

WHITE PAPER | 2026

# How IEC 60079-14:2024 Redefines Flameproof Cable and Cable Gland Selection in Hazardous Areas

Implications for Design, Installation,  
Competence, and Explosion Safety

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# CONTENTS

Executive Summary.....	03
Introduction.....	03
Background: Cable and Gland Selection in Previous Editions.....	04
Drivers for Change in IEC 60079-14:2024.....	06
A Structural Shift: From Individual to System Assessment.....	06
Key Technical Changes Affecting Cable and Cable Gland Selection.....	08
Impact on Industry Stakeholders.....	10
Transitional Considerations & Global Adoption.....	11
Conclusions and Recommendations.....	11
References and Supporting Documents.....	11



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# EXECUTIVE SUMMARY

**The sixth edition of IEC 60079-14 introduces a fundamental change in how cables and cable entry devices are selected for use in hazardous areas.**

**What was previously a largely component-based and prescriptive process has evolved into a system-based, application-dependent assessment requiring deeper technical understanding, documented justification, and demonstrable personnel competence.**

This whitepaper examines the most significant changes affecting cable and cable gland selection, particularly for flameproof (Ex d) applications, and explains why these changes represent more than a routine standards update. It explores the technical, organisational, and competency implications for designers, equipment manufacturers, installers, inspectors, and end users, and highlights the risks associated with continued reliance on historic practices.

## INTRODUCTION

**Cables and cable entry devices have long been treated as peripheral components in explosion-protected installations.**

**However, experience has shown that incorrect selection, installation, or interaction between these elements can directly compromise the integrity of explosion protection concepts. IEC 60079-14:2024 confronts this reality by significantly increasing the level of scrutiny applied to cable management systems and their interfaces with Ex equipment.**

This whitepaper aims to explain not just what has changed in the latest edition of the standard, but why these changes matter, how they alter established industry practices, and what organisations must do to respond effectively.



# BACKGROUND: CABLE AND GLAND SELECTION IN PREVIOUS EDITIONS

Previous editions of IEC 60079-14 approached cable and cable gland selection primarily through prescriptive requirements and simplified decision tables.

While this approach enabled consistency and ease of application, it also encouraged assumptions about cable behaviour, gas migration, and sealing performance that were not always technically justified.

## THE APPLICATION-BASED FRAMEWORK OF IEC 60079-14:2007 (EDITION 4)

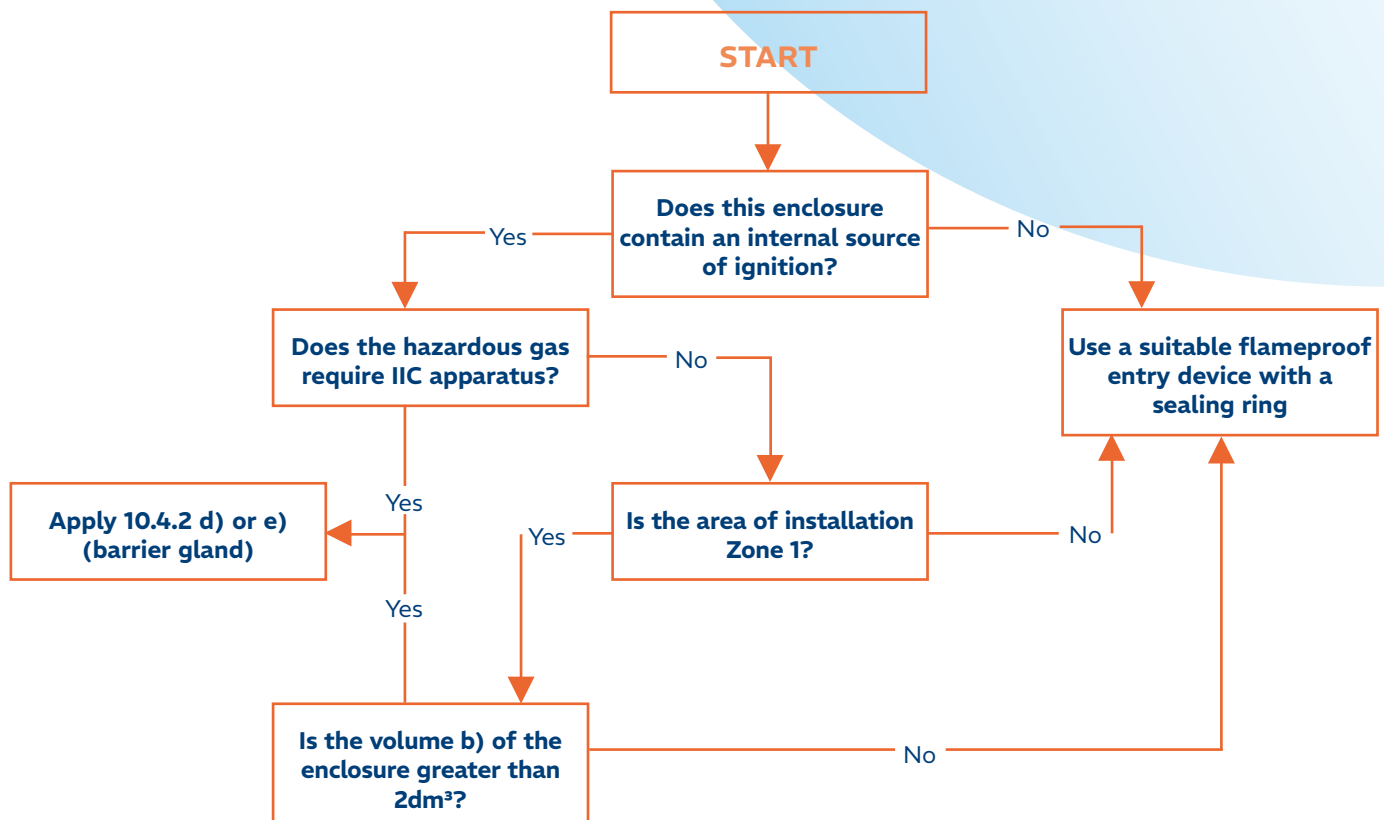
Edition 4 of IEC 60079-14 (published in 2007) adopted a flowchart-based approach to the selection of cable entry devices for flameproof (Ex d) enclosures.

This framework explicitly considered key aspects of the application, including the presence of internal ignition sources, hazardous area classification, equipment group, and enclosure volume.

The flowchart provided a structured and transparent decision-making process, guiding users toward appropriate solutions based on the characteristics of the installation rather than relying solely on prescriptive component criteria. Importantly, it required the designer or installer to engage with the intended function and operating conditions of the equipment, reinforcing the principle that explosion protection is inherently **application dependent**.

While relatively simple to apply, the 2007 methodology was widely regarded as intuitive and enforceable. It supported consistent interpretation across designers, manufacturers, installers, and inspectors, and its logic could be readily followed and justified during verification and inspection activities.

The removal of this application-based flowchart in subsequent editions marked a significant departure from this approach. The transition away from explicit decision logic in the 2013 edition was therefore met with concern across the industry, particularly where the replacement requirements were perceived to reduce clarity while increasing reliance on assumptions rather than explicit engineering assessment.



## BACKGROUND: THE LEGACY APPROACH INTRODUCED IN THE 2013 EDITION

The 2013 edition of IEC 60079-14 marked a significant change in the approach to cable entry device selection for flameproof (Ex d) enclosures. In that edition, the previously used flowchart-based methodology was replaced by a set of conditional requirements intended to provide flexibility while maintaining safety.

In practice, this change proved problematic. The revised requirements were widely regarded as difficult to interpret, inconsistently applied, and challenging to enforce. Rather than improving clarity, the new approach introduced ambiguity into an area where consistent engineering judgement is critical.

At a high level, the requirements permitted several established solutions without further justification, including:

- The use of barrier cable glands
- Factory-fitted bushings or sealing devices
- Mineral insulated (MI) cable systems

However, for non-barrier cable glands used with non-MI cables, compliance relied on a combination of conditions that, while technically defined, failed to adequately address real-world application risks.

These conditions included:

- The requirement for the cable gland to be certified as Ex d
- A minimum cable length of 3 metres
- Compliance of the cable with the construction requirements referenced in Clause 9.3.2(a)

While these criteria appeared objective, their practical implementation exposed significant weaknesses in the framework.

## LIMITATIONS OF EX D CERTIFICATION FOR NON-BARRIER CABLE GLANDS

Under the 2013 framework, non-barrier cable glands could be certified as Ex d based on testing that did not involve a representative cable. In many cases, certification relied on a pressure test conducted on a steel mandrel, rather than on an actual cable construction, and without subjecting the assembly to an internal explosion test.

As a result, certification demonstrated the mechanical integrity of the gland body and sealing system under pressure, but provided limited assurance regarding its sealing performance when installed with real cables of varying construction, materials, and deformation characteristics. This created a disconnect between certification results and in-service performance.

## THE AMBIGUITY OF THE 3-METRE CABLE LENGTH REQUIREMENT

The requirement for a minimum cable length of 3 metres became one of the most contentious aspects of the 2013 edition. While straightforward to measure at the point of installation, it proved difficult to interpret during equipment design, cable specification, and system engineering.

Questions frequently arose, including:

- Whether the 3 metres referred to cable inside or outside the enclosure
- Whether coiled cable could be used to achieve the required length
- How the requirement applied when only a short length of cable was exposed between enclosures

Because the standard did not explicitly address these scenarios, consistent interpretation was difficult to achieve. This led to uncertainty among manufacturers, installers, and inspectors, and undermined confidence in the robustness of the requirement.

## CABLE COMPLIANCE AND THE ABSENCE OF APPLICATION-BASED ASSESSMENT

The reference to cable compliance with Clause 9.3.2(a) further contributed to ambiguity. In practice, this often reduced the assessment to a basic evaluation of cable geometry, primarily whether the cable was round and met the minimum length requirement.

This approach made compliance relatively easy to achieve but failed to account for critical factors such as:

- Cable construction and material behaviour under pressure
- Gas migration pathways
- Interaction between cable, gland, and enclosure
- The specific characteristics of the installation environment (crucially the Gas Group)

As a result, cable glands increasingly became treated as interchangeable commodities, selected to satisfy minimum criteria rather than as safety-critical components requiring application-specific engineering consideration.

## CONSEQUENCES OF THE 2013 APPROACH

The net effect of the 2013 framework was an environment in which formal compliance could be achieved without adequately addressing explosion safety risk. While no major incidents have been conclusively attributed to these practices, the approach relied heavily on implicit assumptions rather than demonstrable performance.

The absence of application-based assessment, combined with ambiguous requirements and limited testing relevance, was widely recognised as an unsatisfactory direction for explosion-protected installations. These shortcomings directly informed the more rigorous, system-based revisions introduced in IEC 60079-14:2024.

# DRIVERS FOR CHANGE IN IEC 60079-14:2024

The changes introduced in Edition 6 were discussed at length within the standard committee.

The changes reflect a growing recognition within IEC TC 31 that historical simplifications no longer adequately address (if they ever did) the diversity of modern cable constructions, installation practices, and hazardous area applications.

## A STRUCTURAL SHIFT: FROM INDIVIDUAL TO SYSTEM ASSESSMENT

One of the most significant changes in IEC 60079-14:2024 is the move away from treating cables and cable entry devices as independent components.

The standard now requires them to be considered as part of an integrated system, whose suitability depends on application-specific parameters. The standard now states in the section Cables for direct entries into flameproof enclosures that “Cables and cable entry devices should be considered together for direct entries into flameproof enclosures”.

The publication of IEC 60079-14:2024 represents the culmination of more than a decade of technical debate and standards development following the shortcomings identified in the 2013 edition. While the resulting methodology does not fully satisfy all technical viewpoints, it reflects a deliberate and considered compromise intended to balance safety, practicality, and global applicability. The testing requirements and selection criteria are based on empirical data collated into IEC document “**IEC SC31J-SD-001:Ed1/2021-03 - Background to flameproof cable gland requirements in IEC 60079-14**” A review of the history and technical factors associated with cable gland selection for flameproof (Ex “d”) enclosures as background to the selection criteria in IEC 60079-14”.

An extract of the abstract of this document reads: **This paper reviews the history and technical factors associated with cable gland selection for flameproof (Ex “d”) enclosures as background to the selection criteria in IEC 60079-14. A wide range of available test results are included to assist in understanding this background.**

This document was put together by a sub-working group of MT-60079-14 (the maintenance team of the standard) to present all available test data so that the selection criteria has verifiable support. This report includes data of historical tests with a range of enclosures and cables of different sizes and types.

Central to this revision is the recognition that cable glands and cables cannot be selected or assessed in isolation. Their combined behaviour, interaction with the enclosure, and suitability for the specific hazardous atmosphere must be evaluated as a system. This principle underpins the revised flowchart-based approach introduced in Edition 6.

The purpose of the new flowchart is not to prescribe a single “preferred” solution, but to mitigate explosion propagation risk by explicitly linking gland selection to gas group, cable length, enclosure characteristics, and demonstrable cable performance. In doing so, the standard moves away from implicit assumptions and toward structured, application-based decision-making.

## RISK-BASED DIFFERENTIATION BY GAS GROUP AND CABLE LENGTH

The first stage of the flowchart requires identification of the hazardous gas group, with particular focus on IIC and IIB + hydrogen atmospheres. These gases represent the highest explosion risk due to their ignition characteristics and flame propagation behaviour.

To reflect this increased risk, the permitted cable length thresholds differ:

- For IIC and IIB + hydrogen atmospheres, a minimum cable length of 3 metres is required
- For all other gas groups, the minimum cable length is reduced to 0.5 metres

Where these minimum lengths are not met, the use of a flameproof entry device incorporating a barrier around the conductors is mandatory. In such cases, no further assessment is required, as the risk mitigation is achieved through sealing at the point of entry.

This initial decision step provides a clear and enforceable endpoint for higher-risk or shorter-cable installations, reducing ambiguity and limiting reliance on further assumptions.

## ENCLOSURE VOLUME RELAXATION

Where the gas group is on the lower risk side of the flowchart (IIB and IIA gases), and minimum cable length requirement is satisfied, the flowchart introduces a further differentiation based on enclosure volume, specifically whether the rated enclosure volume is less than or greater than 2,000 cm<sup>3</sup>.

The inclusion of enclosure volume reflects the understanding that smaller enclosures generate lower explosion pressures and energies, reducing the likelihood of flame propagation through connected cable systems. Where the enclosure volume is below this threshold, and the cable length criteria are met, the standard permits the use of a flameproof entry device with an elastomeric seal.

In practice, enclosure volume data is not always readily available in published documentation. In such cases, the standard implicitly requires designers and installers to obtain this information from the manufacturer or, where uncertainty remains, to adopt a conservative assumption that the volume exceeds the threshold.

## INTRODUCTION OF EVIDENCE BASED CABLE PERFORMANCE VIA ANNEX C

For installations where enclosure volume exceeds 2 000 cm<sup>3</sup>, or where enclosure volume cannot be confidently established, the assessment moves to the most significant technical change introduced in Edition 6: the requirement for demonstrable cable performance.

The flowchart explicitly asks whether there is sufficient reliable evidence to support that the cable would meet the criteria of Annex C. This represents a decisive shift away from assumed cable suitability based on geometry or catalogue descriptions alone.

Annex C introduces a normative test intended to assess a cable's resistance to flame propagation and gas migration under defined conditions. Where credible evidence exists that a cable would meet these criteria, such as validated test data or equivalent substantiation, a flameproof entry device with an elastomeric seal may be used.

Where such evidence is absent or insufficient, the use of a barrier-type flameproof entry device is required.

It is acknowledged within the standard that cable manufacturing variability can complicate reliance on a single test or data source. Consequently, catalogue references alone may not constitute sufficient evidence, reinforcing the need for engineering judgement and documented justification.

## A DELIBERATE COMPROMISE TOWARD SYSTEM INTEGRITY

The revised flowchart reflects a deliberate compromise between differing technical perspectives within the international community. On one hand, it accommodates scenarios where non-barrier entry devices may be safely used, provided sufficient competence, assessment, and evidence exist. On the other, it establishes clear decision points that default to barrier solutions where uncertainty or higher risk is present.

In contrast to previous editions, the 2024 approach prioritises system integrity over component compliance. It requires users to actively engage with the interaction between gas group, cable length, enclosure characteristics, and cable performance, rather than relying on simplified prescriptive rules.

This shift represents a significant increase in both technical responsibility and competency requirements, but it also provides a more robust framework for managing explosion risk across a wide range of installation scenarios.

# KEY TECHNICAL CHANGES AFFECTING CABLE AND CABLE GLAND SELECTION

## REVISED SELECTION OF CABLE ENTRY DEVICES FOR EX D

Edition 5 Clause No.	Cl 10.2 + Table 10
Edition 6 Clause No.	Cl 7.5.2 + Table 15

Edition 6 introduces a new flowchart-based approach to selecting cable entry devices for flameproof enclosures. This approach requires explicit consideration of equipment group, enclosure volume, cable length, and cable construction, factors that were previously implicit or overlooked.

## INTRODUCTION OF NORMATIVE CABLE TESTING (ANNEX C)

Edition 5 Clause No.	Annex E (informative)
Edition 6 Clause No.	Figure 2, Annex C (normative)

The replacement of the informative Annex E with the normative Annex C represents a major change in how cable suitability is assessed. In certain applications, cable testing is no longer optional but mandatory, forming a critical part of the selection process.

## CABLES AND ENTRY DEVICES CONSIDERED TOGETHER FOR DIRECT ENTRIES

Edition 5 Clause No.	Cl 10.6
Edition 6 Clause No.	Cl 7.4.3

IEC 60079-14:2024 explicitly requires cables and cable entry devices to be assessed together for direct entries into flameproof and restricted breathing enclosures. This change reflects an understanding that the performance of one cannot be assumed independently of the other.

## EXTERNAL INFLUENCES AND CABLE ROUTING

Edition 5 Clause No.	Cl 5.9
Edition 6 Clause No.	Cl 7.3.2

Edition 6 places increased emphasis on external influences and cable routing, recognising their impact on sealing integrity, material performance, and long-term reliability. This section examines the expanded list of external influences and the new documentation requirements related to cable routing.

## PERSONNEL COMPETENCE: FROM QUALIFICATION TO DEMONSTRABLE CAPABILITY

Edition 5 Clause No.	Cl 4.5, Annex A
Edition 6 Clause No.	Cl 1. Scope (NEW), Cl 5.5, Annex A

By embedding personnel competence into the scope of the standard, IEC 60079-14:2024 makes it clear that correct application cannot be achieved through documentation alone. This section explores the implications of the shift from "qualification" to "competence" and what constitutes demonstrable, up-to-date knowledge in practice.



# IMPACT ON INDUSTRY STAKEHOLDERS

## DESIGNERS AND ENGINEERS

A major consequence of the changes are that the cable entry device selection activities should move upstream away from the installers and towards those making the equipment and cable designs and selections.

This fundamental change means that the equipment designers, project engineers and procurement professionals need to be aware of these changes and have the necessary training and decision-making capabilities to make correct and safe selections.

Designers must now engage more deeply with cable behaviour, enclosure characteristics, and installation conditions.

## EQUIPMENT MANUFACTURERS

Manufacturers must consider how their equipment interfaces with a wider range of cable systems and how supporting information is provided to users.

Traditionally equipment manufacturers who provide their equipment fitted with standard cable entry devices fitted, now risk incompatibility with the cables fitted by the end customer, or any downstream packaging or integration activities.

## INSTALLERS AND CONTRACTORS

Historic installation practices may no longer be sufficient. In many cases, the installer was the only member of the organisation that has undergone Ex cable entry device training.

Cable entry device selection conducted under edition 5 of the standard (IEC 60079-4:2013) would lead to standardised installation practices with the installers given a "one-size fits all" approach with an industry aversion to the use of barrier type cable entry devices, leading to wide adoption of non-barrier types, regardless of the cable type, enclosure volume or consideration of the gas group. This approach should change now there is a requirement for these things to be considered.

## INSPECTORS AND VERIFIERS

Inspection is no longer limited to checking compliance with prescriptive rules.

Inspectors must assess the adequacy of engineering decisions and supporting evidence. Inspectors should check the flowchart has been followed with regard to cable entry device selection, and depending on the type of cable entry device selected, there should be a check of the "sufficient reliable evidence" with regard to the Annex C testing. It may also be a requirement to check the enclosure volume, if that section of the flowchart has been used. Inspectors may need to undergo detailed inspection training on the changes to the standard and what constitutes a compliant installation and a non-compliant installation.

## END USERS AND OPERATORS

End users face increased exposure if systems are designed or installed without adequate understanding of the new requirements. End users face the possibility of non-compliant installations (to the latest edition and therefore latest technical knowledge) which can be for a number of reasons, these include:

- Lack of knowledge and competence of those selecting cable entry devices
- Old site / project specifications written based on previous editions of the standard (a lot of specifications standardise on non-barrier types regardless of cable construction due to the additional complexity and cost)
- Equipment manufactured / shipped prior to the release of the latest edition of the standard

# TRANSITIONAL CONSIDERATIONS AND GLOBAL ADOPTION

**Although IEC standards are formally voluntary, their adoption as national and regional standards makes transition management critical.**

The IEC edition of the standard was approved (Voted: Yes or abstained) by all member countries with the exception of the UK. At the time of writing (January 2026) various EN editions of Edition 6 of the standard have been released. The BS-EN version is not yet released, pending the approval of a National Foreword that will address issues not related to cable or cable entry device selection.

## CONCLUSIONS AND RECOMMENDATIONS

**IEC 60079-14:2024 represents a decisive move toward more rigorous, system-based explosion safety engineering.**

Organisations that fail to adapt risk not only non-compliance, but compromised safety and increased liability. Organisations will need to focus training and support to the designers and engineers making the cable and cable entry device decisions, as this is where incorrect selections will lead to non-compliance but more importantly, the selection of equipment that is not suitable for the type of gas and the application and increasing the chances of fatal explosions.

## REFERENCES AND SUPPORTING DOCUMENTS

- IEC 60079-14:2007
- IEC 60079-14:2013
- IEC 60079-14:2024
- IEC SC 31J SD 001



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