

THE ENGINEERING EQUIPMENT AND MATERIALS USERS' ASSOCIATION

Electrical Safety of Instruments, Instrument/Control Panels and Control Systems

A Design Guide

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ENGINEERING EQUIPMENT AND MATERIALS USERS' ASSOCIATION

The Engineering Equipment and Materials Users' Association, more commonly known as EEMUA, is a European non-profit membership Association helping companies that own or operate industrial facilities - the *users* of engineering equipment and materials.

EEMUA aims to improve the safety, environmental and operating performance of industrial facilities in the most cost-effective way, thereby demonstrating and pursuing leadership in asset management.

EEMUA Members pursue these aims through collaboration for mutual benefit, sharing engineering experiences and expertise and by promoting their distinct interests as the users of engineering products.

Specifically, the aims of EEMUA Member companies are achieved by:

- providing the organisation within which networking, information sharing and collaboration on non-competitive technical matters can take place;
- influencing the way written regulations are interpreted and applied in practice;
- presenting and promoting Members' views, and encouraging the application of good, sound engineering practices;
- developing user guides, specifications, training and competency schemes;
- facilitating Members' participation in national and international standards making;
- influencing relevant national and European legislation and regulations.

Formed in 1949 as the Engineering Equipment Users Association, and re-named in 1983 (as a result of taking over the materials association, OCMA), EEMUA has for more than fifty years given companies that own and operate process plants, power stations and other significant industrial facilities, a collaborative voice in addressing technical and engineering related issues that impact on good integrity management and asset management practices. The Association is open to companies of all sizes that meet its 'engineering user' criteria. Further details of current Members of EEMUA is available on the Association's website, www.eemua.org.

EEMUA activities often lead to the production of publications. These are prepared for Members' use and are often offered for sale as well.

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To enquire about corporate Membership, write to enquiries@eemua.org or call +44 (0)20 7621 0011.

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Comments will be considered by the relevant EEMUA Technical Committee and may be incorporated in future editions of this Publication. New editions will be publicised on the EEMUA website.

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Foreword

EEMUA Publication 178 was first issued in 1994. This original text has been reviewed by electrical practitioners and the result is this revised and updated 2nd Edition.

Incidents of electrical shock, burns and arcing continue to occur during the installation, commissioning, routine maintenance and testing of instruments, instrument/control panels and control systems. This fact demonstrates a need for this Publication, which gives a description of those safety aspects which should be considered, in a straightforward non-technical language, for use by technicians and engineers alike.

This Publication has been prepared principally for those who have little prior experience and wish to become aware of the basic issues, to become more proficient in their tasks and thereby contribute to their own safety and that of others. Those closely involved in the subject can also benefit from being reminded of the basic concepts.

This Publication is concerned solely with the means to minimise potential dangers resulting from inadvertent contact with instrument and control parts which may be live (carrying an electric current) at dangerous voltages. It does not address hazards attributable to any other cause.

This Publication has been prepared after discussions between EEMUA Member Companies and with additional advice from the GB Health & Safety Executive (HSE). Its content can therefore be considered to be authoritative and has been prepared to assist compliance with existing UK legislation. Whilst reference is mainly made in this Publication to legislation relevant to the United Kingdom, similar legislation has been enacted in most countries. National authorities should be consulted regarding legislation applicable in any specific country.

A significant change from the 1st Edition concerns the guidance on instruments. The original document gave guidance to those who designed instruments as well as those who subsequently specified, installed and used them. Now, instruments are generally purchased as standard items from international suppliers and consequently the user has less opportunity to influence the design. As a consequence, the former Chapter specific to instruments has been deleted but, where relevant, some aspects are included in the new Chapter 2 on instruments and control panels.

1. Introduction and Scope

Advice given in this Publication is intended to assist not only installers of instrumentation and control systems and panel builders who must satisfy the tightly specified requirements of large companies and utilities, but also those installers and panel builders upon whom the client relies entirely to produce a panel to meet the end application and which also complies with legislation concerning worker health and safety.

This Publication covers:

- instruments and their control panels;
- control systems;
- general observations from an inspector's viewpoint and legal aspects.

The guidance given applies to small instruments and equipment through to, for example, the control aspects of motors and provides details relevant to those who specify, build and subsequently install and use instruments.

This Publication is intended to apply to electrically powered instrument systems and their control panels used to measure, indicate, compute, control, record, etc. and which are suitable for use in process control and similar applications. However, as the requirements are based on the safe use of electricity, they are equally applicable to electrical equipment used for other purposes.

Fundamental principles to be followed at all times are:

- that all instrumentation and control equipment should be installed to facilitate accessibility and maintenance;
- that instrumentation and control equipment should be protected against any external influence to which they may be subjected, including electromagnetic interference;
- that the overall integrity of any control system should not be damaged or destroyed as a result of examination, maintenance, authorised alteration or expansion;
- that inappropriate or unauthorised alterations to wiring or to programmes of programmable systems are to be avoided, as such alterations may alter the functionality of the equipment and may also result in the designed safety functions not being preserved;
- supplementary to the above, but not detailed in this publication, is an inherent requirement to provide effective work instructions and, where necessary, permits to work and protective clothing.

Many of the accidents and injuries ascribed to electrical faults could be eliminated by attention to detail at all stages.

This Publication makes reference to the UK Electricity at Work Regulations 1989 and it is recommended that this document is studied in conjunction with this Publication. In countries outside the UK, similar regulations are usually available and should be studied likewise.

In the UK, the employment of 'Competent Persons' to undertake work is a requirement of the Electricity at Work Regulations 1989. Such a requirement exists in many other jurisdictions. This requirement for competency should be brought to the attention of all concerned, whether it is with design, manufacture,

installation, commissioning or any other activity where incompetence could compromise the safety of people and equipment.

Schemes such as CompEx™ provide training and certification for technicians working on electrical installations situated in potentially explosive atmospheres. EEMUA CompEx™ is a leading UK training, assessment and certification scheme for electrotechnical craftspersons working in potentially hazardous or explosive atmospheres, jointly developed in the 1990s through participation with industry, regulators, trades unions and others, and currently operated by JTL Ltd.

The safety requirements required when working at voltages greater than 1000 volts greatly exceed those required at low voltage. Consequently special training and clothing are required before work on high voltage power equipment is to be undertaken. It should be noted that high voltages may be found within some types of apparatus normally operating from low voltage sources.

Where hazards may be attributable to safety issues other than electrical, other regulations are likely to be applicable. This Publication does not deal with these non-electrical safety issues. Installers and panel builders should make themselves separately aware of their requirements.

For instance, for chemical agents or potentially explosive atmospheres, in the UK the Dangerous Substances and Explosive Atmospheres Regulations (DSEAR) will need to be considered. These Regulations implement the EU Directive on the safety and health protection of workers in potentially explosive atmospheres (1999/92/EC) and relevant parts of the Directive on chemical agents (98/24/EC).

For electromagnetic compatibility issues, the EMC Directive (2004/108/EC) is mandatory for all new equipment throughout the EU. International equivalents operate in most other countries. By meeting electromagnetic compatibility requirements, electromagnetic interference affecting the operation of electrical and electronic equipments is minimised. With poorly designed equipment, it is possible that electromagnetic radiation from one item could affect the operation of another item.

For equipment provided for work in general, regulations such as the UK Provision and Use of Work Equipment Regulations, have to be met.

Under regulations, such as the UK Construction (Design and Management) Regulations, there is a duty on employers to ensure that risks are designed out. The safety of persons and plant is at risk where equipment fails to comply with the regulations.