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SOUTH AFRICAN NATIONAL STANDARD

Cable glands for use on flameproof enclosures (Ex d)

Amdt 1; amdt 2

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SANS 808:2013

Edition 1.3

Table of changes

Change No.	Date	Scope
Amdt 1	1972	Amended to change the title, to replace non-metric units by metric units, to change the requirements for marking and clamping of flexible cords and cables without a metal sheath or armouring, and to add two new (corresponding) tests.
Amdt 2	1994	Amended to change the title, to change certain requirements for clamping, to change the loading test, and to add an appendix.
Amdt 3	2013	Amended to update referenced standards.

Foreword

This South African standard was prepared by National Committee SABS/TC 065, *Explosion prevention*, in accordance with procedures of the South African Bureau of Standards, in compliance with annex 3 of the WTO/TBT agreement.

This document was published in October 2013.

This document supersedes SABS 808:1967 (edition 1 as modified by amdt 1:1972 and amdt 2:1994).

A vertical line in the margin indicates where the text has been technically modified by amendment No. 3.

Compliance with this document cannot confer immunity from legal obligations.

<p>Reaffirmed and reprinted in March 2020. This document will be reviewed every five years and be reaffirmed, amended, revised or withdrawn.</p>

	Page
Foreword	
1 Scope	3
2 Definitions	3
3 Constructional requirements	4
4 Marking	9
5 Sampling and compliance with the specification.....	10
6 Inspection and methods of test	11
6.1 Inspection	11
6.2 Effectiveness of sealing (explosion test)	11
	Amdt 2
6.3 Loading test for glands for cables without a metal sheath or armouring and for trailing cables	11
	Amdt 2
6.4 Loading test for glands for armoured cables	12
Appendix A Loading of compound in sealing boxes.....	17
Appendix B Note to users of cable glands for use on flameproof enclosures	17
	Amdt 2
Appendix C Applicable standards.....	18
	Amdt 3

SANS 808:2013

Edition 1.3

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Cable glands for use on flameproof enclosures (Ex d)

Amdt 1; amdt 2

1 Scope

1.1 This specification covers those constructional details of cable glands for use on flameproof enclosures that are required to ensure

- a) initial flameproofness of the assembly of flameproof enclosure and cable gland,
- b) flameproofness as far as possible during normal conditions of use, and
- c) either interchangeability of cable glands or an obvious non-interchangeability.

1.2 The specification covers cable glands designed for use with any of the following cables:

- a) tough rubber sheathed (TRS), PVC sheathed, and polythene sheathed cables, with or without screens;
- b) metal sheathed cables without further mechanical protection;
- c) metal sheathed cables with steel tape or galvanized steel wire armouring; and
- d) cables without a metal sheath but armoured with steel tape or galvanized steel wire.

1.3 Only cable glands for cables designed for a maximum voltage of 1 000 V to earth are covered.

Amdt 2

NOTE The attention of users of this specification is drawn to the following:

- a) The type(s) of cable with which the glands are to be used must be specified in the order or contract (see 3.1.4.1).
- b) The notes to 3.1.6 and 3.2.5.

2 Definitions

2.1 For the purposes of this specification the following definitions apply.

approved

approved by the appropriate authority, i.e. the authority without whose permission flameproof apparatus may not be put into use in spheres under its jurisdiction

SANS 808:2013

Edition 1.3

cable gland

device that mechanically attaches the end of a cable to electrical apparatus, locates the cable securely, transmits earthing contact between apparatus and the cable armouring or screening, seals off the opening in the enclosure in a flameproof way, and mechanically secures each component of the cable in such a way as to prevent damage to the cable and, when relevant, spilling or leakage of the filling compound used in the sealing box

defective

cable gland that fails in one or more respects to comply with the appropriate requirements of the specification

flameproof enclosures

apparatuses constructed in accordance with the principle of flameproof enclosure

lot

not more than 240 glands of the same type, construction and size, from one manufacturer, submitted at any one time for inspection and test

principle of flameproof enclosure

that principle which, when applied during design and construction of an electrical apparatus, imparts to the apparatus the property that, should a specified flammable gas or vapour ignite inside the apparatus, the apparatus will not, under practical operating conditions within the rating of the apparatus or under recognized associated overloads, transmit a flame that is able to ignite a specified flammable atmosphere outside the apparatus

- a) via any openings in the apparatus (such as venting devices, shaft glands, or joints in the structure), or
- b) through distortion or destruction of the enclosure by the pressure of the explosion inside it.

seal

arrangement of soft and pliable or of semi-liquid and hard-setting materials used to prevent transmission of flame through a cable entrance

3 Constructional requirements

3.1 General (all glands)

3.1.1 Attachment of glands to flameproof enclosures

Unless the gland body is to form an integral part of the flameproof enclosure, the design of the gland shall be such that it is attached to the enclosure by one of the following methods:

- a) by bolted flanges (which may be spigoted);
- b) by conduit thread; and
- c) by any other approved method.

Amdt 1

The cable gland shall be constructed in such a way that when it is fixed to the flameproof enclosure in the intended manner, the joints between the gland and the enclosure comply with the relevant requirements of SANS 62444. The method of fixing the gland to the enclosure shall be such that the complete enclosure will comply with the strength requirements specified in SANS 62444. **Amdt 3**

3.1.2 Joints in glands

All joints in a gland, through which flame might be transmitted in the event of an explosion inside the flameproof enclosure, shall comply with the requirements for joints given in SANS 62444. **Amdt 3**

3.1.3 Sealing: Effectiveness

The cable gland shall be designed to seal off the opening between the cable and the enclosure. After being tested as described in 6.2, the gland shall not have suffered deformation or displacement of the sealing material, and the external gas mixture shall not have been ignited.

3.1.4 Sealing: Constructional requirements

3.1.4.1 General

Sealing shall be effected by means of packing material in a stuffing box, by means of a solid-setting compound in a sealing box, or by a combination of these methods, depending on the type of cable for which the gland is designed (see table 1).

Table 1

1	2
Type of cable	Type of sealing
Vulcanized rubber insulated	Stuffing box or sealing box
PVC or polythene insulated	Stuffing box or sealing box
Paper insulated	Sealing box
Mineral insulated, metal sheathed	Stuffing box

3.1.4.2 Sealing by means of a stuffing box

- a) The packing material shall be applied round the cable bedding or around the cable sheath or (for unarmoured TRS and similar cables) around the cable as a whole.

Except for unarmoured TRS and similar cables, packing material applied around the serving, taping, or braiding of a cable is not acceptable as a means of flameproof sealing of a cable entry.

- b) The packing material used in the stuffing box shall not lose its efficiency as a flameproof seal when subjected to

- 1) continued use,
- 2) continued compression,
- 3) heat, up to the recommended limiting temperature for the type(s) of cable for which the gland is intended, and
- 4) moisture¹⁾.

- c) The gland shall form a stuffing box such that a pressure-tight seal is formed between the cable and the internal walls of the cable gland. **Amdt 2**

1) Apart from moisture, other corrosive agents may also be present. The purchaser or user should ensure, through consultation with the suppliers, that the sealing material is suitable for the expected condition of use.

SANS 808:2013

Edition 1.3

- d) The design of the parts compressing the packing shall be such that the cable is not damaged when the packing is compressed and that the packing does not migrate from the stuffing box or become ineffective on compressing.
- e) The packing (when fully compressed) shall, with the cable, form a seal of effective axial length at least 12,5 mm. **Amdt 1**
- f) The press nut shall be secured against being loosened by vibration. A grub screw, screwed on to a thread, shall not be used for this purpose.
- g) All edges where cables enter into or emerge from the gland shall be rounded to avoid damage to the insulation, bedding, or serving, whichever is applicable.

3.1.4.3 Sealing by means of a sealing box²⁾

- a) The solid-setting compound shall surround the cable cores completely for an axial length of at least 12,5 mm. **Amdt 1**
- b) The sealing chamber shall be designed to allow easy and complete filling with compound in all positions of the gland that may be encountered in practice.
- c) The compound used shall set solidly and shall not flow or lose its efficiency as a flameproof seal when subjected to
 - 1) continued use,
 - 2) heat (up to the recommended limiting temperature for the type(s) of cable for which the gland is intended), and
 - 3) moisture¹⁾
- d) Any bituminous or asphaltic compound in glands for use with PVC or polythene insulated cables shall be cold setting, shall not have a deleterious effect on the cable insulation, and neither its curing temperature nor its pouring temperature shall be higher than 150 °C for PVC insulated cables and 120 °C for polythene insulated cables.

3.1.5 Stress on cable

The cable gland shall be so designed that any mechanical stress on the cable is not imparted to the seal, the sealing compound, or the terminal connections on the cable.

3.1.6 Electrical continuity

Except in the case of glands for TRS, PVC or polythene sheathed cables without screens or armouring, provision shall be made to ensure electrical continuity between the metallic covering of the cable or, when relevant, the screen(s) of the cable and the metallic structure of the enclosure. Any part of the cable gland on which electrical continuity depends, shall, if liable to come into contact with corroding substances, be made of corrosion resistant material or be treated to prevent corrosion. Care shall also be taken to avoid electrolytic action as a result of contact between dissimilar metals.

NOTE The purchaser or user should ascertain what corroding substances may be expected at the site of installation and should provide the supplier with this information.

2) Recommendations regarding the use of compound in sealing boxes are given in appendix A.

3.2 Glands for cables without a metal sheath or armouring, and for trailing cables

3.2.1 Clamping

Glands for cables without a metal sheath or armouring, for flexible cords, and for trailing cables shall be provided with a device for the mechanical clamping of the cable. The clamp shall be

- a) an integral part of the gland,
- b) an integral part of the flameproof enclosure,
- c) attached to the enclosure, or
- d) attached to the gland.

Amdt 1

The gland and its parts shall be so constructed that when a clamping tightness test is performed in accordance with 6.3.1, the mandrel or cable (as relevant) will withstand a tensile load, in newtons, equal to 20 times the value, in millimetres, of the diameter of the mandrel or cable sample, without slipping more than 6 mm, and when a mechanical strength test is subsequently performed in accordance with 6.3.2, no noticeable damage is found on the gland or on any of its parts

Amdt 1; amdt 2

3.2.2 Attachment of braiding or screening

Amdt 1

If the gland is designed for cables or cords with a metallic screen or braid and provision is made for secure attachment of the metal screen or braid, clamping as required in 3.2.1 may be omitted if the attachment of the screen or braid is such as to withstand the load specified in 3.2.1.

Amdt 1; amdt 2

3.2.3 Earthing of screening

Amdt 1

Unless the gland is to be used with cables where a special earth-core is provided, the construction of the gland shall be such that the screening of screened cables can be earthed to the inner or outer surface of the gland or of the enclosure.

3.2.4 Control of flexing

Amdt 1

The gland shall be provided with a means for controlling the amount of flexing that can take place at the point where the cable emerges from the gland. One of the following means shall be used:

- a) Rounding the corners of the gland (through an angle of at least 30 degrees) to the relevant radius given in table 2 (see figure 1).
- b) The provision of a special bell-shaped mouth of the appropriate dimensions given in figure 2.
- c) Making provision in the design of the gland for the clamping of a piece of rubber tubing fitted over the cable (see figure 3). (This method is similar to the protection of a flexible cord at the entry to an appliance connector.) The length of this tubing shall be at least five times the outside diameter of the cable, but never less than 150 mm. The rubber tubing shall fit loosely over the cable and shall be made of rubber that will withstand normal conditions of use without deterioration. The thickness and shore hardness of the rubber in relation to the flexibility of the cable which it is intended to control shall be such as to provide satisfactory control of flexing at both the point of entry of the cable into the tubing and at the point of entry of the tubing and cable into the gland.

Amdt 1

NOTE The purchaser or user should acquaint himself with the working conditions prevailing at the site of operation and should provide the supplier with information on these conditions.

SANS 808:2013

Edition 1.3

Table 2

Amdt 2

1	2
Cable diameter, mm	Radius, mm
Up to and including 37	12,5
Over 37 up to and including 50	19
Over 50 up to 75	25

Amdt 1

3.3 Glands for metal sheathed cables

3.3.1 Attachment of metal sheath

Cable glands for metal sheathed cables shall include means for receiving and securely attaching the metal sheath of the cable to the cable gland.

3.3.2 Plumbed joints

If the cable gland is designed for the making of a plumbed joint between the gland and the lead sheath of a lead sheathed cable, the gland shall include a suitably tinned metal component that is intended for this purpose.

3.3.3 Other joints

If the cable gland does not provide for a plumbed joint, it shall include other efficient means (that will not damage the metal sheath or the insulating material of the cable) for attaching it to, and for ensuring permanent electrical contact with, the metal sheath of the cable.

3.4 Glands for metal sheathed cables with steel tape or galvanized steel wire armouring

If a cable gland is designed for a metal sheathed cable with galvanized steel wire armouring or steel tape armouring the gland shall provide for earthing contact between gland, metal cable sheath, and cable armouring and shall be such as to permit the attachment of the metal sheath and the armouring with as little disturbance as possible of the wires or tape comprising the armouring. In addition the requirements given in 3.3 and 3.5 shall apply.

3.5 Glands for cables (without a metal sheath) armoured with steel tape or galvanized steel wire

3.5.1 Attachment of armouring

A cable gland for an armoured cable shall include means for receiving and securely attaching the armouring of the cable.

3.5.2 Draw gland

If a coned draw gland is used for attaching the wire armouring of the cable, the included angle of the cone shall be as small as practicable and shall in no case exceed 60 degrees. The clamping ring shall be solid and of adequate strength. Clamping surfaces shall be machined. The size and number of bolts used shall be as given in column 2 or 3 (as appropriate) of table 3 and the tensile strength of the bolts shall comply with the requirements specified in SANS 62444.

Amdt 1; amdt 2; amdt 3

SANS 808:2013

Edition 1.3

3.5.3 Resistance to slipping

The cable gland and its parts shall be so constructed that when a clamping tightness test is performed in accordance with 6.4.1, the cable will, without slipping, withstand a tensile load, in newtons, equal to 80 times the value, in millimetres, of the diameter of the cable over the armour, and when a mechanical strength test is subsequently performed in accordance with 6.4.2, no noticeable damage is found.

Amdt 1; amdt 2

4 Marking

4.1 Markings

Each gland shall bear the following information in legible and permanent markings:

- a) name or trademark of the manufacturer;
- b) one or more of the following: 1, IIA, IIB or IIC indicating the enclosure group(s), as given in SANS 60079-1, for use with which the gland has been certified.

Amdt 1; amdt 2

4.2 Labelling

In addition, each gland shall bear a securely attached label that indicates the type(s) of cable for which the gland is intended and describes the correct method of application of the gland; or the glands shall be individually packed in boxes, each box including a leaflet or label giving this information.

Table 3

Amdt 2

1	2	3
Diameter of cable, mm *	Size of bolts, mm	
	If 2 bolts are used	If 3 bolts are used
Not exceeding 9,5	8	6
Over 9,5, but not exceeding 15,5	8	6
Over 15,5, but not exceeding 21,0	10	8
Over 21,0, but not exceeding 28,7	10	8
Over 28,7 but not exceeding 35,8	10	8
Over 35,8 but not exceeding 45,5	12	10
Over 45,5, but not exceeding 56,6	12	10
Over 56,6, but not exceeding 69,5	12	12
Over 69,5, but not exceeding 83,0	16	12
Over 83,0, but not exceeding 99,0	20	16
* In the case of armoured cables, the actual diameter of the cable under the armour.		

Amdt 1; amdt 2

SANS 808:2013

Edition 1.3

5 Sampling and compliance with the specification³⁾

5.1 Sampling

The following procedure shall be applied in determining whether a lot complies with the relevant requirements of the specification, and the samples so taken shall be deemed to represent the lot.

5.1.1 Sample for dimensional checks on joints

From the lot take at random the number of units shown in column 2 of table 4 relative to the appropriate lot size given in column 1. **Amdt 1; amdt 2**

5.1.2 Sample for other inspections

From the lot take at random the number of units shown in column 3 of table 4 relative to the appropriate lot size given in column 1. **Amdt 1; amdt 2**

Table 4

Amdt 1; amdt 2

1	2	3	4
Lot size, glands	Size of sample, glands		
	For checking for compliance with dimensional requirements for joints	For other inspections	For testing
1—4	All	1	1
5—20	5	2	1
21—40	10	4	2
41—60	15	6	3
61—80	20	8	4
81—100	25	10	4
100—120	30	12	5
121—140	35	14	6
141—160	40	16	6
161—180	45	18	7
181—200	50	20	8
201—220	55	22	9
221—240	60	24	10

Amdt 1; amdt 2

3) This section applies to the sampling for inspection and testing before acceptance or rejection of single lots (consignments) in cases where no information about the implementation of quality control or testing during manufacture is available to help in assessing the quality of the lot. It is also used as the procedure for adjudicating in cases of dispute.

5.1.3 Sample for testing

From the lot take at random

- a) in the case of glands for metal sheathed unarmoured cables: the number of units shown in column 4 of table 4 relative to the appropriate lot size given in column 1, **Amdt 1; amdt 2**
- b) in all other cases: twice the number of units shown in column 4 of table 4 relative to the appropriate lot size given in column 1. **Amdt 1; amdt 2**

5.2 Compliance with the specification

The lot shall be deemed to comply with the requirements of the specification if, after inspection and testing of the samples taken in accordance with 5.1, no defective is found.

6 Inspection and methods of test

6.1 Inspection

Inspect the samples taken in accordance with 5.1.1 and 5.1.2 for compliance with the appropriate requirements of the specification (other than those laid down in 3.1.3, 3.2.1, 3.2.2 and 3.5.3).

6.2 Effectiveness of sealing (explosion test)

- a) Fit in accordance with the manufacturer's instructions (see 4.2) a short length of cable (of the size and type for which the gland is intended) to each gland to be tested (to each gland taken in accordance with 5.1.3(a) or to half the glands taken in accordance with 5.1.3(b), as relevant).
- b) Fit the gland to a suitable flameproof enclosure in the manner prescribed by the manufacturer (see 4.2).
- c) Test the assembly as specified in subsection 14.2 of SAN 60079-1 and then examine the gland for deformation and displacement of the sealing material. **Amdt 2**

6.3 Loading test for glands for cables without a metal sheath or armouring and for trailing cables

Amdt 2

The tests of clamping of non-armoured cables in cable entries shall be performed using, for each type of cable entry, sealing rings of the different allowable sizes. Each test is in two parts. **Amdt 2**

6.3.1 Clamping

Amdt 2

In the case of elastomeric sealing rings or bushes, each ring or bush is mounted on a clean, dry, polished cylindrical mild steel mandrel of diameter equal to the smallest cable diameter allowable in the ring and specified by the manufacturer of the cable entry. **Amdt 2**

In the case of metal sealing rings, each ring is mounted on the metal sheath of a sample of clean, dry cable of diameter equal to the smallest cable diameter allowable in the ring and specified by the manufacturer of the cable entry. **Amdt 2**

The assembly is then fitted into the cable entry and the latter is mounted in a tensile test machine. The sealing ring is then compressed in increments and the first value observed of the tightening torque that has been applied to the screws (in the case of a gland with clamp and screws) or to the nut (in the case of screwed glands), and that prevents slipping of the mandrel or cable when the applied tensile force reaches a value, in newtons, equal to 20 times the value, in millimetres, of the diameter of the mandrel or cable sample. **Amdt 2**

SANS 808:2013

Edition 1.3

A torque of a value equal to 110 % of that observed in the conditions defined above is then applied to the screws or to the nut, as relevant. A constant tensile force equal to that defined above is then applied for 6 h. **Amdt 2**

The tightness of the clamping device is considered sufficient if the slipping of the mandrel or of the cable sample is not more than 6 mm. **Amdt 2**

6.3.2 Mechanical strength

Amdt 2

The cable entry is then removed from the tensile test machine and is submitted to a test of mechanical strength by application to the screws or the nut, as relevant, of a torque of which the value is twice that which prevents slipping (see 6.3.1). **Amdt 2**

The cable entry is finally dismantled and the components are examined. **Amdt 2**

The gland is considered satisfactory if no noticeable damage is found. Any deformation of the sealing ring shall be disregarded. **Amdt 2**

6.4 Loading test for glands for armoured cables

Amdt 1; amdt 2

The tests of clamping of armoured cables in cable entries shall be performed using, for each size of entry, a sample of armoured cable of the smallest diameter allowable as indicated by the manufacturer of the cable entry. Each test is in two parts. **Amdt 2**

6.4.1 Clamping

Amdt 2

The sample of armoured cable is fitted into the clamping device of the cable entry and this is then mounted in a tensile test machine. The clamping device is tightened and the value is observed of the minimum torque that has been applied to the screws (in the case of a clamping device tightened by screws) or to the nut (if the clamping device is a nut) and that prevents slipping of the cable when the applied tensile force reaches a value, in newtons, equal to 80 times the value, in millimetres, of the diameter of the cable over the armour. **Amdt 2**

The tightness of the clamping device is considered sufficient if the slipping of the armour is effectively zero during 2 min of tensile loading, the tensile force being maintained at a constant value. **Amdt 2**

6.4.2 Mechanical strength

Amdt 2

The cable entry is then removed from the tensile test machine and is submitted to a mechanical strength test by application to the screws or the nut, as relevant, of a torque of which the value is twice that determined in the clamping test (see 6.4.1). **Amdt 2**

The cable entry is finally dismantled and the components are examined. **Amdt 2**

The gland is satisfactory if no noticeable damage is found. **Amdt 2**

6.5 Proof torque test

Amdt 1

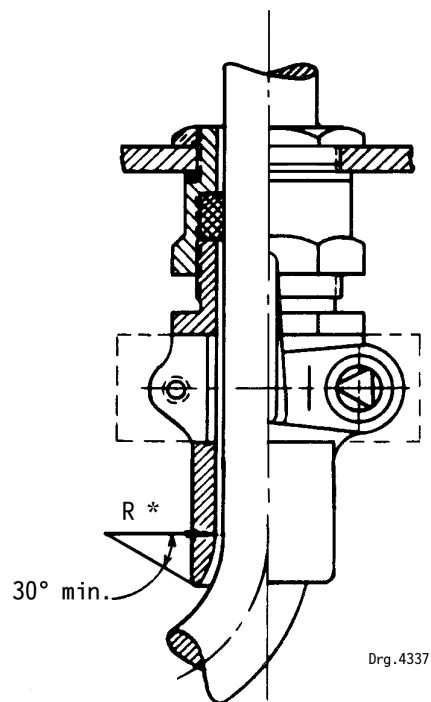
Fix the gland, in the intended manner, in a hole in a substantial block of steel. Ensure that the hole is bored accurately square to the face of the block and that, if the design of the gland required it, the hole is suitably threaded.

Assemble to the gland a short piece of the appropriate kind and size of cable and apply the appropriate proof torque see table 2 to the clamping device.

Then dismantle and inspect the clamping device for damage. **Amdt 1**

SANS 808:2013

Edition 1.3



* See table 2

**Figure 1 — Gland with rounded corners
(for flexible cable up to and including 75 mm diameter)**

Amdt 1

SANS 808:2013

Edition 1.3

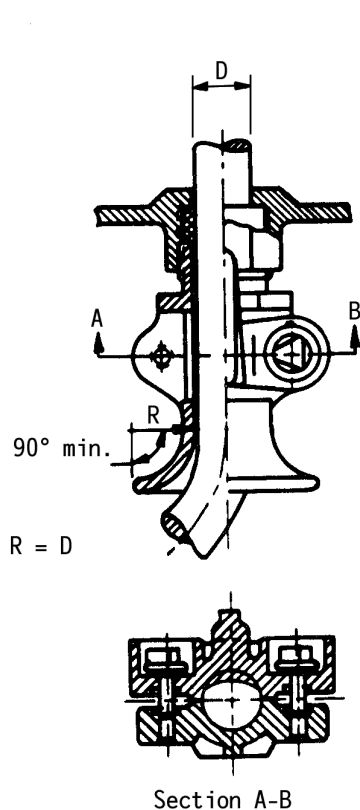


Figure 2(a) — For cables of diameter not exceeding 25,5 mm

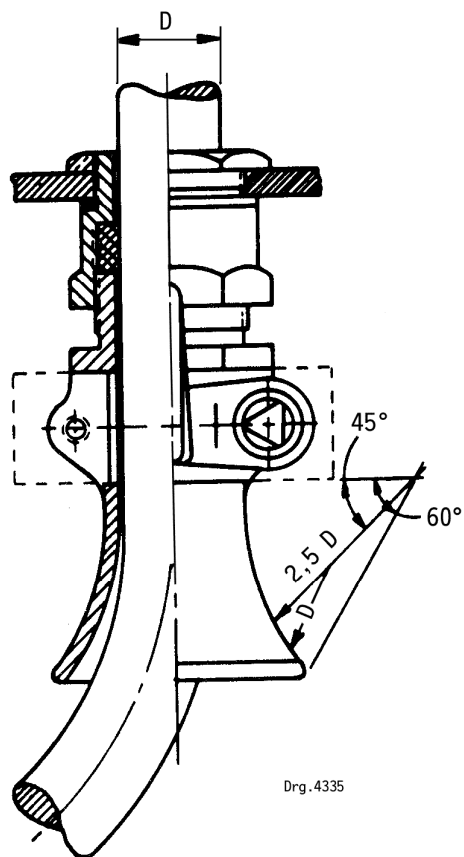


Figure 2(b) — For cables of diameter greater than 25,5 mm (D = cable diameter)

Figure 2 — Gland with bell-shaped mouth

Amdt 1

SANS 808:2013

Edition 1.3

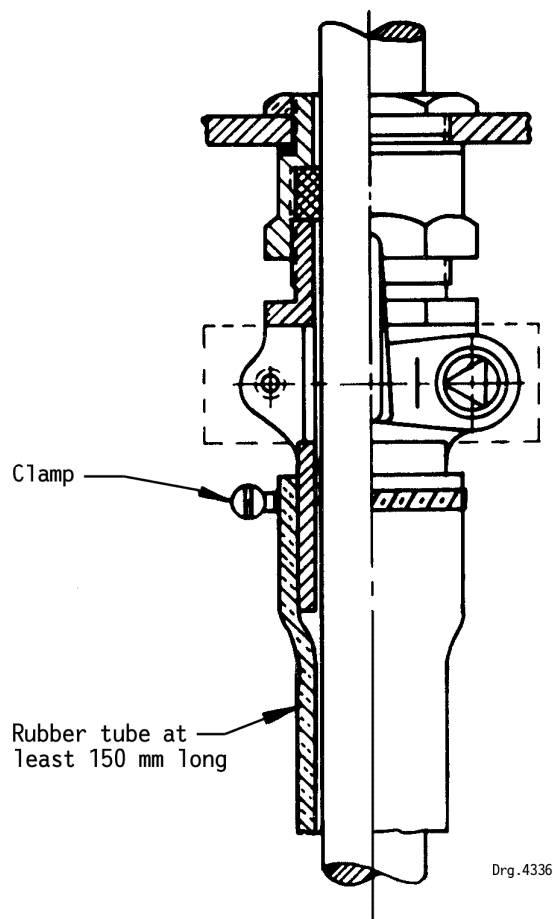


Figure 3 — Gland with rubber tubing to control flexing

Amdt 1

SANS 808:2013
Edition 1.3

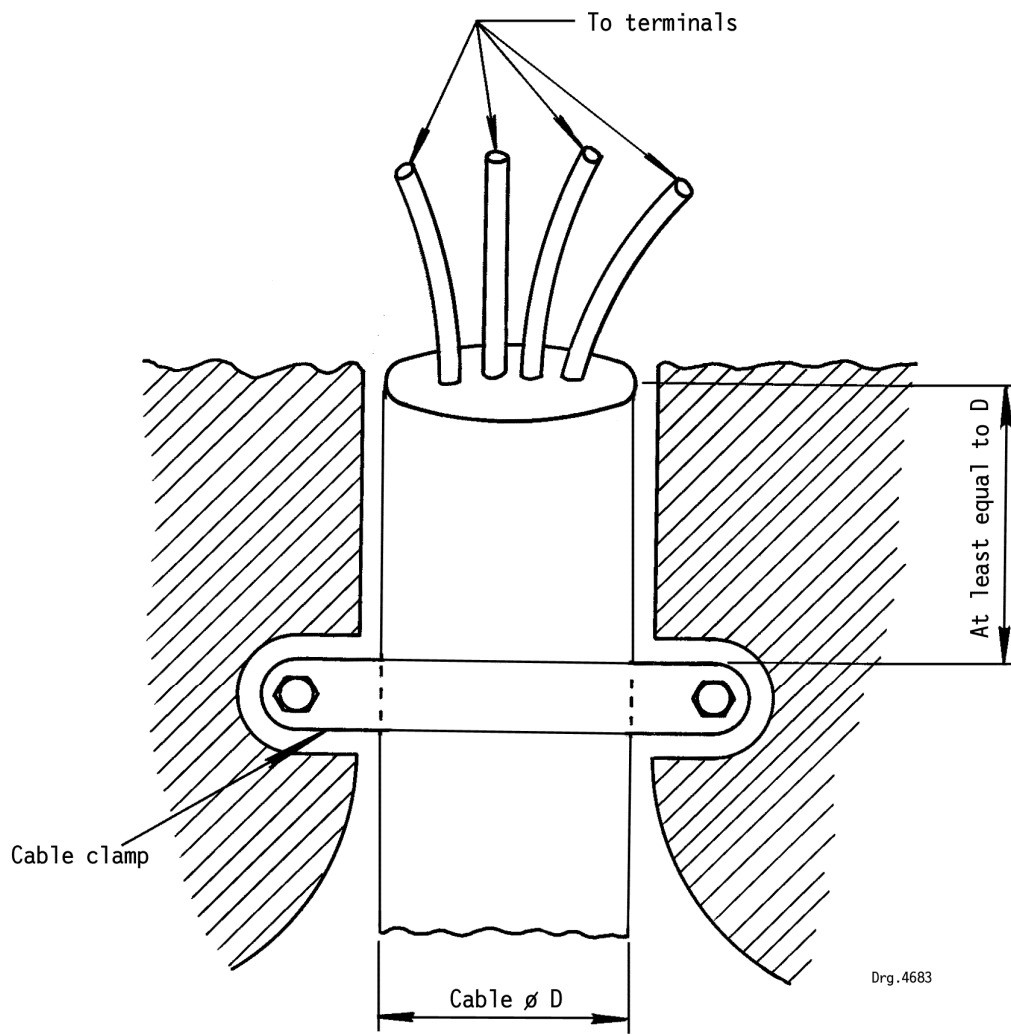


Figure 4 — Position of cable clamp

Appendix A

Amdt 2

Loading of compound in sealing boxes

A.1 Use of compound in sealing boxes

All components in the sealing chamber and the interior of the chamber should be clean and free from oil and grease before the chamber is filled with compound.

The compound must be suitable for the working temperature and the class of cable with which it is to be used; it must be kept clean and dry.

A.2 Hot-pouring compound

When using hot-pouring compound for filling sealing boxes, the maximum temperature to which the compound may be heated without causing deterioration, and also the pouring temperature, should be ascertained. If the compound is to be used with cables having PVC or polythene insulation, the pouring temperature should not exceed the values quoted below:

PVC insulation : 150 °C

Polythene insulation : 120 °C

Polythene insulation is liable to crack when subjected to prolonged contact with some bituminous box-filling compounds. If therefore polythene insulated cables are required to terminate in compound filled enclosures, the advice of the cable manufacturer should be sought on the recommended grade of compound.

A.3 Cold-pouring compound

When cold-pouring compound is to be used, it should not be mixed until the sealing box is ready to be filled.

It is essential that the manufacturer's instructions and recommendations regarding the storage, mixing, and application of cold-pouring compound are strictly observed.

Appendix B

Amdt 2

Note to users of cable glands for use on flameproof enclosures **Amdt 2**

Cable glands for use on flameproof enclosures are required to seal effectively against the outer sheath in the case of unarmoured cable and against the bedding in the case of armoured cable. It is therefore imperative that users

Amdt 2

a) ensure that the cable or its bedding (as appropriate) is substantially round and of uniform diameter and that in the case of beddings, the PVC effectively fills the interstices between conductor cores.

Amdt 2

b) physically measure the outer sheath or bedding diameter (as appropriate) before selecting the appropriate cable gland. Cable glands must be selected on this basis only.

Amdt 2

SANS 808:2013
Edition 1.3

- NOTE Use of a cable gland that is too large for the cable renders the installation unsafe. **Amdt 2**
- c) note that cable specifications do not specify tolerances on the cable bedding diameter or on overall diameters. **Amdt 2**

Appendix C	Amdt 3
Applicable standards	Amdt 3
SABS 314, <i>Flameproof enclosures for electrical apparatus</i>.	Amdt 3
SANS 60079-1/IEC 60079-1, <i>Explosive atmospheres – Part 1: Equipment protection by flameproof enclosures "d"</i> .	Amdt 2
SANS 62444/IEC 62444, <i>Cable glands for electrical installations</i> .	Amdt 3