Barrier Glands — IEC 60079-14 Rules & Hawke ICG 653

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Whether a flameproof (Ex d) enclosure takes a compression gland or a barrier gland is decided by IEC 60079-14, and the rule has been rewritten twice: the 2 litre selection chart used to 2007 and kept alive in UK practice by HSE notice HID 1-2016, the 2013 cable-construction and 3 metre rule, and the 2024 flowchart with its normative Annex C cable pressure test. This reference sets the three rule sets side by side as decision tables, works six cases through all of them, and then specifies the barrier answer in Hawke's range — the ICG 653/UNIV by size, core limits, compound, BFOU sizing arithmetic, inspection points and article number, with the conversion kits that turn an installed dual-marked 501/453/UNIV into a barrier gland.

Published by cballast.com. Last reviewed November 2026. Standards content is drawn from the published contents and forewords of IEC 60079-14, the IEC SC 31J supporting document SD 001:2022, HSE safety notice HID 1-2016, the national foreword of BS EN IEC 60079-14:2024 and published summaries of the 2024 edition. Product figures are from Hawke International's current specification sheet and assembly instructions for the ICG 653/UNIV. The edition of the standard in force on the site and the instruction sheet packed with the gland always govern. In brief. A flameproof enclosure is built to contain an explosion inside it. The cable is the one part of that containment the enclosure maker does not supply. Whether a cable may enter through a gland that seals on its inner sheath, or must enter through a barrier gland that seals around the individual cores with a setting compound, is decided by the installation standard, IEC 60079-14, and the rule has been rewritten twice: a selection chart from 1996 to 2007, a cable-construction and 3 m rule in 2013, and a flowchart with a normative cable pressure test in 2024. The United Kingdom kept the chart as a national annex and its regulator told duty holders to go on using it. This reference sets the editions side by side as decision tables, works six cases through all of them, and then gives the data needed to specify the barrier answer in Hawke's range, the ICG 653/UNIV: sizes, core limits, compounds, a sizing table for NEK TS 606 BFOU cable, inspection points and the cballast article number for every size and material.

1. Key facts

Two certified flameproof cable entries exist. A flameproof gland with an elastomeric sealing ring (a compression gland) seals on the cable's inner sheath. A barrier gland seals around each core with a compound that sets hard. Both are certified to IEC 60079-1 and marked Ex db.

The gland certificate does not decide which one is allowed. The installation standard does. IEC 60079-14 has used three different rules: a chart (1996 to 2007 editions), cable construction plus 3 m of cable (2013), and a flowchart plus cable test evidence (2024).

The chart (to 2007). A barrier gland or sealing device is required when the enclosure contains an internal source of ignition and either the gas requires IIC equipment, or the enclosure is in Zone 1 and its volume exceeds 2 dm³ (2 litres).

The 2013 rule. Either a barrier gland, or a flameproof gland with sealing ring on a cable that is circular and compact with extruded bedding and non-hygroscopic fillers, with at least 3 m of connected cable.

The United Kingdom. BS EN 60079-14:2014 kept the chart in an informative National Annex, and HSE safety notice HID 1-2016 (1 February 2016) tells duty holders to apply it as relevant good practice.

The 2024 rule. Edition 6 (published 30 August 2024) selects the entry from a flowchart, Figure 2, using gas group (IIC or IIB + H2 against the rest), connected cable length (3 m or 0.5 m), enclosure volume (2,000 cm³) and evidence that the cable has passed the pressure test of the new normative Annex C.

Transition dates. EN IEC 60079-14:2024 was approved by CENELEC on 4 October 2024; conflicting national standards are withdrawn by 4 October 2027. BSI published BS EN IEC 60079-14:2024 on 31 August 2026; it supersedes BS EN 60079-14:2014, which is withdrawn on 4 October 2027.

A barrier gland is accepted on every branch of every edition. A compression gland is accepted on some. That asymmetry is why specifications default to barrier glands for hydrogen and IIC service, short cable tails, large enclosures and cables of unknown construction.

Hawke's barrier gland for armoured cable is the ICG 653/UNIV. Sizes Os to F, entry threads M20 to M75, 12 to 120 cores, cable up to 78 mm overall; Ex db IIC Gb, Ex eb IIC Gb, Ex nR IIC Gc, Ex tb IIIC Db; " 60 to +80 °C; IP66, IP67, IP68, IP69; certificates CML 18ATEX1268X, IECEx CML 18.0131X and CML 21UKEX1132X.

In the cballast catalogue the ICG 653/UNIV is listed in 24 size and material variants, with conversion kits that turn an installed, dual-marked 501/453/UNIV into a barrier gland in sizes Os, O, A and B. Article numbers are in section 14.

2. Two glands, one job

A flameproof enclosure does not keep gas out. It lets an internal ignition happen and prevents the flame from reaching the atmosphere outside. Every opening is therefore a designed flame path, and a cable entry has two of them: past the gland's seal, and through the cable itself.

Property | Flameproof gland with elastomeric sealing ring (compression gland) | Barrier gland |

Inner seal | A ring or diaphragm compressed onto the cable's inner sheath | A two-part compound filling the space between and around the individual cores |

What the flame path through the cable depends on | The cable's own construction: fillers, bedding, compactness | The compound; the cable's interstices are closed at the gland |

Certification | IEC 60079-1, as equipment, marking Ex db (usually also Ex eb) | IEC 60079-1, as equipment, marking Ex db

(usually also Ex eb) |
Assembly | Mechanical | Mechanical, plus mixing or injecting compound, inspecting it, and letting it cure before energising |
Size limits | Inner and outer sheath diameter ranges | Outer sheath range, maximum inner sheath, maximum diameter over cores, maximum number of cores |
Re-termination | The gland can be re-made on the cable | The cured compound is permanent; re-terminating needs a new compound kit |
Hawke types | 501/453/UNIV and 501/453/RAC for armoured cable; 501/421 for unarmoured cable | ICG 653/UNIV for armoured cable, and for unarmoured cable to assembly instruction AI 2040 |

What the research behind the standard established is recorded in IEC SC 31J's supporting document SD 001:2022, *Background to flameproof cable gland requirements in IEC 60079-14*:

Finding in SD 001:2022 | Consequence |

Flame can pass by the gland seal or through the cable, including the gaps between cores and fillers | The cable's construction is part of the flameproof joint when a compression gland is used |
Damage to the bedding under the seal from pressure or heat "might lead to flame transmission" in later ignitions | Transmissions in the test record often occurred only after multiple ignitions, which is why the tests use repeated explosions |
"There is insufficient evidence to suggest that flame transmission could occur through the gaps between strands"; the conductors are thought to quench a flame as an arrestor does | The barrier is made around cores, not inside them |
"Flame transmission is also fundamentally different to gas or liquid transmission", which "could occur even through the strands of an individual conductor" | A gland that stops flame is not, by that fact, a gas-migration seal; where gas or liquid migration along a cable matters it is addressed separately |
In later test work "the extent of 'gaps' in a cable" was the prime criterion | The 2013 and 2024 rules moved from enclosure properties to cable properties |

A point that is easy to miss: a gland's certification tests are made on test mandrels, not on the cable the installer will use. The certificate proves the gland. Only the installation standard addresses the combination of gland and cable, which is why the standard, not the certificate, carries the selection rule.

The standard also recognises entries that avoid the question: indirect entry through an increased-safety (Ex e) terminal chamber, mineral-insulated cable with its own flameproof gland, and flameproof sealing devices such as sealing chambers. This reference covers direct entry of sheathed cable, where the choice between the two glands arises.

3. The rule in each edition

Edition | Published | Where | Rule for direct cable entry into Ex d | Decided by |

1 | 1984 | — | No requirement for compound-sealed glands | — |
2 | 1996 | Selection chart | Requirement for compound-sealed glands introduced, drawn largely from ERA report 3051/85 (United Kingdom, April 1976) | Ignition source, gas group, zone, enclosure volume |
4 | 2007 | Clause 10.4.2, Figure 1 | Same chart | Ignition source, gas group, zone, enclosure volume |
5 | November 2013 | Clause 10.6.2; cable in 9.3.2(a); informative Annex E | Chart removed. Barrier gland, or sealing-ring gland on a qualifying cable at least 3 m long | Cable construction and cable length |
6 | 30 August 2024 | Clauses 7.4.3 and 7.5.7, Figure 2, normative Annex C | Flowchart | Gas group, cable length, enclosure volume, cable test evidence |

Which edition applies is a matter of jurisdiction and contract:

Where | Position in November 2026 |

IEC and IECEx-based projects | Edition 6 is the current edition |
EU and EEA (EN IEC 60079-14:2024) | Approved 4 October 2024; latest date of national publication 4 July 2025; EN 60079-14:2014 withdrawn by 4 October 2027. Both are in circulation until then |
United Kingdom | BS EN IEC 60079-14:2024 published 31 August 2026 with a National Annex NA; BS EN 60079-14:2014 is withdrawn on 4 October 2027; HSE notice HID 1-2016 remains published |
Operator and project specifications | Frequently stricter than any edition, for example barrier glands on all IIC and hydrogen service |

4. 1996 to 2007: the selection chart

The chart applies to cable that is sheathed with thermoplastic, thermosetting or elastomeric material, is substantially compact and circular, has extruded bedding, and whose fillers, if any, are non-hygroscopic. Any other cable goes to a barrier gland or a sealing device without entering the chart. For a qualifying cable the chart asks four questions in order:

1. Internal source of ignition in the enclosure? | 2. Gas requires IIC equipment? | 3. Zone 1? | 4. Enclosure volume above 2 dm^3? | Entry |

No | — | — | — | Flameproof gland with sealing ring |
Yes | Yes | — | — | Barrier gland or sealing device |
Yes | No | No (Zone 2) | — | Flameproof gland with sealing ring |
Yes | No | Yes | No | Flameproof gland with sealing ring |
Yes | No | Yes | Yes | Barrier gland or sealing device |

Internal sources of ignition are sparks or equipment temperatures occurring in normal operation that can cause ignition. An enclosure containing terminals only, or an indirect-entry enclosure, is treated as having none.

The chart's evidence base is described in SD 001:2022. It rests on ERA report 3051/85, *Flameproof Enclosures: The Integrity of Cable/Cable Gland Inlet Assemblies* (April 1976), which tested tape-bedded and extruded cables mainly on 60-litre enclosures, using repeated explosions to stress the cable and gland. The supporting document observes that "there are no reported tests for flame transmission using less than 60-litre enclosures", and that the work treated severe cable damage as an indication of possible flame transmission, "a critical assumption that was not fully examined." Later work by PTB and

Dekra with a 40-litre enclosure and multiple ignitions could not reproduce the original failures and concluded that the gaps in the cable were what mattered. That conclusion produced the 2013 rule.

5. 2013: cable construction and three metres

Edition 5 removed the chart. Clause 10.6.2 offers, for sheathed cable entering directly:

Option | Requirement |

(a) | Barrier cable glands in compliance with IEC 60079-1 and certified as equipment |
(b) | Cable glands in compliance with IEC 60079-1, certified as equipment, combined with cables complying with 9.3.2(a) and with a minimum length of connected cable of 3 m |

A cable complying with 9.3.2(a) is sheathed with thermoplastic, thermosetting or elastomeric material, is circular and compact, has extruded bedding or sheath, and has non-hygroscopic fillers if it has fillers at all.

Three effects followed.

Enclosure properties dropped out. Gas group, zone, volume and the presence of an ignition source no longer mattered. A compression gland became permissible on a large IIC enclosure with arcing contacts in Zone 1, provided the cable qualified and was 3 m long.
Every flameproof enclosure came in. The rule applies to junction boxes with terminals only, which the chart had exempted. A 1 m tail between two boxes now needs a barrier gland at both ends, or a different entry method.
The burden moved to the cable. The installer has to know the cable's construction, and an informative annex (Annex E) described a test of the cable's openness.

SD 001:2022 records that the 3 m minimum "was proposed as being conservative", "possibly many times the minimum cable length required to control flame transmission". Its test table shows why length matters at all: in 2016 tests with 450 mm of cable outside the enclosure, flame transmission was recorded in 4 of 22 entries, and the note against them reads "Subsequent tests in 2017 with longer cable lengths of 1.5m were successful (i.e. no flame transmission)." Length, gas group and cable construction interact, which is the background to the 2024 rewrite.

6. The United Kingdom position

Date | Document | What it says |

2014 | BS EN 60079-14:2014 | Implements Edition 5, and reproduces the earlier selection chart as Figure 1 of an informative National Annex. HSE quotes the UK committee as "unclear as to the justification for this change" |
1 February 2016 | HSE safety notice HID 1-2016, *Use of Barrier Glands in Potentially Explosive Atmospheres to meet IEC 60079-14:2013 (Edition 5)* | HSE classes the National Annex as an established standard; duty holders "should therefore apply the Informative National Annex of BS EN 60079-14: 2014 as Relevant Good Practice" when deciding whether to fit a barrier gland. Addressed to chemical processing, engineering, warehousing and offshore, including COMAH operators |
31 August 2026 | BS EN IEC 60079-14:2024 | Implements Edition 6. The national foreword records that the UK committee voted against approval of the European standard, citing its treatment of extra-low-voltage circuits for earthing and equipotential bonding, advises users to consult BS 7671, and draws attention to a National Annex NA "which provides further guidance" |
4 October 2027 | BS EN 60079-14:2014 | Withdrawn |

HSE's stated reasons in 2016 were that no documented test evidence had been seen to justify removing the chart, that the tests behind the change addressed ignition through the cable while repeated explosions inside an enclosure can damage insulation and bedding, and that HSE held independent third-party evidence supporting the UK committee's view.

For a UK site the working position during the transition is: read the site's own engineering standard first; where it follows HSE's notice, the chart in section 4 is applied in addition to the edition being worked to; and National Annex NA of the 2024 British Standard is read before a compression gland is accepted on a flameproof enclosure. A barrier gland satisfies the chart, the 2013 rule and the 2024 flowchart at once.

7. 2024: the flowchart and the Annex C cable test

Edition 6 was restructured into design (clause 6), selection (clause 7), installation (clause 8) and initial inspection (clause 9), and its title now reads *Electrical installation design, selection and installation of equipment, including initial inspection*. For flameproof entries the relevant parts are clause 7.4.3, *Cables for direct entries into flameproof enclosures*; clause 7.5.7, *Cable entry device for Type of Protection "d"*; Figure 2, *Selection of cable entry devices*; and Annex C (normative), *Pressure test procedure for cables into Ex "d" enclosures*, with sections on test apparatus, test method and test report. Restricted-breathing enclosures have their own clauses (7.4.4 and 7.5.8).

The Chair of IEC TC 31 summarised the change in November 2024: the flowchart brings together "the use of hydrogen, cable lengths of the connecting cable or enclosures with a volume "d 2 000 cm3", and the Annex C test is applied where the cable length is more than 3 m in the IIC and hydrogen groups, or more than 0.5 m where the rated enclosure volume is above 2,000 cm³. Read together with a certification body's published walk-through of Figure 2, the logic is:

Gas group | Connected cable length | Enclosure volume | Evidence that the cable passes Annex C | Entry device |

IIC, or IIB + H2 | Under 3 m | Any | Not relevant | Barrier gland (sealing around the cores) |
IIC, or IIB + H2 | 3 m or more | Any | Yes | Gland with elastomeric seal permitted |
IIC, or IIB + H2 | 3 m or more | Any | No | Barrier gland |
IIA, IIB | Under 0.5 m | Any | Not relevant | Barrier gland |
IIA, IIB | 0.5 m or more | 2,000 cm³ or less | Not required | Gland with elastomeric seal permitted |
IIA, IIB | 0.5 m or more | Above 2,000 cm³, or not known | Yes | Gland with elastomeric seal permitted |
IIA, IIB | 0.5 m or more | Above 2,000 cm³, or not known | No | Barrier gland |

This table is a reading of published summaries, not a reproduction of the standard. Figure 2 and clauses 7.4.3 and 7.5.7 are the authority, including for the exact treatment of the boundary values and for the cable construction requirements that sit ahead of the flowchart.

Three things about Annex C matter to a specifier.

It is normative. The cable test of the 2013 edition was informative. Where the flowchart calls for evidence, the evidence is now part of compliance.
Its purpose is narrow. In the TC 31 Chair's words the test "is solely to assist a user in the determination of the type of Ex "d" cable entry device (that is, with elastomeric seal or sealing around the cores) which can be used into an Ex "d" enclosure", and it "does not prove that the cable is 'gas tight' or 'flameproof'".
It is a property of a cable type. The evidence is a test report for the specific cable construction. It is requested from the cable maker with the cable, filed with the gland schedule, and its absence sends the entry to a barrier gland.

8. Six cases through three rule sets

Each case assumes a cable that is circular and compact with extruded bedding and non-hygroscopic fillers, unless stated. "Compression" means a flameproof gland with elastomeric sealing ring. The 2024 column follows the published summaries in section 7.

Case | Chart (to 2007; UK practice under HID 1-2016) | 2013 rule | 2024 flowchart |

1. Starter enclosure with contactors, IIB, Zone 1, 8 litres, 25 m of cable | Barrier: ignition source, Zone 1, above 2 dm³ | Compression permitted: qualifying cable, over 3 m | Compression only with Annex C evidence for the cable; otherwise barrier |
2. Switch housing with contacts, 0.4 litre, hydrogen service (IIC), Zone 1, 15 m of cable | Barrier: ignition source and IIC | Compression permitted | Compression only with Annex C evidence; otherwise barrier |
3. Control station with pushbutton contacts, IIA, Zone 2, 1.5 litres, 1.2 m tail from an adjacent box | Compression: Zone 2 | Barrier: tail under 3 m | Compression permitted: over 0.5 m, volume not above 2,000 cm³ |
4. Junction box, terminals only, IIB, Zone 1, 5 litres, 10 m of cable | Compression: no internal ignition source | Compression permitted | Compression only with Annex C evidence; otherwise barrier |
5. Analyser enclosure with ignition-capable parts, IIC, Zone 1, 2 m of cable | Barrier | Barrier: under 3 m | Barrier: IIC and under 3 m |
6. Any enclosure; cable with tape bedding, hygroscopic fillers or an open, poorly filled lay-up | Barrier or sealing device: cable is outside the chart | Barrier: cable fails 9.3.2(a) | Barrier is the entry that does not depend on the cable's construction |

The three rule sets agree on cases 5 and 6 and disagree on cases 1 to 4. A site that must satisfy more than one of them, which describes most UK sites and any project built to both an operator specification and the current standard, converges on the barrier gland wherever any column says barrier.

9. When a barrier gland is the specified answer

Condition | Rule set that requires it |

Hydrogen or other IIC gas, enclosure with an internal source of ignition | Chart |
Zone 1, enclosure above 2 dm³ with an internal source of ignition | Chart |
Connected cable shorter than 3 m, any gas group | 2013 |
Connected cable shorter than 3 m in IIC or IIB + H2; shorter than 0.5 m in IIA or IIB | 2024 |
IIC or IIB + H2, no Annex C evidence for the cable | 2024 |
Enclosure above 2,000 cm³ or of unknown volume, no Annex C evidence for the cable | 2024 |
Cable not circular and compact, tape-bedded, or with hygroscopic fillers | Chart, 2013 |
Cable construction unknown, or cable not yet selected when glands are ordered | All, as the only entry that is certain to comply |
Operator specification calling for barrier glands on a service or area | Contract |

Separately from the selection rules, Hawke states the ICG 653/UNIV's application as sealing around the individual cores on cables with cold-flow characteristics, cables that are not effectively filled, cables with hygroscopic fillers and cables containing fibre-optic cores. Cold flow is the movement of a cable's sheath under the compressive force of a gland seal; low-smoke and fire-resistant cables usually show it. A barrier seal does not depend on compressing the inner sheath.

10. The Hawke ICG 653/UNIV: data

Item | Value |

Type | Barrier cable gland for armoured cable; used on unarmoured cable to assembly instruction AI 2040 |
Marking | Ex db IIC Gb; Ex eb IIC Gb; Ex nR IIC Gc; Ex tb IIIC Db |
Certificates | ATEX CML 18ATEX1268X; IECEx CML 18.0131X; UKEX CML 21UKEX1132X. Ex nR: CML 19ATEX4507X; IECEx CML 21.0012X; CML 21UKEX4133X |
North America | cCSAus 1024328; Class I Division 1 Groups A, B, C, D; Class I Zone 1 AEx db IIC Gb and AEx eb IIC Gb |
Marine type approvals | ABS 19-LD1876514-1-PDA; BV 43523/B0; DNV TAE0000BS |
Standards | IEC/EN 60079-0, -1, -7, -15, -31; IEC/EN 62444 (anchorage type D) |
Operating temperature | " 60 to +80 °C |
Ingress protection | IP66, IP67, IP68, IP69 to IEC 60529; NEMA 4X. IP68 is 30 m for 7 days with thread sealant, or 10 m for 24 hours without it on sizes Os to C |
Impact and deluge | IK10 to IEC 62262; deluge protection to DTS01 |
Materials | Brass, nickel-plated brass, 316L stainless steel |
Entry threads | Metric, 1.5 mm pitch, 15 mm thread length as standard; NPT options |
Armour | Reversible clamp ring for wire armour, braid and tape; alternative ring for intermediate thicknesses |
Barrier | Transparent elastomeric compound pot, inspectable; ExPress injectable resin as standard, QSP hand-mixed putty by adding Q to the part string |
Schedule of limitations | Compound cross-section at least 20% of the total area over a depth of 20 mm; in increased-safety use the entry thread is sealed to maintain the enclosure's ingress rating |
Field identification | Red deluge boot (the 501/453/UNIV has a black one) |

Sizes and limits:

Size | Metric entry | NPT options | Max. cores | Max. fibre-optic cores | Max. Ø over cores (mm) | Max. Ø inner sheath (mm) | Outer sheath min–max (mm) | Across flats (mm) |

Os | M20 | ½" | 12 | 48 | 8.0 | 8.1 (10.0 with QSP putty) | 5.5–12.0 | 24 |
O | M20 | ½" | 12 | 48 | 8.8 | 11.7 | 9.5–16.0 | 24 |
A | M20 | ¾" or ½" | 15 | 72 | 10.8 | 14.0 | 12.5–20.5 | 30 |
B | M25 | 1" or ¾" | 30 | 144 | 15.9 | 19.9 | 16.9–26.0 | 36 |
C | M32 | 1¼" or 1" | 42 | — | 21.9 | 26.2 | 22.0–33.0 | 46 |
C2 | M40 | 1½" or 1¼" | 60 | — | 26.7 | 32.3 | 28.0–41.0 | 55 |
D | M50 | 2" or 1½" | 80 | — | 37.7 | 44.2 | 36.0–52.6 | 65 |
E | M63 | 2½" or 2" | 100 | — | 49.0 | 56.0 | 46.0–65.3 | 80 |
F | M75 | 3" or 2½" | 120 | — | 59.8 | 68.0 | 57.0–78.0 | 95 |

An M16 entry is available on the smallest sizes and reduces the maximum diameter over cores to 7 mm. Armour acceptance follows the 501/453 family: with the standard ring, 0.8–1.25 mm or 0–0.8 mm on sizes Os to A, 1.25–1.6 or 0–0.7 mm on B, 1.6–2.0 or 0–0.7 mm on C and C2, and 1.8–2.5 or 0–1.0 mm on D to F, by ring orientation; the alternative ring (suffix R) covers 0.9–1.25 or 0.5–0.9 mm on B, 1.2–1.6 or 0.6–1.2 mm on C and C2, and 1.45–1.8 or 1.0–1.45 mm on D to F.

The part string is built as type, size, thread, material, then options: 653U C M32 is a size C gland with an M32 entry in brass; NP denotes nickel-plated brass; R the alternative armour ring; Q the QSP putty in place of ExPress resin. NPT threads are written as decimals (1.25 for 1¼").

11. Sizing a barrier gland: four checks, not two

A compression gland is sized on two diameters. A barrier gland adds two limits that come from the compound pot, and on multi-core and larger power cable they are often the limits that decide the size.

Check | Measured on the cable | Compared with |

1. Overall diameter | Over the outer sheath | Outer sheath min–max of the size |
2. Inner sheath | Over the bedding, under the armour | Maximum inner sheath of the size |
3. Core bundle | Over the laid-up cores after stripping the inner sheath and removing fillers and tapes | Maximum diameter over cores of the size |
4. Core count | Every insulated core | Maximum cores of the size |
Then | Armour type and thickness | Clamp ring orientation, or the alternative ring |

The table below applies those limits to the nominal dimensions one cable maker (Prysmian, BFOU 0.6/1 kV to NEK TS 606) publishes for halogen-free offshore power and control cable. The cable maker does not publish the diameter over cores, so the table shows the arithmetic the installer needs: the bundle limit of the first size that accepts the sheath dimensions and core count, how much smaller than the inner-sheath diameter the bundle must therefore be, and the next size where one accepts the overall diameter. The bundle is smaller than the diameter over the inner sheath by twice the bedding thickness. Where the required reduction is greater than that, the larger size is the one to order.

Cores × mm² | Ø over inner sheath (mm) | Overall Ø (mm) | First size by sheaths and core count | Its bundle limit (mm) | Bundle must be smaller than the inner-sheath Ø by at least (mm) | Next size that accepts the overall Ø, with its bundle limit |

2 × 1.5 | 10.0 | 13.0 | O (M20) | 8.8 | 1.2 | A (M20), 10.8 |
2 × 2.5 | 10.5 | 14.0 | O (M20) | 8.8 | 1.7 | A (M20), 10.8 |
3 × 1.5 | 10.5 | 13.5 | O (M20) | 8.8 | 1.7 | A (M20), 10.8 |
3 × 2.5 | 11.3 | 14.8 | O (M20) | 8.8 | 2.5 | A (M20), 10.8 |
3 × 4 | 12.5 | 16.0 | A (M20) | 10.8 | 1.7 | none |
3 × 6 | 13.5 | 17.5 | A (M20) | 10.8 | 2.7 | B (M25), 15.9 |
3 × 10 | 15.5 | 19.5 | B (M25) | 15.9 | none: the bundle always fits | — |
3 × 16 | 18.0 | 22.0 | B (M25) | 15.9 | 2.1 | C (M32), 21.9 |
3 × 25 | 21.9 | 24.6 | C (M32) | 21.9 | none: the bundle always fits | — |
3 × 35 | 24.1 | 28.6 | C (M32) | 21.9 | 2.2 | C2 (M40), 26.7 |
3 × 50 | 27.5 | 32.5 | C2 (M40) | 26.7 | 0.8 | none |
3 × 70 | 32.0 | 37.5 | C2 (M40) | 26.7 | 5.3 | D (M50), 37.7 |
3 × 95 | 37.0 | 43.0 | D (M50) | 37.7 | none: the bundle always fits | — |
4 × 1.5 | 11.3 | 15.0 | O (M20) | 8.8 | 2.5 | A (M20), 10.8 |
4 × 2.5 | 12.5 | 16.0 | A (M20) | 10.8 | 1.7 | none |
4 × 4 | 13.5 | 17.5 | A (M20) | 10.8 | 2.7 | B (M25), 15.9 |
4 × 6 | 15.0 | 18.5 | B (M25) | 15.9 | none: the bundle always fits | — |
4 × 10 | 17.3 | 20.6 | B (M25) | 15.9 | 1.4 | none |
4 × 16 | 20.0 | 24.0 | C (M32) | 21.9 | none: the bundle always fits | — |
4 × 25 | 24.3 | 27.0 | C (M32) | 21.9 | 2.4 | none |
4 × 35 | 26.8 | 31.5 | C2 (M40) | 26.7 | 0.1 | none |
4 × 50 | 30.5 | 35.5 | C2 (M40) | 26.7 | 3.8 | none |
4 × 70 | 35.5 | 41.0 | D (M50) | 37.7 | none: the bundle always fits | — |
7 × 1.5 | 13.5 | 17.0 | A (M20) | 10.8 | 2.7 | B (M25), 15.9 |
7 × 2.5 | 14.6 | 18.5 | B (M25) | 15.9 | none: the bundle always fits | — |
12 × 1.5 | 17.6 | 22.1 | B (M25) | 15.9 | 1.7 | C (M32), 21.9 |
12 × 2.5 | 19.5 | 23.5 | B (M25) | 15.9 | 3.6 | C (M32), 21.9 |
19 × 1.5 | 20.5 | 24.5 | C (M32) | 21.9 | none: the bundle always fits | — |
19 × 2.5 | 22.9 | 27.7 | C (M32) | 21.9 | 1.0 | none |
27 × 2.5 | 27.9 | 33.3 | C2 (M40) | 26.7 | 1.2 | none |
37 × 2.5 | 31.5 | 36.0 | C2 (M40) | 26.7 | 4.8 | D (M50), 37.7 |

Three things follow. On the smallest cables the choice is between two M20 sizes and costs nothing to get right. On three- and four-core power cable from 16 mm² upward the required reduction is frequently 2 mm or more; where the bedding is thinner than half that figure, the barrier gland lands one size, and one entry thread, above the compression gland that would have been chosen for the same cable, and the enclosure entry or an adaptor has to follow. And on rows marked "none", no larger size accepts the cable's nominal overall diameter, so the bundle is measured on the actual cable before the order is placed. Where a nominal diameter sits on the edge of a size's range, as 37 × 2.5 mm² does on size D, the actual cable decides. Other makers' dimensions differ; the cable in hand is measured in every case.

12. Compound, assembly and conversion

Property | ExPress barrier resin (standard supply) | QSP two-part putty (suffix Q) |

Form | Two-part epoxy in a cartridge with a mixing nozzle, mixed 1:1 by volume as it is dispensed | Two-part hand-mixed epoxy putty, mixed 1:1 until one uniform colour |
Before filling | Purge a bead of about 25 mm onto a disposable surface so that what enters the pot is fully mixed | Keep at 20 °C or above before use; do not mix or install below 5 °C |
Filling | Gland held vertical; fill from the bottom of the pot to about 3 mm below flush, the fill line on the pot | Pack between the spread cores, close the cores, pack around them, slide the pot over |
Inspection | No voids; move the cores and work out air through the pot; top up to the fill line if the level drops | Inspect for voids through the transparent pot and repair before cure |
Working time | 30-minute gel time (specification sheet) | Use within 30 minutes of mixing |
Cable without inner sheath, or poorly filled | Tape the base of the cores to form a sealing surface; pack large voids with non-conductive putty or wadding | The resin dam is removed when putty is used |
After filling | Place the entry over the pot to hold its shape while the resin gels; cores are manipulated and the circuit energised only when the resin has fully cured | The same |
Instruction | AI 2035 | AI 2034 |

The resin's data sheet gives 14, 24 and 50 ml cartridges, a cured hardness of 75 to 85 Shore D and a shelf life of 24 months unopened. Gloves supplied with the kit are worn throughout. Cure time depends on temperature and is read from Hawke's cure graphs.

Assembly, in outline (AI 2001, Issue H): slide the backnut, middlenut and armour clamp ring onto the cable; fit the spigot and push the armour to its shoulder; clamp the armour by tightening the middlenut to the entry hand tight plus ½ to ¾ turn, then open and inspect the clamp; strip the inner sheath to between flush and 3 mm from the spigot end so that it protrudes through the resin dam; fit the pot and fill it; fit the entry to the enclosure, seat the pot, and tighten the middlenut hand tight plus !U to ¼ turn; tighten the backnut until it seals on the cable, then one further full turn; check the backnut position against the tightening guide. The complete step tables, strip lengths and clamp-ring orientations are in the Hawke 501/453 and ICG 653 installation and inspection guide. On unarmoured cable (AI 2040) the same parts are used; the clamp ring's orientation is unimportant and it sits between the spigot and the middlenut.

Converting an installed gland. A 501/453/UNIV whose body is dual-marked "HAWKE 501/453 UNIV (BLACK) / HAWKE ICG 653 UNIV (RED)" can be converted to an ICG 653/UNIV with Hawke's barrier upgrade kit (AI 2037), reusing the entry, middlenut, backnut and armour clamp ring. The kit supplies the compound pot and spigot, a red deluge boot and the compound. For a site moving from one rule set to another, or correcting entries found non-compliant at inspection, this turns a cable re-termination into a kit per entry instead of a new gland per entry. Conversion kits in the cballast catalogue: size Os, size O, size A, size B.

13. Inspection and records

The 2024 edition gives initial inspection its own clause (clause 9) and an informative annex of inspection tables aligned with IEC 60079-17, which continues to govern periodic inspection. For a flameproof cable entry the checks reduce to the following.

Check | What is looked for |

Entry type against the rule applied | The gland schedule states the rule set (edition, national annex, operator specification) and the entry type it produced for each enclosure |
Identity | Marking Ex db IIC Gb on the gland; certificate number ending in X, so the schedule of limitations has been read; red deluge boot on an ICG 653/UNIV |
Compound | Pot filled to the line, no voids, cores central; inspected through the transparent pot at assembly and whenever the entry is opened at a detailed inspection |
Limits | Core count and bundle diameter within the size's limits; compound cross-section at least 20% of the area over 20 mm depth |
Mechanical | Armour clamped; backnut position on the tightening guide; entry perpendicular to the enclosure face; thread engagement to IEC 60079-1 |
Ingress | Certified sealing washer or other approved method on a smooth, undamaged face; thread sealant where the IP68 depth rating is relied on; sealed entry thread in increased-safety use |
Cable evidence | Where a compression gland was accepted under the 2024 flowchart, the Annex C test report for the cable type is in the file |
Cable length | Connected length recorded where the 3 m or 0.5 m test was relied on |

The record that makes these checks quick is a gland schedule with one row per entry: enclosure tag, gas group, zone, volume, internal ignition source yes or no, cable type, connected length, Annex C evidence yes or no, rule applied, entry type, gland identifier, compound batch and installation date.

14. Article numbers: ICG 653/UNIV and the compression alternative

Hawke ICG 653/UNIV barrier glands in the cballast catalogue, by size and body material. Each number is the Nordic trade article number and links to the product page.

Size | Entry thread | Brass | Nickel-plated brass | 316 stainless steel |

Os | M20 | 1253270 | 1232812 | 1232821 |

O | M20 | 1253271 | 1232811 | 1232820 |
A | M20 | on request | 1232804 | 1232813 |
B | M25 | 1253273 | 1232805 | 1232814 |
C | M32 | 1253274 | 1232806 | 1232815 |
C2 | M40 | 1253275 | 1232807 | on request |
D | M50 | 1253276 | 1232808 | 1232817 |
E | M63 | 1253277 | 1232809 | 1232818 |
F | M75 | 1253278 | 1232810 | on request |

The compression alternative on the same body, the 501/453/UNIV, for the entries where the rule applied permits it:

Size | Entry thread | Brass | Nickel-plated brass | 316 stainless steel |

Os | M20 | 1253539 | 1232844 | on request |
O | M20 | 1253540 | 1232843 | 1253810 |
A | M20 | 1253541 | 1232833 | 1253811 |
B | M25 | 1253542 | 1232834 | 1253812 |
C | M32 | 1253543 | 1232835 | 1253813 |
C2 | M40 | 1253544 | 1232836 | 1253814 |
D | M50 | 1253545 | 1232837 | on request |
E | M63 | 1253546 | 1232838 | 1253816 |
F | M75 | 1253547 | 1232839 | on request |

For unarmoured cable the compression gland is the 501/421 (for example size B, M25, brass). Entry accessories used with either gland: sealing washers (M20, M25), locknuts (M20, M25), earth tags (M20, M25), serrated washers (M20, M25) and thread adaptors such as the 476 M25 to M20. Every family, size and thread is tabulated in the Hawke cable glands sourcing index, and the full listing is on the Hawke brand page. Sizes and materials shown as "on request" are quoted against the same part string.

A schedule is quoted in one pass when it carries these lines:

BARRIER GLAND SCHEDULE
1 Rule set for entry selection: IEC 60079-14 edition, national annex, operator specification
2 Per enclosure: gas group, zone, volume, internal source of ignition (yes/no), entry thread
3 Per cable type: maker, standard, cores x mm2
4 Measured: overall diameter, diameter over inner sheath, diameter over cores, armour type and thickness
5 Connected cable length per entry
6 Annex C test report held for the cable type (yes/no)
7 Gland: Hawke ICG 653/UNIV, size, thread, material (brass, nickel-plated brass, 316L)
8 Compound: ExPress resin or QSP putty; number of spare compound kits
9 Per entry: sealing washer, locknut, earth tag, serrated washer, shroud, adaptor or reducer
10 Quantity per size, spares allowance, required date, delivery point
11 Documents: ATEX, IECEx and UKEX certificates, declaration of conformity, assembly instructions, origin
Schedules and single lines are quoted at sales@cballast.com.

Frequently asked questions
When is a barrier gland required on an Ex d enclosure?It depends on the rule set in force. Under the selection chart used in IEC 60079-14 to 2007 and still applied in UK practice: when the enclosure contains an internal source of ignition and either the gas is IIC, or the enclosure is in Zone 1 and larger than 2 dm³. Under the 2013 edition: when the cable is not circular and compact with extruded bedding and non-hygroscopic fillers, or the connected cable is shorter than 3 m. Under the 2024 edition: when the cable is shorter than 3 m in IIC or IIB + H2 service or shorter than 0.5 m otherwise, and wherever the flowchart calls for Annex C test evidence that is not available.What is the difference between a barrier gland and a standard flameproof gland?A standard flameproof gland seals on the cable's inner sheath with an elastomeric ring, so the flame path through the cable depends on the cable's construction. A barrier gland fills the space around the individual cores with a compound that sets hard, so the path is closed at the gland whatever the cable's construction. Both are certified to IEC 60079-1 and marked Ex db.What is the 2 litre rule for barrier glands?It is the last question of the selection chart in IEC 60079-14 up to the 2007 edition: for an enclosure with an internal source of ignition in Zone 1 and a gas group below IIC, a barrier gland or sealing device is required if the enclosure volume exceeds 2 dm³. The chart remains in the National Annex of BS EN 60079-14:2014.What is the 3 metre rule?Clause 10.6.2(b) of IEC 60079-14:2013 allows a flameproof gland with a sealing ring only on a qualifying cable with at least 3 m of connected cable. Shorter tails need a barrier gland or another entry method. In the 2024 edition 3 m remains the minimum length for IIC and IIB + H2 service.What changed for cable glands in IEC 60079-14:2024?The selection of flameproof cable entry devices moved to a flowchart, Figure 2, which uses gas group, connected cable length (3 m, or 0.5 m for IIA and IIB), enclosure volume (2,000 cm³) and evidence that the cable has passed the pressure test in a new normative Annex C. Cables and entry devices for direct entry have their own clauses, 7.4.3 and 7.5.7.What is the Annex C test?A pressure test procedure for cables entering Ex d enclosures, normative in IEC 60079-14:2024. It exists only to help the user decide between a gland with an elastomeric seal and one that seals around the cores. It does not show that a cable is gas tight or flameproof. The evidence is a test report for the cable type, obtained from the cable maker.Does the United Kingdom still use the selection chart?BS EN 60079-14:2014 carries the chart in an informative National Annex, and HSE safety notice HID 1-2016 tells duty holders to apply it as relevant good practice. That edition is withdrawn on 4 October 2027. BS EN IEC 60079-14:2024, published on 31 August 2026, has its own National Annex NA, which is read together with the site standard.Is a barrier gland required for hydrogen?Under the chart, yes, wherever the flameproof enclosure contains an internal source of ignition, because hydrogen requires IIC equipment. Under the 2024 flowchart a barrier gland is required for IIC or IIB + H2 when the connected cable is shorter than 3 m, and whenever Annex C evidence for the cable is not available. Many hydrogen project specifications call for barrier glands on all flameproof entries.Can a barrier gland be used on Ex e equipment?Yes, where its marking covers it. The Hawke ICG 653/

UNIV is marked Ex db IIC Gb, Ex eb IIC Gb, Ex nR IIC Gc and Ex tb IIIC Db. On increased-safety equipment it is typically chosen for cables with cold-flow characteristics, poorly filled cables and cables with fibre-optic cores; the entry thread is then sealed to maintain the enclosure's ingress rating.How many cores can a Hawke ICG 653/UNIV take?12 in sizes Os and O, 15 in A, 30 in B, 42 in C, 60 in C2, 80 in D, 100 in E and 120 in F, subject to the maximum diameter over cores for each size (8.0 to 59.8 mm). Fibre-optic limits are 48, 48, 72 and 144 for sizes Os to B.Can an installed Hawke 501/453/UNIV be converted to a barrier gland?Yes, if its body is dual-marked "HAWKE 501/453 UNIV (BLACK) / HAWKE ICG 653 UNIV (RED)". Hawke's upgrade kit replaces the diaphragm seal and spigot with a compound pot and spigot, a red deluge boot and compound, reusing the entry, middlenut, backnut and clamp ring. The cable is re-terminated to the ICG 653/UNIV instruction.ExPress resin or QSP putty?ExPress is the standard supply: an injectable two-part epoxy dispensed from a cartridge through a mixing nozzle into the transparent pot, with a 30-minute gel time. QSP is a hand-mixed putty packed around the cores, used within 30 minutes of mixing and not mixed or installed below 5 °C. Both are inspected through the pot before cure; in both cases the circuit is energised only after full cure.Do existing installations have to be changed when the standard changes?IEC 60079-14 governs design, selection, installation and initial inspection. What is done about entries installed under an earlier edition is decided by the operator's inspection regime under IEC 60079-17 and by the national regulator's guidance, as in the UK notice described above. Where an entry is to be changed, the conversion kit avoids replacing the gland on dual-marked bodies.Where are Hawke ICG 653/UNIV barrier glands and conversion kits sourced? cballast.com lists the ICG 653/UNIV in brass, nickel-plated brass and 316 stainless steel from size Os (M20) to size F (M75), with conversion kits for sizes Os to B and the washers, locknuts, earth tags and adaptors each entry consumes, and quotes complete gland schedules against the part strings. Requests go to sales@cballast.com.

16. Terms

Barrier gland: a flameproof cable gland that seals around the individual cores with a setting compound.
Compression gland: in this reference, a flameproof cable gland whose inner seal is an elastomeric ring or diaphragm on the cable's inner sheath.
Direct entry: cable entering the flameproof enclosure itself; indirect entry passes through a separate terminal chamber.
Internal source of ignition: sparks or equipment temperatures occurring in normal operation that can cause ignition; terminals alone are not one.
Connected cable length: the length of cable attached to the entry, the quantity tested against 3 m and 0.5 m.
IIB + H2: equipment grouping for IIB gases plus hydrogen; treated with IIC in the 2024 flowchart.
Annex C: the normative pressure test procedure for cables into Ex d enclosures in IEC 60079-14:2024.
Cold flow: movement of a cable sheath under the compressive force of a gland seal.
Diameter over cores: the diameter of the laid-up core bundle once the inner sheath, fillers and tapes are removed.
ExPress: Hawke's injectable two-part barrier resin. QSP: Hawke's quick-set two-part putty.
Dual-marked gland: a 501/453/UNIV body also marked ICG 653 UNIV, convertible with the upgrade kit.
Schedule of limitations: the special conditions for safe use indicated by the X at the end of a certificate number.
Gland schedule: the per-entry record of enclosure, cable, rule applied, entry type and gland identifier.
dow: date of withdrawal, the date by which national standards conflicting with a European standard are withdrawn.

17. Sources

IEC 60079-14, editions of 2007, 2013 and 2024 (published contents, clause titles and figures list). IEC SC 31J, supporting document SD 001:2022, *Background to flameproof cable gland requirements in IEC 60079-14*. Health and Safety Executive, safety notice HID 1-2016, *Use of Barrier Glands in Potentially Explosive Atmospheres to meet IEC 60079-14:2013 (Edition 5)*, 1 February 2016. BSI, BS EN 60079-14:2014 (National Annex) and BS EN IEC 60079-14:2024 (national and European forewords). M. Thedens, Chair of IEC TC 31, "Edition 6 of IEC 60079-14 is here!", Hazardex, November 2024. Element Materials Technology, *How IEC 60079-14:2024 redefines flameproof cable and cable gland selection*. IEEE PCIC paper 2018-PCIC-0385, *Cables and cable glands for hazardous locations*. Hawke International: specification sheet for the ICG 653/UNIV; assembly instructions AI 2001, AI 2034, AI 2035, AI 2037 and AI 2040; ExPress resin technical data sheet. Prysmian: datasheet for BFOU 0.6/1 kV to NEK TS 606. Standards referred to: IEC 60079-0, -1, -7, -15, -17 and -31; IEC 60529; IEC 62262; IEC 62444.

Related guides

Hawke 501/453 Universal, 501/453/RAC and ICG 653: installation, inspection and replacement field guide
Hawke International: product range, types and certificates
Hawke cable glands sourcing index: every family by size, thread, cable range, material and article number
ATEX and IECEx hazardous-area zoning and equipment marking
Cable gland size chart, M12 to M63
Hazardous area equipment in the cballast catalogue

cballast.com is an industrial parts catalogue and planned-procurement sourcing house operated from Norway, listing more than 330,000 part numbers from more than 1,000 brands across 54 categories for operators, EPC contractors, shipyards, utilities and public institutions. Hawke requirements, from single lines to complete gland schedules, are handled at sales@cballast.com.

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