Test Report No:	**MASC 18-1294**	
This report was written by :	D.P Visser Technical Specialist	Signed : 
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Date of issue:	**05 June 2018**	
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Clients name: Address:	Advanced Comms 108 Sandler Rd Glenhazel Johannesburg 2192 South Africa	
Standards:	Publication:	
	SANS 60079-0:2012 “Explosive atmospheres” – Part 0: Equipment - General Requirements **SANS 60079-11:2012** “Explosive atmospheres Part 11: Equipment protection by intrinsic safety "i"”	

Test item description:	**Kutta MFT43 Medium Frequency Radio**
Trademark:	N/A
Model/type reference:	**MFT43**
Manufacturer:	**Kutta Radios, Inc**

Address:	2075 West Pinnacle Peak Road Suite 102 Phoenix AZ 85027 USA
Code (e.g. Ex __ II__ T__):	Ex ia I Ma
Rating:	Ex ia I Ma

Marking:

Manufacturer:	Kutta Radios, Inc
Supplier:	Advanced Comms
Model:	Kutta MFT43 Radio
Serial No:	See "Conditions of Certification"
Ex Rating:	Ex ia I Ma
I.A. Number:	MASC M/18-1294X

Warning:

- The unit must be fully contained in a non-metallic, non-static poach in hazardous area.
- A Static hazard may exist. Only wipe with a damp cloth

Particulars: test item vs. test requirements

Classification of installation and use :	Ex ia I Ma
Ingress protection :	IP54
Rated ambient temperature range (°C):	-20°C to +40°C

General remarks: **None.**

1 Scope

This report provides the basis for certification of a **Kutta MFT43 Medium Frequency Radio**, according to IEC/SANS 60079-0:2012 and IEC/SANS 60079-11:2012 in standard atmospheric pressure for category **ia** Group **I**, EPL level **Ma** in ambient temperatures between **-20 ºC and +40 ºC.**

2 Equipment

The unit is a portable Medium Frequency Radio that is powered from a 12V Nickel-Metal-Hydride Battery pack. The unit comprises of a main body, antenna and a speaker-microphone unit. The main unit houses a Processor, Medium Frequency Transceiver and Carrier board PCB. On the enclosure there is a Power/volume knob, Power-in port, Hirose 12-pin port (round) as well as a TNC RF port (Antenna). The Speaker/Microphone connects to the Hirose port and the battery to the Power In port. The main unit is manufactured from a light aluminium alloy which is not allowed for underground applications. The unit is however a portable device and fully contained in a non-metallic, non-static poach. The unit has approximate dimensions of 140mm x 30mm x 110mm. A minimum ingress protection rating of IP54 must be maintained. See conditions.

3. Test and assessment

3.1 General aspects

3.1.1 Description of enclosure

See Equipment above.

/. Metallic…

3.1.1.a Metallic enclosures – light metal requirements

The main unit is manufactured from a light aluminium alloy which is not allowed for underground applications. The unit is however a portable device and fully contained in a non-metallic, non-static poach. See conditions

3.1.1.b Non-metallic enclosure requirements

See Equipment above

3.1.2 Thermal endurance requirements (only for non-metallic enclosures using Annex F)

N/A. Annex F not applied.

3.1.3 Resistance to chemical agents (only Group I non-metallic enclosures using Annex F)

N/A. Annex F not applied.

3.1.4 Impact test / assessment (only for enclosures using Annex F)

N/A. Annex F not applied.

3.1.5 Drop test / assessment

The battery enclosure and radio unit are separated from each other and contained inside the carrier poach. The individual was subjected to -25°C for a period of 24 hours and dropped from a height of 1m onto a solid concrete floor. No separation or breakage that could impair the IP rating was recorded.

3.1.6 Ingress protection method and test (including gasket retention and cable entry provisions)

The unit maintains an IP54 rating by means of rubber seals on the main unit and speaker/microphone. The rod antenna is a sealed unit with a semi rubber over-mold. The battery enclosure is fully encapsulated. See conditions.

3.1.7 Resistance to light test / assessment (only for non-metallic enclosures using Annex F)

N/A. Annex F not applied.

3.1.8 Connection arrangement, including transient protection requirements

Connections to the main unit are made with screw-on or clip on male and female multi-pin connector plugs.

3.1.9 Dielectric strength test

The unit is a battery powered handheld device. From this no further assessment is required.

3.1.10 Earthing, bonding and circulating currents

No earthing required for intrinsic safety compliance.

3.1.11 Encapsulation

The main unit houses three PCBs that must be fully encapsulated to at least 1mm to free air. See conditions.

/. Plastic…

3.1.12 Plastic electrostatic hazard assessment and tests

The main unit is manufactured from metallic material. The battery is contained inside a non-metallic, non-static poach and should not be removed from the poach in the hazardous area (See conditions). The speaker/microphone has a projected surface area of just more than 10 000mm^2. A static hazard may exist. See conditions. Details kept in the MASC project file.

3.1.13 Printed circuit board

The PCBs are constructed of a glass fibre epoxy.

3.1.14 Partitions, including earth screens

The apparatus utilizes no partitions. No test required.

3.1.15 Cable pull test

The apparatus does not contain a cable requiring testing as part of this approval.

3.1.16 Internal connectors

Internal connectors between the three PCBs are done by means of connector pins and SATA connectors fastened in place along with the PCB self.

3.1.17 Internal wiring

The main unit has internal wiring from one of the external connectors to the PCB. Connection to the PCB is made by means of a plug connector with reversal protection.

3.1.18 Marking requirements, including warning markings

See marking above.

3.1.19 Instructions, including live maintenance procedures (if any)

The unit is supplied with an instruction manual.

3.1.20 Any other general aspects

None

3.2 Spark ignition assessment and tests

3.2.1 Design of equipment to comply with spark ignition requirements

The structure and electrical parameters of the equipment are sufficiently well defined to allow the ignition curves and method given in Annex A of IEC/SANS 60079-11 to be applied.

3.2.2 Apparatus supply and input/output parameters

See marking above.

3.2.3 Protection against polarity reversal

The battery is connected to the main unit with a cable and clip on connector. The connector has a polarity protection mechanism.

/. Resistive…

3.2.4 Resistive spark ignition assessment and tests

The current is actively limited by triplicated load monitoring / current limiting circuitry. The current is limited to less than 900mA. At a maximum voltage of 16.01V (15V Zener clamps with a 5% safety factor) this results in an effective resistance of 18.85Ω. This is considered intrinsically safe for Group I applications operating at 16.01V including a 1.5 times safety factor on current.

Details kept in MASC project file..

3.2.5 Inductive spark ignition assessment and tests

The maximum allowed energy for Group I applications are 525µJ (SANS 60079-11).

E = ½ L x Io.

I_{sc} = 0.789A. From this the maximum allowed inductance amounts to 576.1 µH. The total inductance in the unit was determined to be 518µH which is less than the allowed inductance. From this no further assessment is required.

Note Io = 900mA was used for the inductive assessment

Details kept in the MASC Project file.

3.2.6 Combination of resistive, capacitive and inductive assessment and tests

The total capacitance in the circuit was found to be more than allowed for per standard (including a 1.5 safety factor). It is therefore required to exclude the components from the explosive atmosphere by means of encapsulation. See conditions.

3.2.7 Let-through energy assessment and tests

The unit is a handheld battery powered unit and hence there is no possibility of a brief transient voltage / current higher than allowed for per Table A.1 . Therefore, no further assessment required.

3.2.8 Any other spark ignition assessments and tests

No other spark ignition assessment and tests are required.

3.3 Thermal ignition assessment and tests

3.3.1 Design of equipment to comply with thermal ignition requirements

The power to the PCB is limited by the triplicated current limiting circuitry and resulting 18.85Ω in-line resistance. The PCB's are housed inside an IP54 enclosure. The battery pack and main unit PCBs are fully encapsulated to at least 1mm to free air. From this no further assessment is required.

3.3.2 Components temperature assessment and tests, including small component ignition test

The power is calculated using the nominal voltage from the battery pack and the resulting resistance from the triplicated active current limiters.

$$Pd = (V_{zener} \times 1.05)^2 / (4\ R_{resuling})$$

Pd = 1.9936W

This is less than the allowed 3.3W for Group I applications.

/. Wiring…

3.3.3 Wiring temperature assessment and tests

The equipment has been assessed as suitable for Group I temperature class (150°C). Reference to clause 5.6.3 of SANS60079-11 shows that such a power is acceptable for wiring without any further evaluation.

3.3.4 Printed board tracks assessment and tests

See “3.3.2 above”.

3.3.5 Enclosure external temperature assessments and tests

Enclosure external temperatures will be less than internal component temperatures which comply with the assigned Group I.

3.3.6 Service temperature determination and assessment

No further assessment is required for external temperature, as the assessment above covers Group I sufficiently.

3.3.7 Any other thermal ignition assessments and tests

No other thermal ignition assessment and tests required.

3.4 Segregation requirements

Annex F was not applied.

3.5 Safety components

3.5.1 Transformers

No transformers are incorporated.

3.5.2 Resistors

The unit does not utilize physical resistors.

3.5.3 Capacitors

The equipment contains no blocking capacitors.

3.5.4 Semiconductors

The equipment contains voltage clamps and triplicated series current limiters. See Section 3.5.11 below.

3.5.5 Opto-isolators

The unit contains no opto-isolators.

3.5.6 Relays

The unit contains no relays.

/.Fuses…

3.5.7 Fuses

The unit utilises three 4.4A PTC fuses, but these are not included as part of the safety components.

3.5.8 Infallible connections

N/A

3.5.9 Infallible windings

No infallible windings are applicable in this application.

3.5.10 Any other safety components used

No other safety components are used in this application.

3.5.11 Ratings of safety components

Component designation	Component location	Value	Rating used * (W2)	Maximum Rating (W1)	W1 / W2
D9 & D10	Power header – Main PCB	5W	2.025W	5W	> 1.5
U1, U2, U3	Battery PCB	4V – 80V	12.6	80V	>1.5
Q1, Q2, Q3	Battery PCB	130W	11.34W	130V	> 1.5

3.6 Requirements of specific components

3.6.1 Batteries

The unit is powered from a Nickel-Metal-Hydride battery pack consisting of 10, 1.2V (min) cells connected in series. Three 4.4A PTC Trip fuses are in-line. The cells have rated capacity of 1.5Ah (min) and internal resistance of 15mOhm.

The cells were subjected to a short circuit assessment to determine the worst-case surface temperature.

The highest temperature after assessing 10 individual cells was 154°C on the surface of the cell itself. The cells are however fully encapsulated inside an IP54 enclosure and the maximum temperature on the surface of the enclosure was less than the required 150°C. From this no further assessment is required.

Details kept in the MASC project file.

3.6.2 Piezo electric devices

No piezo electric devices are used in this application.

3.6.3 Fibre optic cables/ Optical and RF Energy

No fibre optic cables or Optical devices are used in this application

3.6.4 Safety barriers – assessments and tests

No safety barriers are used in this application.

/.Simple…

3.6.5 Simple apparatus

No simple apparatus forms part of this assessment

3.6.6 Determination of parameters of loosely specified components

This clause was not applied for the equipment in this assessment.

3.6.7 Ex components and their mounting method

No Ex components are used in this application.

3.6.8 Any other components

No other components on which the intrinsic safety depends are used in this application.

4 Results

The **Kutta MFT43 Medium Frequency Radio, COMPLY** with the requirements of IEC/SANS 60079-0:20012 and IEC/SANS 60079-11:20012 in standard atmospheric pressure for category **ia** Group **I,** EPL level **Ma** in ambient temperatures between -20ºC and +40ºC.

5 Additional information

None.

6 Conditions

6.1 Conditions of manufacture

- All PCBs in the main unit must be encapsulated to at least 1mm to free air.

6.2 Conditions of safe use

- The unit must be fully contained in a non-metallic, non-static poach in hazardous area.
- A Static hazard may exist. Only wipe with a damp cloth

7 Schedule

The tests and assessments provided in this report are considered applicable to the following range of equipment:

Kutta MFT43 Medium Frequency Radio

/.Documents…

8 Documents

Medium Frequency Transceiver v4.3	MFT-SCH-4.3-001	-	31 July 2013
Top-Level Block Diagram	RCP1-BLK1	-	-
Dipole Rod Antenna Matching Circuit	D1-P-DPA1-LY	Rev B	08-08-2014
Dipole Rod Antenna Assembly (With BOM)	D1-P-DPA1-AS	Rev B	08-08-2014
Dipole Rod Antenna Matching Network	D1-P-DPA1-SC	Rev B	14-09-2014
12V Rechargeable Battery for DRUM 100RCP	D1-RCP-ISBAT-1	-	-
900mA Current limiter for Ex ia 12V Battery Pack	D1-RCP-ISBAT-2	Rev A	27-02-2018
DRUM 100P Speaker Microphone	D1-P-SPK1-SM	Rev A	01-06-2010

Photos, BOM and datasheets kept in project file.

/. APPENDIX…

APPENDIX A COMPLIANCE CHECK LISTS
Appendix A.1

No:	Heading of clause	Report clause no., or excluded or no requirement
1	Scope	1
2	Normative references	No requirement
3	Terms and definitions	No requirement
4		
4.1	Apparatus grouping	1
4.2	Group II	1
4.2.1	Group II subdivisions	1, 3.2
4.2.2	Group II – Surface temperature marking	1, 3.1.18, 3.3
4.2.3	Apparatus for a particular explosive atmosphere	1
5		
5.1		
5.1.1	Ambient temperature	1, 3.3
5.1.2	External source of heating or cooling	1, 3.3.1, 6.2
5.2	Service temperature	3.3.1, 3.5
5.3		
5.3.1	Determination of maximum surface temperature	3.3.1
5.3.2		
5.3.2.1	Group I electrical apparatus	1, 3.3
5.3.2.2	Group II electrical apparatus	1, 3.3
5.4	Surface temperature and ignition temperature	1, 3.3
5.5	Small components	1, 3.3.2
6		
6.1	General	1, 3, 4
6.2	Mechanical strength of apparatus	3.1.2, 3.1.3
6.3	Opening times	Excluded
6.4	Circulating currents	3.1.6
6.5	Gasket retention	3.1.3
7		
7.1		
7.1.1	Applicability	3.1.1.b
7.1.2	Specification of materials	3.1.1.b
7.1.3	Plastic materials	3.1.1.b
7.2	Thermal endurance	3.1.2
7.3		
7.3.1	Applicability	3.1.12
7.3.2	Avoidance of a build-up of electrostatic charge	3.1.12
7.4	Threaded holes	Excluded
8		
8.1		
8.1.1	Group I	3.1.1.a
8.1.2	Group II	3.1.1.a
8.2	Threaded holes	Excluded
9	Fasteners	Excluded
10	Interlocking devices	Excluded
11	Bushings	Excluded
12	Materials used for cementing	Excluded
13		
13.1	General	3.6.7

No:	Heading of clause	Report clause no., or excluded or no requirement
13.2	Mounting internal to apparatus	3.6.7
13.3	Mounting external to apparatus	3.6.7
14	Connection facilities and terminal compartments	Excluded
15	Connection facilities for earthing or bonding conductors	Excluded
16		
16.1	General	
16.2	Identification of entries	3.1.6
16.3	Cable glands	3.1.6
16.4	Blanking elements	3.1.6
16.5	Conductor temperature	Excluded
17	Supplementary requirements for rotating electrical machines	Excluded
18	Supplementary requirements for switchgear	Excluded
19	Supplementary requirements for fuses	Excluded
20	Supplementary requirements for plugs and sockets	Excluded
21	Supplementary requirements for luminaires	Excluded
22	Supplementary requirements for caplights and handlights	Excluded
23	Apparatus incorporating cells and batteries	3.6.1
23.1	Batteries	3.6.1
23.2	Cell types	3.6.1
23.3	Cells in a battery	3.6.1
23.4	Ratings of batteries	3.6.1
23.5	Mixture of cells	3.6.1
23.6	Interchangeability	3.6.1
23.7	Charging of primary batteries	3.6.1
23.8	Leakage	3.6.1
23.9	Connections	3.6.1
23.10	Orientation	3.6.1, 3.1.18
23.11	Replacement of cells or batteries	3.6.1, 3.1.18
24	Documentation	8
25	Compliance of prototype or sample with documents	2, 3, 8
26		
26.1	General	2, 3, 7, 8
26.2	Test configuration	3
26.3	Tests in explosive test mixtures	3
26.4		
26.4.1		
26.4.1.1	Metallic enclosures, metallic parts of enclosures and glass of parts of enclosures	3.1.3, 3.1.4
26.4.1.2	Non-metallic enclosures or non-metallic parts of enclosures	3.1.2, 3.1.3, 3.1.4, 3.1.5, 3.1.6
26.4.1.2.1	Group I electrical apparatus	3.1.2, 3.1.3, 3.1.4, 3.1.5, 3.1.6, 3.1.7
26.4.1.2.2	Group II electrical apparatus	3.1.2, 3.1.4, 3.1.5, 3.1.6, 3.1.7
26.4.2	Resistance to impact	3.1.4
26.4.3	Drop test	3.1.5
26.4.4	Acceptance criteria	3.1.4, 3.1.5
26.4.5		
26.4.5.1	Test procedure	3.1.6
26.4.5.2	Acceptance criteria	3.1.6
26.5		

No:	Heading of clause	Report clause no., or excluded or no requirement
26.5.1	Temperature measurement	3.3
26.5.2	Thermal shock test	Excluded
26.5.3		
26.5.3.1	General	3.3.2
26.5.3.2	Procedure	3.3.2
26.5.3.3	Acceptance criteria	3.3.2
26.6	Torque test for bushings	Excluded
26.7		
26.7.1	General	3.1.1.b, 3.1.2, 3.1.3, 3.1.4, 3.1.5, 3.1.6, 3.1.7
26.7.2	Temperature during tests	3.3.6
26.8	Thermal endurance to heat	3.1.2
26.9	Thermal endurance to cold	3.1.2
26.10		
26.10.1	Applicability	3.1.7
26.10.2	Test procedure	3.1.7
26.10.3	Acceptance criteria	3.1.7
26.11	Resistance to chemical agents for Group I electrical apparatus	3.1.3
26.12	Earth continuity	Excluded
26.13	Surface resistance test of parts of enclosures of non-metallic materials	3.1.12
26.14		
26.14.1	Introduction	3.1.12
26.14.2	Principle of the test	3.1.12
26.14.3	Samples and apparatus	3.1.12
26.14.4	Ambient conditions	3.1.12
26.14.5	Conditioning	3.1.12
26.14.6		
26.14.6.1	Method A: Rubbing with a pure polyamide cloth (Figure 6)	3.1.12
26.14.6.2	Method B: Rubbing with a cotton cloth	3.1.12
26.14.6.3	Method C: Charging by influence with a d.c. high-voltage power supply (Figure 8)	3.1.12
26.14.7	Assessment of discharge	3.1.12
26.15		
26.15.1	Test procedure	3.1.12
26.15.2	Acceptance criteria	3.1.12
27	Routine verifications and tests	6.1
28		
28.1	Certificate	No requirement
28.2	Responsibility for marking	3.1.18
29		
29.1	Location	3.1.18
29.2	General	3.1.18
29.3	Different type of protection	3.1.18
29.4	Order of marking	3.1.18
29.5	Ex components	3.1.18
29.6	Small apparatus and Ex components	3.1.18
29.7	Extremely small apparatus and Ex components	3.1.18
29.8	Warning markings	3.1.18
29.9	Cells and batteries	3.1.18

No:	Heading of clause	Report clause no., or excluded or no requirement
29.10	Examples of marking[3]	3.1.18
30		
30.1	General	3.1.19
30.2	Cells and batteries	3.1.19
Annex A	Ex cable glands	Excluded
Annex B	Requirements for Ex components	3.6.7

Appendix A.2

No:	Heading of clause	Report clause no., or excluded or no requirement
1	Scope	1, 3
2	Normative references	No requirement
3	Terms and definitions	No requirement
4	Grouping and classification of intrinsically safe apparatus and associated apparatus	1
5		
5.1	General	1, 3.1.18, 3.2, 3.3, 3.4
5.2	Level of protection “ia”	1, 3.1.18, 3.2, 3.3, 3.4
5.3	Level of protection “ib”	1, 3.1.18, 3.2, 3.3, 3.4
5.4	Level of protection “ic”	1, 3.1.18, 3.2, 3.3, 3.4
5.5	Spark ignition compliance	3.2
5.6		
5.6.1	General	3.3
5.6.2	Temperature for small components	3.3.2
5.6.3	Wiring within apparatus	3.3.3
5.6.4	Tracks on printed circuit boards	3.3.4
5.7	Simple apparatus	3.6.5
6		
6.1	Enclosures	3.1.1, 3.1.6
6.1.1	Apparatus complying with Table 5	3.1.1, 3.1.5
6.1.2	Apparatus complying with Annex F	3.1.1, 3.1.2, 3.1.3, 3.1.4, 3.1.5, 3.1.6, 3.1.7
6.2		
6.2.1	Terminals	3.1.8, 3.4
6.2.2	Plugs and sockets	3.1.8
6.2.3	Determination of maximum external inductance to resistance ratio (Lo/Ro) for resistance limited power source	3.2.2
6.2.4	Permanently connected cable	3.1.8, 3.1.15
6.3	Separation distances	3.4
6.3.1	Separation of conductive parts	3.1.1, 3.1.10, 3.1.14, 3.4
6.3.1.1	Distances according to Table 5	3.4
6.3.1.2	Distances according to Annex F	3.4
6.3.2	Voltage between conductive parts	3.4
6.3.3	Clearance	3.4, 3.1.14
6.3.4	Separation distances through casting compound	3.1.9, 3.1.11, 3.4
6.3.5	Separation distances through solid insulation	3.1.9, 3.4

No:	Heading of clause	Report clause no., or excluded or no requirement
6.3.6	Composite separations	3.4
6.3.7	Creepage distance	3.1.13, 3.1.14, 3.4
6.3.8	Distance under coating	3.1.13, 3.4
6.3.9	Requirements for assembled printed circuit boards	3.1.13, 3.4
6.3.10	Separation by earth screens	3.1.14, 3.4
6.3.11	Internal wiring	3.1.17, 3.4
6.3.12	Dielectric strength requirement	3.1.9
6.3.13	Relays	3.5.6
6.4	Protection against polarity reversal	3.2.3
6.5	Earth conductors, connections and terminals	3.1.8, 3.1.10
6.6	Encapsulation	3.1.11
7		
7.1	Rating of components	3.2.2, 3.5.11
7.2	Connectors for internal connections, plug-in cards and components	3.1.10, 3.1.16
7.3	Fuses	3.1.11, 3.2.2, 3.5.7, 3.5.11
7.4	Primary and secondary cells and batteries	3.6.1
7.4.1	General	3.1.18, 3.1.19, 3.6.1, 6.2
7.4.2	Electrolyte leakage and ventilation	3.1.11, 3.6.1
7.4.3	Cell voltages	3.6.1
7.4.4	Internal resistance of cell or battery	3.6.1
7.4.5	Batteries in apparatus protected by other means of protection	3.2.2, 3.6.1
7.4.6	Batteries used and replaced in explosive gas atmospheres	3.1.5, 3.1.11, 3.6.1
7.4.7	Batteries used but not replaced in explosive gas atmospheres	3.1.5, 3.1.18, 3.1.19, 3.6.1
7.4.8	External contacts for charging batteries	3.1.8, 3.2.2, 3.6.1
7.4.9	Battery construction	3.1.11, 3.2.3, 3.6.1
7.5		
7.5.1	Transient effects	3.5.4
7.5.2	Shunt voltage limiters	3.2.8, 3.5.4, 3.5.11
7.5.3	Series current limiters	3.5.4, 3.5.11
7.6	Failure of components, connections and separations	3, 3.2, 3.3.2, 3.5.11
7.7	Piezo-electric devices	3.6.2
7.8	Electrochemical cells for the detection of gases	3.2.1, 3.2.4
8	Infallible components, infallible assemblies of components and infallible connections on which intrinsic safety depends	1, 4
8.1	Mains transformers	3.5.1
8.1.1	Protective measures	3.5.1, 3.5.7, 3.5.11
8.1.2	Transformer construction	3.1.9, 3.4, 3.5.1, 3.5.7
8.1.3	Transformer type tests	3.1.9, 3.4, 3.5.1
8.1.4	Routine test of mains transformers	3.5.1, 6.1
8.2	Transformers other than mains transformers	3.5.1, 6.1
8.3		
8.3.1	Damping windings	3.5.9
8.3.2	Inductors made by insulated conductors	3.5.9
8.4	Current-limiting resistors	3.5.2
8.5	Blocking capacitors	3.5.3

No:	Heading of clause	Report clause no., or excluded or no requirement
8.6		
8.6.1	General	3.2.8, 3.5.4, 3.5.6, 3.5.11
8.6.2	Safety shunts	3.5.4
8.6.3	Shunt voltage limiters	3.5.4
8.7	Wiring, printed circuit board tracks, and connections	3.1.13, 3.1.16, 3.5.8
8.8		
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VALIDITY OF THIS REPORT

Any modification to the unit, or exceeding its ratings, or using it in another atmosphere as described above, will invalidate the applicability of this report to the equipment.

This report only covers the type approval of the equipment.

According to the relevant requirements of the MHS Act and the OHS Act, production units of explosion protected equipment are required to comply with third party quality assurance (an approved mark scheme or batch testing by an accredited test laboratory.)

Mining And Surface Certification