

The GMTC Guide to

BS EN 50262

and

BS 6121 (new edition), Parts 1 and 5

the new standards for

Electrical Cable Glands, their accessories and use

The Gland Manufacturers Trade Committee (formerly Technical Committee) was founded in 1975, and represents the cable gland manufacturers within the UK. It is represented on several UK and European standards committees, and collectively ensures the safe design manufacture and installation of cable glands.

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New Standards for Cable Glands

Introduction

A new European standard for Cable Glands, EN 50262, was published in September 1998. The new standard is very different from the previous British standards in four important respects.

EN 50262 was published in the UK in March 1999, and the pre-1999 BS 6121 series of British Standards for Mechanical Cable Glands has subsequently been revised or withdrawn because they contain conflicting requirements. Because BS EN 50262 does not cover all the types of cable glands covered by the pre-1999 BS 6121 series, a revised BS 6121 Part 1 has been published, covering only those gland types not covered by BS EN 50262. BS 6121 Part 5 has been extensively revised, providing a code of practice for selection, installation and maintenance of all cable glands.

The New Methodology of The European Standard

It is important to understand the key change in methodology. The pre-2000 BS 6121 was a dimensional standard ensuring a single and relatively high level of performance, expected to cover the vast majority of users' requirements. The new standards require only that a product meets the minimum requirements for safety. This means that users can no longer simply specify or buy any product, assuming it will meet his needs. The new standards allow the product to be classified as meeting performance levels above the minimum, but the user must be careful to ensure the specification of the cable gland and accessories meets his needs. The most basic products meeting the requirements of EN 50262 will not go anywhere near meeting all users' requirements.

More Information, More Decisions To Be Made

The manufacturer must now publish more detailed information about his products. This includes a complete performance classification to help specification and selection and full installation instructions to ensure safety. There is now a greater onus on the user to investigate published information on the product in terms of his own needs. Manufacturer's will provide much more information than before, but the user must now make more decisions regarding the suitability of the product for the application.

Increased Flexibility of Design

The change in methodology will allow a wider choice of products, some traditional, some innovative, only some of which will be to familiar designs and suitable for normal UK installation practice. Conversely this means that manufacturers can offer products tailor-made for specific applications, provided they meet the mandatory requirements of the new standards.

When Is A Cable Gland Not A Cable Gland

The new EN standard does not include all products which were included in BS 6121, because the new standard defines a cable gland as having three functions/features: metric threads, cable retention and cable sealing. Products which we would have described as cable glands in the past that do not offer cable sealing are outside of the scope of EN 50262 and so are included in the revision of BS 6121. Cable glands with non-metric entry threads are covered by a UK National Annex to EN 50262.

CE Marking

Cable glands, as electrical products, must comply with the Essential Safety Requirements of the Low Voltage Directive, and so have to be sold CE marked. Under the LVD, unlike products covered by the "new approach" Directives, products made to any EN standard are deemed to meet the Essential Safety Requirements of the Directive, whether or not the standard has been listed in the Official Journal of the EU. The new EN (at amendment level A1) has been listed under the LVD. A user who wants to ensure he meets the requirements of the LVD is advised to always buy from a supplier who both provides the technical (catalogue) information required by the standard and retains the CE Marking technical file required by the Directive. It is important to note that where the product is of non-EU origin the company importing the product into the EU is responsible for applying the CE mark and maintaining the technical file.

The new standards do not require any third party certification. It is sufficient that a manufacturer declares that his products conform. The same declaration will in effect be the manufacturer's declaration required under the rules for CE Marking.

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Details

Timing of Changes

- No new designs tested to the pre-2000 editions of BS 6121 may be launched after 01/03/2001.
- Designs tested to BS EN 50262 may be put on the market any time from 01/03/1999.
- Designs tested to the revised BS 6121 may be put after 21/02/2005.

CE Marking

According to information received by GMTC, the following applies to industrial glands, i.e. all except those manufactured for use in hazardous areas:-

1. All industrial glands must be CE marked, but marking may be on packaging.
2. Products made to the new EN standard, as well as those made to any new BS standards which are not yet (or will not be) published at European level, will meet the requirements of the LVD.
3. It is not enough for a manufacturer to simply mark products with a C and an E. It is necessary for the manufacturer or importer to maintain a Technical File and to make and publish a Declaration of Conformity. This system is policed by the Trading Standards Office.
4. For products of non-EU origin, the importer must physically keep the Technical File in the EU country into which the goods are first imported.

Industry Interpretation of CE Marking Requirements

According to the Low Voltage Directive (73/72/EC) most low voltage electrical equipment must meet certain essential safety requirements before it can be sold in EU member states. All such equipment (except items which are purely components) must also be CE marked in accordance with Directive 93/68/EEC. To bear the CE mark, equipment must meet the essential safety requirements of the Directive, and the manufacturer or importer must maintain a file in which he keeps (amongst other information) details of how he can demonstrate that the products meet these requirements.

It is possible to meet the requirements by ensuring and demonstrating that the equipment is designed and constructed in accordance with those requirements. However it is easier if the product is “presumed to comply”. Such a presumption is made if the products are manufactured in accordance with harmonised European standard documents (of types EN or HD), or IEC standards (where no EN/HD exists) or National standards (where not yet published at European level).

At one time the definition of a “harmonised” standard in the context of the LVD was not the same as in the case of other “New Approach” Directives, where “harmonisation” is concluded only once the EN standard is listed in the Official Journal of the EU as offering a presumption of conformity with a particular Directive. In the case of the LVD, the EN standard became “harmonised” on publication at national level. This now appears to have changed so that the LVD works like other directives. There is now a nationally published European (EN) standard for cable glands (BS EN 50262:1999) which covers all cable glands which feature cable retention, cable sealing and metric threads.

The EU issues a Guide to the LVD and in this guide states quite clearly that cable management systems are included in the scope of the Directive as equipment. Coupled with advice received from both BEAMA and the DTI, the GMTC has for a long time adopted the policy that cable glands are both completely within the scope of the Directive and must be CE marked. The hierarchy of methods GMTC members adopt to meet the essential safety requirements of the Directive is therefore:

Glands with sealing and metric entry threads	Presumed to meet requirements where they are manufactured in accordance with BS EN 50262:1999.
Glands with sealing and non-metric entry threads	Compliance with requirements via testing in accordance with BS EN 50262:1999 and its UK National Annex.
Glands with no sealing	These products (formerly known as BW cable glands) are now referred to as armour glands, and compliance with requirements is demonstrated by testing in accordance with the new edition of BS 6121 Part 1 (there is not an EN standard for these products).

New and Old Standards

Philosophy

In one important respect the old and new standards are the same: Neither of them require third party certification. In both cases it is enough that the manufacturer certifies or declares that his products conform. In nearly every other way, the philosophy of the new standards differs from the old ones, as follows:

New Standards	Pre-2000 BS 6121 Standards
Are performance and safety standards. The EN plus amendment A1 is currently harmonised under the Low Voltage Directive. (A1 is mandatory for compliance after 1/4/2003).	Was a construction and type test compliance standard.
Are written primarily for test house use, except for BS 6121 Part 5, so users need only buy the new revision of BS 6121, Part 5.	Was written in such a way as to be readily understandable by specifiers as well testers.
Are generally entitled "Cable Glands for Electrical Installations".	Were generally entitled "Mechanical Cable Glands".
Do not specify any named types of cable glands.	Specified distinct types of product (e.g. BW, CW, E1W etc).
Are not prescriptive about design (they are not blue-prints).	Specified dimensional properties (they were blue-prints).
Require classifications by manufacturer (some being mandatory and some optional). Some classifications have defined sub-categories to represent levels of performance, whilst some simply specify a minimum and leave the manufacturer to declare a higher performance.	Required simply that the products met the tests specified in the standard.
Do not mention different types of cable, except that some tests refer loosely to "armoured" cable.	Specified gland types for use with various particular types of cable.

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Structure

The structure of the new standards differs from the old ones, as follows:

New Standards	Pre-2000 BS 6121 Standards
The European standard (EN) only covers cable glands with metric threads <u>and</u> sealing.	There was no European standard.
<p>A National Annex to EN 50262 deals with testing glands with non-metric threads.</p> <p>The revision to BS 6121 will cover products outside the scope of the EN:</p> <ul style="list-style-type: none"> ▪ BS 6121 Part 1 covers glands with no seal, now called "Armour Glands". ▪ BS 6121 Part 5 is a code of practice for selection, installation and inspection of cable glands. This part is about using the products, and is the only part to give guidance to the user. 	<p>The old BS standard comprised four parts as follows:</p> <ul style="list-style-type: none"> ▪ BS 6121 Part 1 gave a specification for metal glands. ▪ BS 6121 Part 2 gave a specification for polymeric glands. ▪ BS 6121 Part 3 gave a specification for special corrosion resistant glands. ▪ BS 6121 Part 4 was going to give a specification for insulated cable glands, but was never published. ▪ BS 6121 Part 5 was a code of practice, giving recommendations on the selection, installation and inspection of cable glands for use in electrical installations. It included some test requirements for accessories. ▪ BS 6121 Part 6 was going to give a specification for lightweight polymeric glands, but was never published.
The various parts of the new BS standard are no longer about different materials. Cable glands of any material are covered either by the EN or the new BS standard.	The various parts of the old BS standard concerned different materials. Requirements were different according to material.
BS 6121 Part 1 refers to tests specified in EN 50262.	Each part of the standards had its own test requirements.
The EN cross-refers only to IEC and EN standards, whilst the BS standard will refer to certain HD and BS documents. BS 6121 Part 5 refers to the IEE Wiring Regulations.	The standards referred to various BS documents.
<p>The new standards (except BS 6121, Part 5) are based on the following structure:</p> <ul style="list-style-type: none"> ▪ Scope, Normative References and Definitions ▪ General requirements ▪ General conditions for test (not for products themselves, just for testing) ▪ Classification (what it is intended for and how it performs) ▪ Marking and documentation ▪ Construction ▪ Mechanical properties ▪ Electrical properties ▪ Electro-magnetic compatibility ▪ External influences (weather, temperature and salty or sulphurous atmospheres) 	<p>The old standards were based on the following structure (using Part 1 as the example):</p> <ul style="list-style-type: none"> ▪ Scope and Definitions ▪ Types of Gland and Sizes of Gland ▪ Marking ▪ Materials and Construction ▪ Dimensions ▪ Type Tests ▪ Annex: Information required when ordering ▪ Annex: Proof torque test ▪ Annex: Load test for type A glands ▪ Annex: Armour clamp tensile test ▪ Annex: Electrical continuity test ▪ Annex: Seal test ▪ Annex: Tests for insulated adaptors

Test Requirements

Table 1 lists the actual test requirements of the new EN, compared to those of the pre-2000 BS 6121, Part 1 (metal glands).

Classifications

Table 2 shows the classifications available to manufacturers under the new standards.

Table 3 cross-refers to some common (pre-2000) BS 6121 glands, showing what a user should look for if he is used to ordering a particular (pre-2000) BS 6121 gland type.

Information

Information which must be supplied by the manufacturer or user includes:

New Standards	Pre-2000 BS 6121 Standards
<p>On the Product:</p> <ul style="list-style-type: none"> • name, logo or registered mark of the manufacturer or supplier • identification of the product • the standard number (BS 6121 only) • the entry thread size and type (BS 6121 only) <p>In the Literature:</p> <ul style="list-style-type: none"> • sealing range (maximum and minimum cable dimensions) • installation torques, if any • entry thread length, if any • clearance hole diameter • type of cable retention (and range, if armour retention is declared) • type of cable anchorage and anchorage range, if any • impact category • correct assembly of the cable gland for use as part of the PE conductor or electrical connection • IP code in accordance with EN 60529 if not standard • temperature range if not standard • entry thread specification (including thread fit) (BS 6121 only) <p>From user with order:</p> <ul style="list-style-type: none"> • none, but we recommend that: • unless a user selects a particular gland and orders by part number, he still has to help by giving his requirements: application, classifications, cable, interface with enclosure (in short, any of the information required under the old standards, where applicable) 	<p>On the Product:</p> <ul style="list-style-type: none"> • standard number • gland size • gland type • the letter "R" on packing where a compound seal is used <p>In the Literature:</p> <ul style="list-style-type: none"> • nothing <p>From user with order:</p> <ul style="list-style-type: none"> • the standard number • the type and size of gland • the standard number of the cable • the type, size and voltage rating of the cable • the actual diameter of the cable's inner sheath • the actual overall diameter of the cable • the size and type of the cable's armour or screen wires • whether an earth bond is required, and if so its size • details of any special environmental conditions • the type of seal required (elastomeric or compound) • braided wire details • if a size M20 thread is acceptable on a size 16 gland • for insulated adaptors, the required voltage (if greater than the standard test voltage)

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Hazardous Area Products

The new standards state that cable glands should comply with EN 50262 (and/or BS 6121 as revised) and that there may be other/different requirements for glands for use in hazardous areas. This clause is open to interpretation, and it may be that some hazardous area products are tested only to the hazardous area standards.

There is no relationship between the bodies who write the industrial standards and the hazardous area ones, so it is not to be expected that there will be any commonality between the requirements. (There is certainly none now).

The rules about using cable entries in EExi or ExN equipment are specified in the hazardous area standards, and it may be the case that industrial glands made to non-hazardous area standards will suffice.

Pitfalls

Be aware that some two-part grommets might need to meet these requirements.

Sealing arrangements which are integral to the equipment, such as a male bush with a sealing ring may be deemed to be a cable gland and therefore must meet these requirements.

References

- BS EN 50262:1999 (incorporating Amendments Nos 1 and 2) – Cable Glands For Electrical Installations
- BS 6121 Part 1: 2005 – Mechanical Cable Glands, Part 1: Armour glands – Requirements and test methods
- BS 6121 Part 1: 2005 – Mechanical Cable Glands, Part 5: Code of practice for selection, installation and maintenance of cable glands and armour glands.
- Information on the Low Voltage Directive and standards harmonised under it can be found at: <http://europa.eu.int/comm/enterprise/newapproach/standardization/harmstds/reflist/lvd.html>

Disclaimer

The information in this document is intended to be used as a guide only. It is intended to help GMTC members' clients. For detailed information and advice, you should refer to the relevant published standards.

Nothing in this document should be taken as conflicting with the requirements of BS 6121, Part 5:2005.

Any errors or omissions should be reported to:

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Amendments to EN 50262 / BS 6121

Amendment No 1

The first amendment to EN 50262 was approved by CENELEC in March 2001. It was published at National level in April 2002.

It included various technical and nomenclature changes in line with other standards or for the sake of clarity and consistency.

Technically it introduced several changes which affect product design/testing, adding new requirements as well as clarifying requirements for some of the traditionally British designs of product.. The technical changes were:

- Two classifications for “cable retention for armoured cable” – the first is per the original standard, the second is more reflective of hazardous area requirements.
- A test for basic corrosion resistance was introduced (for resistance to salty and sulphurous atmospheres).
- Requirements for multi-orifice seals were added. This refers to a cable gland which can accept multiple cables, not one which has a multi-hole inner seal to seal individual cores of a single cable. The normal requirements will apply in the latter case.
- Cable glands with a protective connection now have to meet a higher retention requirement.
- The table of electrical current values (for the test of a protective connection to earth) was changed so that
 - a) the current ratings are more in line with current practice
 - b) the ratings are based on cable diameter not entry size (as are all other tests)
 - c) category A became the lowest requirement, C the highest

Amendment No 2

The second amendment to EN 50262 was approved by CENELEC in October 2004. It was published at National level in February 2005.

The changes are relatively minor:

- A change of title and scope (~~Metric~~ Cable Glands)
- A change to the specification for test mandrels
- Inclusion of threads above M75
- Requirement to publish the clearance hole diameter
- Clarification of some test procedures

Additional Parts of the Standards

A further part of BS 6121 was planned, then offered as a new draft EN 50262 Part 2. This was to cover cable gland accessories. It has been abandoned.

Revision to BS 6121

No revisions are currently planned.

Tables

Table 1 Test Requirements

Standard(s)	EN 50262 / BS 6121(new)	BS 6121, Part 1
Test Conditions	<ol style="list-style-type: none"> 1. Tests are carried out at +15 to +25°C 2. All non-metal glands or their parts are pre-conditioned at 70°C (or higher) for 1 week and at 20°C (RH40-60%) for 1 day before mechanical, electrical and IP testing. 3. Three samples required for each test. Any slight variation requires separate testing. 4. Test mandrels are rubber-coated metal. 5. Clearance hole sizes are specified. 	No gland may be adjusted during the tests. No other general conditions are specified. Some tests require pre-conditioning or other environmental conditions during the test.
Classification	<ol style="list-style-type: none"> 1. By material. 2. By mechanical properties. 3. By electrical properties. 4. By resistance to external influences. 5. By sealing system. 	<p>By TYPE:</p> <ol style="list-style-type: none"> 1. As Type A1, A2, A3 or A4 (unarmoured cable) 2. As Type B (armoured cable, no sealing) 3. As Type C (armoured cable, sealing on outer sheath) 4. As Type D1 or D2 (armoured cable, sealing on inner sheath) 5. As Type E1 or E2 (armoured cable, sealing on both sheaths) 6. For armour type: <ul style="list-style-type: none"> ▪ W = SWA ▪ X = braided ▪ T = pliable wire ▪ Y = aluminium strip ▪ Z = DSTA <p>By SIZE:</p> <ol style="list-style-type: none"> 1. One of 12 pre-determined sizes as per the standard, from M16 to M75 with some small (S) sizes.
Marking and Documentation	See section above on " Information"	
Construction	<ol style="list-style-type: none"> 1. Must be designed to avoid effects of dissimilar metals, but no other restriction on materials used. 2. Hexagonal form (or equivalent) on parts tightened during installation. 3. External edges to be smooth. 4. Designed to avoid cable damage. 	<ol style="list-style-type: none"> 1. All parts of gland to be metal, excluding skid washers, insulation and seals. 2. Turning parts must be hexagonal 3. All sharp edges must be removed. 4. Attachment must be possible with a with a single hole in the enclosure. 5. Armour clamping must be concentric with cable, and not use bolts/clips. 6. Skid washers required between rotating parts and seals. 7. The sealing face must be perpendicular to the axis of the cable. 8. BS grade metals to be used

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<p>Dimensional Requirements</p>	<p>1. EN: Thread on entry component (if any) must comply with EN 60423 (ISO 965 above M75).</p> <p>Note re new BS 6121: In BS 6121 Part 1, Armour Glands may use other thread forms as specified in the standard.</p>	<p>1. Thread on entry component must comply with BS 3643 or other recognised standard.</p> <p>2. Minimum thread length on entry component</p> <p>3. Bore diameter in entry component</p> <p>4. Protrusion Length</p> <p>5. Maximum across corners dimension</p> <p>6. Maximum across flats dimension</p> <p>7. Armour acceptance sizes</p> <p>8. Braid sizes</p> <p>9. Maximum cable overall diameters</p>
<p>Mechanical Properties</p>	<p>1. Retention: Must at least provide retention on same cable range as sealing. The type test is a load of 5-70N. Glands for armoured cable must provide retention in accordance with electrical test requirements.</p> <p>2. Anchorage: May provide anchorage (combination of jerk force test and twist test on same or different cable range as sealing). The type test A is a load of 30-115N, type test B is 75-450N. Type test on twist test is 0.1Nm - 1.2Nm torque.</p> <p>3. Impact: Impact resistance test at smallest cable size to one of 8 categories (from 2N @ 0.1m to 20N @ 1.0m) followed by IP54.</p> <p>4. Torque: Torque test at largest cable size to 1.5 times declared (installation) torque followed by another IP54 test.</p> <p>5. Other: Cable guard test i.a.w. relevant product standard.</p>	<p>1. Torque (App B): Must be no damage after tightening to values specified in standard.</p> <p>2. Cable Retention (App C): Type "A" glands must show minimal movement when tested on mandrel.</p> <p>3. Armour Retention (App C): Other Types (glands for armoured but not braided cable) must show zero movement when tested on cable.</p>
<p>Electrical Properties</p>	<p>1. Continuity: Bonding to equipment (between parts of gland and bonding point of gland). Maximum resistance shall be 0.1 Ω .</p> <p>2. Continuity: Connection to metal layers in cable (braid, armour, screen, lead sheath etc). Maximum resistance shall be 0.1 Ω .</p> <p>3. Continuity: Protective bonding to earth:</p> <ul style="list-style-type: none"> • First a 5 minute tensile test on cable (which is also the retention test for armoured cable) showing no more than 3mm displacement. • Second an electrical current test: 1 second at values per table (Cat A = 26-43kA, Cat B = 3.06-10.4 kA, Cat C = 1.0-5.0 kA). <p>4. Insulation resistance test. Pre-condition for 120 hours at RH91-95%. Insulation test in conductive media at 500v DC giving a resistance not less than 5 MΩ .</p>	<p>1. Continuity (App E): All glands (except type A1 or A2) must be tested. Resistance between two glands connected by cable must not exceed twice that exhibited by the cable armour (or metal sheath), and the resistance after three heating periods must not exceed 25$\mu\Omega$ or the initial value plus 10%.</p> <p>2. Insulated adaptor Test (App G): Insulated adaptors must withstand proof torque, tensile load and radial load tests. They shall also undergo a voltage withstand test in humid conditions at 2kV (ac) or 3kV (dc).</p>

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Electromagnetic Compatibility	No test required (glands are considered passive).	Not mentioned in BS 6121.
External Influences	<ol style="list-style-type: none"> 1. IP 54 test (carried out after impact and torque tests). 2. Flame Test: Exposed non-metallic parts (except sealing system components) are subject to a 650°C glow-wire and must not flame for more than 30s or drop residues which ignite tissue paper under sample. 3. Atmospheric Corrosion: May provide resistance to common forms of atmospheric corrosion (as may be found by the sea or in power stations). Separate salt and sulphur dioxide resistance tests are specified. Salt test is referred to a method specified in EN 60068-2-52. Sulphur dioxide test is per ISO 6988, with 7 x 24h tests at 40°C and 16h rest periods between them. No corrosion to be evident after the two tests. Testing not required for unplated glands made from stainless steel, brass or aluminium. 	<ol style="list-style-type: none"> 1. Seal Tests (App F): IP 66 is required (with no water ingress at all) for all except A1, A3 and BW types. Seal must exhibit compression set below 25% and not more than 15% hardness change on ageing. Compound seals must meet IP 66 before and after ageing.

Table 2 Classifications

There are several mandatory features and various classifications (optional and mandatory).

Mandatory Features		
	EN 50262	BS 6121-1 (new)
Retention	Yes	Yes
Sealing	Yes	No
Metric Thread	Yes	Optional

Mandatory Classifications			
Material:	Mechanical:		Construction:
<i>Base Material:</i>	<i>Retention:</i>	<i>Impact:</i>	<i>Sealing System:</i>
1. Metallic 2. Non-metallic 3. Composite	4. With retention 5. With anchorage: Type A (low) or Type B (higher)	Category 1 (lowest), to Category 8 (highest)	With single-orifice seal With multi-orifice seal

Optional Classifications			
Electrical:		External Influences:	
<i>Continuity:</i>	<i>Insulating:</i>	<i>IP rating:</i>	<i>Temperature Range:</i>
1. Bonding to Equipment 2. Bonding to layers in cable 3. Protective Bonding to Earth Category A (low) Category B (mid) Category C (high)	Declared as insulating or not	Declared only if over IP54	Declared if range exceeds: -20°C to +65°C.

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Table 3 Typical "Old BS 6121" Classifications

<i>Classification</i>	<i>Brass E1W</i>	<i>Nylon A2</i>
Material	Metallic (brass)	Non-metallic (specify material)
Retention	Has armour retention (for steel wire armour) and may have anchorage	Has cable retention and may have anchorage
Impact	Category 7	Category 4
Sealing System	Single orifice (2 seals)	Single orifice
Continuity	Has continuity to equipment and to cable armour	None
Insulating	None	None
IP Rating	IP66	IP66
Temperature Range	(was not specified in BS 6121)	(was not specified in BS 6121)