National Standard of the People's Republic of China

GB3836.2–2000
eqv IEC 60079-1:1990
Substitute GB 3836.2-1983

Electrical apparatus for explosive gas atmospheres —

Part2：Flameproof enclosure "d"

Contents

GB3836.2-2000

Foreword

This standard is a revision of GB3836.2-1983 based on International Electrotechnical Commission publication IEC60079-1:1990 (3rd Edition) and its Supplement A1 (1993). It is equivalent to IEC standards in the technical contents including general elements, technical elements and complementary elements, in order to adapt to international trade, technology and economic exchanges.

This standard is formed with a normative appendix (Appendix C) and an informative appendix (Appendix D) based on IEC60079-1:1990 (3rd Edition). Appendix C retains the relevant contents of GB3836.2-1983 with regard to enclosure materials, the cable entry mode, the clearance and creepage distance in the junction box and the anti-loose measures of threaded flameproof joint of Class I electrical equipment, in consideration of specific coal mine environment and production conditions in China, which is more stringent and specific than IEC60079-1. The additional provisions about the flameproof cable entry device adopts the European standard EN 50018:1994 Appendix C, which are proved to be essential to ensure the safety of flameproof cable entry device by practice. And the new draft amendment of IEC 60079-1 adds this part of content. The content about explosion-proof liner is compiled in reference to the industrial practice experience based on GB 3836.2-1983 as a reference to the design of it.

Compared with GB3836.2-1983 technically, the major changes in this standard include the number of threads of explosion-proof threaded joint, the requirement to the cable or wire entry device and explosion test; the deleted contents include chip explosion-proof structure, and the special provision on motor, bolt and lighting; the added contents include the test requirements of non-metallic components of flameproof housing.

GB3836 is divided into the following parts under the general title - Electrical Apparatus for Explosive Gas Atmospheres:

Part 1 (i.e. GB 3836.1): General Requirement;

Part 2 (i.e. GB 3836.2): Flameproof Type “d”

Part 3 (i.e. GB 3836.2): Increased safety Type “e”

Part 4 (i.e. GB 3836.4): Intrinsic Safety Type “i”

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This standard supersedes National Standard GB3836.2-1983 as from the date when this Standard is enforced.

Appendix A, B, and C are the normative annex and Appendix D is an informative annex.

The standard is proposed by the State Administration of Machinery Industry.

This standard is steered by the National Technical Committee for Explosion-proof Electrical Apparatus Standardization.

The standard is drafted by the Nanyang Explosion Protected Electrical Apparatus

Research Institute of the Ministry of Machanical Industry, Fushun Institute under Coal Research Institution of Ministry of Coal Industry, etc.

The main drafting persons of this standard include Ma Jinggang, Li Shuanghui, Wang Wenzhao, Zhang Changshun, Sang Gaoyuan, Xiang Yunlin and Wang Pingtang.

This standard was issued initially in August, 1983 and was revised for the first time in January, 2000.

National Technical Committee for Explosion-proof Electrical Apparatus Standardization is entrusted to be responsible for making explanations for this Standard.

GB 3836.2-2000

Foreword of IEC

1) All the formal resolutions or agreements of the International Electrotechnical Commission (IEC) regarding technical problems are made by the Technical Committee. All IEC National Committees that have special interest in the subject have their representatives in the technical committee. So the resolutions and agreements on the subject reflect as possible as they can the internationally uniform opinions.
2) The resolutions and agreements adopt the common international recommendation form, and have been accepted by national committees.
3) With view to promoting international unification, the International Electrotechnical Commission hopes that all the national committees should adopt the recommended standard of IEC as their own standard under the allowed conditions. In case there is any difference between IEC's recommended standard and the relevant national standards, it shall be clearly described in the relevant national standard respectively.
This Standard is formulated by Sc31A “Branch Committee Flameproof Enclosure” of IEC 31 “Technical Committee of Electrical Apparatus for Explosive Atmospheres”.
This Standard is the third edition of IEC60079-1 standard and it will substitute the second edition published in 1971 and the first revision version published in 1979.
This Standard is formulated on the basis of the following files:

FDIS	Report on Voting
31A（ZhongBan）29	31A（ZhongBan）30

For the voting information for this Standard, please see the Report on Voting indicated in the above table.
This Standard is one of the publications regarding Electrical Apparatus for Explosive Gas Atmospheres.
The published parts of IEC Standard 60079: Electrical Apparatus for Explosive Gas Atmospheres are as follows:
—General Requirement（60079-0:1983)
—Appendix D: Test Method of Assessing Maximum Experimental Safe Gap
—“p” Explosion-proof Electrical Apparatus（60079-2:1983）
—Spark Test Equipment of Intrinsically Safe Circuit（60079-3:1990)
—Test Method of Ignition Temperature (60079-4:1975 & 60079-4A:1970)
—Sand-Filled Type Electrical Apparatus (60079-5:1967) and its Supplement A:1969
—Oil-filled Type Electrical Apparatus (60079-6:1968)
—“e” Explosion-proof Electrical Apparatus (60079-7:1990)
—Classification of Hazardous Locations (60079-10:1986)
—Structures and Test of Intrinsically Safe and Its Associated Electrical Apparatus (60079-11:1984)
—Grading of the Mixture of Gas or Vapor and Air in Accordance with the Maximum Experimental Safe Gap and Minimum Ignition Currents (60079-12：1978)

—Structure and Use of Pressurization Protected Houses and Buildings (60079-13:1982)
—Electrical Installation in Explosive Gas Atmospheres (60079-14:1984)
—“n” Explosion-proof Electrical Apparatus (60079-15:1987).

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Electrical apparatus for explosive gas atmospheres —

Part2：Flameproof enclosure "d"

Chapter 1 General Rules

1 Scope

1.1 This Standard specifies the structural requirements, inspection and test of flameproof type for explosive gas atmospheres.

In addition to complying with this standard, the flameproof type should also meet the relevant provisions of GB3836.1-2000 Electrical Apparatus for Explosive Gas Atmospheres Part 1: General Requirement.

This standard applies to flameproof enclosure made of metallic materials and non-metallic materials and enclosure components (For additional requirements for non-metallic materials, please see Appendix A).

1.2 The applicable explosive gas temperature in this Standard is -20 ℃ to +60 ℃, and the electrical apparatus running temperature is -20 ℃ to +40 ℃. When the ambient temperature is below -20 ℃, the enclosure with higher strength should be used because the low temperature may cause high explosion pressure and the embrittlement of the enclosure material. When the ambient temperature exceeds 60 ℃, the enclosure with smaller joint clearance should be used because the high temperature will cause the maximum experimental safe gap to decrease.

1.3 The Standard only involves flameproof type but not including the type adopting other measures to prevent the risk of explosion. The content is included in the respective standard of GB3836 standard.

2 Cited Standards

The clauses contained in the following standards constitute the provisions of this Standard with the references are made in this Standard. When this Standard is published, all the indicated editions are valid. All standards are subject to revisions, and all parties who apply this Standard shall explore the possibilities to use the latest editions of the following standards:

GB3836.1-2000 Electrical apparatus for explosive gas atmospheres—Part 1 General requirement (eqv IEC 60079-0:1998)

GB3836.3-2000 Electrical apparatus for explosive gas atmospheres—Part 3: Increased safety "e" (eqvIEC60079-7.1990)

GB3836.11-1991 Measurement method of the maximum experimental safe gap of

electrical apparatus for explosive atmospheres (eqv IEC 60079-1A1975)
GB/T4207-1984 Method for determining the comparative and the proof tracking indices of solid insulating materials under moist conditions (neq IEC 60112:979)
GB/T11026-1989 Test methods for the determination of the flammability of solid electrical insulating materials when exposed to an igniting source (eqv IEC 60707:1981)

Instruction for use
1] The name of IEC standard is Electrical Apparatus for Explosive Gas Atmospheres—Part 1 Structure and Test of Flameproof Enclosure of Electrical Apparatus.

Approved on 2000-01-03 by the State Bureau of Quality and Technical Supervision
Implemented on 2000-08-01

IEC60079-lA: 1975 Electrical apparatus for explosive gas atmospheres Appendix D: Test Method of Assessing Maximum Experimental Safe Gap Supplement 1
ISO179:1982 Plastic – Measurement method for pendulum impact strength of rigid material
ISO468:1982 Surface roughness - Parameters, special requirements the values and general procedures
ISO965-1:1989 General-purpose metric screw threads - Tolerances - Part 1: Principles and basic data
ISO965-3:1980 General-purpose metric screw threads - Tolerances - Part 3: Deviations for constructional screw threads
ISO1210:1982 Plastics - Determination of burning characteristics of small plastic specimens in contact with a small-flame ignition source
ISO1817:1985 Rubber, vulcanized rubber - Determination of the liquid effect
ISO2738:1987 Permeable sintered metal material - Determination of density, oil content and open porosity
ISO4003:1977 Permeable sintered metal materials - Determination of bubble test pore size
ISO4022:1987 Permeable sintered metal materials — Determination of fluid permeability
ISO4892:1981 Plastics – Methods of exposure to laboratory light sources

3 Definitions

The following definitions are used in this Standard.

3.1 Flameproof enclosure

An explosion-proof type of electrical apparatus. The enclosure can withstand the explosion caused by infiltrating flammable mixture through any joint or structure gap on the casing without damage, and does not cause external ignition of the explosive environment formed by a kind of or a variety of gas or vapor.

Note: the explosion-proof type flameproof enclosure is often referred to as flame-proof type, representing with the letter "d".

3.2 Volume

Total volume inside the enclosure. If the enclosure and interior components can not be separated, the volume means the net volume.

3.3 Flameproof joint

It refers to the place that the relevant surfaces of different parts of the flameproof enclosure fit together (or enclosure connections) and the flame or combustion products may spread to the outside enclosure through such position.

3.4 Length of flame path (width of joint)

The minimum path length from the inside to the outside of the flameproof enclosure through flameproof joints.

Note: This definition does not apply to threaded joints.

3.5 Gap (diametric clearance)

The distance between the corresponding surfaces of the flameproof joints. For the cylindrical surface, the gap is the diametric gap (the difference between the two

diameters).

3.6 Shaft

The parts with round cross-section used to transfer rotational motion.

3.7 Operating rod (spindle)

The parts with round cross-section used to transfer rotation or linear movement, or both combined movement.

3.8 Pressure piling

It refers to a status that the explosive gas mixture in a cavity or gap within the enclosure is ignited to cause the ignition of the pre-pressured explosive gas mixture in other connected cavities or gaps.

4 Classification and Temperature Groups

The classification and temperature groups specified in GB3836.1 apply to the flame-proof type. Class II electrical apparatus is divided into Grade A, B and C.

GB3836.2-2000

Chapter 2 Structure Requirements

5 Flameproof Joint (Joint)

5．1 General Requirement

All joints of the enclosure which is close for long time or opened frequently shall comply with Table 1 to Table 5 and the following requirements.

Note

1 Use of other types of joints is allowed, such as the labyrinth joint (see Figure 1) or saw-tooth joint (see Figure 2). However, the structure and test requirements about these joints are not specified in this Standard. Inspection of these joints requires a lot of explosion tests, and the safety factor will be determined by the inspection organization.

2 The surface of joints should be treated with preservative, but it is not allowed to coat with paint or similar material, unless it is proved that the material or the coating process does not affect the flameproof performance.

5.2 Non-threaded joint

5.2.1Width of joint

For the cylindrical metal parts (e.g., bushing pressed in the metal flameproof wall with the volume no more than 2000cm3), if the designed structure meets the following requirements, the width of joints can be reduced to 5mm:

a) Do not rely on interference fit to prevent the components from displacement during the type test in Chapter 15;

b) In the case of the most unfavorable interference fit tolerance, the structure can meet the impact test requirements specified in GB3836. 1;

c） The diameter of the interference fit components should not exceed 60mm.

If the joints include conical surface, the width of the joint and the gap vertical to the joint surface should comply with the corresponding dimensions specified in Table 1 to Table 4. The gap between the conical parts should be even. For the enclosure for IIC electrical apparatus, taper shall not exceed 5°.

5.2.2 Surface roughness

The average surface roughness of joints R_a should not exceed 6. 3μm.

5.2.3 Gap

In addition to quick-open door or cover, there should not be any gap caused intently between the plane joints. If there is any gap between the joints, no matter where they are, they should not exceed the corresponding maximum value specified in Table 1 to Table 4.

For Class I electrical apparatus, the gap of the plane joints of doors and covers opened frequently should be checked directly or indirectly (see Figure 3).

5.2.4 Spigot joint

When determining the width of the spigot joint, comply with the following case:

a) When the cylindrical plane parts are taken into account, the following additional conditions should be used (see Figure 4):

L=c+d

c≥6mm (only for IIC)
d≥0.5L (only for IIC)
f≤1mm
b）Only the cylindrical part is taken into consideration (see Figure 5 - Figure 7), the plane part should meet the following requirements:
For Class I, II A and II B, plane part is not required to meet the clearance requirements;
For II C, the gap of plane part should not exceed the maximum gap of cylindrical part specified in Table 4.
If the liners are installed on the plane part (see Figure 6), then the gap of plane part should be measured after the liners are compressed. Before and after the compression of liners, a minimum width of the cylindrical part joint shall be maintained. However, if the IIC electrical apparatus use metal or metal-coated compressible liners (see Figure 7), then the gap between each surface of plane part and the seal liner should be measured after the liners are compressed.
5.2.5 II C Plane joint
The IIIC equipment used in explosive environments containing acetylene only adopt the plane joints when they meet Note 2 in Table 4.
Note: In order to prevent the surrounding explosive mixture from igniting due to the internal dirt or dust deposition, in particular, the carbon arising from incomplete combustion of acetylene sprayed through the joints, appropriate measures should be taken, for example adding liner (according to 5.4), using the corner joints or labyrinth joint, deflecting baffle or shielding.

5.2.6 Holes or screw holes on the joints

If the joints are separated by the holes of fastened bolts or the like, the minimum value of the distance l shown in Figure 8, Figure 9 and Figure 10 shall meet the following requirements:

When L<12.5mm, l≥6mm;

When 12.5mm≤L<25mm, l≥8mm;

When L≥25mm, l≥9mm.

The distance l should be taken into consideration as the following requirements.

5.2.6.1 Plane joint

When the hole is located outside enclosure, the distance l between each hole and the inside of enclosure should be measured. When the hole is located inside enclosure, the distance l (see Figure 8, Figure 9 and Figure 10) between each hole and the outside of enclosure should be measured.

5.2.6.2 Spigot joint

When f ≤1mm and the gap of the cylindrical part shall be no more than 0.2mm for Class I and IIA, no more than 0.15mm for IIB, and no more than 0.1mm for IIC, the distance l is the total of the width a of cylindrical part and the width b of plane part (see Figure 11). If the above conditions can not be met, the distance l is the width b of plane part.

5.3 Threaded joint

5.3.1 For Class I, IIA and IIB enclosure, the minimum engaged number of threaded joints is 5. When the volume is greater than 100cm^3, the minimum axial engaged length is 8mm; when the volume is no more than 100cm^3, the minimum axial engaged length is 5mm.

Class I equipment also shall meet the supplementary provisions[1] of Appendix C.

5.3.2 For IIC enclosure, threaded joints shall comply with the provisions in Table 5.

Note: the values in Table 5 can be used for Class I, IIA and IIB enclosure.

5.4 Liner and O ring

5.4.1 If the liners made of compressible material are used (for example, use IP ratings to prevent moisture, dust and liquid), the liner shall only be used as an auxiliary part of flameproof joints, but not included in the flameproof joints (see Figure 12 ~ Figure 15). The effective parameters of flameproof joints in addition to liners shall meet the requirements in Table 1 to Table 4. This requirement does not apply to the seal liners of wire and cable entries and transparent parts of lights.

5.4.2 If the liners are made of compressible non-combustible metal or metal-coated material in line with the provisions of ISO 1210, the joints of insulating sleeve and transparent parts can be installed with liners. This kind of liners plays the role of explosion proof, which is an exception to the requirement of 5.4 .1.

Please see Appendix D[2] for the designed reference dimension of liners.

5.5 Adhesive joint

5.5.1 When the adhesive or sealing material is used, its designed enclosure strength shall not depend on the bonding strength of adhesive material or sealing materials.

5.5.2 The shortest path from internal to external of flameproof enclosure with volume V through the adhesive joints:
When $V \leq 10cm^3$, the path shall be no less than 3mm;
When $10cm^3 < V \leq 100cm^3$, the path shall be no less than 6mm;
When $V > 100cm^3$, the path shall be no less than 10mm.
5.5.3 If the component is directly adhesive to enclosure wall to form an inseparable part, or be adhesive to the metal frame to form a component (the adhesive part is not damaged when this component is changed), the adhesive joints are not required to meet the requirements of 5.2.
6 Operating rod (spindle)
When the operating rod or spindle passes through the flameproof enclosure wall, the following requirements shall be met:
Application Note:
1] There is no such supplementary regulation in IEC standard.
2] There is no content about Appendix D in IEC standard.

6.1 The width of joints of the operating rod or spindle supported by the enclosure wall shall not be less than the minimum width of joints specified in Table 1 to Table 4.

6.2 If the diameter of the operating rod or spindle is greater than the minimum width of joints specified in Table 1 to Table 4, the width of joints shall not be less than the diameter of the operating rod or spindle, but not necessarily greater than 25mm.

6.3 The fit diameter clearance between the enclosure wall hole and the passing operating rod or spindle shall not exceed the maximum gap value specified in Table 1 to Table 4.

6.4 If the diameter gap may become larger due to wear in normal use, measures shall be taken, such as setting the replaceable liners to avoid an infinite increase of gap. A cap which is not easy to wear in normal use shall be added under special circumstances.

7 Shaft and bearing

The flameproof bearing cap shall be installed where the rotating shaft passes through the flameproof enclosure wall. The bearing cap shall be designed to not be worn due to wear and tear or eccentric of bearing.

Bearing cap can be cylindrical (see Figure 16), labyrinth type (see Figure 1) or floating (see Figure 17).

Flame path length and diameter gap shall take the corresponding values in Table 1 to Table 4 according to the following requirements.

The minimum unilateral clearance of rotating motor shaft K (see Figure 18), shall be no less than 0.075mm for Class I, IIA and IIB, and be no less than 0.05mm for IIC.

7.1 Sliding bearing

The flame path length of the flameproof bearing cover with sliding bearing shall be no less than the diameter of rotating shaft when the shaft diameter is no more than 25mm, and shall be no less than 25mm when the shaft diameter is greater than 25mm.

If the cylindrical or labyrinth bearing cap is used on the rotating motor with sliding bearing, and the unilateral gap between the stator and rotor is greater than the allowed unilateral gap displacement by bearing cap, the bearing cap shall be made of non-sparking material (e.g. brass) (see Figure 19 and Figure 20). This requirement does not apply to floating bearing cap.

Sliding bearing is not allowed to be used on IIC rotating motor.

7.2 Rolling bearing

The maximum unilateral gap calculated value "m" (see Figure 18) of rotating bearing cap with rolling bearing shall not exceed the two-thirds of the maximum allowable gap of bearing cap specified in Table 1 to Table 4.

7.3 Bearing cap

When determining the flame path length of the bearing cap with oil seal groove, the oil seal groove part shall not be calculated. The length of bearing cap end shall be no less than the corresponding values specified in Table 1 to Table 4 (see Figure 16) .

The diameter gap should not exceed the corresponding values specified in Table 1 to Table 4, but shall not be less than 0.10mm.

8 Transparent parts

In addition to the requirements of this Standard, the transparent parts (such as a transparent viewing window and the transparent cover of lights) shall withstand the relevant tests in GB3836.1.

8.1 Material

The transparent parts can be made of glass or other materials with stable physical and chemical performance which can effectively withstand the maximum temperature under the rated conditions of equipment.

8.2 Installation of transparent parts

8.2.1 The sealing material, adhesive material or liner used to fix the transparent parts shall meet the provisions of Article 5.4 and 5.5.

8.2.2 Transparent parts shall be installed by one of the following methods:

a) Transparent parts can be directly sealed inside the enclosure to form an integral part with it;

b) Transparent parts can be fastened directly inside the enclosure with or without liner;

c) Transparent parts can be sealed or adhesive on a frame fastened to the enclosure, so that the observation window can be replaced as an integral part, without the need to be sealed on-site.

8.2.3 Precautions shall be taken to make the installed transparent parts generate unsuitable internal mechanical stress.

GB3836.2-2000

9 Breathing device and draining device

9.1 If breathing device and liquid draining device are required due to technical reasons, its structure shall not lose safety in the use (such as the accumulation of dust or paint). The way deliberately increasing the joint gap shall not be adopted as a measure of breathing and draining (see Appendix B).

9.2 The opening size constituting the path shall remain a certain safety margin, compared with the flameproof size proved in test (e.g. as specified in this Standard).

9.3 If the device has a detachable structure, it shall be designed to a structure that parts can not be reassembled after reducing or increasing openings constituting the path.

10 Fasteners

10.1 When removable screws or bolts are used to fasten any parts of flameproof enclosure, these screws or bolts holes shall not penetrate the enclosure wall. The thickness of the metal around the hole shall be not less than one-third of the hole diameter, and be at least 3mm.

10.2 When screws or bolts are completely screwed into holes without washers, thread excess shall be remained between the end of screw or bolt and the bottom of screw hole.

10.3 If it is required to drill through the enclosure wall for manufacturing convenience, the hole shall be plugged with screw, the joint of which meet the requirements in Table 5. The plug shall be fastened as required in Article 10.4.

10.4 The screws or bolts permanently fixed to the enclosure shall be welded or riveted securely, or fixed with some equivalent methods.

10.5 Under normal circumstances, measures should be taken to prevent fasteners loosening due to vibration.

10.6 For Class I enclosure, the fasteners used to fix door, cover and plug plate on the enclosure should meet the requirements of GB3836.1 for special fasteners.

11 Enclosure mechanical strength

11.1 Flameproof enclosure should be able to withstand the internal test pressure in the third chapter without being damaged or causing the enclosure mechanical strength to drop or joint gap to increase permanently to deform with more than gap value specified in Table 1 to Table 4.

The material of Class I equipment enclosure should also comply with Supplementary provisions Appendix C [1].

11.2 When two or more flameproof enclosure combine together, this standard applies to each individual enclosure, and also applies to a partition plate between them and terminals or operating rods through the partition plate.

11.3 When the enclosure is composed of two or more connected cavities, or separated by components in the device, then the pressure piling may appear (see the definition of 3.8). This will cause a sharp rise in pressure and will exceed the expected maximum pressure. Therefore, the internal shape of enclosure should be designed to eliminate pressure piling. If the pressure piling can not be avoided, the mechanical

strength of the enclosure should be improved.

11.4 When there is a high risk that a liquid will produce explosive mixture beyond the design capacity of the flameproof enclosure, such liquid should not be used in the flameproof enclosure.

12 Entry and connection of cable and lead

12.1 Cables and wires can be connected as one of the following two ways:

a) Indirect entry, a connected way with a junction box or plug device;

b) Direct entry, a connected way of entry into the main enclosure.

When Class I equipment use direct entry method, the supplementary provisions of Appendix C shall be met[1].

Whichever entry way is used, measures shall be taken to prevent the cables damaging terminals due to drag or twist.

12.2 The equipment with conduit entry should be set with the threaded connector with the thread engagement of at least 5.

12.3 Indirect entry

If the junction box is flame-proof type, it shall comply with the requirements of 12.4. If the junction box is other explosion-proof types, the corresponding explosion-proof type requirement shall be met. Furthermore, it should meet the following requirements.

Application Note:

1] There is no content about Appendix C in IEC standard.

12.3.1 External wires and cables shall be connected with the internal circuit inside the main flameproof enclosure by the insulating sleeve, which shall comply with the provisions of Chapter 5 and be fixed on the partition plate separating the two cavities.

12.3.2 The table with seal cover can replace insulating sleeve, but the seal cover can not change the flame-proof performance of the enclosure.

12.3.3 If the separation of plug and socket will not change the flameproof performance of enclosure, the socket device with such structure is allowed as an indirect entry.

12.3.3.1 The width and gap of joints of flameproof enclosure of socket device shall be determined by the volume the moment that contact terminal is separated. The grounding, shield grounding or intrinsic safety contact terminal will not be considered.

12.3.3.2 When the plug contacts or is separated from the contact terminal of socket, the socket device shall maintain the performance of flameproof enclosure. The grounding, shield grounding or intrinsic safety contact terminal will not be considered.

12.3.3.3 The requirements of Article 12.3.3.1 and 12.3.3.2 do not apply to the socket device fixed with fasteners according to b) of Article 20.1 in GB3836. 1-2000.

12.4 Direct entry

The direct entry of cable or wire should use the way of seal cover or seal ring that will not change the flameproof performance of enclosure.

After the seal is compressed, the minimum axial dimension X of seal should comply with the minimum length requirements of the flame path specified in Table 1 to Table 4 (see Figure 21 to Figure 23).

If the cable is sealed inside the main enclosure, the length of cable outside the enclosure shall be at least 1m.

When the apparatus is equipped with a connecting conduit, wire or cable should enter inside the enclosure through a packing box or built-in structure forming an integral part with the enclosure or connecting on the enclosure.

13 Symbols

Symbols of the flameproof enclosure shall comply with the requirements specified in GB3836.1.

The cover of the equipment producing sparks or electric arc during normal operation should be equipped with interlock device or the signs that it is not allowed to open when powering.

Chapter 3 Check and Test

14Overview

For flameproof type, in addition to the inspection and test specified in GB3836.1, the following tests also shall be carried out.

15 Type test

Generally, the tests specified in GB3836.1 should be carried out firstly, and then the test shall be carried out as the following specified order.

15.1 Enclosure pressure test

The object of test is to prove whether the enclosure is able to effectively withstand the internal explosion.

The eligibility of enclosure shall be determined by the test specified in 15.1.1 and 15.1.2.

The test shall be carried out under the state that the enclosure is equipped with the complete internal device or with the objects of equivalent effect on the device. But if the enclosure is designed to work after some of internal parts are removed, the test shall be carried out under the most severe conditions the test organization consider.

During the test, if the enclosure has no damage or permanent deformation, the enclosure is considered as a qualified product. In addition, there should not be any permanent enlargement on any part of the joints.

15.1.1 Measurement of explosion pressure (reference pressure)

Reference pressure is the highest value of maximum smooth pressure higher than atmospheric pressure obtained by testing.

Note: One way to obtain smooth pressure is to insert a (5 ± 0.5) kHz wave filter in the pressure signal circuit.

The test includes igniting explosive mixture within the enclosure and measuring the formed pressure. The gap shall be within the manufacturing tolerance specified on draft during the test.

Number of tests, used explosive mixture and its volume rate with air under atmospheric pressure are given in Table 6.

The mixture should be ignited with one or more high-voltage spark plugs, or other low-energy ignition sources. In addition, if the enclosure is equipped with the switch that can ignite explosive mixture, it is best to use this switch to ignite. The formed pressure by explosion should be measured and recorded during the process of each test. The number and installation place of spark plugs and pressure sensors is determined by the test organization.

For IIC electrical apparatus specified for a particular kind of gas, the test shall be carried out according to the requirements of Table 6.

The removable liners specified to use by the manufacturer shall be installed on the electrical apparatus during the test.

The test shall be carried out to the rotating motor under stationary and rotating state. Whether it is necessary to do both of tests, it is up to the test organization. When the test is made under rotating state, whether the motor is powered on or off is not limited, but the test should be carried out when the rotating speed is equal to or very close to maximum rated speed.

Reference pressure should be measured on the ignition side, the opposite side to the ignition side and any place expected to generate excessive pressure when the enclosure is designed.

15.1.2 Overpotential test

The test should be carried out as one of the following methods. These methods are equivalent.

15.1.2.1 Static pressure test

Test pressure should be 1.5 times as high as the reference pressure, but should be at least 0. 35MPa. Pressurization time should reach 10^{+2}_{0} s.

For the enclosure with the volume greater than 10cm^3, but not subjected to factory testing (see Chapter 16), the test pressure should be 4 times as high as the reference pressure.

If the reference pressure can not be measured because the enclosure is too small and the dynamic pressure method can not used, the static pressure test shall be carried out with the following corresponding pressure:

a) 1MPa for Class I, IIA, IIB;

b) 1.5MPa for IIC.

The static pressure test is only carried out for one time.

Note: The static pressure test may be carried out to the overall enclosure or enclosure components. Test conditions shall be discussed and agreed by the manufacturer and test organization.

15.1.2.2 Dynamic pressure test

If the reference pressure has been known, then the maximum pressure that the enclosure can withstand in dynamic pressure test is 1.5 times can be as high as the reference pressure. There shall not be big difference between the rising speed of pressure and the speed when the reference pressure is measured. Under special

circumstances, the explosive mixture pre-pressed for measurement of reference pressure can be used in the test.

If the reference pressure can not be measured (e.g., the volume is too small or the pressure is abnormal), the explosive mixture specified in Table 6 may be filled in the enclosure under the 1.5 times as high as to carry out the test. Dynamic pressure test is only made for one time, but the test shall be made to IIC enclosure for three times with each kind of explosive experimental mixture.

15.2 Non transmission explosion test of internal ignition

The enclosure is put in a test tank. The test shall be made when the enclosure and the test tank are filled with the same explosive mixture.

The mixture in the enclosure should be ignited with a high-voltage spark plug, or other low-energy ignition sources. In addition, if the enclosure is equipped with the switch that can ignite explosive mixture, this switch can be used to ignite.

The liners irrelevant with the explosion proof shall be removed.

If the ignition does not spread to the test tank, then the test result is considered as qualified.

15.2.1 Class I, IIA, IIB enclosure

The volume ratio of the used explosive mixture with air is given in Table 6.

15.2.1.1 The test is made to the enclosure under the normal conditions without manmade gap (the joint is within the manufacturing tolerance specified in the instructions), which can be indicates with the formula as follows:

$$0.8\ i_C \leqslant i_E \leqslant i_C \leqslant i_T$$

where, i_c - the maximum structural gap specified in factory drawings;

i_E – test gap;

i_T –allowable maximum gap in Table 1 to Table 3.

15.2.1.2 If IIA and IIB enclosures are potential to be destroyed or damaged during this test, the gap value is allowed to increase and exceed the manufacturer's specified maximum value. The gap amplification factor is 1.42for the IIA, and is 1.85 for IIB. The axial length of threaded engagement of fit threaded joints in line with ISO Standard shall be shortened one-third compared with the length specified by the manufacturer, and shall be shortened one-two inferior to ISO Standard. It is not necessary to be shortened for the tapered threaded joints.

The volume ratio of the explosive mixture used in the enclosure and test tank and the air under atmospheric pressure is as follows:

a) (4.2±0.1)% propane for IIA;

b) (6.5±0.5)% ethylene or (19±1) % hydrogen - methane (85/15) mixture for IIB.

15.2.2 IIC enclosure

The test shall be made with one of the following methods:

15.2.2.1 The first method

The gap of plane joints, cylindrical joints, shaft with bearing and the operating rod will be increased to the following values:

$i_E = i_c + 0.5i_c$ (for plane joints, the minimum gap is 0.1mm)

$i_E = 1.5i_T$ (for plane joints)

or $i_E = i_c + 0.5\ i_T$ (for cylindrical joints)

where: i_E – test gap;

i_c - the maximum structural gap specified in factory drawings;

i_T- allowable maximum gap in Table 4.

The axial length of threaded engagement of fit threaded joints in line with ISO Standard shall be shortened one-third compared with the length specified by the manufacturer, and shall be shortened one-two inferior to ISO Standard. It is not necessary to be shortened for the tapered threaded joints.

A kind of explosive mixture specified in Table 6 shall be filled in the enclosure and test tank under atmospheric pressure.

15.2.2.2 The second method

The test is made to the enclosure under the normal conditions without manmade gap. The gap is:

$0.8\ i_c \le i_E < i_c \le i_T$

A kind of explosive mixture specified in Table 6 shall be filled in the enclosure and test tank under 1.5 times as high as atmospheric pressure.

Note

1 If a test is made with a gap less than $0.8\ i_c$, the pressure of the test mixture shall be increased proportionally to compensate for the smaller gap value. Test pressure can be calculated as the following formula:

Test pressure = $\frac{i_C}{i_E}$ ×1.2 times atmospheric pressure

2 The volume ratio between the test tank and the enclosure shall be at least 5:1.

15.2.2.3 For the electrical apparatus only manufactured for one or a few samples, the test shall be made to each sample with a kind of mixture in the first method under atmospheric pressure for five times.

16 Factory test

16.1 Factory test is the pressure test made to sample equipment with one of the methods described by 15.1.2 or specimens of the prototype pressure test. The test methods required to take for these tests shall be determined by the inspection organization and manufacturers.

For factory test, empty enclosure can be used. Each component constituting the enclosure can be tested separately, but the stress suffered by it shall be the same as that the entire enclosure is tested. However, if dynamic pressure method is used for the factory test, and the enclosed equipment or built-in parts will cause the pressure rising in the case of the internal explosion, the test conditions shall be discussed and determined by the inspection organization and the manufacturer.

It is not necessary for the enclosure with the volume not more than $10cm^3$ to carry out the factory test. For the enclosure with the volume more than $10cm^3$, if the type test is carried out with the static pressure of 4 times reference pressure, it is also not necessary to carry out the factory test. But the enclosure with the welded structure should carry out the factory test in any case.

Note: The measures specified in above factory tests are aimed to ensure that the enclosure can withstand pressure on one hand, there are not through-holes and cracks reducing flameproof performance of the enclosure or its components on the other hand.

16.2 When the test is made with the dynamic pressure specified in 15.1.2.2, the factory test should use one of the following ways:

a) The explosion test shall be carried out with the explosive mixture specified in Table 6 in the internal and external enclosure under 1.5 times atmospheric pressure.

b) One of dynamic pressure tests specified in type tests in 15.1.2.2 shall be made firstly, and then the explosion test shall be carried out with the explosive mixture specified in 15.2 in the internal and external enclosure under atmospheric pressure.

GB3836.2-2000

C) One of dynamic pressure tests specified in type tests in 15.1.2.2 shall be made firstly, and the static pressure test with the pressure of at least 0.2MPa shall be made.

16.3 If the reference pressure can not be measured because the enclosure is too small and the dynamic pressure method can not used, the static pressure test shall be carried out with the following corresponding pressure:

a) 1.0MPa for Class I, IIA, IIB;

b) 1.5MPa for IIC.

Note: The static pressure test may be carried out to the overall enclosure or enclosure components. Test conditions shall be discussed and agreed by the manufacturer and test organization.

16.4 If there is not any structural damage or permanent deformation that possibly affects flameproof performance on the enclosure, the test is deemed as qualified.

表 1I 类外壳隔爆接合面的最小宽度和最大间隙”

Table 1 Minimum width and maximum gap[1)] for Class I enclosure flameproof joints

Width of joints L mm	Maximum gap[2)] corresponding to the enclosure volume V (cm^3) mm	
	V≤100	V＞100
Plane joint and spigot joint		
6≤L＜12.5	0.30	-
12.5≤L＜25	0.40	0.40
25≤L	0.50	0.50
Operating rod and spindle[3)]		
6≤L＜12.5	0.30	-
12.5≤L＜25	0.40	0.40
25≤L	0.50	0.50
Shaft with sliding bearing[4)]		
6≤L＜12.5	0.30	-
12.5≤L＜25	0.40	0.40
25≤L＜40	0.50	0.50
40≤L	0.60	0.60
Shaft with rolling bearing[5)]		
6≤L＜12.5	0.450	-
12.5≤L＜25	0.60	0.60
25≤L	0.750	0.750

1) In addition to the values given in this table, the values given in table IIA, IIB and IIC can be used for Class I enclosure.

2) The gap means the maximum diameter difference for operating rod, spindle and

shaft.

3) If the diameter of operating rod or spindle is larger than the smallest width of flameproof joints specified in this table, Article 6.2 applies.
4) If the diameter of rotating shaft is larger than the smallest width of flameproof joints specified in this table, Article 7.1 applies.
5) Unilateral gap shall not exceed the allowable diameter difference of sliding bearing (see Article 7.2)

GB3836.2-2000

Table 2 Minimum width and maximum gap[1)] for IIA enclosure flameproof joints

Width of joints L mm	Maximum gap[2)] corresponding to the enclosure volume V (cm^3) mm		
	V≤100	100＜V≤2000	V＞2000
Plane joint and spigot joint			
6≤L＜9.5	0.30	-	-
9.5≤L＜12.5	0.30	-	-
12.5≤L＜25	0.30	0.30	0.20
25≤L	0.40	0.40	0.40
Operating rod and spindle[3)]			
6≤L＜12.5	0.30	-	-
12.5≤L＜25	0.30	0.30	0.20
25≤L	0.40	0.40	0.40
Shaft with sliding bearing[4)]			
6≤L＜12.5	0.30	-	-
12.5≤L＜25	0.350	0.30	0.20
25≤L＜40	0.40	0.40	0.40
40≤L	0.50	0.50	0.50
Shaft with rolling bearing[5)]			
6≤L＜12.5	0.450	-	-
12.5≤L＜25	0.50	0.450	0.30
25≤L＜40	0.60	0.60	0.60
40≤L	0.750	0.750	0.750

1) In addition to the values given in this table, the values given in table IIB and IIC can be used for IIA enclosure.
2) The gap means the maximum diameter difference for operating rod, spindle and shaft.
3) For L≥9.5mm and gap≤0.040mm,the volume of enclosure not exceeding 5800cm^3 is only applicable to plane joints. There is no volume limitation for other joints.
4) If the diameter of operating rod or spindle is larger than the smallest width of flameproof joints specified in this table, Article 6.2 applies.
5) If the diameter of rotating shaft is larger than the smallest width of flameproof joints specified in this table, Article 7.1 applies.
6) Unilateral gap shall not exceed the allowable diameter difference of sliding bearing (see Article 7.2)

Table 3 Minimum width and maximum gap[1)] for IIA enclosure flameproof joints

Width of joints L mm	Maximum gap[2)] corresponding to the enclosure volume V (cm^3) mm		
	V≤100	100＜V≤2000	V＞2000
Plane joint and spigot joint[3)]			
6≤L＜9.5	0.20	-	-
9.5≤L＜12.5	0.20	-	-
12.5≤L＜25	0.20	0.20	0.150
25≤L	0.20	0.20	0.20

GB3836.2-2000

Table 3 (End)

Width of joints L mm	Maximum gap[2] corresponding to the enclosure volume V (cm^3) mm		
	V≤100	100＜V≤2000	V＞2000
Operating rod and spindle[4]			
6≤L＜12.5	0.20	-	-
12.5≤L＜25	0.20	0.20	0.150
25≤L	0.20	0.20	0.20
Shaft with sliding bearing[5]			
6≤L＜12.5	0.20	-	-
12.5≤L＜25	0.250	0.20	0.150
25≤L＜40	0.30	0.250	0.20
40≤L	0.40	0.30	0.250
Shaft with rolling bearing[6]			
6≤L＜12.5	0.30	-	-
12.5≤L＜25	0.40	0.30	0.20
25≤L＜40	0.45	0.40	0.30
40≤L	0.60	0.450	0.40

1) In addition to the values given in this table, the values given in Table 4 can be used for IIB enclosure.
2) The gap means the maximum diameter difference for operating rod, spindle and shaft.
3) For L≥9.5mm and gap≤0.040mm, the volume of enclosure not exceeding 5800cm^3 is only applicable to plane joints. There is no volume limitation for other joints.
4) If the diameter of operating rod or spindle is larger than the smallest width of flameproof joints specified in this table, Article 6.2 applies.
5) If the diameter of rotating shaft is larger than the smallest width of flameproof joints specified in this table, Article 7.1 applies.
6) Unilateral gap shall not exceed the allowable diameter difference of sliding bearing (see Article 7.2)

Table 4 Minimum width and maximum gap for IIC enclosure flameproof joints

Width of joints L mm	Maximum gap corresponding to the enclosure volume V (cm^3) mm				
	V≤100	100＜ V≤500	500＜ V≤1500	1500＜ V≤2000	2000＜ V≤6000[1]

Plane joint[2)]					
6≤L＜9.5	0.10	-	-	-	-
9.5≤L＜15.8	0.10	0.10	-	-	-
15.8≤L＜25	0.10	0.10	0.040	-	-
25≤L	0.10	0.10	0.040	0.040	0.040
Spigot joint (Figure 5, 6, 7)					
6≤L＜12.5	0.10	0.10	-	-	-
12.5≤L＜25	0.150	0.150	0.150	0.150	-
25≤L＜40	0.150	0.150	0.150	0.150	0.150
40≤L	0.20	0.20	0.20	0.20	0.20

GB3836.2-2000

Table 4 (End)

Width of joints L mm	Maximum gap corresponding to the enclosure volume V (cm^3) mm				
	V≤100	100< V≤500	500< V≤1500	1500< V≤2000	2000< V≤6000[1)]
Spigot joint (Figure4) C≥6mm d_{min}=0.5L L=c+d					
f≤1mm	0.150	0.150	0.150	0.150	-
12.5≤L<25	0.180	0.180	0.180	0.180	0.180
25≤L<40[3)]	0.20	0.20	0.20	0.20	0.20
40≤L					
Cylindrical joints, operating rod or spindle[5)]					
6≤L<9.5	0.10	-	-	-	-
9.5≤L<12.5	0.10	0.10	-	-	-
12.5≤L<25	0.150	0.150	0.150	0.150	-
25≤L<40	0.150	0.150	0.150	0.150	0.150
40≤L	0.20	0.20	0.20	0.20	0.20
Gland joints of barrel bearing for rotating motor with rolling bearing					
6≤L<9.5	0.15	-	-	-	-
9.5≤L<12.5	0.150	0.15	-	-	-
12.5≤L<25	0.250	0.250	0.250	0.250	-
25≤L<40	0.250	0.250	0.250	0.250	0.250
40≤L	0.30	0.30	0.30	0.30	0.30

1) Special requirements shall be made for the enclosure with the volume greater than 6000cm^3 and the size larger than 1m based on the agreement made by the manufacturer and test organization.
2) It is not allowed to use plane joints for the explosive mixture of acetylene and air, except the case that L≥9.5mm, gap≤0.040mm and the volume≤500cm^3.
3) If f≤0.5mm, i_T for cylindrical part can be increased to 0.20.
4) If f≤0.5mm, i_T for cylindrical part can be increased to 0.250.
5) Please pay special attention to the requirements of wear under Chapter 6. If the diameter of the operating rod or spindle is greater than the minimum width of joints specified in this table, then the Article 6.2 applies.

Table 5 Threaded joints for IIC enclosure

Parameter of joints	Regular screw threads	Special screw threads
Pitch of screw P[1)], mm	$0.7 \leq P \leq 3$	$P \geq 1.27$
Grade of pit[2)] (ISO 965-1 and ISO 965-3)	Medium: $0.7 \leq P \leq 2$ Senior: $2 \leq P \leq 3$	- -
Minimum engaged number[3)]	≥5	≥5 (Taper thread) ≥6 (Rectangular thread 5H4h) ≥7 (Rectangular thread 6H6g) ≥8 (Rectangular thread 7H8g)

GB3836.2-2000

Table 5 (End)

Parameter of joints		Regular screw threads	Special screw threads
Minimum axial engagement length of enclosure with the volume V (cm^3) mm	V≤100	≥5	-
	V＞100	≥8	-

1) When the pitch of screw is more than 2 mm, the necessary special measures can be taken to ensure that the electrical equipment can pass non transmission explosion test of internal ignition specified in the Article 15.2.
2) It is allowed to use the cylindrical threaded joints which do not comply with ISO standard. But the electrical equipment is required to pass non transmission explosion test of internal ignition specified in the Article 15.2.
3) If it is difficult that taper thread engagement number is 5 when the standard thread is used, the engagement number of less than 5 is permissible.

Table 6 Explosion test

Enclosure	Measurement of explosive pressure (reference pressure)		Non transmission explosion test of internal ignition	
I	Number of tests	Mixture of explosive test	Number of tests	Mixture of explosive test
	3	Methane (CH_4) (9.8±0.5)%	5[3]	Methane (CH_4) Hydrogen (H_2) (58±1)% CH_4 (42±1)% H_2 (12.5±0.5)% MESG=0.8mm
IIA	3	Propane (C_3H_8) (4.6±0.3)%	5[3]	Hydrogen (H_2) (55±1)% MESG=0.65mm
IIB	3[1]	Ethylene (C_2H_4) (8.0±0.5)%	5[3]	Hydrogen (H_2) (37±1.0)% MESG=0.35mm
IIC[2]	5	Hydrogen (H_2) (31±1.0)%	5	Hydrogen (H_2) (27±1.0)%
	5	Ethyne (C_2H_2) (14.0±0.5)%	5	Ethyne (C_2H_2) (7.5±1)%

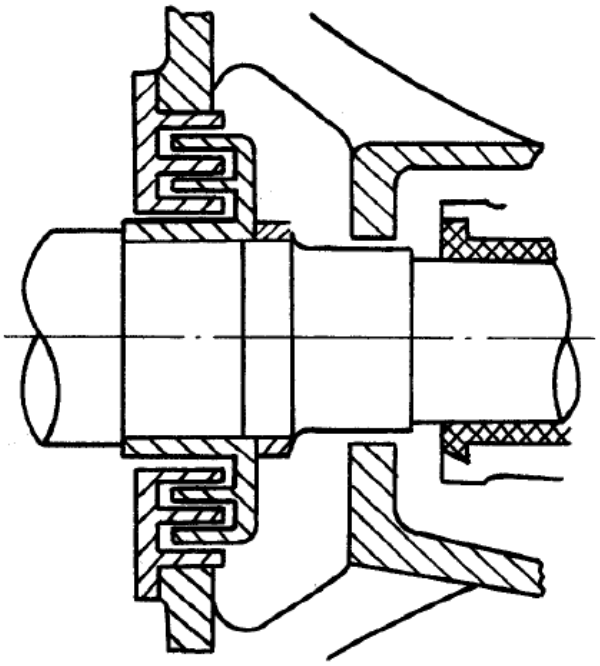
1) Tests shall be made for 5 times in the case of pressure piling repeatedly with the mixture of (24±1)% Hydrogen- Methane [(85±1)% H_2 and (15±1)% CH_4] and air.
2) If the enclosure is marked that it can only be used in the explosive environment of hydrogen or acetylene, the tests can only be made to the specified gas for 5 times.
3) The explosive mixture used in this test contains a known safety factor. The safety factor K is the ratio between the maximum experimental safe gap (MESG) that is easiest to ignite the mixture (see IEC 79-1A) in the gas group and maximum experimental safe gap of the selected explosive mixture.

Class I: $K=\frac{1.14}{0.8}=1.42$

ⅡA: $K=\frac{0.92}{0.65}=1.42$

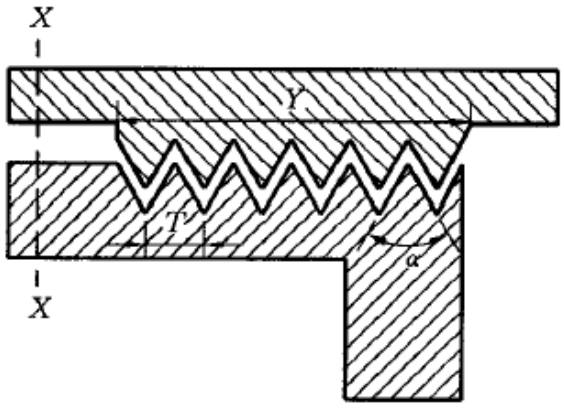
ⅡB: $K=\frac{0.65}{0.35}=1.85$

GB3836.2-2000



注：如果曲路轴承盖曲折部分或零部件之间的间隙不符合表1~表4的规定而满足第二篇的试验要求时，是允许的（见第5.1条）。

Figure 1 Applicable for labyrinth structure of cylindrical bearing and rolling bearing
Note: If the gaps between the curved parts or components of labyrinth bearing cap do not meet the provisions in Table 1 to Table 4, but meet the test requirements under Chapter 2, it is permissible (see Article 5.1).



$Y \geqslant 5\ T$　　试验长度$=\frac{Y}{1.5}$　　$T \geqslant 1.25$ mm　　$\alpha=60°(\pm 5°)$

Figure 2 Saw tooth joints

试验长度 Test length

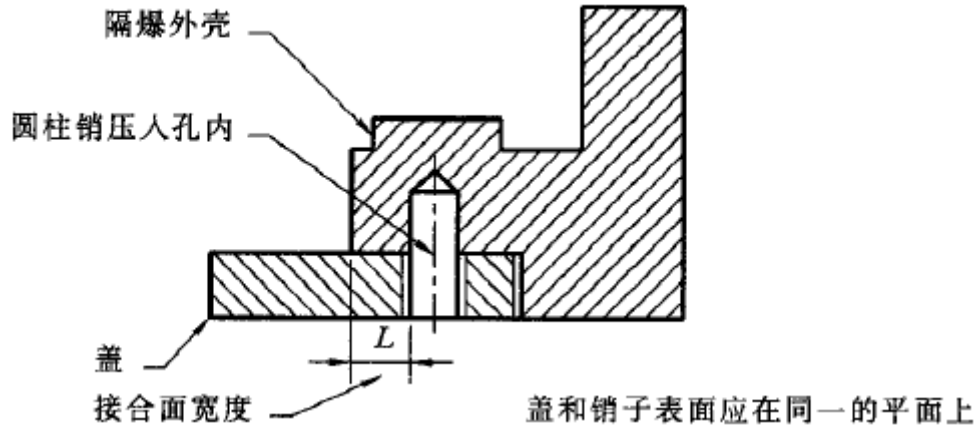


Figure 3 Sample for checking the gap of joints indirectly

隔爆外壳 Flameproof enclosure
圆柱销压入孔内 Cylinder pin pressed in the hole
盖 Cap
接合面宽度 Width of joints
盖和销子表面应在同一的平面上 Cap and pin shall on the same level

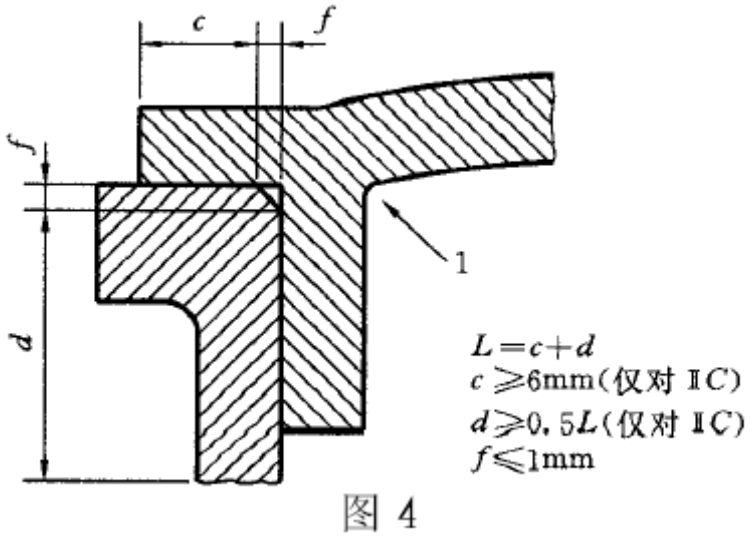


图 4

Figure 4
(仅对 IIC) (only for IIC)

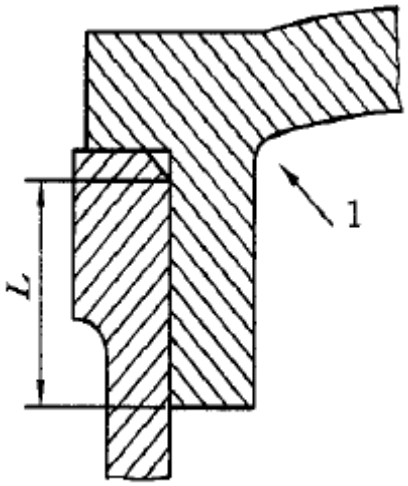


图 5

Figure 5

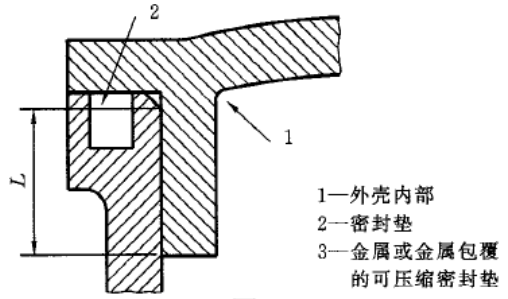


图 6

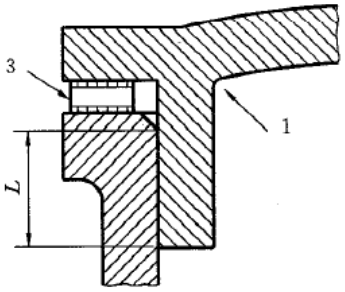


图 7

Figure 6 Figure 7

Figure 4~Figure 7 Spigot joint

外壳内部 Inside the enclosure

密封垫 Seal pad

金属或金属包裹的可压缩密封垫 Compressible metal of metal-coated seal pad

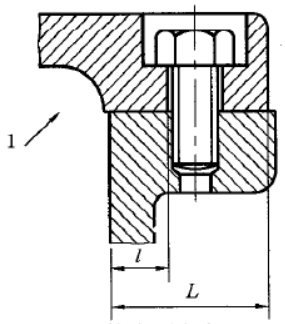


图 8

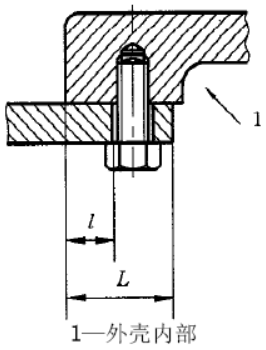


图 9

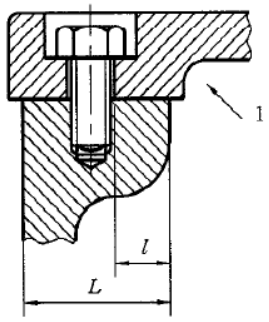


图 10

Figure 8 Figure 9

Figure 10

接合面宽度 Width of joints

外壳内部 Inside the enclosure

Figure 8, 9 and 10 Holes on the flameproof joints

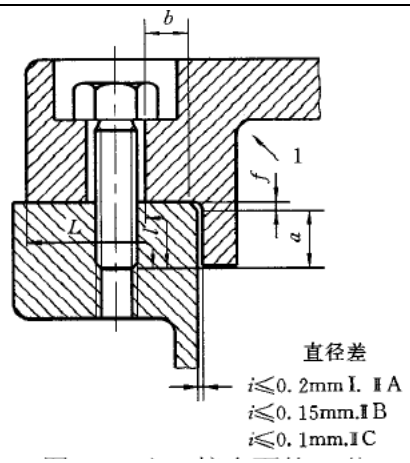


Figure 11 L value of spigot joint

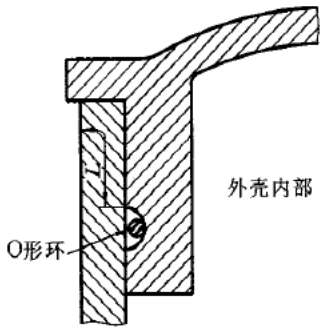


Figure 12 Bushing and O ring

直径差 Diameter difference

外壳内部 Inside the enclosure

O 形环 O ring

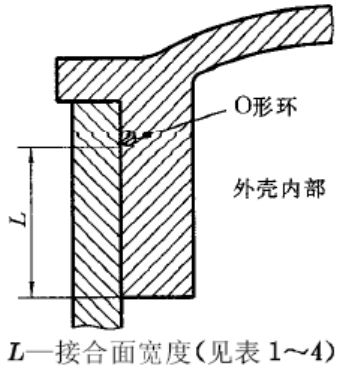


Figure 13 Bushing and O ring

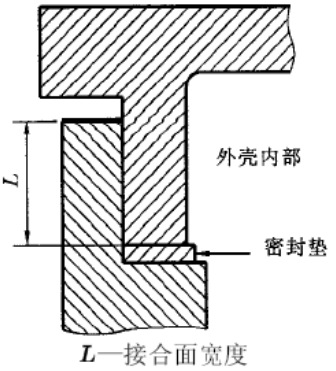


Figure 14 Bushing and O ring

O 形环 O ring

外壳内部 Inside the enclosure

接合面宽度（见表 1~4）Width of joints (see Table 1~4)

外壳内部 Inside the enclosure

密封垫 Seal pad

接合面宽度 Width of joints (see Table 1~4)

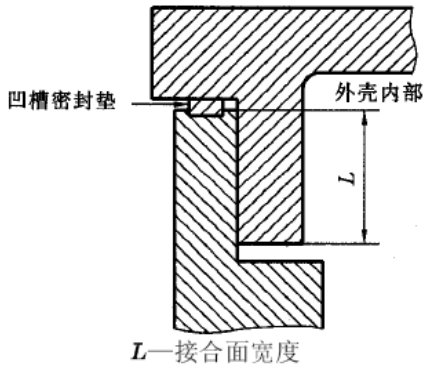


Figure 15 Bushing and O ring rolling bearing

凹槽密封垫 Groove seal pad

外壳内部 Inside the enclosure

接合面宽度 Width of joints

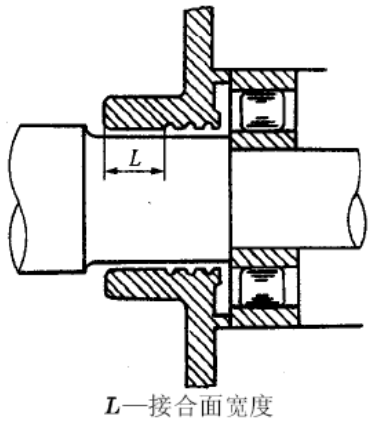
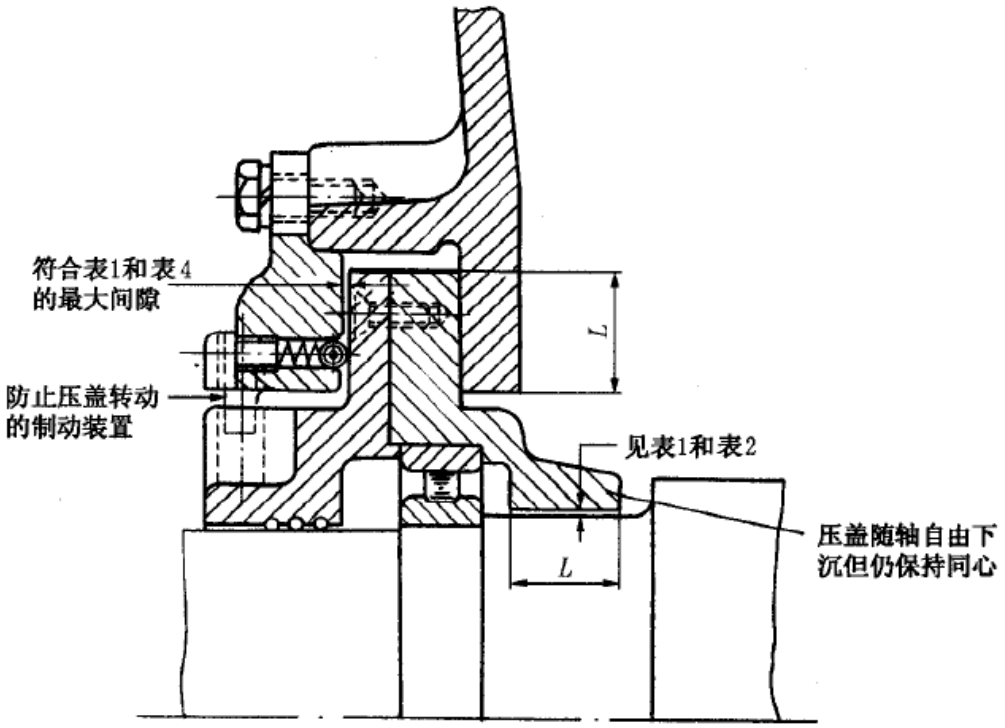


Figure 16 Cylindrical bearing cap applicable for



Note: The float degree required for the design should take into account the gap between the rotor and the stator and the allowed bearing wear.

Figure 17 Typical floating bearing glands

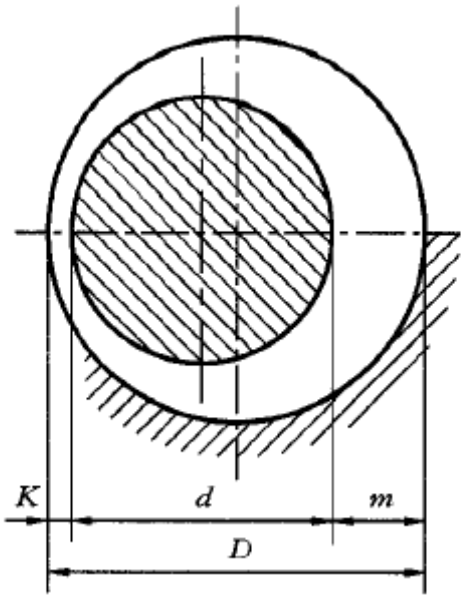
符合表 1 和表 4 的最大间隙 Maximum gap in accordance with Table 1 and Table 4

防止压盖转动的制动装置 Brake device preventing gland rotating

见表 1 和表 2 see Table1 and Table 2

压盖随轴自由下沉但仍保持同心 Gland lowering automatically with the shaft, but

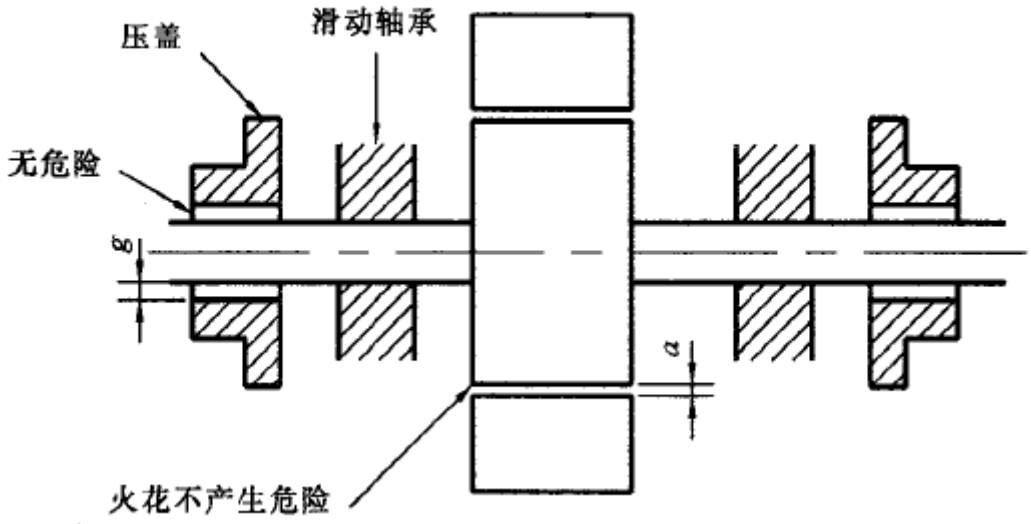
remaining concentric
接合面宽度 Width of joints



K—最小径向间隙；
m—最大径向间隙；
D−*d*＝直径差

Figure 18 Joints of rotating motor shaft

最小径向间隙 Minimum radial gap
最大径向间隙 Maximum radial gap
直径差 Diameter difference



a - Radial gap between rotator and stator; g - Allowable radial gap of bearing cap

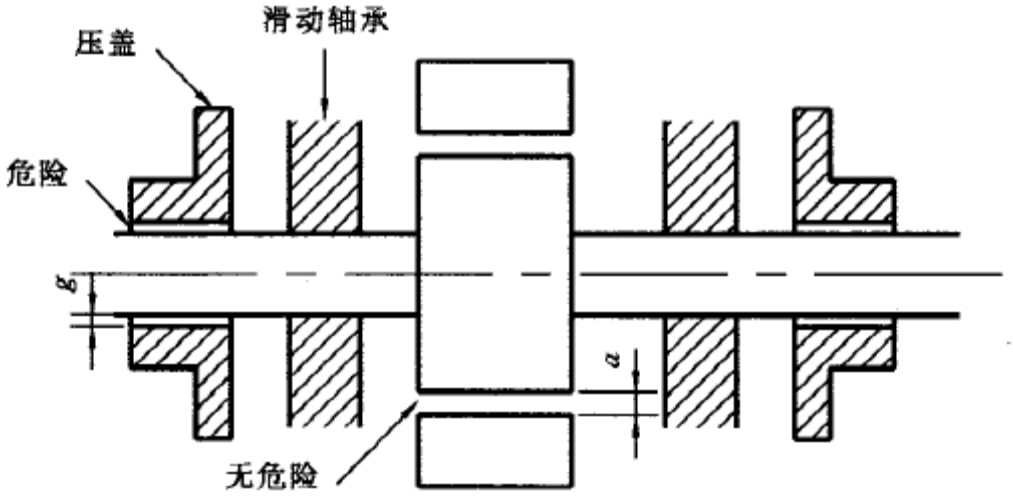
Figure 19 Status for sliding bearing a＜g

滑动轴承 Sliding bearing

压盖 Gland

无危险 No danger

火花不产生危险 Sparks will not cause danger



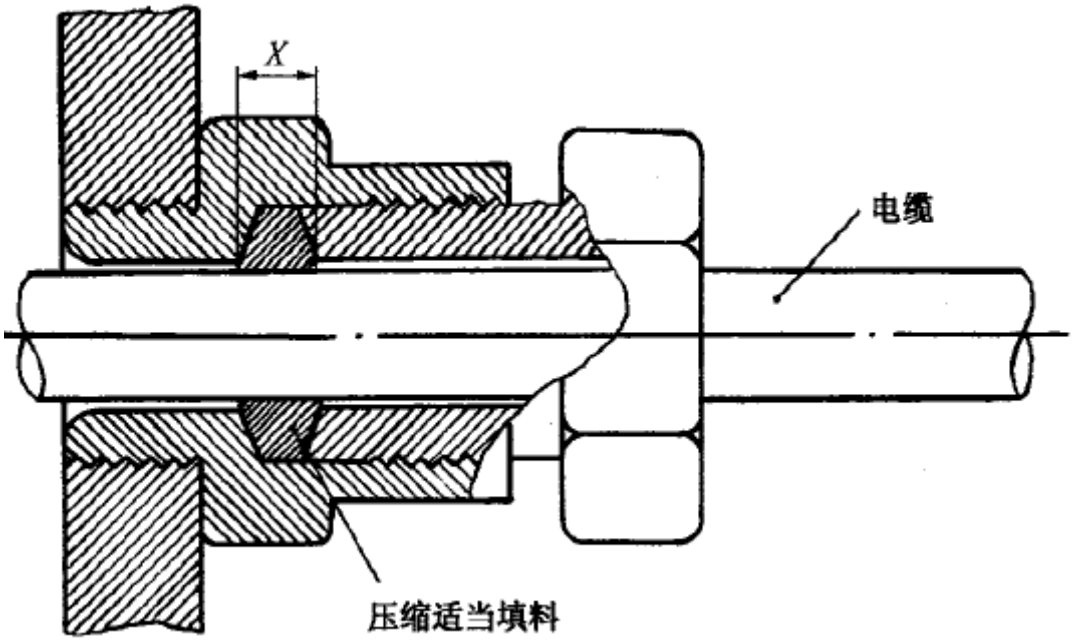
a - Radial gap between rotator and stator; g - Allowable radial gap of bearing cap

Figure 20 Status for sliding bearing a＞g

滑动轴承 Sliding bearing

压盖 Gland

危险 Dangerous
无危险 No danger

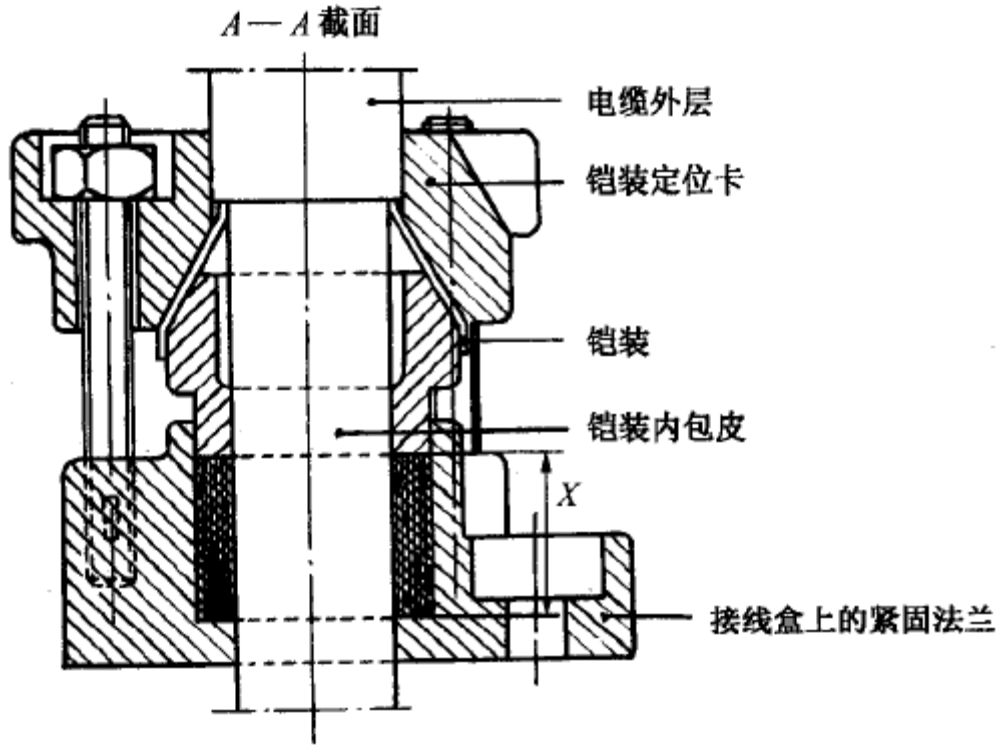


X – Sealing width
Note: This figure shows the requirement of Article 12.4 with legend, but it does not show the real structure details. The sealing width X shall be measured with the compressible material.

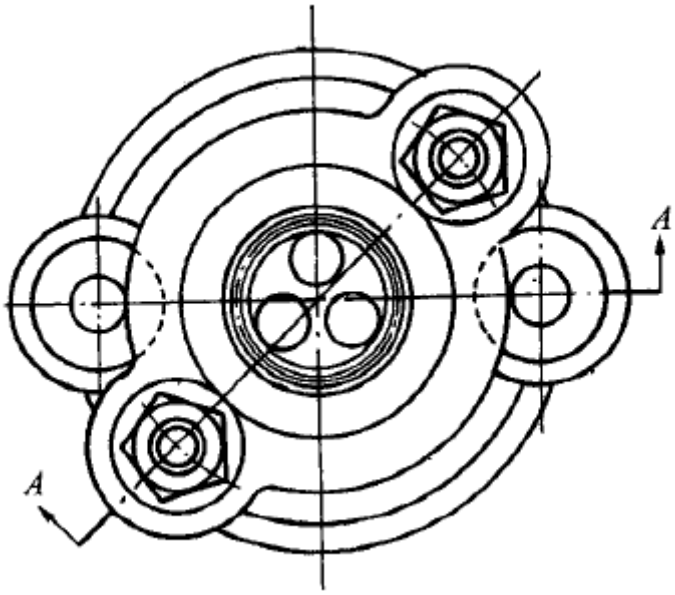
Figure 21 Example for direct entries of cable

电缆 Cable
压缩适当填料 Compress suitable packing

GB3836.2-2000



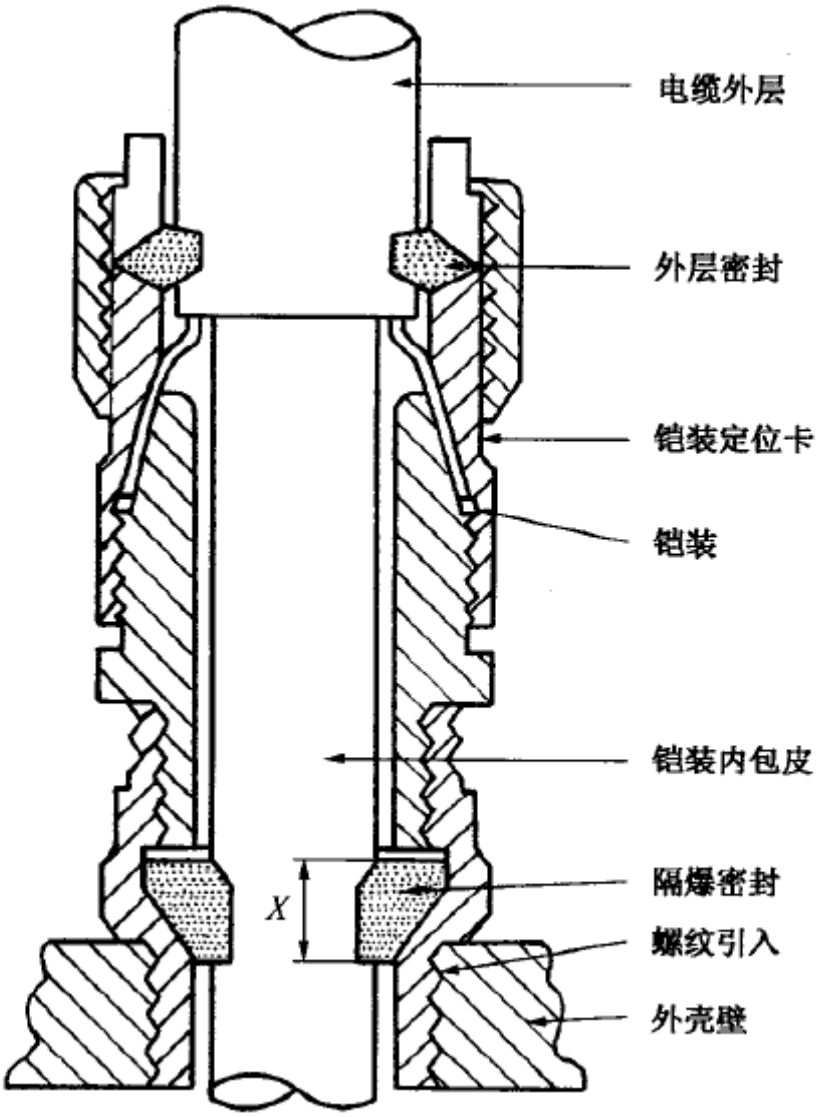
A-A 截面 A-A Cross section
电缆外层 Cable coat
铠装定位卡 Armoured positioning card
铠装 Armour
铠装内包皮 Coat in armour
接线盒上的紧固法兰 Fastening flange on junction box
隔爆外壳 Flameproof enclosure
挤压之后测量 X Measure X after compressing



X – Sealing width

Figure 22 Example for direct entries of armoured flameproof cable (see Article 12.4)

GB3836.2-2000



电缆外层 Cable coat
外层密封 Outer seal
铠装定位卡 Armoured positioning card
铠装 Armour
铠装内包皮 Coat in armour
隔爆密封 Flameproof seal
螺纹引入 Thread entry
外壳壁 Enclosure wall
X – Sealing width
Figure 23 Example for using direct entries of armoured cable

GB3836.2-2000

Appendix A
(Normative appendix)
Non-metallic components of flameproof enclosure

A1 Scope

This appendix applies to non-metallic flameproof enclosures and non-metallic components of the enclosure, with the following exceptions:

a) Seal ring of cable entries;

b) Non-metallic parts irrelevant with the explosion-proof type.

A2 Special structural requirements

A2.1 Resistance to leakage and creepage distances of enclosure inner wall surface

When non-metallic enclosure or non-metallic parts of the enclosure are used to support the exposed live parts directly, the resistance to leakage and creepage distance of the enclosure inner surface or enclosure parts shall comply with the requirements specified in GB3836.3.

However, for Class I flameproof enclosure, under the conditions that the rated current is greater than 16A and arcing is generated in the air to make the insulating material withstand the electrical stress (switching devices including circuit breakers, contact and isolating switch), the comparative tracking index (CTI) of the insulating material shall be equal to or greater than 400M (according to IEC112).

A3 Supplementary requirements for type test

A3.1 Overview

A3.1.1 Ambient temperature when carrying out the test

When some tests must be carried out under the different ambient temperatures depending on testing places, these temperatures should be:

a) Upper temperature limit, the highest ambient temperature under operation increases at least 10K, but up to 15K;

b) 10K Lower temperature limit, the lowest ambient temperature under operation increases at least 5K, but up to 10K.

A3.1.2 Test sequence

Class I electrical apparatus should be tested with six samples:

a) Two samples should be subjected to high temperature test of heat resistance (A3.1.3), followed by low temperature test of heat resistance (A3.1.4), and then by mechanical tests according to GB3836.1. Finally, one sample is subjected to explosion test (A3.2) and another sample is subjected to flammability test (A3.3).

b) Two samples should be subjected to oil resistant test (A3.1.6), followed by mechanical tests according to GB3836.1. Finally, one sample is subjected to explosion test (A3.2) and another sample is subjected to flammability test (A3.3).

c) Two samples should be subjected to mining equipment hydraulic oil resistant test (A3.1.6), followed by mechanical tests according to GB3836.1. Finally, one sample is subjected to explosion test (A3.2) and another sample is subjected to flammability test (A3.3).

Two samples shall be used for test of Class II electrical apparatus. These samples should be subjected to high temperature test of heat resistance (A3.1.3), followed by low temperature test of heat resistance, and then by mechanical tests according to GB3836.1. Finally, one sample is subjected to explosion test (A3.2) and another sample is subjected to flammability test (A3.3).

A3.1.3 High-temperature test of heat resistance

High-temperature test of heat resistance shall be determined depending on plastic enclosure or plastic components of the enclosure related to explosion proof type integrity. These enclosures or plastic parts should be stored under the environment with the relative humidity of (90±5)% and the temperature higher than the maximum operating temperature (20±2)℃, but at least 80 ℃ for four weeks.

Under the conditions that the maximum operating temperature exceeds 75 ℃, the temperature (95 ± 2) ℃ and the relative humidity (90±5)% for two weeks of store time replaces the above specified four weeks store time. The enclosure or components shall be placed in the test box with the temperature higher than the maximum operating temperature (20 ± 2) ℃ and normal humidity for two weeks.

A3.1.4 Low-temperature test of heat resistance

Low-temperature test of heat resistance shall be determined depending on plastic enclosure or plastic components of the enclosure related to explosion proof type integrity. These enclosures or plastic parts should be stored under the environment with the lowest operating temperature reduced as specified in A3.1.1 for 24h.

A3.1.5 Light exposure test

Light exposure test of materials shall be made to plastic enclosure or the plastic components of the enclosure without the light protection. For Class I devices, the test is only suitable for lighting.

The test shall be made to six test bars with the standard size of 50mm×6mm×4mm in accordance with ISO179. Test bars shall be made as the same condition of manufacturing the enclosures. These conditions should be described in the test report of electrical equipment.

The test shall be made in an exposure room with the Xenon (Xe) lamps and sunlight filtering system in accordance with ISO4892. The temperature of black board shall be (55 ± 3) ℃, and the exposure time shall be 1000h.

Evaluation shall be made based on the impact bending strength requirements specified in ISO179. When the outer side (exposed surface) is impacted, the impact bending strength after exposure of light shall be at least 50% of the corresponding values of the specimen not exposed to light. For the material which can not be measured with impact bending strength due to not being broken before the exposure of light, the number of test bars that are possible to break after light exposure test will not exceed three.

A3.1.6 Chemical reagent resistance test of Class I electrical apparatus

Plastic enclosures and plastic parts of the enclosure should be subjected to the following chemical resistance tests:

a) Oil and grease;

b) Mine hydraulic oil.

The relevant test shall be made on the four samples inside the enclosures which are sealed well to prevent the test liquid in.

a) Two samples should be placed in No. 2 oil specified in the Appendix “Impregnated Liquid” in ISO1817 standard for (24 ± 2) hours with a temperature of 50℃.

b) The other two samples should be placed in the hydraulic oil consisting of ethylene glycol solution containing 35% of water (by volume) for (24 ± 2) hours.

After the test, the relevant enclosure sample shall be taken out from the liquid tank, carefully dried and placed in the laboratory for 24 hours. Then each enclosure sample should be subjected to the mechanical test specified in GB3836.1.

If one or more samples fail to pass the mechanical test, the special conditions for safe use should be described in a certificate, and the electrical equipment shall take the symbol X according to GB3836.1.

A3.2 Explosion test

A3.2.1 The non-metallic enclosures and non-metallic parts of the enclosure carrying

out the specified test in the Article A3.1 and pass the test shall be subjected to the explosion test in the following sequence.

A3.2.2 Test of the ability of the enclosure to withstand the explosion pressure

These tests should be carried out according to 15.1 in this Standard.

A3.2.3 Flame ablation test

The test shall be made on the enclosure with at least one plastic side on the flameproof joints.

Exception: If the volume is less than 100cm^3, and the material has passed the flammability test specified in the Article A3. 3. 1, it is not necessary to carry out the flame ablation test.

For such kind of test:

a) The stationary gap of the plane part of the plane joints and spigot joints on the enclosure should be adjusted to 0.1mm-0.15mm. However, if the involving level allows the maximum stationary gap less than 0.15mm, the gap should be adjusted to allowable maximum value;

b) The cylindrical part of cylindrical joints and spigot joints and the gap of screw joints may not change;

c) The insulating sleeve through two adjacent flameproof enclosures shall carry out the test as the enclosure with strict test conditions.

The corresponding level of explosive mixture shall be ignited for 50 times in this test according to the requirement in Article 15.1.1. For IIC electrical apparatus, two kinds of explosive mixtures shall be ignited for 25 times in accordance with Table 6 respectively. If they can pass the following non transmission explosion test, the test is qualified.

A3.2.4 Non transmission explosion test of internal ignition

This test should be carried out according to the Article 15.2 in this Standard.

A3.3 Flammability test

A3.3.1 This test should be carried out according to ISO 1210.

The sample should be:

a) Cut off from the enclosure of electrical apparatus,

b) Molded into a single piece of sample block, or

c) Cut off from the plastic board prepared for this purpose.

The plastic boards which are molded into a single piece of test block or cutting test block should be manufactured as the conditions close to the production of electrical equipment enclosure. These production conditions should be recorded in the manufacturer's technical document.

Note: If the condition of manufacturing enclosure is the key factor, it should be recorded in the certificate.

After the flame is removed, the time for any test block to burn on shall be less than 15s. During this duration, the test block should not be burned completely (ISO1210).

A3.3.2 If the test can not be carried out because the sample curls in the flame according to A3.3.1, any of the following test methods shall be used.

A3.3.2.1 First test method

The test shall be carried out according to the requirements of GB/T11020 (Method FV: flame - vertical sample).

The test blocks should be:

a) Cut off from the enclosure of electrical apparatus, or

b) Molded into a single piece of sample block, or

c) Cut off from the plastic board prepared for this purpose.

The plastic boards which are molded into a single piece of test block or cutting test block should be manufactured as the conditions close to the production of electrical equipment enclosure. These production conditions should be recorded in the manufacturer's technical document.

A3.3.2.2 Second test method

The flammability test should be carried out in a small room, container or unventilated test cabinet. Each sample shall be held and supported by clamping ring perpendicular to the axis from the top (6mm to the end), so that the bottom of the sample is 10mm higher than the top of burning tube and 300mm above the horizontal medical dry cotton (maximum single-layer non-standard thickness of 50mm×50mm absorbent cotton is 6mm) layer.

Bunsen burner shall be equipped with a 100mm long tube with an inner diameter (9.5 ± 0. 5) mm. The tube does not need end accessories such as stabilizers. Industrial purity methane should be used and appropriate controller and instrumentation shall be equipped to form a uniform flow (the natural gas containing about 37MJ heat per cubic meter can produce the similar results). Length of the sample is (125 ± 5) mm long, (13 ± 0.3) mm wide and (3.0 ± 0.2) mm thick. If necessary, the samples should be pretreated (see Article 5.2 in ISO1210: 1982).

Bunsen burner should be ignited and adjusted at a place away from samples to produce a 20mm high blue flame. Then the amount of gas supply is increased to the yellow tip disappeared. If necessary, re-measure and correct the flame height. The test flame is put in the center at the bottom of the test specimen and allowed to stay 10s. Then move the test flame at least 150mm away and record the flame burning duration of the sample. When the flame on the sample flame goes out, the test flame should immediately be moved back below the sample. The test flame is withdrawn after 10 seconds, and it is necessary to record the flame and flameless combustion duration.

Acceptance criteria for combustion characteristics of the tested material:

a) No sample can burn over 10s after the test flame is burning each time;

b) All the samples can not burn over 50s after each group of three samples subjected to 10 test flame;

c) No sample burns or flamelessly burns the holder;

d) No particles falling from the burning sample can ignite the dried medical cotton at 300mm under the test sample.

e) After the flame is removed for the second time, flameless combustion of no sample is over 30s.

GB3836.2-2000

Appendix B
(Normative Appendix)
Breathing Device and Draining Device

B1 Scope

This appendix applies to breathing device and draining device used for flameproof enclosure.

The following requirements also apply to sound transmission device, but not including the following devices:

a) Pressure relief device of internal explosion accidents, or

b) Pressure device with the gas which can form explosive mixtures with air internally and gas pressure more than 1.1 times the atmospheric pressure.

B2 General requirement

Breathing device and draining device contains some ventilation components, which should be able to withstand the pressure produced by the explosion inside the flameproof enclosure and to prevent explosion propagation to explosive atmosphere surrounding the enclosure.

They should also withstand the dynamic effects of an explosion within the flameproof enclosure without creating a continuous burning or damages reducing its fire retardant performance.

The ventilation holes in the breathing device and draining device should not be produced by the way of deliberately increasing the gap of plane joints.

Note: The equipment can be designed into the structure with breathing device, draining device, or a combination of two devices together.

If due to technical reasons, breathing device and draining device shall be equipped, the manufacturer shall provide the instructions of notices to ensure that then are not easy to fail in operation (e.g. due to accumulation of dust or paint).

B3 The materials used for the devices should be provided directly or implemented by reference to existing valid standards. The copper content of the material used for the components of breathing device and draining device for acetylene environment shall not exceed 600％ (by mass) to limit the formation of acetylene compounds.

B4 The size of breathing device and draining device should be specified together with their components.

B5 Components with measurable channel

If the component can pass through the test described in Article B11, then the channel gap and measurable channel length do not necessarily comply with the values given in Table 1 to Table 4.

B6 Supplementary requirements for curled ribbon components of breathing device and draining device

B6.1 The curled ribbon element components should be made of nickel-copper alloy, stainless steel or the metal agreed by the manufacturer and testing organization. But aluminum, titanium, magnesium and its alloys shall not be used.

B6.2 If the channel of the straight device can be specified in the drawings and be measured in the complete device, then the top and bottom tolerances of channel dimensions should be specified and controlled in production.

B6.3 If the requirement provided in B6. 2 is not suitable, B7.2 should be adopted.

B6.4 The type test specified in Article 15.2 shall be made on the samples with the maximum allowable manufacturing gap size.

B7 Components with immeasurable channel

If the channels through the components are immeasurable (e.g. sintered metal components), the components should comply with the requirements specified in B7.1 to B7.5. These components should be graded by density and pore size.

Due to the functional reasons, liquid permeability and ventilation rate may also be required to specify.

B7.1 If necessary, the manufacturer shall specify:

a) Component density;

b) Maximum hole size;

c) Liquid permeability rate;

d) Ventilation rate.

These contents should be determined depending on recognized standard method of specific materials and processing methods.

B7.2 Supplementary requirements for components with immeasurable channel of breathing device and draining device

B7.2.1 Sintered metal components

B7.2.1.1 Sintered metal components shall be manufactured by the following methods:

a）Stainless steel;

b) 90/10 copper tin brass, or

c) Special-purpose metals or alloys agreed by the manufacturer and testing organization.

B7.2.1.2 Equivalent bubble pressure pore size shall be determined according to the method specified in ISO4003.

B7.2.1.3 The density of sintered metal components shall be determined according to the method specified in ISO2738.

B7.2.1.4 Due to the functional reasons of these components, the ventilation and / or liquid permeability rate shall be determined according to the method specified in ISO4022 and ISO2738.

B7.2.1.5 Sintered metal components should be clearly listed in the technical document:

a) The materials used comply with B3 and B7.2.1.1;

b) Maximum bubble test pore size (unit: μm) complies with B7.2.1.2;

c) The density complies with B7.2.1.3

d) The thinnest thickness;

e) If necessary, the ventilation and / or liquid permeability rate shall comply with B7.2.1.4.

B7.2.2 Pressed metal wire components

B7.2.2.1 Pressed metal wire components shall be made of stainless steel or other special-purpose metal wires agreed by the manufacturer and testing organization. These materials shall be rigid with the specified size.

Note: The manufacture starts with the weaving of metal wire. The laminated woven is pressed into a box to form a uniform matrix.

B7.2.2.2 In order to assess density, the diameter of metal wire should be specified as well as the data including mass, laminated metal wire woven and mesh size. The mass ratio between the filter and the same solid metal with the equivalent volume should be between 0.4-0.6.

B7.2.2.3 Equivalent bubble pressure pore size shall be determined according to the method specified in ISO4003.

B7.2.2.4 The density of components shall be determined according to the method specified in ISO2738.

B7.2.2.5 Due to the functional reasons of these components, the ventilation and / or liquid permeability rate shall be determined according to the method specified in ISO4022 and ISO2738.

B7.2.2.6 Components should be clearly indicated according to the requirements in the technical document:

a) The materials used comply with B3 and B7.2.1.1;

b) Maximum bubble test pore size (unit: μm) complies with B7.2.2.3;

c) The density complies with B7.2.2.4;

d) Dimension, including tolerance;

e) Original metal wire diameter;
f) If necessary, the ventilation and / or liquid permeability rate shall comply with B7.2.2.5.
B7.2.3 Metal foam components
B7.2.3.1 The component shall be made of nickel-plated mesh-shape polyurethane (PU) foam, eliminating polyurethane (PU) by thermal decomposition, changing nickel into a nickel-chromium alloy (e.g. with gas diffusion), and compressing the material when necessary.
B7.2.12 Metal foam components shall contain at least 15% of chromium (by mass).
B7.2.3.3 Equivalent bubble pressure pore size shall be determined according to the method specified in ISO4003.
B7.2.3.4 The density of components shall be determined according to the method specified in ISO2738.
B7.2.3.5 Due to the functional reasons of these components, the ventilation and / or liquid permeability rate shall be determined according to the method specified in ISO4022 and ISO2738.
B7.2.3.6 Metal foam components should be clearly indicated according to the requirements in the technical document:
a) The materials used comply with B7.2.3.1 and B7.2.3.2;
b) Maximum bubble test pore size (unit: μm) complies with B7.2.2.3;
c) The thinnest thickness;
d) Minimum density;

e) If necessary, the ventilation and / or liquid permeability rate shall comply with B7.2.2.5.

B8 If the device is removable, its structure should be designed to avoid narrowing or expanding the opening gap when reassembling.

B9 Installation and layout of components

Components of breathing device and draining device of breathing should be sintered, welded, brazed or glued according the provisions of Article 5.5, or installed with other appropriate methods:

—Directly fixed onto the enclosure to form an integral part of the enclosure;

—Or fixed on an appropriate component, and then installed on the enclosure by the way of clamp or screw so that it can be replaced as a component.

In addition, components can also be installed by the way of forming flameproof joints. In this case, the corresponding requirements in Chapter 5 shall be met. If the layout of component has passed the type test in Chapter 3, the surface roughness of components is not required to meet the requirements of 5.2.2. If necessary, clamping or similar methods can be used to maintain the integrity of the enclosure. Components of breathing device and draining device may be installed with any of the following methods:

a) Can be installed inside the enclosure, with the bolt and clamping ring removed from inside;

b) Or installed from the external enclosure, with the fasteners in accordance with the requirements of Chapter 10.

B10 Mechanical strength

The device and its guard (if available) in the normal installation shall pass through the impact test of IEC79-0.

B11 Test of flameproof enclosure with breathing device and draining device

The test shall be carried out on the sample which has already withstood the impact test specified by B10 according to the provisions of Article Bll.1 ~ Bll.3 B10.

For devices with immeasurable channel, the pore size of the sample should be not less than 85% of the maximum pore size.

B11.1 Test of ability of the enclosure to withstand the explosion pressure

The test shall be carried out according to Article 15.1 and the following supplementary requirements.

B11.1.1 When the explosion pressure is measured according to the provisions of Article 15.1.1, the breathing device and draining device shall be replaced by solid plug.

B11.1.2 When the over-pressure test is made according to the provisions of Article 15.1.2, a soft flexible thin film (such as thin plastic sheets) shall be glued to inside surface of the breathing device and draining device. After the over-pressure test is finished, the device does not have any permanent deformation and damage to affect explosion-proof performance.

B11.2 Thermal test

B11.2.1 Test procedure

The test shall be carried out to the enclosure with one or more breathing device according to B11.3.1, but the ignition source can only be set in the place where it may lead to the most unfavorable results.

Monitor the outer surface temperature of one or more devices when carrying out the test. Test should be carried out for 5 times. The used test mixture should be (4.2+0.1)% propane (volume ratio with air at atmospheric pressure). In addition, the device specified to be used in the acetylene environment should use (7.5 ± 1)% acetylene mixture (volume ratio with air at atmospheric pressure).

When there is a possibility that the enclosure will absorb or extract potentially dangerous gas stream, the enclosure shall be arranged to allow gas to flow through the device to the enclosure when carrying out the test.

Any ventilation system and sampling system shall be operated according the provisions in manufacturer's documentation. After the test has been made for five times, the explosive mixture should maintain sufficient time to allow any continuous combustion on the device surface to a significant level (e.g. to maintain at least 10min to allow the temperature of the device outer surface to increase or make the temperature spread to the outer surface).

B11.2.2 Qualified criteria

No flame spread or no observation of continuous flame burning.

The temperature group of electrical equipment can be determined with the safety factor of 1.2 multiplied by the temperature increase of the measured device outer surface.

B11.3 Non transmission explosion test of internal ignition

The test shall comply with Article 15.2 and the following supplementary requirements.

B11.3.1 Test procedure

The ignition source should firstly be placed on the inner surface of the breathing device and draining device. If necessary, it should be placed on one or more place on the device surface where the maximum peak explosion pressure and maximum pressure rise rate. When the enclosure is equipped with more than two same devices, then the testing device should be able to lead to the most unfavorable test results. The gas mixture inside the enclosure should be ignited. The test shall be carried out for five times for each ignition source.

B11.3.2 The test shall be carried out for Class I, IIA and IIB breathing device and draining device in according with the requirement of non transmission explosion test of 15.2.1.

The Class IIC breathing device and draining device with measurable channel shall comply with the requirements of 15.2.2 and B11.3.2.1 or 15.2.2 and B11.3.2.2.

The breathing device and draining device with immeasurable channel shall comply with the requirements of B11.3.2.1 and B11.3.2.2.

B11.3.2.1 Method A

For hydrogen environment, only hydrogen / air mixture is required for test with 1.5×10^5Pa precharge pressure for 5 times.

B11.12.2 Method B

The use of this method includes limit range of group IIC gases. When it is required to limit special gas or a variety of gases, the electrical equipment shall be labeled with the symbol "×".

Ethyl nitrate is exceptional.

For the enclosure with the volume greater than 100cm^3, it shall not be used for carbon dioxide.

The gas mixture used for the enclosure and test tank consists of the following composition (the volume ratio to air at atmospheric pressure):

a) (40 ± 1)% hydrogen, (20 ± 1)%oxygen and remaining nitrogen;

b)(10 ± 1)% acetylene，(24 ± 1) %oxygen and remaining nitrogen。

For hydrogen, the gas mixture in the item a) shall be used.

Appendix C
(Normative Appendix)
Supplementary Provisions of Class I Electrical Apparatus[1]

C1 Material of flameproof enclosure

Cl.1The enclosure of electrical equipment for mining working surface with (including electrical equipment installed on the machinery including coal mining machine, rock loader, conveyors) shall be made of steel or cast steel. Other components or the enclosure which the external impact can not reach and the volume is not more than 2000cm^3 can be made of not less than HT250 grade gray cast iron. However, in addition to the motor base shall be made of steel or cast steel, other parts also can be made of HT250 gray cast iron.

C1.2 The enclosure of electrical equipment for non mining working surface can be made of not less than HT250 grade gray cast iron.

C1.3 The enclosure material of electrical equipment specially used for chamber is not limited by Cl.2.

Cl.4 When the volume is not greater than 2000cm^3, enclosure can be made of non-metal materials. But it is not allowed to create the fastening thread on non-metallic enclosure directly (except the outlet port).

C2 Direct entries of equipment

When the electrical equipment meet the following two conditions, it is allowed to adopt direct entry way:

a) Under normal operation, sparks, arcs or dangerous temperature do not appear.

b) The rated power of electrical equipment is not more than 250W, and the current is not more than 5A.

C3 The electric clearance and creepage distance of junction box of electrical equipment or terminal part of direct entry shall comply with GB3836.3.

C4 The threaded flameproof joints of the equipment shall be applied with the measures to prevent self-loosening.

Application Note:

1] There is no such appendix in IEC standard. This appendix is compiled considering the China's specific coal mine situation according to the relevant requirement of GB 3836.2 (1st edition).

GB3836.2-2000

Appendix D
(Informative Appendix)
Supplementary Provisions of Flameproof Cable Entry and Liner[1]

D1 Structural requirement of entry device

D1.1 Entry devices with rubber seals

D1.1.1 If the cable entry uses any seal rings with the same outer diameter but with a different inner diameter size, the non-compressed axial length of the seal ring:

a）For round cable with a diameter up to 20mm and the circumference of the cross section of non-circle cable up to 60mm, the minimum value is 20mm;

b) For round cable with a diameter more than 20mm and the circumference of the cross section of non-circle cable more than 60mm, the minimum value is 25mm;

D1.1.2 If the cable entry only uses one specified kind of rubber seal ring, the minimum non-compressed axial length of the seal ring should be 5mm. In this case, the cable device should be labeled with "×". But for Class I and IIC flameproof enclosure with the volume greater than 2000cm^3, the minimum axial length should be consistent with the requirements of Article Dl.1.1.

D1.2 Cable entry sealed with packing

The minimum axial length of packing seal when installing is 20mm.

The manufacturer shall specify:

a) Maximum allowable outer circumference diameter of the used cable core wire of cable entry.

b) Maximum packing core wire.

These specified values should ensure that at least 20% of the cross section is filled with packing on each point along the seal length of 20mm.

Cable entry shall be installed on the electrical equipment, and can be removed from the electrical equipment. The packing seal characteristic will not be damaged after the specified solidification duration of packing expires.

Manufacturer should provide packing and the instructions to users. These instructions can be used as a part of the documentation.

D1.3 Threaded cable entry

When there are threaded joints on cable entry, the threads should comply with Article 5.3. For the cylindrical thread, the threaded portion shall be at least 8mm long with at least 6 threads. If the thread has relief grooves, an inseparable and incompressible washer and similar parts shall be fitted when assembly in order to ensure the required length of thread engagement.

Note: 6 engaged thread is required to ensure that at least 5 threads engage when the cable entry is installed on the flameproof enclosure.

D2 Test of cable entry

D2.1 Sealing test

D2.1.1 Entry devices with rubber seals

The test shall be carried out with different allowable sizes of seal rings. The clean, dry,

polished low carbon steel round mandrel shall be used, with the mandrel diameter equal to the minimum allowable cable diameter of seal rings specified by the manufacturer.

When the metal or composite seals rings are used, each kind of seal rings must be installed on each clean, dry analog metal rod for test, with the metal rod diameter equal to the minimum allowable cable diameter of seal rings specified by the manufacturer.

The non-circular cable seal rings shall be installed on a clean, dry analog cable sample, with the circumference of analog cable sample equal to the minimum allowable cable size of seal rings specified by the manufacturer.

Then install the seal rings in the cable entry and apply the torque on the bolt (using flange clamping device) and nut (using compression nut) to ensure to maintain seal under Class I 2MPa hydraulic pressure and Class II 3MPa hydraulic pressure.

Application note:

1] There is no such appendix in IEC60079-1:199. The contents about the flameproof entry in this Appendix equivalently use Appendix C of European standard EN50018: 1994 and Appendix C of newly revised draft 31A/70/CDV:1997 of IEC60079-1. The contents on the explosion-proof liners are compiled based on the specific situation in China by GB3836.2 (1st edition).

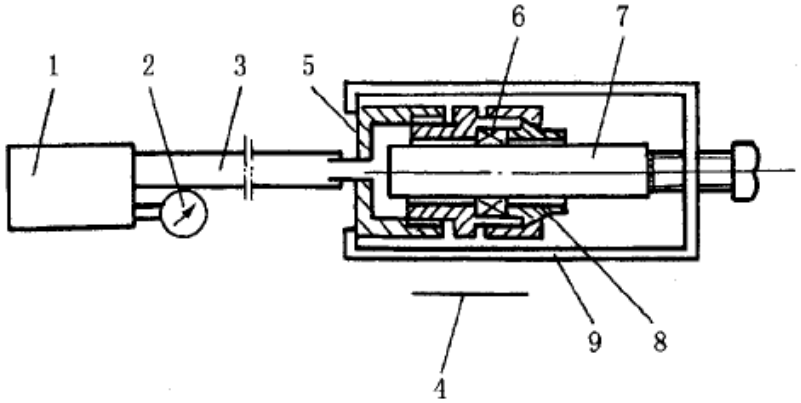
GB3836.2-2000

Note: The torque can be determined by experience before carry out the test or provided by the manufacturer.

Install the assembled entry device in the hydraulic test equipment (using color water or oil as liquid), with the schematic as shown in Figure D1. Charge the fluid and increase hydraulic pressure.

Class I equipment remain 2min under 2MPa pressure, or Class II equipment remain 2min under 3MPa pressure. If any sign of leakage does not appear on the absorbent paper, the sealing requirements can be met.

Note: In addition to the joints related to seal rings, all other joints should be sealed. When the metal-sheathed cable samples are used, it is necessary to avoid applying pressure to wire ends or cable interior.



1- hydraulic pump; 2-pressure gauge; 3-hose; 4- blotting paper; 5-adaptor; 6-seal rings;

7- mandrel bar/ metal sheathed cable; 18-compressing component; 9-fixing clamp

Figure D1 Seal test device

D2.1.2 Cable entry sealed with packing

For cable entry sealed with packing, the test shall be made to each size of metal mandrel bar used for cable entry. The number and diameter make any minimum actual packing filling amount of any cross section on the cable entry meet the requirement of D1.2.

Prepare the packing according to manufacturer's instructions, and then fill them in the appropriate space and wait to solidify at the appropriate time. The test shall be carried out according to Article 23.4.7.3 and Article 23.4.7.4 in GB3836.1-2000. Then install it in the seal test device to carry out the seal test by the same procedure.

D2.2 Mechanical strength test

D2.2.1 Cable entry of threaded clamping components

During the process of the test, apply 2 times the torque required in the seal test on compressing components, but the applied torque (unit: N·m) is at least 3 times the maximum allowable cable diameter of the round cable 3 (unit: mm) or the maximum allowable cable circumference of non-circular cable (unit: mm).

Then remove entry device and check the components.

D2.2.2 Cable entry of compressing components fastened by bolts

The torque applied on the compressing components bolts by the cable entry of compressing components fastened by bolts shall be 2 times the torque required in the seal test on compressing components, but at least equal to the following values (unit: N·m):

M6：10 N·m　　M12：60 N·m

M8：20 N·m　　M14：100 N·m

M10：40 N·m　　M16：50 N·m

Then remove entry device and check the components.

D2.2.3 Cable entry of packing seal

Screw the threaded cable entry into the steel test sample with the corresponding screw with the applied torque equal to the minimum torque specified in D2.2.1 (unit: N·m). Then remove entry device and check the components.

D2.2.4 Qualified criteria

If any damage to the components of cable entry can not be found, the test specified in D2.2.1~D2.2.3 can be considered as qualified.

Note: When it is proved that the mechanical strength of cable entry can withstand the required operating strength, any damage of the seal can be neglected.

GB3836.2-2000

D3 The irregularly opened parts in the maintenance can use liners as flameproof measures. In addition to meeting the requirement of 5.4.2, the liners shall be designed into:

a) The thickness of liners shall be not less than 2.0mm;

b) Width of joints is not less than 6.0mm when the enclosure volume is not more than 100cm^3, and not less than 9.5mm when the enclosure volume is greater than 100cm^3.

c) The installed liners should be guaranteed not to fall off in the structural design, and not be squeezed out when the explosion pressure appears inside the enclosure.