

Certex, TÜV Rheinland and SGS (SA) Appointed Ex Laboratory

7 Spanner rd. PO Box 467
Olifantsfontein
1665

Tel: +27 (11) 316 4601
Fax: +27 (11) 316 5670
E- mail: info@explolabs.co.za

ASSESSMENT AND TEST REPORT No.: XPL/8612/06875

OPTIMAC (PTY) LTD
PO BOX 69080
HIGHVELD TECHNOPARK
0046

Your Reference: PO100022
Enquiries: Willem Herholdt
Date: 16 February 2007
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INTRINSICALLY SAFE MINERS CAPLAMP MODEL HALO 200

1. STANDARDS

- IEC/SANS 60079-0:2000 (including Am 1) "Electrical apparatus for explosive gas atmospheres, Part 0: General requirements"
- IEC/SANS 60079-11:1999 (including Am 1) "Electrical apparatus for explosive gas atmospheres, Part 11: Intrinsic safety 'i' "
- IEC 62013-1:2004 (draft) "Caplights for use in mines susceptible to firedamp, Part 1: General requirements"
- SANS 1438-3:1987 "Helmet light assemblies for miners, Part 3: Cables"

2. PRODUCT DESCRIPTION

Manufacturer : Optimac (Pty) Ltd
Supplier : Optimac (Pty) Ltd
Type of Product : Miners Caplamp
Model : Halo 200
Serial Number(s) : Prototype

This unit consisted of a small battery pack containing 3 Li-Ion batteries connected in parallel with three thermal fuses and the battery protection circuit. The enclosure also had a small compartment, which house the battery charge and other control circuit as well as the on/off switch. The headpiece contained the main and auxiliary LED's and their control circuitry with the standard charging connector and the pluggable cable with strain protection connecting the two units.

3. ASSESSMENT REQUIRED

Batch/Type Approval : Type Approval
Sample Serial Number(s) : Prototype

4. CONCLUSION

The sample(s) as described in Paragraph 2 above have COMPLIED with the requirements as set out in Paragraph 1.

The approved explosion protection rating of the equipment is: **Ex ia I/IIC T4**
Inspection Authority Certificate Number: **MS-XPL/06875 X**

See Paragraphs 8 and 5.3 Clause 11 of this report for tests required during manufacturing.
See Paragraph 8 of this report for Special Conditions of Use (X).

5. ASSESSMENT AND TEST RESULTS

5.1 GENERAL

The **VERDICT** is designated by one of the following:

C = Complied with the Requirement NA = Requirement is Not Applicable to this Equipment

F = Failed to Comply with the Requirement NT = This Requirement was Not Tested for.

5.2 TEST PARAMETERS

5.2.1 REQUESTED

Enclosure: IP54
 Environment: Gas: Group I/II C
 Temperature: 150 °C
 Zone: Zone 1
 Hazardous locations on surface and in mines.

5.2.2 CERTIFIED

Enclosure: IP55
 Environment: Gas: Group I/II C
 Temperature: 135 °C / T4
 Zone: Zone 1
 Hazardous locations on surface and in mines.

5.2.3 COMPONENTS CRITICAL TO THE INTRINSIC SAFETY OF THE EQUIPMENT

No	Component	Designation	Identification	Rating
1	Li-ion batteries	BATTERY	LG Chem Lithium Ion model ICR18650 S2	3.7V nominal, 4.2VOC, 2200mAh
2	Resistor	R20, R21, R22	Metal film	100Ω 0.25W
3	Thermal fuse	F1,F2,F3 in battery pack	V086 TAM	250V 2A 86 °C

5.3 RESULTS

CLAUSE	DESCRIPTION	RESULT	VERDICT
IEC/SANS 60079-0: 2000			
4	APPARATUS GROUPING AND TEMPERATURE CLASSIFICATION		
4.2.2	Marking Max Surface Temperature	Group I	NA
5	TEMPERATURES		
5.3	Surface and Ignition Temperature	< 275 °C (small components)	C
7	NON-METAL ENCLOSURES AND NON-METAL PARTS		
7.1.1	Plastics Material		C
7.3	Electrostatic Charges	Exposed surface < 20cm ²	C
8	ENCLOSURES CONTAINING LIGHT METALS		
	Group I		C
	Groups II		NA
23	TYPE VERIFICATION AND TESTS		
23.4.6.1	Maximum Surface Temperature	44 °	C

CLAUSE	DESCRIPTION	RESULT	VERDICT
IEC/SANS 60079-11: 1999			
5	CATEGORIES OF ELECTRICAL APPARATUS		
5.2	Category ia		C
5.3	Category ib		NA
5.4	Simple Apparatus Used		NA
6	APPARATUS CONSTRUCTION		
6.1	Enclosure IP20 / IP54	IP55	C
6.2	Wiring and Small Components		
6.2.2	Wiring Table 1		C
6.2.3	Wiring Table 2		C
6.2.4	Small Components Table 3		C
6.3	Connection of External Circuits		
6.3.1	Terminals Table 4		NA
6.3.2	Plugs & Sockets Interchangeable		NA
6.3.3	L/R Ratio		NA
6.3.4	Permanently Connected cable		C
6.4	Separation Distances		
6.4.1	Separation IS to Non-IS		NA
	Separation IS to IS		NA
	Separation Earth to Circuit		NA
	Separation Table 4		C
	Metal Partition ≥ 0.45 mm		NA
	Metal Partition Clause 10.10.2		NA
	Non-Metallic Partition ≥ 0.9 mm		NA
	Non-Metallic Partition Clause 10.10.2		NA
	Non-Metallic Partition CTI		NA
6.4.2	Voltage Between Conductive Parts	4.2V	C
6.4.3	Insulating Parts Table 4 Line 4		C
	> 1575 V Partition Clause 6.4		NA
6.4.4	Separation Distances Through and Requirements of Casting Compound		NA
6.4.5	Separation Distances Through Solid Insulation		
	Solid Insulation Clause 6.4.12	< 5mA	C
	Solid Insulation Table 4		C
6.4.6	Composite Separations		NA
6.4.7	Creepage in Air		C

CLAUSE	DESCRIPTION	RESULT	VERDICT
6.4.8	Creepage under Coating		C
6.4.9	Assembled PCBs		C
6.4.10	Separation by Earth Screens		NA
6.4.11	Internal Wiring		C
6.4.12	Electric Strength Tests		
	Insulation IS to Frame 500 V		C
	Leakage Current < 5 mA or X		NA
	Insulation IS to non-IS > 1500V		NA
	IS Breakdown > 500 V		C
6.4.13	Relays		NA
6.5	Protection Against Polarity Reversal		
	Protection	Single diode	C
6.6	Earth Conductors, Connections and Terminals		NA
6.7	Encapsulation for Exclusion of Potentially Explosive Atmospheres		NA
7	COMPONENTS ON WHICH INTRINSIC SAFETY DEPENDS		
7.1	Rating of IS Critical Components		C
7.2	Connectors		NA
7.3	Fuses	91 °C 15A Thermal fuse in battery pack	C
7.4	Primary and Secondary Cells and Batteries		
7.4.3	Voltages	3 Li-ion in parallel 4.2V	C
7.4.4	Internal Resistance	<25mΩ	C
7.4.5	Current Limiting Devices [Ex]		NA
7.4.6	Current Limiting Devices Ex		NA
7.4.7	Current Limiting Devices		
	a) Install and Replace in Ex area		C
	c) Change battery warning	Need warning	C
7.4.8	External Contacts for Charging	Mechanical protection	C
7.4.9	Construction		C
7.5	Semiconductors		
7.5.1	Transient Effects		C
7.5.2	Shunt Voltage Limiters	Battery protection	C
7.5.3	Series Current Limiters		NA
7.6	Failure of Components and Connections		
	Non-Countable Faults	IC short	C
	Countable Faults	Track open, Resistors open, MOSFET	C

CLAUSE	DESCRIPTION	RESULT	VERDICT
7.7	Piezo-Electric Devices		
	Piezo-Electric Devices Used		NA
8	INFALLIBLE COMPONENTS, ASSEMBLIES AND CONNECTIONS		NA
8.1	Mains Transformers		NA
8.2	Transformers Other Than Mains Transformers		NA
8.3	Damping Windings		NA
8.4	Current-Limiting Resistors		NA
	Construction	Metal film SMD	C
	Rating	0.25W	C
8.5	Blocking Capacitors		NA
8.6	Shunt Safety Assemblies		NA
8.6.1	Diodes/Zener Diodes		NA
	Connections Clause 8.7		C
	Rating	Short circuit considered as countable fault	C
	Faults	Short of MOSFET	C
8.6.2	Safety Shunt Assemblies		NA
8.6.3	Shunt Voltage Limiters		NA
8.7	Wiring and Connections		
	a) Wires		
	1) 2 in parallel OR	Countable fault	C
	2) < 50mm or supported OR		NA
	3) stranded, >0.125mm ² , <50mm		NA
	b) PCB Tracks		
	1) min width 1mm and parallel	Countable fault	C
	2) 2mm wide or 1% of length		NA
	3) copper cladding > 35 μm		NA
	c) Connections (excluding plugs, sockets and terminals)		
	1) 2 in parallel		NA
	2) soldered, wires pass through PCB		C
	3) screwed or bolted connection Clause 6.6		NA
8.8	Galvanically Separating Components		NA
9	DIODE SAFETY BARRIERS		NA
10	TYPE VERIFICATION AND TYPE TESTS		
10.1	Spark Ignition Test	Used tables and graphs	C
10.2	Explosive Test Mixtures		NA

CLAUSE	DESCRIPTION	RESULT	VERDICT
10.3	Calibration of the Spark Tester		NA
10.4	Tests with the Spark Tester		NA
10.5	Temperature Tests	44 °C	C
10.6	Voltage Tests	4.2V	C
10.7	Small Component Ignition Test	No ignition	C
10.8	Determination of Parameters of Loosely Specified Components		NA
10.9	Tests for Cells and Batteries		C
10.11	Tests for Apparatus Containing Piezoelectric Devices		NA
10.12	Type Tests for Diode Safety Barriers and Safety Shunts		NA
11	ROUTINE VERIFICATIONS AND TESTS		NA
IEC 62013-1: 2004			
10	Type verifications and tests		
10.1	General		C
10.2	Impact tests		C
10.3	Drop tests		C
10.4	Tests to verify IP54	IP55 at least	C
10.7	Test to verify resistance of cable sheath to fatty acids		C
10.8	Test to verify resistance of cable sheath to fire		C
10.9	Test to verify strength of cable entries, anchoring and cable		C
SANS 1438-3: 1987			
3.	Requirements		
3.5	Mechanical strength of center cord	Up to 305 N with elongation at 265 N equal to 5%	C
3.6	Flexibility of cable	Resistance to alternating bend test	C
IEC/SANS 60079-0: 2000			
27	MARKING		
27.1	Legible and Durable		C
27.2	Manufacturer/Supplier	Optimac (Pty) Ltd	C
	Description	Miners Caplamp	C
	Model	Halo 200	C
	Serial Number	Proto	C
	Ex Symbol	Ex	C

CLAUSE	DESCRIPTION	RESULT	VERDICT
	Ex Protection Type	ia	C
	Gas Group	I/IIC	C
	Temperature Class	T4	C
	Associated Apparatus Marking		NA
	FP Associated Apparatus		NA
	Certification Body Marking	XPL	C
	T _{ambient}		NA
27.3	Multiple Protection Methods		NA
27.4	Marking Order Correct		C
27.5	Component Marking		NA
27.6	Minimum Marking		NA
IEC/SANS 60079-11: 1999			
12	MARKING		
12.1	Safety Parameters	Fixed loop < 5m	NA
12.2	Connections Marked		NA
	Light Blue Color Plugs/Sockets		NA

6. SAFETY PARAMETERS

None

7. DOCUMENTATION

The following documents were provided as part of the intrinsic safety assessment and testing of the unit:

No.	Type	Description
1	Circuit diagram	Halo_200_BP/01/DK rev1.04 10/01/2007 (control) Halo_200_HP/01/DK rev1.04a 10/01/2007 (headpiece) Halo_200_BPcct/01/DK rev1.01 10/01/2007 (batt protection)
2	Track layouts	Halo_Hp rev1.02 headpiece Halo_200_Main rev1.02 control
3	Bill of Materials	Halo 200 main BOM 16/2/2007 Halo 200 Headpiece BOM 16/2/2007
4	Data sheets	LG Chem ICR18650 S2 LRB-PS-CY220 13-01-2003 SEFUSE NEC/SCOTT 18 pages

Copies of which are kept on record at Explolabs.

8. NOTES ON TEST RESULTS

Warnings for safe use and storage instructions from battery-cell manufacturer must be stipulated on the battery pack.

Routine tests during manufacturing:

None

Special Conditions of Use (X):

1. Only charge/replace batteries in safe area.

9. VALIDITY

This report covers only the unit described in Paragraph 2 of this report. Other identical units will only be covered by:

- a. additional approvals covering all serial numbers, or
- b. approval of certified equipment under a product certification scheme accepted by the Department of Minerals and Energy and/or the Department of Labour as relevant.

This type approval report remains valid unless modifications are made to the equipment without obtaining prior approval.

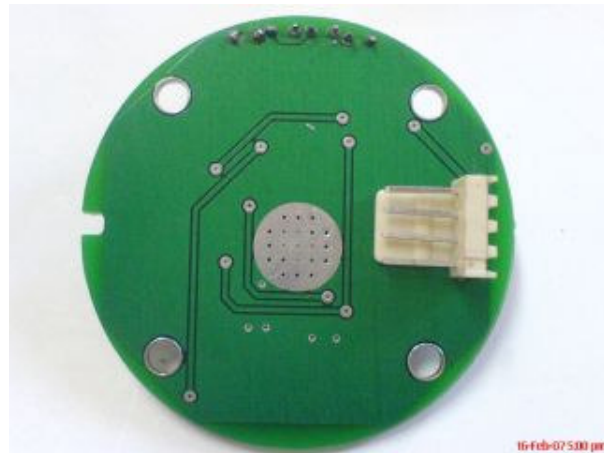
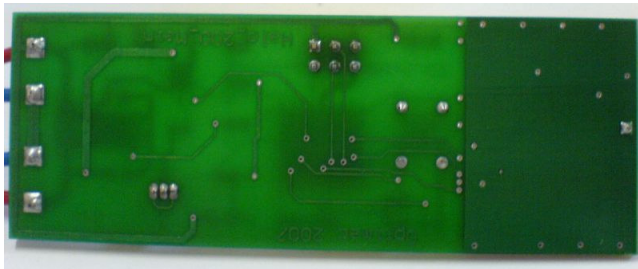
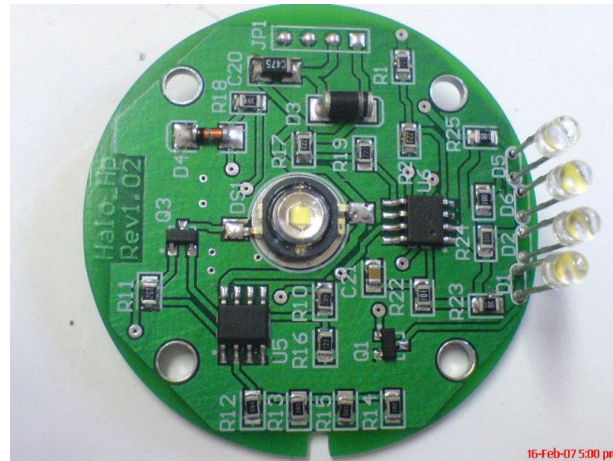
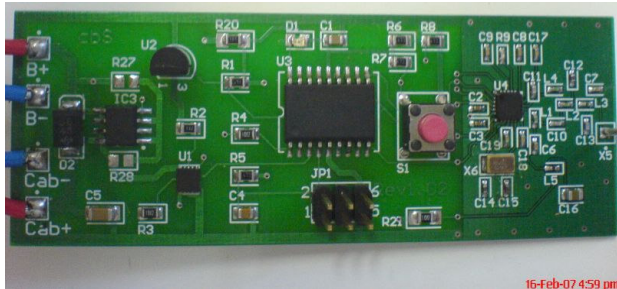
Tested by:

Willem Herholdt
TESTING OFFICER

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Explolabs (Pty) Ltd shall not be liable for any losses or damages sustained on account of any failure or omission to properly perform our duties in terms of any contract undertaken by us. This disclaimer is immutable and automatically incorporated in any contract undertaken by us, notwithstanding anything to the contrary, save for the express written waiver of our managing director.

Fotographs of Miners Caplamp model Halo 200 from Optimac (Pty) Ltd



APPROVED INSPECTION AUTHORITY

T0104

IN TERMS OF:
R21.17.2 OF THE MINERALS ACT (INCORPORATED IN THE MINE HEALTH AND SAFETY ACT, NO 29 OF 1996); AND
EMR 8(2) OF THE OCCUPATIONAL HEALTH AND SAFETY ACT, NO 85 OF 1993

CERTIFICATE

OPTIMAC (PTY) LTD
PO BOX 69080
HIGHVELD TECHNOPARK
0046

Issued: **16 Feb 2007**
*Expire: **16 Feb 2017**
Page 1 of 2

Equipment: Miners Caplamp
Manufacturer: Optimac (Pty) Ltd
Type: Halo 200
Serial No: All serial numbers of equipment covered by a valid report, or accepted product certification mark.

Supplied by
Optimac (Pty) Ltd

Identified by Inspection Authority number
MS-XPL/06875 X

And as described in the ExploLabs test report number XPL/8612/06875 is hereby certified "Explosion Protected Ex ia I/IIC T4", having been examined and inspected in accordance with the relevant requirements of South African Standards.

- IEC/SANS 60079-0:2000 (including Am 1) "Electrical apparatus for explosive gas atmospheres, Part 0: General requirements"**
- IEC/SANS 60079-11:1999 (including Am 1) "Electrical apparatus for explosive gas atmospheres, Part 11: Intrinsic safety 'i' "**
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- SANS 1438-3:1987 "Helmet light assemblies for miners, Part 3: Cables"**

Locations		Gas and dust: Underground
	Zone 1	Gas: Surface
Environment	Group I/IIC	Methane and Coal dust, Propane to Hydrogen and Acetylene
Frequency		Intermittent as could occur under normal operation
Limiting Temperature	T4	135°C

This certification indicates compliance with R21.17.2 of the Mine Health and Safety Act and/or EMR 8(1) of the Occupational Health and Safety Act, provided that the apparatus is used as relevant in accordance with:

- i) SANS 10086 and SANS 61241-10 requirements as applicable;
 - ii) Any conditions mentioned in the above report;
 - iii) Any relevant requirements and codes of practice enforced in terms of the Mine Health and Safety Act or Occupational Health and Safety Act; and
 - iv) Any restrictions and conditions enforced by the Chief Inspector of Mines or the Principal Inspector or the Chief Inspector: Occupational Health and Safety.
- i) * - New equipment may only be presented for sale between the "Issued" and "Expire" dates.



WA Herholdt
TESTING OFFICER

XPL0105

1. GENERAL

This unit consisted of a small battery pack containing 3 Li-Ion batteries connected in parallel with three thermal fuses and the battery protection circuit. The enclosure also had a small compartment, which house the battery charge and other control circuit as well as the on/off switch. The headpiece contained the main and auxiliary LED's and their control circuitry with the standard charging connector and the pluggable cable with strain protection connecting the two units.

2. DOCUMENTATION

Optimac (Pty) Ltd as part of the type approval of the Miners Caplamp submitted the following documents:

No.	Type	Description
1	Circuit diagram	Halo_200_BP/01/DK rev1.04 10/01/2007 (control) Halo_200_HP/01/DK rev1.04a 10/01/2007 (headpiece) Halo_200_BPcct/01/DK rev1.01 10/01/2007 (batt protection)
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4	Data sheets	LG Chem ICR18650 S2 LRB-PS-CY220 13-01-2003 SEFUSE NEC/SCOTT 18 pages

Copies of which are kept on record at Explolabs.

3. SAFETY PARAMETERS

None

4. SPECIAL CONDITIONS OF USE (X)

4.1. Only charge/replace batteries in safe area.

5. MARKING

The following markings shall be added to the unit in a legible and durable manner:
Optimac (Pty) Ltd
Miners Caplamp model Halo 200
Manufacturer: Optimac (Pty) Ltd
Classification: Ex ia I/IIC T4
IA No.: MS-XPL/06875 X
Serial no.: As set out in the batch reports.



WA Herholdt
TESTING OFFICER

