



Navigating Hazardous Locations: How to Select ATEX & UL Certified Motors for Hazardous Locations (HazLoc): A Complete Compliance Guide

Industrial environments that contain flammable gases, vapors or combustible dust demand specialized equipment. Motors deployed in these hazardous locations (HazLoc) must prevent ignition sources while still delivering the precision and performance required for modern automation.

For many engineering teams, the challenge is not understanding that safety is critical. It is navigating overlapping regulatory systems, aligning global certifications and selecting a motor that meets performance goals without unnecessary size, cost or complexity.

This paper provides a practical framework for selecting and deploying servo motor technology in volatile environments. It explains classification systems, outlines essential protection concepts and presents a structured approach to motor selection for UL, ATEX and IECEx environments. By aligning safety requirements with actual environmental risk, organizations can protect personnel and infrastructure while maintaining high performance and cost efficiency.



The HazLoc challenge

Hazardous locations are areas where flammable gases, vapors, combustible dust or ignitable fibers may be present in quantities sufficient to produce an explosion or fire. In these environments, motors and other electrical equipment pose inherent ignition risks from arcing, sparking or thermal output.

Historically, this created a performance gap. Engineers had to choose between the safety required for HazLoc compliance and the precision motion control needed for advanced automation. Explosion-proof construction also frequently meant larger frames, heavier housings and limited dynamic capability.

Today, this gap is closing. Advances in motor design, materials, thermal management and feedback systems can deliver the torque density, dynamic response and accuracy required for demanding applications. But with these advances, the challenge shifts from technical performance to specification clarity.

Organizations must now navigate differing regulatory standards, classifications, and motion requirements for HazLoc environments. In many cases, uncertainty leads to over-specification—selecting a higher protection level than the environment actually requires—to ensure safety and performance. While well-intentioned, this can add unnecessary cost, weight and integration complexity.

With the proper understanding and framework, organizations can optimize motor selection to achieve both safety and productivity in industrial automation.



Understanding the regulatory landscape

Regional standards define how HazLoc equipment must be designed, tested and certified. North America and Europe have historically maintained distinct systems, but a globalized economy is driving them toward harmonization through the IECEx system. Let's break down the landscape.



North American Standards (UL and CSA)

In the United States, hazardous locations are defined by the National Electrical Code (NEC), primarily in articles 500 through 505. Canada follows the Canadian Electrical Code (CEC). Certification bodies like Underwriters Laboratories (UL) and the Canadian Standards Association (CSA) enforce these standards through rigorous testing and certification.

European Directives (ATEX)

In the European Union, the ATEX framework governs equipment for hazardous environments. It uses a system of Equipment Groups and Categories for classification and consists of two primary directives:



- **Directive 2014/34/EU:** Pertains to the equipment and protective systems intended for use in potentially explosive atmospheres.
- **Directive 1999/92/EC:** Addresses the minimum requirements for improving the safety and health protection of workers potentially at risk from explosive atmospheres.

Global Certification (IECEx)

The primary challenge for global manufacturers is designing equipment that satisfies both UL and ATEX requirements. This is where the International Electrotechnical Commission System for Certification to Standards Relating to Equipment for Use in Explosive Atmospheres (IECEx System) becomes critical.



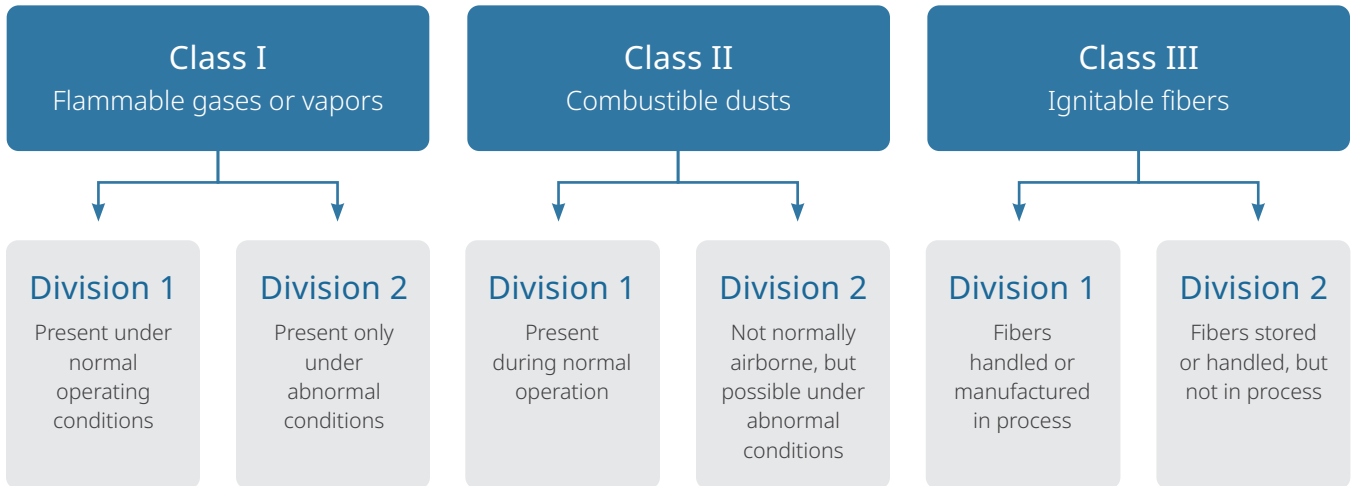
IECEx is not a standard itself but a certification scheme designed to facilitate international trade in equipment for explosive atmospheres. Its goal is to create a single, globally accepted framework for testing and certification. For manufacturers, this means a more streamlined, less costly path to global market access. For end users, it provides confidence that the equipment meets a globally recognized safety benchmark.



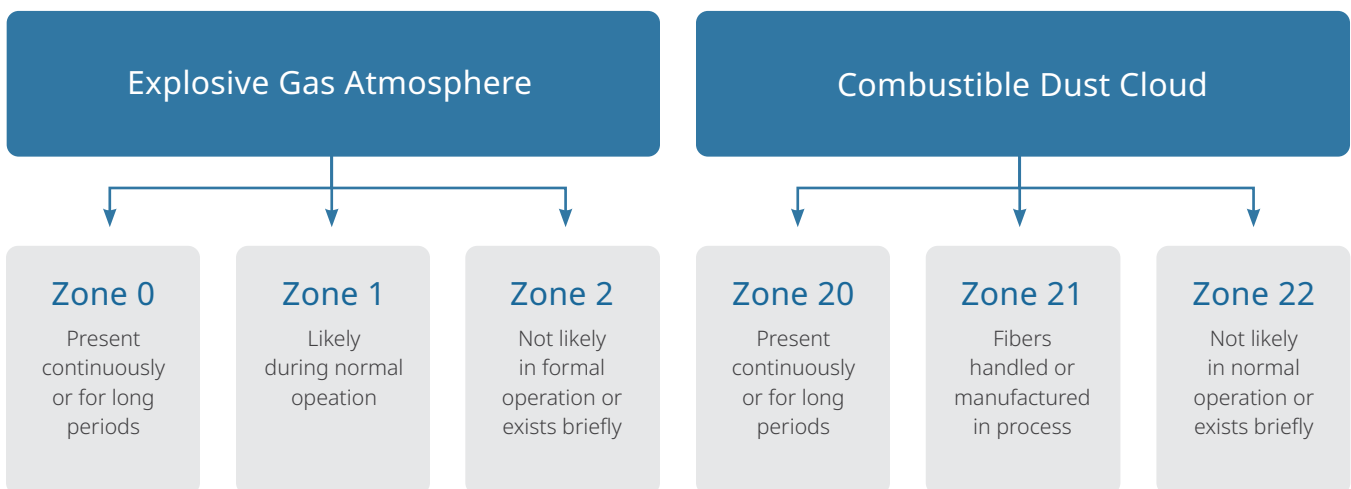
Classifying environmental risk

Environmental classification should drive motor selection. When protection levels exceed what the environment actually requires, it can lead to added size, cost and complexity. On the other hand, under-specifying introduces real risk. There are two primary classification systems used to define and communicate environmental risk in accordance with regional standards: the Class/Division System and the Zone System.

Class/Division System (North America)



Zone System (ATEX/IECEx)



Zone 2 and Zone 22 environments are increasingly common in automated environments. Yet, many manufacturers defer to explosion-proof motors specified for Zone 1 or Division 1. [Kollmorgen's AKME Series](#) is specifically designed and ATEX-certified for use in these explosive atmospheres where hazards are not likely during normal operation, providing an ideal solution that eliminates the need for over- or under-specification.

How the classifications compare

Gas/Vapor Environments

Risk Level	Class/Division System (North America)	Zone System (ATEX/IECEX)	Examples
Continuous presence	Class I, Div 1	Zone 0	Inside tanks, enclosed vapor spaces
Likely in normal operation	Class I, Div 1	Zone 1	Pump rooms, paint spray booths, refinery process areas
Not likely in normal operation	Class I, Div 2	Zone 2	Adjacent to sealed processing systems, ventilated enclosures

Combustible Dust Environments

Risk Level	Class/Division System (North America)	Zone System (ATEX/IECEX)	Examples
Continuous dust cloud	Class I, Div	Zone 20	Inside grain silos or dust collectors
Likely during normal operation	Class I, Div 1	Zone 21	Grain handling, flour transfer systems
Abnormal condition only	Class I, Div 2	Zone 22	Packaging areas, enclosed conveyor systems



Translating risk into motor design

With the environment classified, the next step is to understand how hazardous location motors can prevent ignition while maintaining performance. In fact, HazLoc motor design requires enclosure construction, flame management, thermal control, and system integration practices working together to mitigate ignition risk.

Explosion-proof and flameproof construction (Ex d)

Explosion-proof motors are designed to contain an internal ignition event without allowing flame to propagate to the external atmosphere. The enclosure must withstand internal pressure and prevent ignition of surrounding gases. This protection concept is typically required in Zone 1 (or Class I, Division 1) environments.

Dust ignition protection (Ex t)

In combustible dust environments, the primary concern shifts from flame containment to dust ingress and surface temperature control. Enclosures must be sealed to keep dust from entering the motor housing. Certified cable entries and gasketed interfaces are critical to maintaining compliance in Class II or Zone 20–22 areas.

Many dust-prone or washdown environments require high ingress protection ratings such as IP67 or IP69K. While IP ratings do not replace hazardous location certification, they support long-term reliability by preventing dust accumulation and moisture intrusion that could compromise both safety and performance.

Flame paths and mechanical tolerances

These are precisely machined gaps and joints in the motor's construction (e.g., between the motor housing and end caps). If an internal explosion occurs, it forces the hot gases through these long, narrow paths. The path cools the gases to a temperature below the auto-ignition point of the external hazardous atmosphere before they are expelled.

Temperature class (T-Code)

The maximum surface temperature a motor can reach during operation is a critical safety parameter. Temperature classes (T1-T6) define these limits. For example, a T3-rated motor will not exceed 200°C. The selected motor's T-Code must be lower than the auto-ignition temperature of the specific gases or dusts present in the environment.

Cabling and feedback devices

Hazardous location motors must safely manage both high-voltage power and low-voltage feedback signals. Shielded or armored cabling, certified glands and proper conductor separation reduce the risk of arcing or spark induction. In addition, resolvers are often preferred in harsh environments due to their durability and noise immunity, while encoders may be appropriate when properly protected and certified.

In Zone 2 and Zone 22 applications, simplified single-cable configurations can reduce connection points and streamline installation while maintaining compliance.



Installation and commissioning best practices

Proper installation is as critical as motor design. Even a correctly certified motor can lose compliance if installed improperly. HazLoc performance depends on maintaining enclosure integrity, grounding continuity and ensuring a certified system configuration.

Sealing and glanding

Cable entries are common failure points in hazardous installations. Certified cable glands and conduit seals must match the motor's protection concept and environmental classification. Improperly sealed entries can allow flame propagation or dust ingress, compromising compliance. Install all sealing components according to the manufacturer's torque and engagement specifications.

Grounding and bonding

Essential protocols for equipotential bonding prevent static buildup and provide a defined fault current path. Bonding conductors must be secure, continuous and compliant with local electrical codes. Poor grounding increases ignition risk and can affect signal integrity.

Thermal management

Certified temperature limits assume defined operating conditions. Drive parameters must ensure that the motor does not exceed its rated T-Code under peak load or abnormal conditions. Thermal sensors, current limits and overload protection should be configured and validated during commissioning. Finally, verify ambient temperature assumptions against real installation conditions.

Drive pairing

Servo drives are typically installed outside the hazardous area or within a certified purged or pressurized enclosure. Routing between the drive and motor must maintain separation and shielding requirements. Improper drive placement can introduce unintended ignition sources.

Selecting the right motor technology

HazLoc compliance is only one dimension of motor selection. It's also important to consider application performance requirements.

Performance vs. protection

Evaluate whether the selected motor provides equivalent control characteristics to standard industrial platforms. Explosion-proof servo motors, specialized stepper and synchronous motors can deliver comparable responsiveness while maintaining required protection levels. The objective is to ensure motion solutions deliver both safety and performance.

Certification verification

Always check the motor nameplate for certification markings. A UL listing will include a file number, as well as an area classification, while ATEX certification includes the specific marking that denotes its suitability for certain zones. An IECEx certificate provides an added layer of assurance for global compliance.

For OEMs serving international markets, carrying separate motor configurations for UL, ATEX and IECEx environments increases complexity. Multiple part numbers mean larger inventories, longer lead times and higher documentation burdens. Where possible, prioritize motors certified to multiple standards.

Application focus

HazLoc applications span a wide range of motion requirements. While explosion-proof servo motors are common for their compliance and highly dynamic performance, they are not the only option. Alternative motor technologies include synchronous, stepper and permanent magnet DC motors.

Kollmorgen offers one of the [broadest portfolios of hazardous location motors](#) certified to UL, ATEX and IECEx standards. With a wide range of frame sizes and co-engineering capabilities, our motion control experts can help navigate certification complexities and optimize system performance to meet the demands of both the North American Class/Division system as well as the Global alternative Zone system environments.

When specifying a motor for hazardous environments, evaluate:

- Confirmed Class/Division or Zone classification
- Required temperature class (T-Code)
- Torque and speed requirements
- Duty cycle and overload conditions
- Required feedback type (resolver vs encoder)
- Power supply and bus voltage
- IP rating requirements
- Cabling and gland certification
- Global certification needs (UL, ATEX, IECEx, CSA)
- Physical space and mounting constraints

Today's hazardous location facilities are increasingly relying on automation for throughput, consistency and quality. Motors operating in these environments must deliver the precision, reliability and performance these rugged environments demand. With a structured approach to classification, protection concepts and technology selection, manufacturers can design systems that protect personnel while enabling high-performance automation.

Safety is the foundation. Performance is the objective. Kollmorgen can help you achieve both without compromise.



Ready to move forward?

[Contact Kollmorgen](#) to discuss your needs and goals with a Kollmorgen expert for hazardous location applications.

About Kollmorgen

Kollmorgen, a Regal Rexnord Brand, has more than 100 years of motion experience, proven in the industry's highest-performing, most reliable motors, drives, AGV control solutions and automation platforms. We deliver breakthrough solutions that are unmatched in performance, reliability and ease of use, giving machine builders an irrefutable marketplace advantage.