MT

COAL INDUSTRY STANDARD OF

THE PEOPLE'S REPUBLIC OF CHINA

ICS 73.100.99
D 98
File No.: 25344-2008

MT/T 1078-2008

Direct current power supply with intrinsically safe output for a coal mine

矿用本质安全输出直流电源

Issued on: November 19, 2008 **Implemented on: January 01, 2009**

Issued by: State Work Safety Administration

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Direct current power supply with intrinsically safe output for a coal mine

1 Scope

This Standard specifies the product classification, technical requirements, test methods, inspection rules, mark, packaging, transportation and storage of direct current power supply with intrinsically safe output for a coal mine.

This Standard applies to direct current power supply with intrinsically safe output for a coal mine (hereinafter referred to as DC power supply).

2 Normative references

The provisions in following documents become the provisions of this Standard through reference in this Standard. For dated references, the subsequent amendments (excluding corrigendum) or revisions do not apply to this Standard, however, parties who reach an agreement based on this Standard are encouraged to study if the latest versions of these documents are applicable. For undated references, the latest edition of the referenced document applies.

GB/T 191 Packaging - Pictorial marking for handling of goods (GB/T 191-2000, eqv ISO 780:1997)

GB/T 2423.1 Environmental testing for electric and electronic and electronic products - Part 2: Test methods - Tests A: Cold (GB/T 2423.1-2001, idt IEC 60068-2-1:1990)

GB/T 2423.2 Environmental testing for electric and electronic products - Part 2: Test methods - Tests B: Dry heat (GB/T 2423.2-2001, idt IEC 60068-2-1:1990)

GB/T 2423.3 Basic environmental testing procedures for electric and electronic products - Test Ca: Damp heat, steady state (GB/T 2423.2-1992, eqv IEC 68-2-3:1984)

GB/T 2423.4 Basic environmental testing procedures for electric and electronic products - Test Db: Damp heat, cyclic (GB/T 2423.4-1993, eqv IEC 68-2-3:1980)

GB/T 2423.5 Environmental testing for electric and electronic products - Part 2: Test methods - Test Ea and guidance: Shock (GB/T 2423.5-1995, idt IEC

68-2-27:1982)

GB/T 2423.10 Environmental testing for electric and electronic products - Part 2: Test methods - Test Fc and guidance: Vibration (Sinusoidal) (GB/T 2423.10-1995, idt IEC 68-2-6:1982)

GB/T 2829-2002 Sampling procedures and tables for periodic inspection by attributes (Apply to inspection of process stability)

GB 3836.1 Electrical apparatus for explosive gas atmospheres - Part 1: General requirements (GB 3836.1-2000, eqv IEC 60079-0:1998)

GB 3836.2 Electrical apparatus for explosive gas atmospheres - Part 2: Flameproof enclosure “d” (GB 3836.2-2000, eqv IEC 60079-1:1990)

GB 3836.3 Electrical apparatus for explosive gas atmospheres - Part 3: Increased safety “e” (GB 3836.3-2000, eqv IEC 60079-7:1990)

GB 3836.4 Electrical apparatus for explosive gas atmospheres - Part 4: Intrinsic safety “i” (GB 3836.4-2000, eqv IEC 60079-11:1999)

GB 3836.9 Electrical apparatus for explosive gas atmospheres - Part 9: Encapsulation “m”

GB 4208 Degrees of protection provided by enclosure (IP code) (GB 4208-1993, eqv IEC 529:1989)

GB/T 5080.1-1986 Equipment reliability testing General requirements (idt 605-1:1978)

GB/T 5080.7 Equipment reliability testing Compliance test plans for failure rate and mean time between failures assuming constant failure rate (GB/T 5080.7-1986, idt IEC 605-7:1978)

GB/T 10111 Methods for random sampling by utilizing dices of random number

GB 12173 Mining electrical apparatus for non-hazardous area (GB 12173-1990, neq ROCT 24754:1981)

GB/T 17626.3-2006 Electromagnetic compatibility - Testing and measurement techniques - Radiated radio-frequency electromagnetic field immunity test (idt IEC 61000-4-3:1995)

GB/T 17626.4-1998 Electromagnetic compatibility - Testing and measurement techniques - Electrical fast transient/burst immunity test (idt IEC 61000-4-4:1995)

GB/T 17626.5-1999 Electromagnetic compatibility - Testing and measurement

techniques - Surge immunity test (idt IEC 61000-4-5:1995)

AQ 6021 General technical requirements for safety and supervision system of coal mine

MT 210 Basic test methods of communication, inspection and control of electric and electronic products of coal mine

MT/T 286 Planning and management methods for communication and automation of products of coal mine

MT/T 1004 General technical requirements for safe production and supervision system of coal mine

3 Product classification

3.1 Model

Model of product shall be in accordance with the specifications of MT/T 286.

3.2 Classification

3.2.1 According to explosion proof type:

a) Mining flameproof and intrinsically safe type;

b) Ground common and mining intrinsically safe type;

c) Mining general and intrinsically safe type;

d) Mining casting and intrinsically safe type.

3.2.2 According to operating principle:

a) Linear DC power supply;

b) Switching mode DC power supply;

c) Mixed mode DC power supply (linear and switching mode).

3.2.3 According to output function:

a) Single-circuit output;

b) Multi-circuit output.

3.2.4 According to standby battery:

4.4.5 Working hours and transfer time of standby power supply

For DC power supply with standby battery, the working hours of its standby battery shall not be less than 2 h. The transfer time shall not have impact on power receiving equipment and shall be specified in relevant standards.

4.5 Main functions

4.5.1 It shall have input and output power supply indication function.

4.5.2 It shall have current-limiting, voltage limiting and short circuit protection function, thus automatic recovery can be made after fault is removed.

4.5.3 AC power supply with standby battery:

a) It shall have standby power supply indication;

b) It shall use floating charge, with overcharge and over discharge protection.

4.6 Structure

4.6.1 Fasteners shall have measures that avoid automatic loose.

4.6.2 Mental parts shall be implemented with anti-rust and anti-corrosive treatment.

4.6.3 Requirements for other structures indication function are in accordance with GB 3836.1 ~ GB 3836.4, GB 3836.9, GB 12173 and other relevant standards.

4.7 Appearance

4.7.1 Surface of DC power supply shall not have obvious indenture, scratch, crack and deformation; surface coating and plating shall be uniform, without blister, crack and falling.

4.7.2 Mental parts shall not have corrosion and other mechanical damage.

4.7.3 Switch and button shall operate flexibly; parts shall be tight; pluggable moving parts shall be flexible.

4.7.4 Parameter light with different functions shall have different colors; symbols and characters of explanation function and all marks of DC power supply shall be clear and installed tightly.

4.7.5 Other requirements for appearance shall be in accordance with GB 3836.1 ~ GB 3836.4, GB 3836.9, GB 12173 and other relevant standards.

4.8 Protective function of enclosure

AC power supply shall be conducted for working stability test, in which time of power-on test shall not be less than 48 h, and the main technical parameters and functions shall not be below requirements of this Standard.

4.12 Anti-interference performance

4.12.1 AC power supply should be able to pass radiated radio-frequency electromagnetic field immunity test with severity of Level-1 specified in GB/T 17626.3-2006; the main technical parameters and functions shall not be below requirements of this Standard.

4.12.2 AC power supply should be able to pass electrical fast transient and burst immunity test with severity of Level-2 specified in GB/T 17626.3-1998; the main technical parameters and functions shall not be below requirements of this Standard.

4.12.3 AC power supply should be able to pass surge (shock) immunity test with severity of Level-1 specified in GB/T 17626.5-1999; the main technical parameters and functions shall not be below requirements of this Standard.

4.13 Reliability

Mean time between failure of AC power supply (MTBF) shall not be less than 1000 h.

4.14 Environmental suitability

4.14.1 AC power supply shall pass high temperature working test; the main technical parameters, functions and appearance shall not be below requirements of this Standard.

4.14.2 AC power supply shall pass low temperature working test; the main technical parameters, functions and appearance shall not be below requirements of this Standard.

4.14.3 AC power supply shall pass storage in high temperature working test; the main technical parameters, functions and appearance shall not be below requirements of this Standard.

4.14.4 AC power supply shall pass storage in low temperature working test; the main technical parameters, functions and appearance shall not be below requirements of this Standard.

4.14.5 AC power supply shall pass damp heat test; the main technical parameters, functions and appearance shall not be below requirements of this Standard.

4.14.6 AC power supply shall pass vibration test; the main technical parameters, functions and appearance shall not be below requirements of this Standard.

4.14.7 AC power supply shall pass shock test; the main technical parameters, functions and appearance shall not be below requirements of this Standard.

4.15 Explosion-proof performance

AC power supply of explosion proof type shall be in accordance with the relevant specifications of GB 3836.1 ~ GB 3836.4 and GB 3836.9, which shall have dual or multiple current-limiting, voltage limiting and circuit protection function.

4.16 Performance of mining general type

Performance of mining general type shall be in accordance with the specifications of GB 12173.

4.17 Intrinsically safe parameters

4.17.1 The highest output voltage shall meet requirements of intrinsically safe explosion proof and shall be specified in relevant standards.

4.17.2 Maximum output current shall meet requirements of intrinsically safe explosion proof and shall be specified in relevant standards.

4.17.3 Maximum external capacitance shall meet requirements of intrinsically safe explosion proof and shall be specified in relevant standards.

4.17.4 Maximum external inductance shall meet requirements of intrinsically safe explosion proof and shall be specified in relevant standards.

5 Test methods

5.1 Environmental conditions

Unless otherwise specified in environmental test and relevant standards, test shall be conducted in the following environmental conditions:

a) Temperature: 15°C ~ 35°C;

b) Relative humidity: 45% ~ 75%;

c) Atmospheric pressure: 86 kPa ~ 106 kPa.

5.2 Main technical parameters and main function test

5.2.1 Measuring apparatus and equipment

5.2.1.1 General requirements for measuring apparatus and equipment

current gradually increase to rated current, MEASURE output voltage of AC power supply, which is the minimum output voltage.

For multi-circuit output AC power supply, other circuits shall be increased to value of rated load with circuit measured.

5.2.3.2 Period and random deviation

SET source voltage as specified maximum value and minimum value, MEASURE period and random deviation (PARD) when load current is rated value and zero value, TAKE maximum value in measured values.

For multi-circuit output AC power supply, other circuits shall be increased to value of rated load with circuit measured.

5.2.3.3 Indication function of input and output power supply

During the test performed according to 5.3.3.1, OBSERVE whether indication function of input and output power supply is normal.

5.2.3.4 Voltage limiting function

DISCONNECT output terminal of a power supply to make source voltage increase from minimum value to maximum value, OBSERVE AC voltmeter (V), the maximum value is maximum output voltage. CARRY out test for 5 times continuously.

5.2.3.5 Current limiting and short circuit protection function

SET source voltage as specified maximum value, ADJUST artificial load to make load current gradually increase to output short circuit. OBSERVE ampere meter (A), the maximum current is maximum output current of AC power supply, final indicating value is short circuit current of AC power supply. REMOVE over-current and short-circuit faults, INSPECT whether AC power supply can recover by itself or not. CARRY out test for 5 times continuously.

For multi-circuit output AC power supply, output of other circuits shall be rated load.

5.2.3.6 Standby power supply function

It shall be ensured that standby power supply is charged completely. SET source voltage as rated value, ADJUST artificial load to make load current become rated value. DISCONNECT AC power supply, USE oscilloscope to observe whether wave shape of output voltage is discontinuous, the discontinuous time is transfer time. At the same time, COUNT when standby battery is put into use and stop until output voltage of AC power supply is below the minimum output voltage. 80% of the above time is deemed as the working time.

Reliability test shall be conducted in accordance with the relevant specifications of GB/T 5080.7, ADOPT fixed time test plan. Failure judgment shall be conducted in accordance with the relevant specifications of 9.2 in GB/T 5080.1.

5.12 High temperature working test

High temperature test shall be conducted in accordance with relevant specifications of GB/T 2423.2. AC power supply to be tested shall be at connection state for 2 continuous hours with a severity level of highest working environmental temperature.

5.13 Low temperature working test

Low temperature test shall be carried out according to relevant specifications of GB/T 2423.1. AC power supply to be tested shall be at connection state for 2 continuous hours with a severity level of lowest working environmental temperature.

5.14 High temperature storage test

High temperature storage test shall be carried out according to relevant specifications of GB/T 2423.2. AC power supply to be tested shall be at disconnection state for 16 continuous hours with a severity level of +60°C and a recovery time not less than 1 h.

5.15 Low temperature storage test

Low temperature storage test shall be carried out according to relevant specifications of GB/T 2423.1. AC power supply to be tested shall be at disconnection state for 16 continuous hours, with a severity level of -40°C and a recovery time not less than 1 h.

5.16 Damp heat test

5.16.1 Damp heat test below mine shall be carried out according to relevant specifications of GB/T 2423.4, severity level is +40°C, and period is 12 d. Measurement and voltage withstand test of insulation resistance shall be carried out in 2 h before completion of test (at stage of low temperature with high humidity). After test, main technical parameters and main functions shall be inspected.

5.16.2 Damp heat test shall be carried out in accordance with relevant specifications of GB/T 2423.3; severity level shall be in accordance with the specifications of Table 5. After test, measurement and voltage withstand test of insulation resistance shall be carried out immediately; then performance parameters and appearance shall be inspected. Damp heat test of interchanger shall be carried out in accordance with relevant specifications of GB/T 2423.4, severity level is +40°C, period is 12d. Measurement and voltage withstand test of insulation resistance shall be carried out in 2 h before completion of test (at stage of low temperature with high humidity). After test, main technical parameters and main functions shall be inspected.

6 Inspection rules

6.1 Inspection rules

Inspection consists of factory-exit inspection and type inspection.

6.2 Factory-exit inspection

6.2.1 AC power supply shall be carried out for factory-exit inspection. Qualified products shall be given certificate.

6.2.2 Quality inspection department of factory shall be responsible for factory-exit inspection; if necessary, buyers can participate.

6.2.3 Inspection items shall be in accordance with the specifications of Table 8.

6.2.4 Each function and technical parameter of factory-exit inspection shall be in accordance with requirements of this Standard and relevant standards. If there is a unqualified item, then the product is judged as unqualified product.

6.3 Type inspection

6.3.1 Type inspection shall be carried out when one of the following circumstances occurs:

a) When new product or old product is transferred to other plants for type-identification;

b) After formal production, if there is significant change of structure, material and process, which may have impact on performance of AC power supply;

c) Once every three years in normal production;

d) When production is recovered after stopping for one year;

e) When there is significant difference between results of factory-exit inspection and the last type inspection;

f) When relevant national organizations put forward type inspection.

6.3.2 Inspection items shall be in accordance with the specifications of Table 8.

6.3.5 When batch number is more than 50, sampling inspection shall be carried out according to GB/T 2829-2002. Choose one-time sampling scheme; judgment level is III; rejectable quality level (RQL) is not more than 40. Specified RQL of A item is usually below that of B item; specified RQL of C item is usually more than that of B item. For type A item, if one-item is unqualified, then the whole batch is judged as unqualified products, for B- and C-item, unqualified quantities determined shall be in accordance with relevant standards.

Inspection shall be carried out in accordance with requirements for inspection item. Accumulate unqualified quantities or number of unqualified products to judge whether this batch is qualified according to the batch determined. Unqualified products shall be handled in accordance with 5.12 in GB/T 2829-2002.

7 Marking, packaging, transportation and storage

7.1 Marking

7.1.1 Product marks

7.1.1.1 Explosion-proof-type AC power supply shall have MA safety mark.

7.1.1.2 Obvious location of enclosure of explosion-proof-type AC power supply and general-mining-type AC power supply shall be installed clear and permanent mark “Ex” and “KY’ respectively.

7.1.1.3 Nameplate shall be installed at obvious location of enclosure; the nameplate shall be clear, which shall be in accordance with the specifications of GB 3836.1 ~ GB 3836.4, GB 3836.9, GB 12173 and relevant national industry standards, based on type of AC power supply. The following contents shall at least be included:

a) Name and model of products;

b) Serial number of safety marks;

c) Number of explosion-proof certificate or explosion-proof inspection certificate;

d) Necessary technical parameters (rated input voltage, highest output voltage, maximum output current, minimum output voltage, rated working current, etc.);

e) Product number and date of production;

f) Name of manufacturer.

7.1.2 Packaging marks

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