

Nuclear power plants — Instrumentation important to safety — Determination and maintenance of trip setpoints

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National foreword

This British Standard reproduces verbatim IEC 61888:2002 and implements it as the UK national standard.

The UK participation in its preparation was entrusted to Technical Committee NCE/8, Reactor instrumentation, which has the responsibility to:

- aid enquirers to understand the text;
- present to the responsible international/European committee any enquiries on the interpretation, or proposals for change, and keep the UK interests informed;
- monitor related international and European developments and promulgate them in the UK.

A list of organizations represented on this committee can be obtained on request to its secretary.

Cross-references

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**Centrales nucléaires de puissance –
Instrumentation importante pour la sûreté –
Détermination et maintenance des points
de consigne**

**Nuclear power plants –
Instrumentation important to safety –
Determination and maintenance
of trip setpoints**



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INTERNATIONAL ELECTROTECHNICAL COMMISSION

NUCLEAR POWER PLANTS – INSTRUMENTATION IMPORTANT TO SAFETY – DETERMINATION AND MAINTENANCE OF TRIP SETPOINTS

FOREWORD

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International Standard IEC 61888 has been prepared by subcommittee 45A: Reactor instrumentation, of IEC technical committee 45: Nuclear instrumentation.

The text of this standard is based on the following documents:

FDIS	Report on voting
45A/444/FDIS	45A/464/RVD

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 3.

Annex A is for information only.

The committee has decided that the contents of this publication will remain unchanged until 2008. At this date, the publication will be

- reconfirmed;
- withdrawn;
- replaced by a revised edition, or
- amended.

INTRODUCTION

The purpose of this International Standard is to provide descriptions and recommendations on how to determine and maintain calculations for instrument setpoints associated with IEC 61513. This standard addresses known contributing errors in the channel from the process (including the primary element and sensor) through to and including the final setpoint device. This standard applies to the determination of setpoints used for automatic actions. The recommendations may also be used to determine indicator uncertainties for testing or operator decisions.

In general, IAEA NS-R-1 and member country government regulations require that, where an important setpoint is specified for a variable on which a safety limit has been placed, the setting is so chosen that automatic protective action will correct the most severe abnormal situation anticipated before a safety limit is exceeded. Inappropriate selection of a setpoint that does not leave a sufficient margin to account for instrument accuracy, the expected environment, and minor calibration variations can result in failure to trip before a safety limit is exceeded. Protective instruments are provided with setpoints where specific actions are either initiated, terminated or prohibited. Setpoints must be maintained within prescribed limits as defined by the operating licenses through periodic checks of the ability of the channel to perform its function.

The single most prevalent reason for the drift of a setpoint out of compliance with a license requirement or technical specification has been the selection of a setpoint that does not allow a sufficient margin between the license or technical specification limit and the actual setting to account for instrument accuracy, the expected environment and minor calibration variations. In some cases, the setpoint selected was numerically equal to the license or technical specification limit and stated as an absolute value, thus leaving no apparent margin for uncertainties. In other cases, the setpoint was so close to the upper or lower limit of the instrument's range that instrument drift placed the setpoint beyond the instrument's range, thus nullifying the trip function. Other causes for drift of a setpoint out of conformity with the license or technical specifications have been instrument design inadequacies and questionable calibration procedures.

NUCLEAR POWER PLANTS – INSTRUMENTATION IMPORTANT TO SAFETY – DETERMINATION AND MAINTENANCE OF TRIP SETPOINTS

1 Scope

This standard defines the requirements for assuring that automatic setpoints for nuclear safety system instrumentation (as defined in clause 3), are established and maintained within specified limits in nuclear power plants and nuclear reactor facilities.

2 Normative references

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

IEC 60050-394:1995, *International Electrotechnical Vocabulary (IEV) – Chapter 394: Nuclear instrumentation: Instruments*

IEC 60671, *Periodic testing and monitoring of the protective system of nuclear reactors*

IEC 61513:2001, *Nuclear power plants – Instrumentation and control for system important to safety – General requirements for systems*

IAEA NS-R-1: 2000, *Safety of nuclear power plants: Design*

3 Definitions

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

NOTE Additional definitions related to instrumentation terminology may be found in IEC 60050-394.

3.1

allowable value

a limit value that the trip setpoint may have when tested periodically, beyond which appropriate action shall be taken

3.2

analytical limit (of setpoint)

limit of a measured or calculated variable established by the safety analysis to ensure that a safety limit is not exceeded. The margin between the analytical limit (of the setpoint) and the safety limit allows to take into account:

- the response time of the instrument channel,
- the range of transients due to the considered accident.

3.3

as found

the condition in which a channel, or portion of a channel, is found after a period of operation and before recalibration (if necessary)

3.4

as left

the condition in which a channel, or portion of a channel, is left after calibration or final setpoint device setpoint verification

3.5

drift

an undesired change in output over a period of time where change is unrelated to the input, environment, or load

3.6

error

the algebraic difference between the indication and the ideal value of the measured signal

3.7

final setpoint device

a component, or assembly of components, that provides input to the process voting logic for actuated equipment

NOTE Examples of final setpoint devices are bistables, relays, pressure switches, and level switches.

3.8

foldover

a device characteristic exhibited when a further change in the input produces an output signal that reverses its direction from the specified input-output relationship

3.9

independent uncertainty

uncertainty components are independent of each other if their magnitudes or algebraic signs are not significantly correlated

3.10

instrument channel

an arrangement of components and modules, including sensor(s), as required to generate a single protective action signal when required by a plant condition

3.11

instrument channel range

the region between the limits within which a quantity is measured, received, or transmitted. Is expressed by stating the lower and upper instrument channel range values.

3.12

limiting safety system setting (LSSS)

limiting safety system settings for nuclear reactors are settings for automatic protective devices related to those variables having significant safety functions

3.13

nuclear safety system instrumentation

electronic and electrical equipment or instruments for ensuring the proper control and monitoring of a nuclear reactor, including all control and safety system instrumentation