laboratory

Name : **Bontek Compliance Laboratory Ltd.**
Address : Rm 802~804, 8/F, Jinmin Bld., Zizhu 6th Rd., Zhuzi Lin, Futian, Shenzhen 518040, P.R. China
Test location : **Bontek Shenzhen**

Client

Name : **NEW WISDOM INVESTMENT LIMITED**
Address : 4-306, Xianglixincun, Hongli West Road, Shenzhen, China

Test specification

Standard : EN 62013-1: 2002
Non-standard test method : N.A.

Test item

Description : **Miner's cap lamp**
Trademark : N.A.
Model No : **KL5M**
Power rating : Input: 3.3VDC 0.35A
Manufacturer : **NEW WISDOM INVESTMENT LIMITED**
Address : Building A1-4, Shenbao Industry Park, Longgang district, Shenzhen, China
Model difference : --
Note : All test performance on model: **KL5M**



Particulars: test item vs. test requirements

Equipment mobility	: portable equipment
Operating condition	: Continuous
Tested for IT power systems	: No
IT testing, phase-phase voltage (V)	: N.A.
Class of equipment	: Class III
Mass of equipment (kg):	: Less than 600g
Protection against ingress of water	: IP20

Test case verdicts

Test case does not apply to the test object	: N(.A.)
Test item does meet the requirement	: P(ass)
Test item does not meet the requirement	: F(ail)

General remarks:

""See remark #)"" refers to a remark appended to the report.
""See appended table)"" refers to a table appended to the report.
Throughout this report a comma is used as the decimal separator.
The test results presented in this report relate only to the object tested.
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Remarks:

1. This report containing the content of EN62013-1: 2002
2. The following contents are included in this test report:
 Test report pages 1 to 13



Clause	Requirement – Test	Result - Remark	Verdict
4	General		
4.1	Enclosures		P
4.1.1	Enclosure made of light alloy shall conform to 8.1 of IEC 60079-0		P
4.1.2	Enclosure made of plastic material shall conform 7.3 of IEC 60079-0		P
	If the protection against ignition by dangerous electrostatic charges is by virtue of size, shape and layout, this shall be verified in accordance with one of the methods described in 10.13		P
	In the case of the test described in 10.13.1, the capacitance measured shall not exceed 50pF		
	In the case of the test described in 10.13.2, the highest value of charge Q1, Q2 or Q3 shall not exceed 60nC		
4.2	Internal electrical connections shall conform to 4.2 of IEC 60079-7		P
4.3	Solid electrical insulating materials shall conform to 4.5 of IEC 60079-7		P
4.4	Internal wiring shall conform to 4.8 of IEC 60079-7		P
4.5	The caplight shall be constructed in such a manner that the circuit (without apparatus connected)		P
	Behaves as if solely resistive, and		P
	--incorporates means to prevent ignition of firedamp by thermal effects or arcing.		P
4.6	Where the caplight is also used to supply electrical power to another apparatus, the other apparatus shall conform to the requirements of one or more of the types of protection listed in IEC 60079-0 and the combination of the caplight and other apparatus shall be assessed as a whole to ensure that neither the caplight nr the apparatus adversely affects the type of explosion protection provided by each.		N
4.7	Creepage and clearance distances – all wiring connections and printed wiring boards which can affect the type of protection afforded shall be considered to have infallible separations if they meet following creepage and clearance requirements:		P
	--1,6mm in air;		P
	--0,5 mm through solid insulation or under a coating;		P



Clause	Requirement – Test	Result - Remark	Verdict
	-- all insulating materials shall have Comparative Tacking Index (CTI) of at least 175 (when tested in accordance with IEC 60112).		P
4.8	It shall not be possible to obtain a current of great than 50mA between any two accessible points of the caplight when assembled for use.		P

5 Overcurrent protection			
5.1	Overcurrent protection shall be provided which effectively limits the discharge current to a level unlikely to cause an ignition of an atmosphere endangered by firedamp. Such protection shall be provided by one or more of the following means , and shall conform to 5.2, or to 5.3 and 5.4, or to 5.3 and 5.5, and additionally to 5.6:		P
a)	a fuse or thermal circuit-breaker		N
b)	selecting a battery with appropriate internal characteristic so that it is not capable of igniting the test gas when tested in accordance with 10.10;		P
c)	an infallible current-limiting resistor conforming to 3.9 of IEC 60079-11;		P
d)	an active current-limiting device assessed to IEC 60079-11.		P
	If the battery-charging current passes through the protective means, the rating of that means shall be based on the charge current or discharge current, whichever is the greater.		P
5.2	Where the means of overcurrent protection is a fuse or thermal circuit-breaker and the caplight is constructed in such a manner that		P
	--the nominal voltage is not greater than 6 V;	3.3V	P
	--the value of the current in normal use is not greater than 1,5 A, and	0.35A	P
	--the nominal rating of the lamp is not greater than 6 W	<1.2W	P
	the fuse or thermal circuit-breaker shall conform to the following requirements:		N
a)	The fuse or thermal circuit-breaker shall be protected so that, when tested according to 10.5, there is no ignition of any surrounding gas mixture.		N
	NOTE An example of suitable protection is to cover, except for the terminations, with an appropriate encapsulation compound (see 4.21 if IEC 60455-1) with a minimum thickness of 1 mm.		N



Clause	Requirement – Test	Result - Remark	Verdict
b)	the fuse shall comply with IEC 60127-2 and additionally meet the following criteria.	No fuse used	N
	The fusing or interrupting current and fusing or interrupting time shall be as small as possible with regard to the current/time charging and discharging characteristics of the battery. The following rules shall apply:	No fuse used	N
	--fusing or interrupting time at 12 A \pm 0,1 A; not more than 1 s, and	No fuse used	N
	--fusing or interrupting time at 15 A \pm 0,1 A; not more than 200 ms.	No fuse used	N
5.3	In all cases, other than 5.2 above, the combination of the battery and the means of protection shall conform to the requirements of IEC 60079-11 using spark ignition test described in 10.10.		P
5.4	Where the means of overcurrent protection is a resistor, it shall be connected into the circuit as near to battery terminals as possible.		P
	Furthermore, the resistor(s) shall		P
a)	Be of the metal or oxide film type, of the single-layer wire-wound type with mechanical protection to prevent unwinding of the wire in the event of breakage, or any similar construction which has failure mode that increases resistance;		N
b)	operate at no more than two-thirds of its power rating under normal operation.		P
5.5	When the overcurrent protection is made by active current-limiting devices, two devices in accordance with 7.1 of IEC 60079-11 in series shall be used. This does not preclude the use of one active device and fuse, complying with 5.2, in series.		P
5.6	The physical arrangement of the means of overcurrent protection and the cable within the battery container shall be such that a short-circuit current not passing through the means of protection is unlikely.		P
6	Headpiece		
6.1	The enclosure of the headpiece of the caplight shall provide a degree of protection against the ingress of water of at least IP54 (category 2) as specified in IEC 60529.		P
	when tested in accordance with 10.4.1, the headpiece enclosure shall conform to 10.4.2 and 10.4.3.		P

Clause	Requirement – Test	Result - Remark	Verdict
6.2	The headpiece shall be provided with an interlocking device or special fastener to prevent unauthorized access to the internal parts.		P
6.3	The lamp shall be protected by a protective cover which is light transmitting, meets the requirements of table 1 and may have protective rim. The protective cover shall be fitted additionally with a protective grill unless		P
a)	the free surface of protective cover does not exceed 35 cm ² ; or		P
b)	the protective cover withstands the impact test according to 10.2 with the impact energy for the protection cover without the protective grill; or		P
c)	The headpiece is fitted with means to cut off automatically the power supply to all filaments When either the protective cover or the lamp envelope breaks.		P
6.4	The protective cover and protective grill specified in 6.3 shall be removable only after releasing the interlocking device or special fastener specified in 6.2.		P
8	Cable		
8.1	The cable between the battery container and the headpiece shall have a sheathe which is resistant to fatty acids and fire.		P
	When the cable sheath is tested for resistance to fatty acids in accordance with 10.7.1, it shall conform to 10.7.2. When the cable sheath is tested for resistance to fire in accordance with 10.8, it shall conform to the requirements of IEC 60332-1.		P
8.2	The cable entries, the anchoring devices, and the cable comply with the tensile strength type test according to 10.9.		P
8.3	One strand of the cable, when tested in accordance with 1.6, shall not ignite the methane and air mixture.		P
8.4	Where overcurrent protective according to clause 5 is a fuse, each individual strand of each cable conductor shall be capable of carrying the currents specified in 5.2 b) without melting within the time specified.		P
9	External charging contacts		P



Clause	Requirement – Test	Result - Remark	Verdict
	Caplights which are recharged by means of external contacts shall include a mechanical device or an electrical device preventing the withdrawal of current, other than in accordance with 4.2, during the use of the caplight. When the electrical device is not an infallible component (as defined in 3.9 of IEC 60079-11), it shall be duplicated and each component shall be rated such that the maximum battery-charging current is not more than two-thirds of the rated current for the component.		P

10	Type verifications and tests		
10.1	General		
	The caplight shall conform to 23.1, 23.3 and 23.4.1 of IEC 60079-0		P
10.2	Impact test		
	Impact tests shall be carried out in accordance with 23.4.3.1 of IEC 60079-0 with the values of impact energy and temperature, the number of tests and the number of sample, and the acceptance criteria in table 1 of this standard. When the lower temperature of -10°C is specified, the caplight shall be additionally marked (see 11.2d)).		P
10.3.1	The test shall be carried out at a temperature of between 15°C and 35°C on one sample of the headpiece and one sample of the battery container with cable attached and arranged to provide an electrical circuit. When, because of the environmental conditions, a drop test at lower temperature is required, the test shall be carried out at the same temperature as the same temperature used for the impact test (see 10.2).		P
10.3.2	The headpiece, ready for use, shall not have suffered any damage which could give rise to firedamp ignition risk after falling four times in any manner from a height of 2 m ± 0,02 m on a concrete floor. The assessment as to whether any damage could give rise to an ignition risk shall be performed by a visual inspection, repeat of any of the relevant tests or both.		P
10.3.3	The battery container, containing the battery, shall not have suffered any damage which could give rise to a firedamp ignition risk after falling four times in any manner from a height of 1 m ± 0,01 m on to a concrete floor. The assessment as to whether any damage could give rise to an ignition risk shall be performed by a visual inspection, repeat of any of the relevant tests or both.		P



Clause	Requirement – Test	Result - Remark	Verdict
10.4	Test to verify the protection against ingress of dust and water	IP54	P
10.4.1	The test for degree of protection IP54 (category 2) shall be carried out on one sample of the headpiece of and one sample of the battery container according to IEC 60529, except that the wire test of 5.1 is not required. The test shall be carried out with any drain plugs and pressure relief devices in position. If there are drain holes which are normally open, these shall be open for test.		P
10.4.2	At the conclusion of the test for the first numeral 5 (category 2) talcum powder shall not have accumulated in the interior of the enclosures in such a quantity or location that it could interfere with the correct operation, mechanical and/or electrical, of the caplight.		P
a)	be suffered to interfere with the satisfactory mechanical and/or electrical operation of the apparatus;		P
b)	reach electrical live parts not designed to operate when wet.		P
10.4.4	The requirements need not be satisfied in any position which is not appropriate to normal use.		P
10.5	Test to verify the non-ignition of a representative electrolytic gas mixture or firedamp by fuse or thermal circuit-breaker		N
	A current of 15 A \pm 1 A At nominal battery voltage is passed through 20 fuses or circuit-breaker in a mixture of hydrogen and oxygen containing from 66 % to 74 % by volume of hydrogen.		N
10.6	Test to verify the no-ignition of a gas mixture by one strand of the cable between the headpiece and the battery by thermal ignition		P
	A fully charged caplight battery is short-circuited by the smallest cross-section strand of the cable conductor in a mixture of methane and air containing 6,5 % \pm 0,3 % by volume of methane.		P
10.7	Test to verify the resistance of the cable sheathe to fatty acids		P
10.7.1	A sample of the cable sheath, with cores removed, about 80 mm long shall be weighed and then immersed in a mixture of fatty acids of commercial quality having the following nominal composition by mass:		P
	--oleic acid: 60 %		P
	--stearic acid: 20 %		P



Clause	Requirement – Test	Result - Remark	Verdict
	--palmitic acid: 20 %		P
	In addition, a sample of the complete cable, of which the maximum diameter has been measured before the test, about 300 mm long, bent into a U shape, shall be suspended in the same mixture with its ends just above mixture.		P
	Both samples shall remain immersed in the mixture for 96 h \pm 1 h at a temperature of 70°C \pm 1°C, after which they shall be removed, wiped clean, cooled to room temperature and reweighed or remeasured as applicable.		P
10.7.2	The increase in mass of the sample of sheath and increases in diameter of the sample of cable at the point where its diameter was a maximum before the test shall not exceed the following values:		P
	--increase in mass 50 %		P
	--increase in diameter: 30 %		P
10.8	Test to verify the resistance of the cable sheathe to fire		P
	A sample of cable 600 mm \pm 25 mm in length shall be tested according to IEC 60332-1 except that the application time of the flame, T, in clause 7 shall be 10 s.		P
10.9	Test to verify the strength of cable entries, anchoring devices and cable		P
	A sample assembly comprising the cable and those parts of the battery container and headpiece containing the anchoring devices shall be tested. The total assembly shall withstand, without damage, mechanical deformation or movement which impair safety, a tensile force of 150 N 10 s.		P
10.10	Spark ignition test		P
10.10.1	The spark ignition test described for group 1 apparatus in 10.1 of IEC 60079-11 shall be performed on the combination of caplight battery, the means of overcurrent protection and cable. The electrodes of the spark apparatus described in annex B of IEC 60079-11 shall be varied to prevent hot wire ignition to adequately test the circuit only for ignition by electrical arcing and sparking.		P
10.10.2	A safety factor shall be achieved using one of following methods:		P
a)	Increasing the test voltage and current using one of the following methods:		P

Clause	Requirement – Test	Result - Remark	Verdict
b)	In the case of an infallible current-limiting resistor, decreasing its value to obtain 1,5 times the test current;		P
c)	using a test gas mixture of 85 % hydrogen, 15 % oxygen by volume.		P
10.11	Current-limiting resistor temperature assessment		N
	The resistor in combination with any associated overcurrent protection shall be assessed for the worst-case thermal conditions, using a voltage of up to 1,5 times the maximum battery voltage.		N
	The resistor shall not		N
a)	decrease in resistance by more than 10 % of its pre-test value;		N
10.12	Electrolyte leakage test		N
	Test five batteries, filled and fully charged in accordance with the manufacturer's instructions, as follows.		N
	Disconnect the batteries from the charging source. Allow them to stand for 25 min \pm 5 min, then rest each battery for 5 min \pm 0,5 min on each surface on a sheet of clean dry blotting paper.		N
10.13	Verification of non-hazardous electrostatic properties by size, shape and layout		P
10.13.1	Verification of inability to store a dangerous charge by measurement of capacitance		P
10.13.1.1	Principle of the test		P
	This test assesses the risk of a dangerous electrostatic charge occurring on the plastic parts of a fully assembled caplight when it is used underground in a mine. It is based on the 0,2 mJ maximum allowable energy on a charged capacitor in 6.2 of IEC 60079-0 and the fact that there is no record of voltages exceeding 2,5 kV occurring on plastic portions of caplight batteries whilst use underground		P
10.13.1.2	Number of samples		P
	Five complete caplight assemblies with the same type of battery and protective cover.		P
10.13.1.3	Apparatus		P
a)	A capacitance meter capable of measuring in the range 0 pF to 200 pF with an accuracy of \pm 5 % and with connection leads less than 1 m.		P



Clause	Requirement – Test	Result - Remark	Verdict
b)	An earth grounded galvanised steel plate approximately 90 mm × 160 mm × 3 mm.		P
c)	A climatic conditioning chamber.		P
10.13.14	Procedure		P
a)	Condition the caplight assembly in the conditioning chamber for at least 1 h at a		P
b)	Stand the battery upright on grounded steel plate.		P
c)	Measure and record the capacitance between each exposed metallic part on the battery the cover and the metal plate. If there are no metallic parts on the battery or the cover, create a test point by inserting a brass screw into the top surface of the protective cover.		P
10.13.2	Verification of inability to store a dangerous charge by direct measurement of stored charge or by gas ignition		P
10.13.2.1	Principle of the test		P
	This test assesses the risk of a dangerous electrostatic charge occurring on the plastic parts of an empty caplight battery container when tested in laboratory conditions.		P
10.13.2.2	Number of samples		P
	Five empty battery containers of the same type.		P
10.13.2.3	Apparatus (see figures 2,3,and 4)		P
a)	A d.c. high-voltage power supply capable of delivering 30 kV ± 1 k V.		N
b)	An appropriate voltmeter.		P
c)	A 0,1 µF capacitor.		P
d)	A cotton cloth large enough to avoid contact between the battery container and the operator's fingers during the rubbing procedure.		P
e)	A nylon cloth large enough to avoid contact between the battery container and the operator's fingers during the rubbing procedure.		P
f)	A Teflon ¹⁾ handle to fit inside the battery container.		P
g)	A PTFE plate.		P
h)	An earth grounded plate.		P
10.13.2.4	Procedure		P
	All the tests are conducted in a room with a temperature of 23°C ± 2°C and between 30 % to 35 % relative humidity.		P



Clause	Requirement – Test	Result - Remark	Verdict
a)	Conditioning of the sample		P
	Clean the battery container with isopropyl alcohol, rinse with distilled water and dry. Store in the room for 24 h.		P
b)	Determination of the most onerous charging method		P
1)	Rubbing the container with a nylon cloth		P
	Lay the empty container with one of its large sides on an isolated PTFE plate and place the Teflon carrying handle inside the empty battery container (figure 2).		P
	Charge the container by rubbing it 10 times the nylon cloth so that the last rub finishes on the edge of the container.		P
	Move the charged battery container to the measuring probe using the Teflon carrying handle and being careful not to touch it by hand (figure 3).		P
	Discharge the container through the probe to earth via the 0,1 μ F capacitor, record the lightest voltage attained and immediately remove the probe from the container during discharge.		P
	Calculate the charge on the battery container, according to the formula $Q = CV$, where Q is the quantity of charge (coulombs), V is the voltage across the capacitor (volts) and C is the value of the capacitor (farads).		P
	Repeat the test 10 times for each sample, calculate the arithmetical average value for the 50 tests and record this as Q1.		P
2)	Rubbing the container with a cotton cloth		P
	Repeat the above procedure using the cotton cloth instead of the nylon cloth and record the arithmetic average value for the tests as Q2.		P
3)	Charging the container by the influence of a high-voltage power source		P
	Lay the empty container with one of its large sides on a conductive metal plate which is connected to earth (figure 3).		N
	Place the Teflon carrying handle inside the container.		N
	Place the negative point electrode 30 mm above the container surface and apply 30 kV d.c. between the negative electrode and the earthed metal plate.		N



Clause	Requirement – Test	Result - Remark	Verdict
	Move the container around on the earthed plate beneath the electrode for 60 s to distribute the charging influence over the whole of the exposed container surface.		N
	Measure the electrostatic charge on the empty container by discharging it through the capacitor/voltmeter arrangement described in 1)		P
	Repeat the test 10 times for each sample and calculate the arithmetical average value for the 50 tests and record this as Q3.		P

11	Marking		
11.1	The marking of the caplight shall be legible and durable, taking into account possible chemical corrosion.		P
11.2	The manufacturer shall mark the caplight assembly to indicate compliance with this standard. Such marking shall include		P
a)	the name or a trade mark of the caplight manufacturer;		P
b)	the caplight manufacture's type identification;		P
c)	the symbol Ex "1" and the number of this standard;		P
d)	the lower temperature for the impact/drop test when it is applicable (see 10.2 and 10.3);		P
e)	on the battery container or cells, the manufacturer's battery type identification clearly visible, a date or code to indicate the month and year of manufacture.		P
11.3	Where a certificate for the caplight has been obtained:		P
	--the indication of the test station and the certificate reference in the following form: the year of certification followed by the serial number of the certificate in that year;		P