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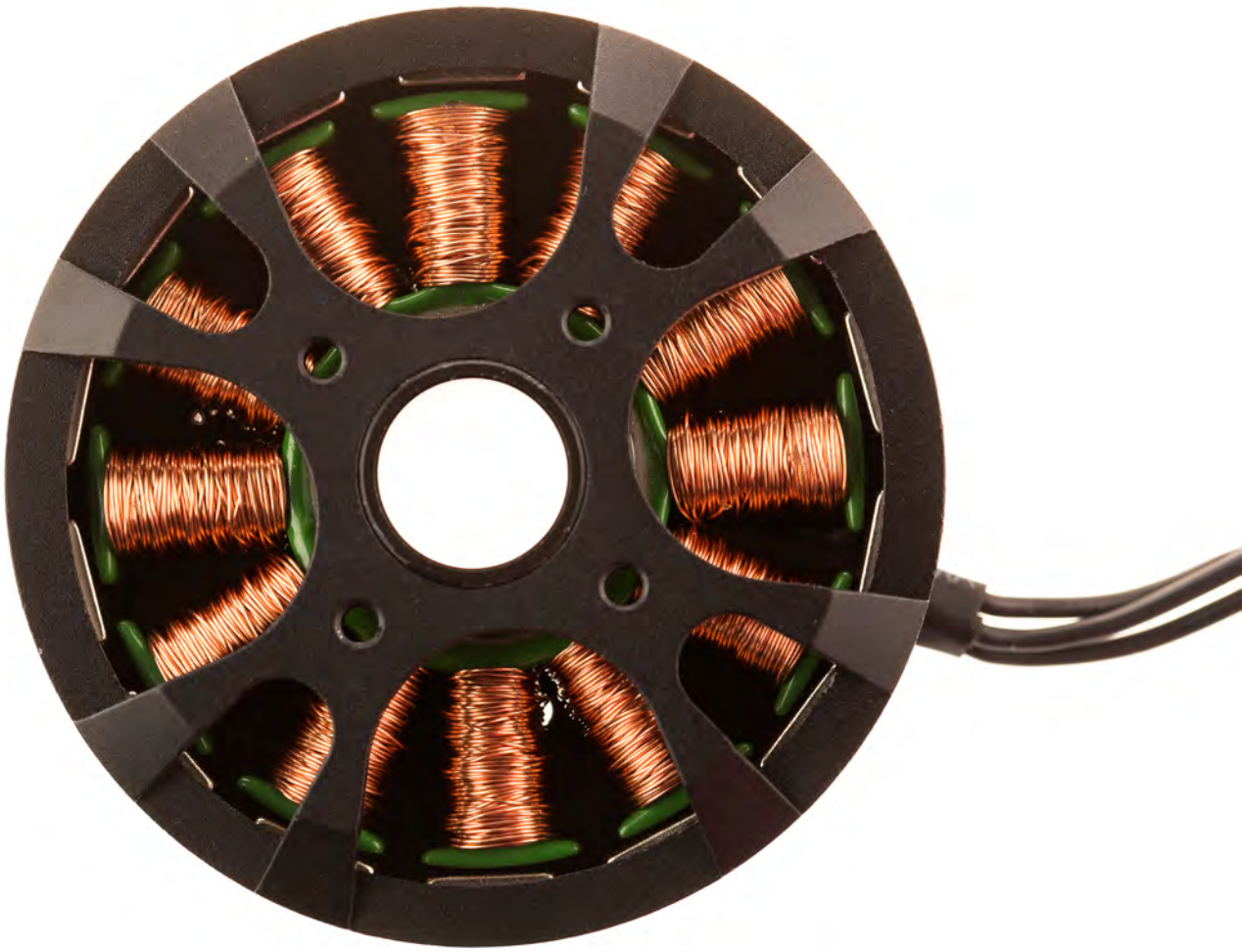


Beyond COMPLIANCE

Standards in modern electrotechnical manufacturing safety

Introduction

Electrical faults and accidents cause over half of UK house fires, resulting in at least one death every week, so it's not surprising that electrical product safety is a critical issue for all manufacturers.

Designers and manufacturers of electrical products must ensure their products comply with safety legislation and meet essential requirements. This responsibility also extends to their wider supply chain partnerships and continues once a product is on the market. Failure to do this brings serious reputational, financial and even criminal consequences.

This report outlines how manufacturers can use standards to help benchmark and improve safety across all stages of the product lifecycle – from design to recycling. It also examines how standards help shape functional safety

Safety first: protecting the consumer

Manufacturers of electrical products, as well as their suppliers, importers and distributors, are legally obligated to ensure those products are safe for consumers to use. This includes complying with relevant laws, showing regulatory compliance marks and meeting essential safety requirements.

Electrical goods for consumer use (as well as those that are reasonably likely to be used by them such as heavy-duty power tools), must be safe. This is regardless of whether they were bought new or second-hand, and whether they are used at home or as part of a service, for example a kettle in a hotel room.

Beyond this, manufacturers, and their supply chain network, must also keep records of associated technical documentation, label products appropriately and provide instructions on safe use.

Once a product is on the market, the manufacturer remains responsible for consumer safety. Distributors are also required to monitor the usage of products, reporting any identified risks back to the producer who must take action if needed, such as issuing a recall.

The legislation is clear. From New Zealand's Electricity (Safety) Regulations 2010 to Japan's Electrical Appliance and Material Safety Law (DENAN), also known as the PSE Mark, to the UK's Electrical Equipment (Safety) Regulations 2016, every country has legal requirements that must be satisfied before electrical equipment is placed on the market.

Failure to meet these requirements can result in criminal proceedings, fines and even imprisonment. There will also be associated costs involved with the forfeiture of goods and product recalls, not to mention the subsequent reputational damage.

The safety of individual consumers is a very real consideration. According to Electrical Safety First, electrical faults and accidents

cause more than half of all house fires in the UK every year, resulting in at least one death every week. Numbers like this make the safety of electrical products a truly critical issue for all manufacturers.

Beyond specific safety legislation, there are a variety of relevant standards that manufacturers can use to demonstrate compliance, minimize risk and protect consumers.

Perhaps the most important is ISO 9001, the world's most recognized quality management system. Through its implementation, manufacturers can establish and maintain a system to manage the design, development and delivery of their products.

Using ISO 9001 also helps businesses to reliably deliver what they say they are going to deliver, on time and to the quality expected. It provides a flexible framework to help manufacturers of all sizes, enabling them to consistently meet the needs of their customers.

Further, the standard allows manufacturers to manage their business effectively, leading to operational resilience and building long-term success. Beyond this, being certified to ISO 9001 is seen by many as a guarantee of uniformity of product across global boundaries ●

Cabling standards for manufacturers

In addition to ISO 9001, there are specific standards covering safety aspects for cabling related to electrical products. For example:

- BS 7211 provides specification for thermosetting insulated, non-armoured cables for electric power, lighting and internal wiring, with low emission of smoke or corrosive gases when affected by fire.
- BS 7629-1 provides the same specification for 300/500 V fire resistant screened cables.
- BS EN 50525 offers general requirements for low voltage energy cables of rated voltages up to and including 450/750 V (U0/U).
- BS 6004 specifies the requirements for PVC insulated and PVC sheathed cables for voltages up to and including 300/500 V, for electric power and lighting, while BS EN 50214 focuses on flat polyvinyl chloride sheathed flexible cables.
- IEC-60245-4 applies to rubber insulated cables, for voltages up to and including 450/750 V and IEC 60227-1 addresses polyvinyl chloride insulated cables of rated voltages up to and including 450/750 V.

These are just some of the most commonly required standards for electrical cables and will ensure that electrical goods meet worldwide standards of safety, reliability and compatibility with other equipment.

Functional safety and manufacturing

Digitalization and automation have transformed the way humans and machines interact across the industrial environment, and burgeoning technological advances promise new manufacturing norms.

Despite all this change, functional safety still has a vital role to play in protecting users in today's fast-moving industrial landscape. In many ways functional safety has actually never been more important. Consider the ongoing progression of autonomous vehicle technology, or the medical implants and devices governed by Internet of Things (IoT) data feeds.

Failure in these realms could have catastrophic repercussions. Even manufacturers of seemingly innocuous products or components must embed functional safety principles, to protect users from injury from misuse or accident.

Traditional safety assessments deal with potential hazards from electrical, mechanical and other design aspects that may occur during usage. Functional safety, however, focuses on the capability of the product to perform correctly and safely. This includes likely operator error and hardware and software failure, as well as environmental stress.

Through a process of risk analysis and verification, manufacturers, importers and resellers can offer consumers an acceptable level of protection, minimizing the severity and probability of harm should malfunction occur.

Taking a standards-based approach is the most efficient way for manufacturers to embed functional safety in their design and production operations.

BS EN 61508 is a seven-part series of standards which contains a set of requirements that can help manufacturers apply, design, deploy and maintain appropriate safety systems to reduce failures, while making compliance with safety regulation more straightforward. Meanwhile, the BS EN 61511 series, which has two parts, provides guidance to ensure that the safety instrumented systems (SIS) that protect critical processes are functionally safe.

The combined application of these standards can go a long way to embed a functional safety culture which will help manufacturers mitigate risk, reduce over-engineering (which saves money and materials) and increase trust amongst customers and stakeholders. It also drives continual improvement, ensuring the right safety levels are maintained in the lifecycle of a particular product or system ●

The increasing importance of functional safety

We spoke to Audrey Canning, Director of Virkonnen Ltd, about the increasing importance of functional safety – and how it has essentially become a requirement for every manufacturer:

Manufacturers need to be aware and understand the consequences if they don't work through this approach to safety. It's challenging, as many aren't used to thinking this way unless they've already had exposure to environmental and operational threats. Functional safety considers what could happen, which may be the thing you don't want to happen. It's about the methods, analyses and even the constraints you need to put on systems to keep risk at an acceptable level.

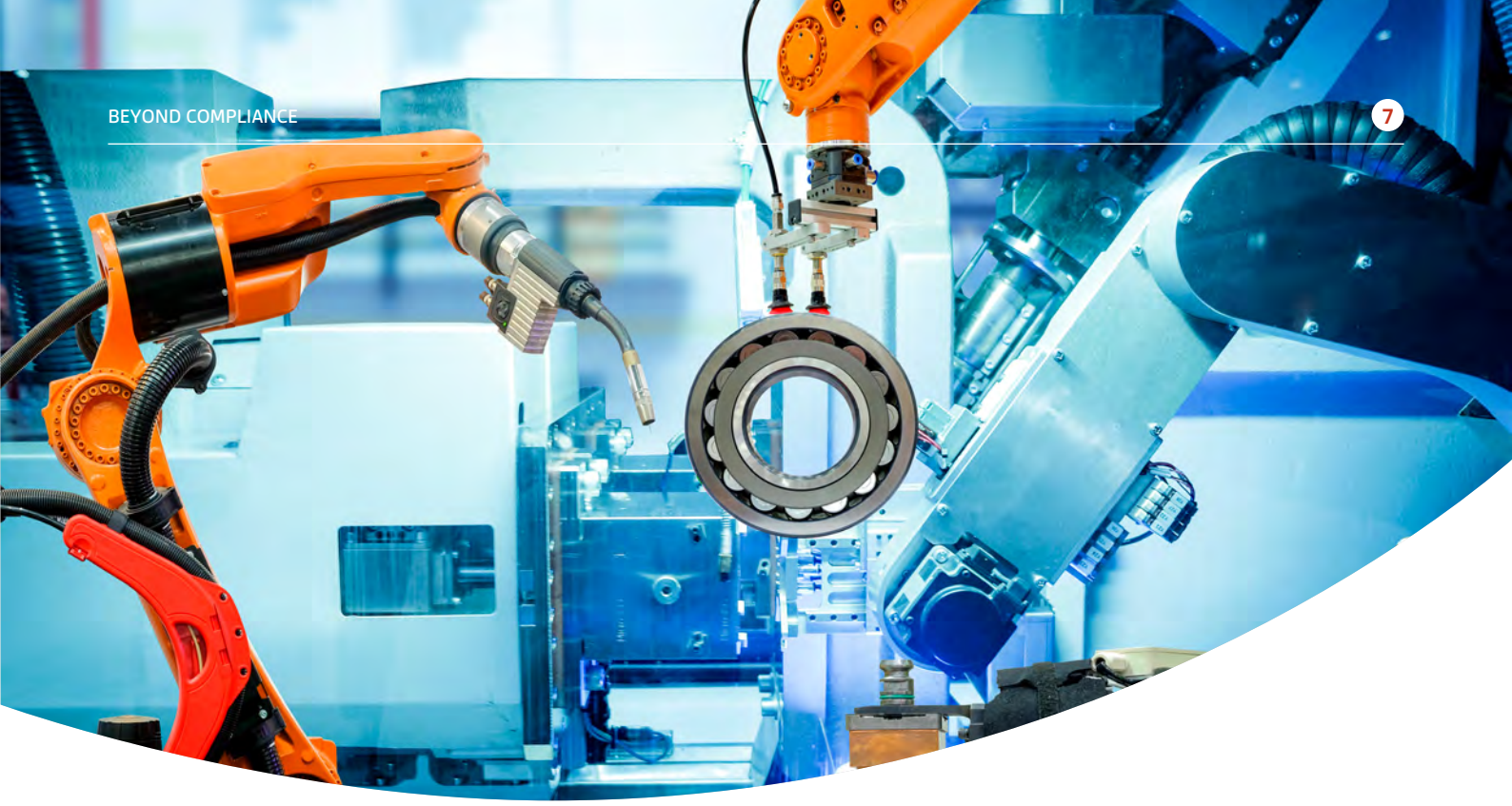
Products and equipment must behave in a predictable manner so you're able to predict the consequences of their use and respond appropriately to unintended consequences. Without functional safety, you are potentially putting human life at risk. At the same time, you're also putting your reputation at risk – so avoiding major consequences makes good commercial sense.

BS EN 61508 in particular is becoming increasingly important because of the level of complexity, automation and autonomy we have introduced, in recent years, to systems that have until now been relatively simple. Amidst the rapid change driving our current industrial revolution, manufacturers must meet new market demand; consumers want things more quickly and at lower cost – while also expecting improved functionality and interconnectivity.

This has led to more complex systems and more dependence on technology. We're building new layers of intricacy within our society. Therefore, manufacturers and designers need to take a more considered approach and incorporate functional safety standards from the outset.

Before long, most electrical devices in the home will be connected to the internet with remote control a real possibility. Meanwhile, machine learning and adaptable devices are already having a profound effect on the human-machine relationship.

It's clear that functional safety is the future for safe electronics, whatever your industry application, allowing us to move into the autonomous future with confidence.



The future factory: standards, safety and information security

The factory of the future is set to take advantage of several developing technological fields, such as machine learning, data processing, cloud computing, automation, the internet of things (IoT) and robotics.

Each of these converging areas presents different integration, safety and security challenges, and manufacturers can use standards to help navigate the path towards efficient and reliable digital production.

Firstly, every manufacturer will vary in terms of how readily it can adopt these enabling technologies. PAS 1040 sets out a practical guide for the manufacturing industry to aid digital technology adoption, such as artificial intelligence, robotics and IoT. It helps companies benchmark their own digital readiness and define areas for attention.

The future factory will also need to embrace a high degree of functional safety – ensuring that safety systems and equipment perform predictably and correctly in response to likely user input changes. BS EN 61511 provides a functional safety framework and application programming requirements for instrumented systems within the process industry sector.

Further to BS EN 61511, PD IEC TR 63074 provides guidance around security threats and vulnerabilities that could negatively influence the functional safety intended by specific safety-related control systems for machinery. PD IEC TR 63069 also outlines a framework for functional safety and cybersecurity for industrial-process measurement, control and automation.

Robotics and artificial intelligence (AI) feature prominently in today's leading-edge manufacturing processes. Companies can maintain safe robotic production operations using BS EN ISO 10218-1, which outlines design and safety requirements for industrial robots. It describes related hazards and provides requirements to mitigate these risks.

Along with cloud computing, the role of internet-connected sensors has become vital in almost every future factory scenario. Constantly monitoring operations, conditions, quality and efficiency while sharing information with other devices and equipment they are intrinsic to what makes a factory 'smart'.

PAS 7040 provides important guidelines for the trustworthiness and precision of networked sensors used in digital manufacturing. It examines security and cybersecurity issues that may impact sensor trustworthiness, including data transmission over a network.

Manufacturers can also make use of the BS EN IEC 62443 series of standards which provide security requirements for industrial automation and control systems.

From a more general data and cybersecurity perspective, manufacturers can create their own information security management system using ISO/IEC 27001, the internationally recognized information security management standard.

Finally, standards development is also active in this area to keep up with technological advances. IEC Technical Committee 65 (IEC TC 65) is tasked with preparing international standards for used for industrial process measurement, control and automation systems, while ISO Technical Committee 299 (ISO/TC 184) is working on a number of industrial robotics standards. ISO/TC 184 develops standardization for automation systems and their integration ●

We spoke to Steven Carter, Digital Manufacturing Integration Lead – SMART Factories (Cyber-Physical Systems), Rolls-Royce PLC, about the role of standards in the factory of the future.

“The future factory will be much like today’s factory, with manufacturers using automation, advanced cybersecurity, mechatronics, and robotics. Machine learning and artificial intelligence dependent IT infrastructure will be increasingly common, alongside blockchain-based advances. All will aid process, factory or supply chain automation. The challenge is to ensure it all works together in harmony as one true cyber-physical system or ‘systems of systems’, with true data interoperability.”

“Safety is crucial when it comes to integrated autonomous technologies, whether for a specific manufacturing process, or on a wider operational basis (and beyond – for example self-driving vehicles). Standards will play a vital role in the factory of the future, and there is ongoing development work to keep in step with technological innovation.”

“For long-term success, all industrial sectors must embrace and support standards development and use – from a safety, quality and system interoperability perspective. A standards-based approach helps teams work collaboratively, share best practice, respond quickly to problems, and push the boundary of what is possible.”

Electrotechnical manufacturing safety in the factory of the future

BS EN 61784
Industrial communication networks safety

BS EN 62061
Safety of machinery. Functional safety of safety-related electrical, electronic and programmable electronic control system.

BS EN 61511
Functional safety. Safety instrumented systems for the process industry sector.

BS EN 61557
Electrical safety in low voltage distribution. Monitoring devices in IT systems and equipment.

PAS 1040
Adopting digital technology, guidance.

ISO/IEC 27001
Information security management.

PD IEC/TS 80004
Nanotechnologies.

BS EN 50402
Electrical apparatus for the detection and measurement of combustible or toxic gases or vapours or of oxygen.

BS EN 60079
Guidance on the functional safety of fixed gas detection systems.

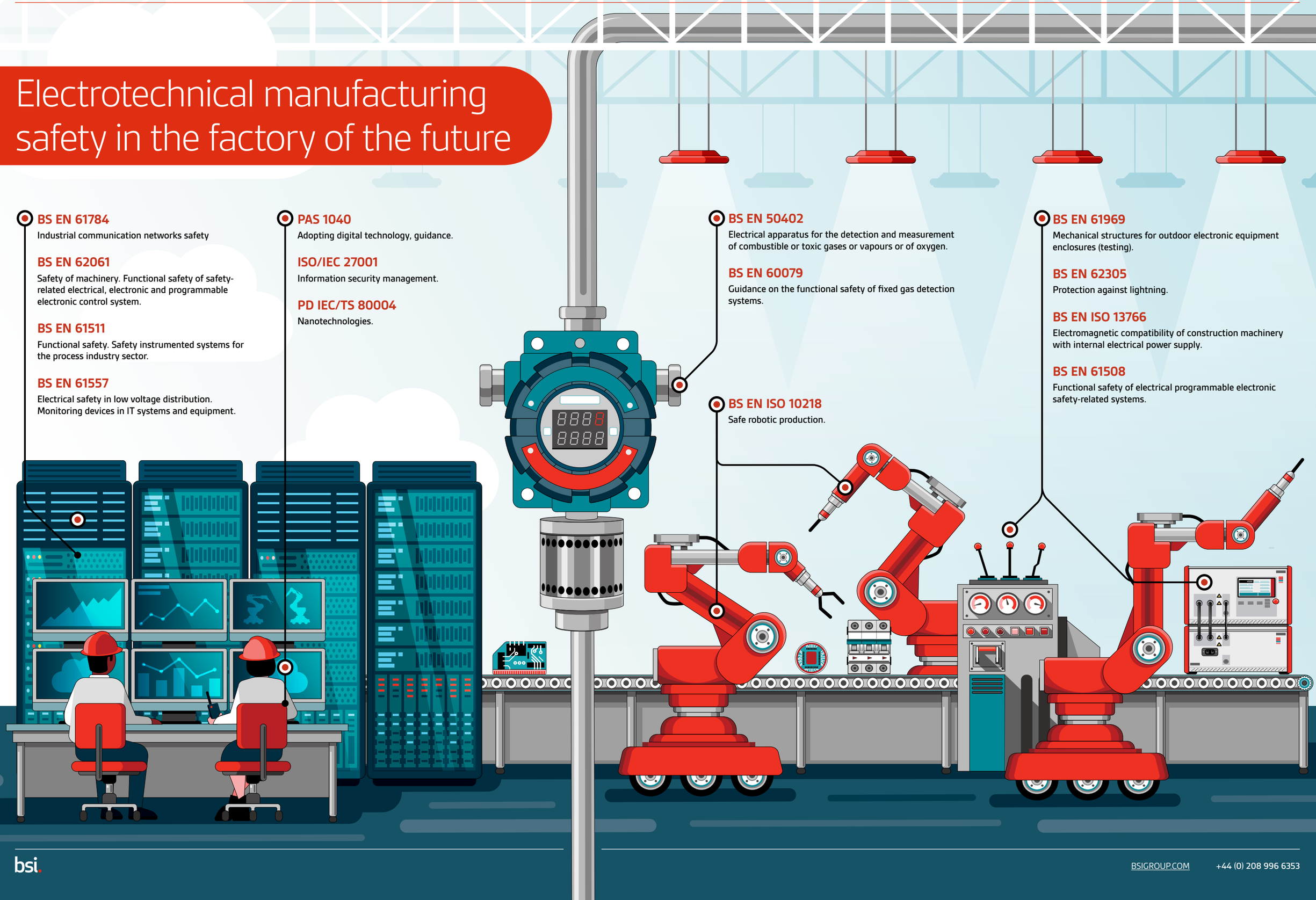
BS EN ISO 10218
Safe robotic production.

BS EN 61969
Mechanical structures for outdoor electronic equipment enclosures (testing).

BS EN 62305
Protection against lightning.

BS EN ISO 13766
Electromagnetic compatibility of construction machinery with internal electrical power supply.

BS EN 61508
Functional safety of electrical programmable electronic safety-related systems.



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