

2026 ANNUAL MEETINGS OF THE IECEX SYSTEM

Future of Sustainability in Ex Electric Motors: Carbon, Circularity and Safety

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2026 IECEx 系统年度会议

防爆电机可持续性的未来： 碳、循环性与安全

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WHY SUSTAINABILITY FOR Ex EQUIPMENT?



Climate change is driving companies to set increasingly ambitious greenhouse gas reduction targets. The focus is shifting rapidly.

Product Environmental Performance

Carbon Footprint: Raw material, production and use

Efficiency and Durability: In-use energy and extended life

Circularity and End-of-Life: Repairability and recycling

Sustainability is moving from the corporate level directly down to the product level.

为什么防爆设备需要注重可持续性？

气候变化正促使企业设定持续增加的温室气体减排目标。
关注点正在迅速转移：

产品环境性能

碳足迹：原材料、生产和使用

高效与耐用：使用中的节能和更长的使用寿命

循环性与终端处理：可修复性与回收利用

可持续性正从企业层面直接落实到产品层面。

FROM ENERGY EFFICIENCY TO SUSTAINABILITY



REGULATORY COMPLIANCE

- Meets global legal requirements.
- Aligned with ESPR, DPP, Green Passport, and Ecodesign.



COMPETITIVE ADVANTAGE

- Market differentiation.
- Strengthens brand reputation and positioning.



INCENTIVES AND OPPORTUNITIES

- Access to incentive and funding programs.
- Qualification for sustainable public and private procurement.



CUSTOMER DEMAND

- Increasing demand for transparency.
- Meets the expectations of consumers and partners committed to sustainability.



YESTERDAY PARADIGM

Efficient Products

The historical regulatory focus was concentrated exclusively on energy efficiency during the use phase (Classes IE1 to IE5).

Key metric: kWh consumption / operating hour

TODAY PARADIGM (ESPR)

Efficient and Circular Products

European regulation (ESPR) expands the concept to include durability, repairability, reusability, recyclability, and total carbon footprint.

Key metric: Cradle-to-grave impact

ESPR – Ecodesign for Sustainable Products Regulation



从节能到可持续发展



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以往的范例

高效产品

历史上的监管重点曾仅集中于使用阶段的能源效率（IE1 至 IE5 等级）。

关键指标：kWh/运行小时

现在的范例(ESPR)

高效循环产品

欧洲法规 (ESPR) 将耐久性、可修复性、可重复使用性、可回收性以及总碳足迹纳入了其概念。

ESPR – 可持续产品生态设计法规

关键指标：从原材料获取、产品制造、运输、使用，一直到报废、回收或最终处置所产生的总体环境影响





The Challenge of Ex Electric Motors

How can standardized **sustainability** principles be applied to equipment designed to operate in explosive atmospheres where **SAFETY** is a **non-negotiable** requirement?



防爆电机的挑战

如何将标准化的可持续发展原则应用于专为在爆炸性环境中运行而设计的设备，同时确保安全性这一不可妥协的要求得到保障？

SAFETY MEETS MATERIAL INTENSITY

Why higher embodied carbon in Ex motors does NOT mean a less sustainable design:



Industrial Electric Motor

Conventional structural requirements



Lower raw material weight/volume



Potentially lower embodied carbon



Ex Electric Motor

Robust enclosures, flame paths, impact resistance



Additional raw material, special and robust components



Higher initial embodied carbon



Additional material thickness and component complexity provide the essential safety envelope that prevents catastrophic explosions in hazardous environments.

Safety is a Functional Requirement, Not an Inefficiency

安全性与材料用量的协调

为什么防爆电机较高的**隐含碳排放**并不意味着其设计的可持续性较低

工业电机

常规结构要求



降低原材料重量/体积



潜在的较低碳足迹

防爆电机

坚固的外壳、隔爆间隙、耐压性能



附加原材料、特殊组件和包装



初始固有碳排放量更高



额外的材料厚度和组件复杂性提供了必要的安全防护，可防止在危险环境中发生灾难性爆炸。

安全是一项功能需求，而非效率低下

Sustainability Potential Challenges for Ex Equipment:

- ✓ Product Carbon Footprint (PCF)
- ✓ Recycled materials
- ✓ Product durability
- ✓ Digital Product Passport (DPP)



防爆设备的可持续性潜在挑战：

- ✓ 产品碳足迹 (PCF)
- ✓ 再生材料
- ✓ 产品耐用性
- ✓ 数字产品护照 (DPP)



CONTROLLED REPAIR IN EX MOTORS



Repairability cannot be separated from explosion protection standards (IEC 60079-19):

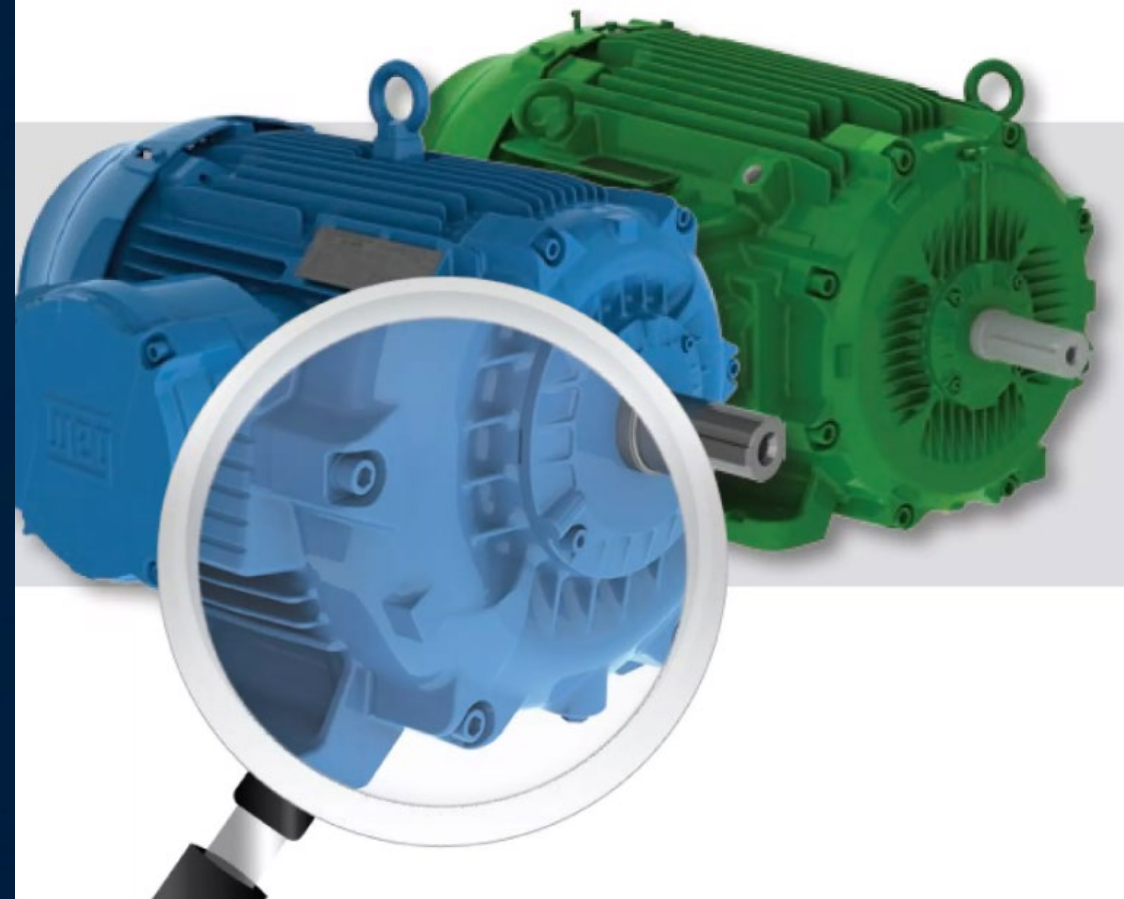
Standard Repair: Focuses on ease of disassembly, simple component swapping, and open user access.

Ex Controlled Repair: Requires certified facilities, OEM flame path tolerances, approved spare parts, and post-repair testing.



Unqualified repairs compromise hazardous area certification

Controlled repair extends product life safely without risk



HOW CAN WE ENSURE THAT FUTURE LEGISLATION INCORPORATES THE SPECIFIC CHARACTERISTICS AND REQUIREMENTS OF THE Ex MARKET?

防爆电机受控维修

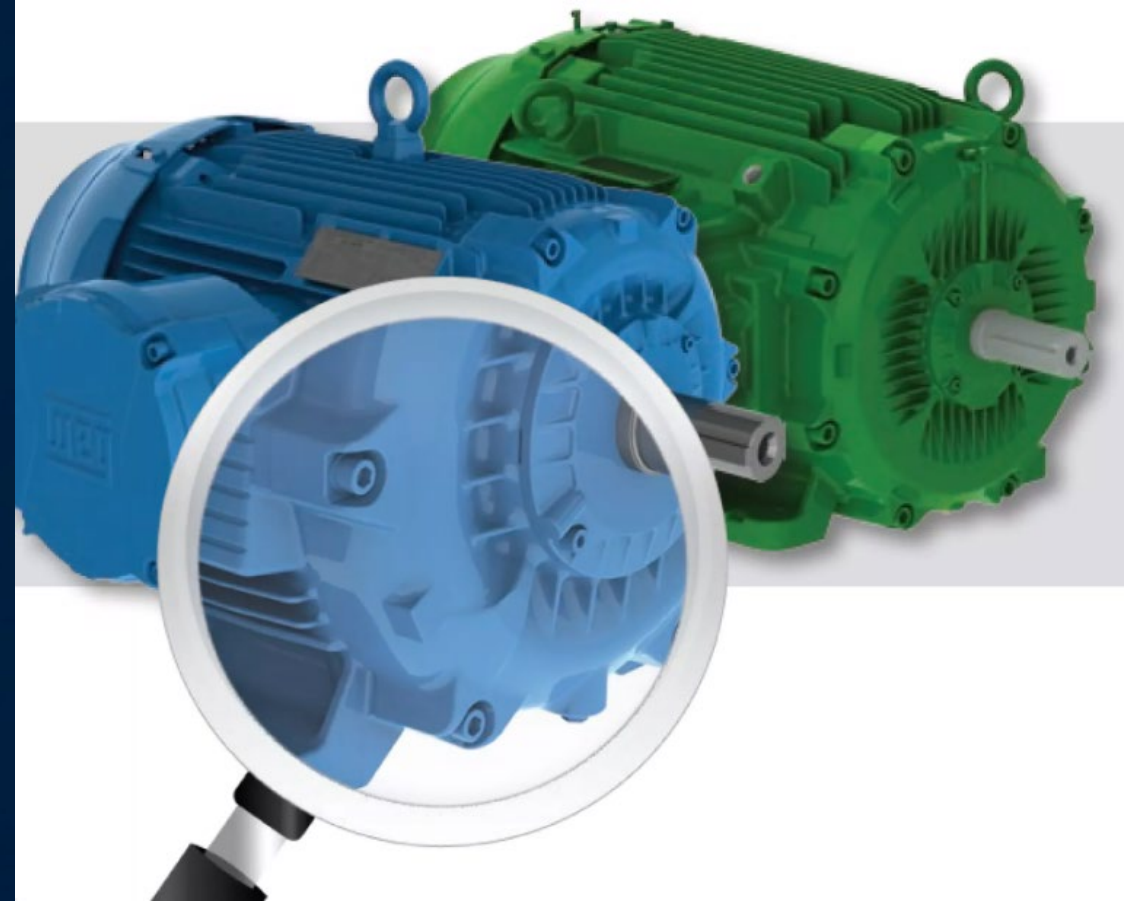
可修复性不能与防爆标准 (IEC 60079-19) 分开:

标准维修: 注重便于拆卸、简单更换部件, 并允许用户直接进行维修。

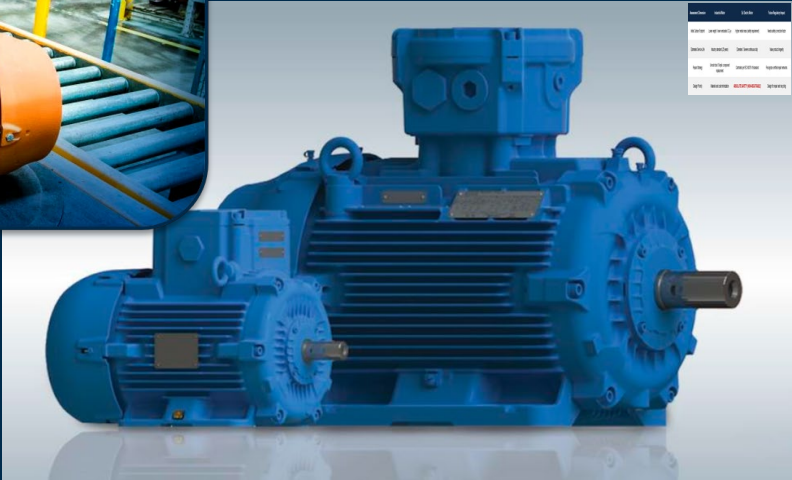
防爆维修: 必须由经过认证的维修机构进行, 严格遵守原制造商规定的隔爆接合面尺寸公差, 使用经过批准的备件, 并在维修后进行测试。



不合格的维修会危及危险区域认证
受控的维修能安全无风险地延长产品寿命。



如何确保未来立法能够纳入防爆市场的具体特征和要求?



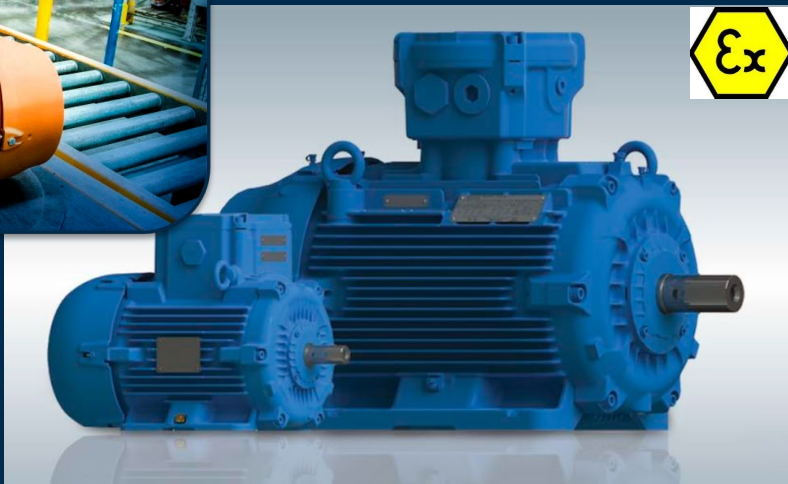
Ex EQUIPMENT NEEDS A CUSTOMIZED SUSTAINABILITY FRAMEWORK

Preserving explosion protection requires balancing material intensity, lifetime extension, and certified repair with future carbon regulation.

Assessment Dimension	Industrial Motor	Ex Electric Motor	Future Regulatory Impact
Initial Carbon Footprint	Lower weight / lower embodied CO ₂ e	Higher metal mass (safety requirement)	Needs safety correction factor
Estimated Service Life	Industry standard (25 years)	Extended / Severe continuous duty	Value product longevity
Repair Strategy	Unrestricted / Simple component replacement	Controlled per IEC 60079-19 standard	Recognize certified repair networks
Design Priority	Material and cost minimization	ABSOLUTE SAFETY (NON-NEGOTIABLE)	Design for repair and recycling

防爆设备需要定制化的可持续性框架

维护防爆需要平衡材料用量、延长使用寿命和认证维修，并考虑未来的碳法规。



评估维度	工业电机	防爆电机	未来法规影响
初始碳足迹	重量更低 / 隐含碳排放更低 (CO ₂ e)	金属用量更高 (安全要求)	需要采用安全修正系数
预计使用寿命	行业标准 (25年)	延长使用寿命 / 适用于严苛的连续运行工况	重视产品的长寿命
维修策略	不受限制 / 简单更换部件	按照 IEC 60079-19 标准进行受控维修	认可经认证的维修网络
设计优先级	材料和成本最小化	绝对安全 (不可妥协)	面向维修和回收进行设计

Challenges for regulations:

Future sustainability regulations are likely to require enhanced digital traceability.

This could create opportunities to connect Digital Product Passports with Ex certification information, repair history and lifecycle management.



法规的挑战：

未来的可持续发展法规很可能会要求实现更完善的数字化追溯。这将带来新的机会，使数字产品护照（DPP）能够与防爆认证信息、维修记录和产品全生命周期管理进行连接。



SIX ACTION AREAS FOR Ex MOTORS



Integrating lifecycle and circularity principles into Ex standards enables environmental progress while guaranteeing explosion protection

01 - MEASURE

PCF and Data Transparency

Quantify lifecycle environmental impact to support transparent, data-driven decisions.

PCF - Product Carbon Footprint

02 - OPTIMIZE

Material and Manufacturing

Optimize materials and processes without compromising structural safety requirements.

03 - IMPROVE EFFICIENCY

Use Energy Savings

Reduce dominant operational emissions while strictly maintaining Ex certification.

04 - EXTEND LIFE

Durability as Circularity

Design for maximum service life and maintainability to reduce replacement needs.

05 - CERTIFIED REPAIR

Controlled Ex Repair

Enable qualified and specialized to extend product lifetime safely.

06 - RECYCLY

Responsible Material Recovery

Maximize end-of-life copper, steel, and aluminum recovery through safe disassembly.

防爆电机六大行动领域

将生命周期和循环性原则整合到Ex标准中，有助于促进环境进步，同时保障防爆安全。

01 - 测量

PCF与数据透明度

量化产品全生命周期的环境影响，为透明且基于数据的决策提供支持。

PCF - 产品碳足迹

02 - 优化

材料与制造

在不降低结构安全要求的前提下，优化材料和生产工艺。

03 - 提高效率

节能

在严格保持防爆认证要求的同时，减少运行阶段的主要排放。

04 - 延长寿命

耐用性作为循环性

通过设计实现最长使用寿命和良好的可维护性，从而减少更换需求。

05 - 授权维修

受控防爆维修

通过具备资质的专业维修，安全地延长产品使用寿命

06 - 回收

做好材料回收

通过安全拆解，最大限度地回收报废产品中的铜、钢和铝。

THE FUTURE: SAFETY & SUSTAINABILITY



Key challenge for engineering

"The time has come to integrate sustainability principles directly into Ex standardization.

Future IEC standards must harmonize safety non-negotiables with carbon footprint and circularity metrics."

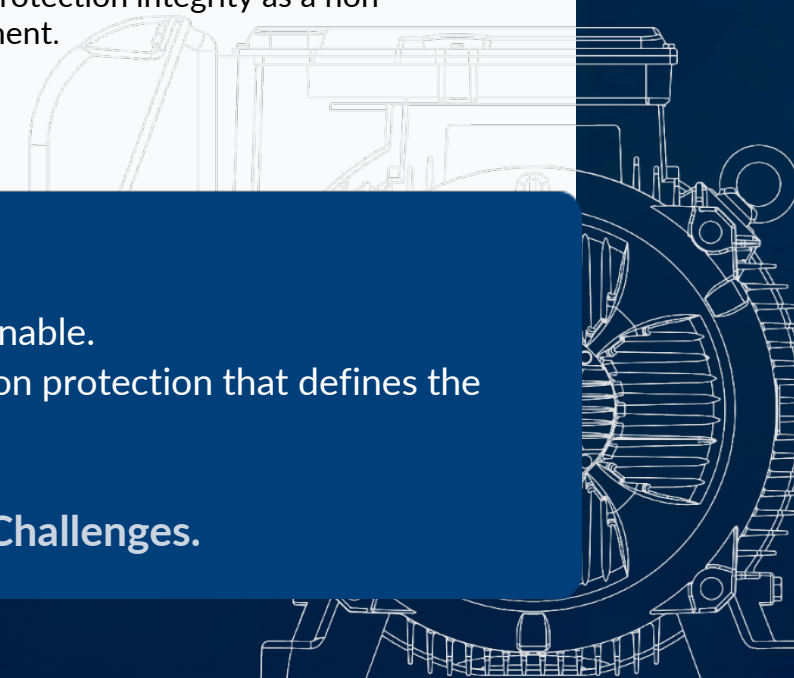
Core Sustainability Pillars

- 🎯 **CARBON:** Measure product carbon footprint with transparency and systematically reduce emissions across the life cycle.
- 🎯 **CIRCULARITY:** Extend equipment lifetime through certified repair practices and responsible material recovery.
- 🎯 **SAFETY:** Preserve explosion protection integrity as a non-negotiable functional requirement.

SAFETY + SUSTAINABILITY

The question is not whether Ex motors should become more sustainable.
The fundamental goal is reducing environmental impact without compromising the explosion protection that defines the product.

Same Sustainability Ambition. Different Engineering Challenges.



工程的关键挑战

现在是时候将可持续发展原则直接纳入防爆标准体系了。

未来的IEC标准必须兼顾安全底线要求与碳足迹和循环性指标。

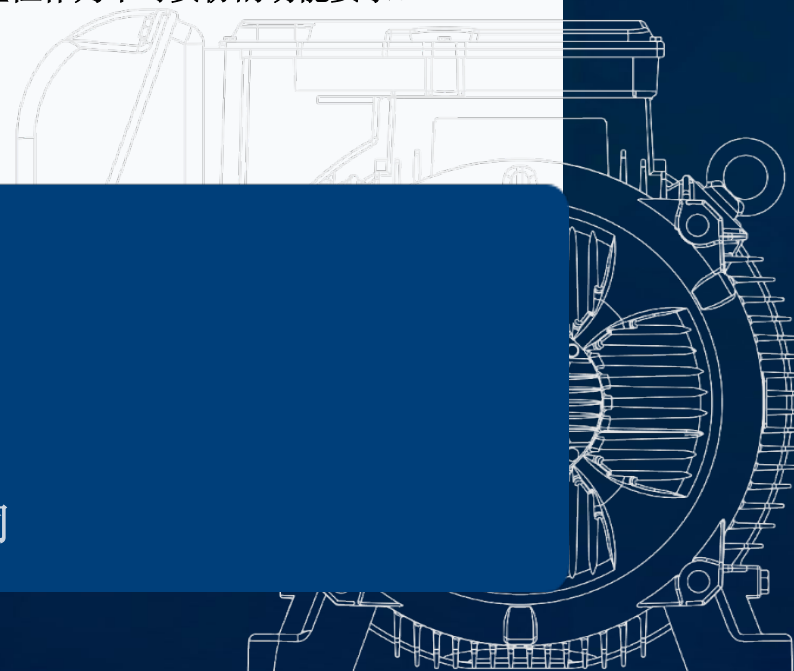
核心可持续性支柱

- 🎯 碳排放：透明地测量产品碳足迹，并系统性地减少全生命周期的排放。
- 🎯 循环性：通过经过认证的维修实践，同时做好材料回收，延长设备的使用寿命。
- 🎯 安全性：将保持防爆性能的完整性作为不可妥协的功能要求。

安全 + 可持续性

问题不在于 Ex 电机是否应该变得更可持续。
根本目标是在不损害产品防爆性能的前提下，减少环境影响。

可持续发展的目标相同，工程面临的挑战不同



“...people who are motivated by an idea are the basis for success.”

Eggon João da Silva
One of WEG's founders

THANK YOU!

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Driving efficiency and sustainability



“... 心怀理想并为之奋斗，是成功的基础。

”

Eggon João da Silva
WEG 的创始人之一

谢谢!

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Driving efficiency and sustainability



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2026 IECEx System Meeting



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