BS 4877:2016

BSI Standards Publication

Nuclear reactor instrumentation and control – Code of practice

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Publishing and copyright information

Published by BSI Standards Limited 2016

ISBN 978 0 580 87517 5

ICS 27.120.10

The following BSI references relate to the work on this document:
Committee reference NCE/8
Draft for comment 16/30310379 DC

Publication history

First published December 1972
Second (present) edition, October 2016

Amendments issued since publication

Date	Text affected

Contents

Summary of pages

This document comprises a front cover, an inside front cover, pages i to iv, pages 1 to 62, an inside back cover and a back cover.

Foreword

Publishing information

This British Standard is published by BSI Standards Limited, under licence from The British Standards Institution, and came into effect on 31 October 2016. It was prepared by Technical Committee NCE/8, *Instrumentation, Control & Electrical Systems of Nuclear Facilities*. A list of organizations represented on this committee can be obtained on request to its secretary.

Supersession

This British Standard supersedes BS 4877:1972, which is withdrawn.

Information about this document

This British Standard has been written by I&C engineers based on experience of typical UK plants so far constructed, with experience of some other plants.

This is a full revision of the standard, originally published in 1972, and introduces the following principal changes:

a) the role of the design base of the plant and the life cycle in the I&C design;

b) summaries of the principal reactor faults for which protection is needed;

c) an outline of the main I&C systems on a nuclear plant and their role in defence in depth;

d) the addition of recommendations for specific measurements, e.g. control rod position, secondary coolant, emergency feedwater flow and electrical system state;

e) the addition of recommendations covering the use of software; and

f) an annex listing and describing the most relevant International Atomic Energy Agency (IAEA) and International Electrotechnical Commission (IEC) documents.

This British Standard gives objectives and recommendations based upon practical experience and meets the principles of the relevant IAEA publications. Detailed references to standards are not included within the clauses, but Annex A contains a comprehensive guide to the relevant IEC and IAEA Safety Guides and Standards.

Use of this document

As a code of practice, this British Standard takes the form of guidance and recommendations. It should not be quoted as if it were a specification and particular care should be taken to ensure that claims of compliance are not misleading.

Any user claiming compliance with this British Standard is expected to be able to justify any course of action that deviates from its recommendations.

Users of this British Standard are expected to be able to demonstrate compliance with all recommendations contained within.

Conformity to this British Standard does not, in itself, meet the requirements of the Office for Nuclear Regulation for nuclear safety justification and users are directed to the ONR (www.onr.org.uk) for further information.

This British Standard has been developed for use by designers, constructors and users of nuclear power plant instrumentation systems, to give guidance and the background to the design and implementation practice for the instrumentation and control (I&C) systems of a nuclear plant.

The users of this document are expected to include:

a) experienced I&C engineers unfamiliar with nuclear power and engineers of other disciplines;

b) engineers needing a comprehensive guide to the relevant IEC standards;

c) those needing a basis in the key safety role of I&C systems in nuclear power;

d) managerial and other professionals needing a background on current practice; and

e) I&C engineers who wish to understand the general principles of I&C on nuclear plants, readable by those with limited experience, and who might have responsibility for others who are designing the detailed I&C for the plant.

Presentational conventions

The provisions of this standard are presented in roman (i.e. upright) type. Its recommendations are expressed in sentences in which the principal auxiliary verb is "should".

Commentary, explanation and general informative material is presented in smaller italic type and does not constitute a normative element.

The word "should" is used to express recommendations of this standard. The word "may" is used in the text to express permissibility, e.g. as an alternative to the primary recommendation of the Clause. The word "can" is used to express possibility, e.g. a consequence of an action or an event.

Notes and commentaries are provided throughout the text of this standard. Notes give references and additional information that are important but do not form part of the recommendations. Commentaries give background information.

Contractual and legal considerations

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

Compliance with a British Standard cannot confer immunity from legal obligations.

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1 Scope

This British Standard provides recommendations for determining the I&C design and identifying the I&C systems and measurements required on a nuclear reactor plant, including the equipment required for reactor safety and protection, automatic control, and for the information and control in the main and supplementary control rooms of the nuclear reactor plant.

This British Standard provides recommendations for a clear life cycle for the design and implementation of control and instrumentation systems. This includes the documentation of the I&C design basis, classification of functions according to their safety importance, identification of a fault schedule and of internal and external hazards such as fire, environmental and seismic events or flood.

This British Standard also provides recommendations for the main I&C systems on the plant and control rooms including:

- sensors;
- actuator interface operation;
- measurements;
- measurement methods;
- the reactor protection system;
- control and display facilities for reactor control and instrumentation; and
- power supplies and communication systems.

This British Standard does not cover commercial or managerial matters, the measurement and control of radioactivity releases, or the specific faults that require protection. It does not cover refuelling systems, the emergency control centre or technical support centre, off-site support for emergencies, or what constitutes an acceptable radiological risk.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

BS 3693, *Recommendations for design of scales and indexes on analogue indicating instruments*

3 Terms, definitions and abbreviations

3.1 Terms and definitions

For the purposes of this British Standard, the following terms and definitions apply.

NOTE Terms are used in accordance with the definitions in the IAEA safety glossary [1].

3.1.1 accident conditions

deviations from normal operation that are less frequent and more severe than anticipated operational occurrences