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ANSI/ISA-67.04.01-2018

Setpoints for Nuclear Safety-Related Instrumentation

Approved 8 December 2018

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Preface

This preface, as well as all footnotes and annexes, is included for information purposes and is not part of ANSI/ISA-67.04.01-2018.

The standards referenced within this document may contain provisions which, through reference in this text, constitute requirements of this document. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this document are encouraged to investigate the possibility of applying the most recent editions of the standards indicated within this document. Members of IEC and ISO maintain registers of currently valid International Standards. ANSI maintains registers of currently valid U.S. National Standards.

This document has been prepared as part of the service of ISA toward a goal of uniformity in the field of instrumentation. To be of real value, this document should not be static but should be subject to periodic review. Toward this end, the Society welcomes all comments and criticisms and asks that they be addressed to the Secretary, Standards and Practices Board; ISA; 67 T.W. Alexander Drive; P. O. Box 12277; Research Triangle Park, NC 27709; Telephone (919) 549-8411; Fax (919) 549-8288; E-mail: standards@isa.org.

The ISA Standards and Practices Department is aware of the growing need for attention to the metric system of units in general, and the International System of Units (SI) in particular, in the preparation of instrumentation standards. The Department is further aware of the benefits to USA users of ISA standards of incorporating suitable references to the SI (and the metric system) in their business and professional dealings with other countries. Toward this end, this Department will endeavor to introduce SI-acceptable metric units in all new and revised standards, recommended practices, and technical reports to the greatest extent possible. *Standard for Use of the International System of Units (SI): The Modern Metric System*, published by the American Society for Testing & Materials as IEEE/ASTM SI 10-97, and future revisions, will be the reference guide for definitions, symbols, abbreviations, and conversion factors.

It is the policy of ISA to encourage and welcome the participation of all concerned individuals and interests in the development of ISA standards, recommended practices, and technical reports. Participation in the ISA standards-making process by an individual in no way constitutes endorsement by the employer of that individual, of ISA, or of any of the standards, recommended practices, and technical reports that ISA develops.

Instrument setpoint drift is a problem that has led to numerous abnormal occurrence reports (now referred to as "Licensee Event Reports"). Section 50.36, "Technical Specifications," of Code of Federal Regulations, Title 10, Chapter 1, Part 50, Washington, D.C., 1987, requires that, where a limiting safety system setting (LSSS) is specified for a variable on which a safety limit has been placed, the setting be 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 allow sufficient margin to account for instrument accuracy, the expected environment, and minor calibration variations can result in calculated drift allowances insufficient for the instrument used. Protective instruments are provided with setpoints where specific actions are either initiated, terminated, or prohibited. Setpoints correspond to certain provisions of technical specifications that are incorporated into the facility operation license.

The single most prevalent reason for the drift of a setpoint out of compliance with a technical specification has been the selection of a setpoint that does not allow a sufficient margin between the technical specification limit to account for instrument accuracy, the expected environment, and minor calibration variations. In some cases, the setpoint selected was numerically equal to the 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 technical specifications have been instrumentation design inadequacies and less than adequate calibration procedures.

ISA sponsored a review of the setpoint drift problem in April 1975 by establishing the SP67.4 Subcommittee (now renumbered as ISA67.04). The Committee's review indicated that a more thorough consideration of setpoint drift was necessary in the design, test, purchase, installation, and maintenance of nuclear safety-related instrumentation.

The 1987 revision was made to provide clarification and to reflect current industry practice. The term "trip setpoint" was made consistent with the terminology used in the NRC Standard Technical Specifications and reflected what previously was known as "upper setpoint limit."

Many of the changes provided in the 1994 revision reflect the Improved Technical Specification program (a cooperative effort between industry and the USNRC). With the issuance of ISA-RP67.04, Part II, *Methodologies for the Determination of Setpoints for Nuclear Safety-Related Instrumentation*, this document became Part I. Additional changes were made to reflect the inclusion of the Recommended Practice, Part II to this standard. Due to changes in ISA policy, ISA-67.04 Part I, was renumbered ANSI/ISA-67.04.01, and ISA-67.04 Part II was renumbered ISA-RP67.04.02.

The 2006 revision addressed a concern with the basic concept of determining a single "allowable value" as an acceptance criterion for testing. A single value did not support doing testing in various plant modes or with reduced setpoints. The single value often only applied to rack-mounted equipment exclusive of the sensors, which are usually the largest error contributors. And finally, there were questions regarding the appropriateness of using statistical combination methods when actual uncertainties had been measured in the field. As a result, the 2006 revision recommended one or more performance tests, whose results would have to support the technical specification requirements for the system.

The 2011 reaffirmation updated the revision of ISA-RP67.04.02 to 2010 and corrected some minor editorial errors.

The 2018 revision adds content in the following four areas:

- 1) Provision of a standard method for addressing the analytical limit avoidance probability at an appropriate statistical confidence level;
- 2) Incorporation of improved guidance establishing statistical confidence and maintaining setpoints;
- 3) Providing the definition of tolerance interval and a recommended method of combination of uncertainties; and
- 4) Incorporating standards for performance monitoring in Sections 4.6 and 6.1 to provide more specific requirements on as-found and as-left tolerances, and required actions when instrumentation fails performance test criteria.

This standard is intended for use primarily by the owners of nuclear power plant facilities or their agents (nuclear steam system suppliers, architect/engineers, etc.) in establishing procedures for determining setpoints, setpoint margins, and test routines in safety-related instrument channels. However, it is equally applicable to large-scale nuclear production reactors.

This standard uses statistical nomenclature, which is customary and familiar to personnel responsible for nuclear power plant setpoint calculations and instrument uncertainty evaluation. It should be noted that this nomenclature may have different definitions in other statistical applications and is not universal, nor is it intended to be. Furthermore, in keeping with the conservative philosophy employed in nuclear power-plant calculations, the combination of uncertainty methodology for both independent and dependent uncertainty components is intended to be bounding. To provide a conservative estimate, the uncertainty should bound the expected operating envelope to ensure safe operation. In cases in which more precise estimation of measurement uncertainty is required, more sophisticated techniques should be employed.

Adherence to this standard will not itself suffice to protect the public health and safety because it is the integrated performance of the structures, the mechanical systems, the fluid systems, the instrumentation, and the electrical systems of the plant that limit the consequences of design-basis events. On the other hand, failure to meet these requirements may be an indication of system inadequacy. Each application for a construction permit or an operating license for a nuclear power plant is required to develop these items to comply with Title 10, Code of Federal Regulations, Chapter 1, Part 50. Applicants have the responsibility to assure themselves and others that this integrated performance is adequate.

ISA Standards Working Group ISA67.04 operates under ISA67, the Nuclear Power Plant Standards Committee, Daniel Steik, Chairman.

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