

**ANSI/ISA-S67.02.01-1996**

Approved June 5, 1996

Standard

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**Nuclear Safety-Related  
Instrument Sensing Line  
Piping and Tubing  
Standard for Use in  
Nuclear Power Plants**



ANSI/ISA-S67.02.01 — Nuclear Safety-Related Instrument-Sensing Line Piping and Tubing  
Standard for Use in Nuclear Power Plants

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## Preface

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This preface and all annexes referring to other standards are included for informational purposes only and are not part of ISA-S67.02.01. Applicability of other standards or codes are as stated in the text. Where references are made to other standards, a particular paragraph reference is indicated for clarity where applicable.

This Standard has been prepared as part of the service of ISA, the international society for measurement and control, 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 Alexander Drive; P. O. Box 12277; Research Triangle Park, NC 27709; Telephone (919) 549-8411; Fax (919) 549-8288; E-mail: standards@isa.org.

ISA Committee SP67.02 formed in 1974, adopted its draft scope on September 19, 1974, and forwarded it to ISA's Standards and Practices Board for acceptance as part of the minutes of that meeting. On December 9, 1974, this Committee received an approved Scope and Project, Charter N677, from American National Standards Institute (ANSI).

It is the consensus of the Committee that this Standard addresses those portions of the safety-related instrument sensing line tubing (piping) runs that are unique to the nuclear power plant, concentrating therefore on meeting nuclear safety considerations as legislated by 10 CFR 50 (Code of Federal Regulations, Title 10, Part 50), Appendix A Criteria. The separation of redundant sensing lines as contained in this Standard is predicated on the assumption that the equipment and instruments to which those sensing lines are connected are adequately separated.

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, recommended practices, and technical reports. 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 and acceptable metric units as optional alternatives to English units in all new and revised standards to the greatest extent possible. *The Metric Practice Guide*, which has been published by the Institute of Electrical and Electronics Engineers as ANSI/IEEE Std 268-1992, and future revisions, will be the reference guide for definitions, symbols, abbreviations, and conversion factors. SI (Metric) unit conversions in this standard are given only to the precision intended in selecting the original numerical value. When working in the SI units system, the given SI value should be used. When working in customary U.S. units, the given U.S. value should be used.

Where the failure of instrument sensing lines from nuclear safety-related processes to instruments that are not nuclear safety-related is demonstrated not to produce either unacceptable leakage of process fluid or unacceptable flooding, jet impingement forces or other failure-related hazards to nuclear safety-related equipment, this standard does not apply.

Instrument sensing lines from nonnuclear safety-related processes to nuclear safety-related instruments are not in the scope of this Standard.

The Figures contained in this revision have been revised and reduced to make them much more user friendly.

The next revision of this Standard will incorporate ANSI/ISA-S67.10-1994.

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## 1 Scope

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This Standard covers design, protection, and installation of nuclear safety-related instrument sensing lines for light water cooled nuclear power plants. The Standard covers the pressure boundary requirements for sensing lines up to and including one inch (25.4 mm) outside diameter or three-quarter inch nominal pipe (19 mm). The boundaries of this Standard span from the root valve/piping class change, up to but not including, the manufacturer-supplied instrument connection. Refer to ANSI/ISA-S67.10 (not in the scope of this standard) for sample tubing criteria.

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## 2 Purpose

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This Standard establishes the applicable code requirements and code boundaries for the design and installation of instrument sensing lines interconnecting nuclear safety-related power plant processes with both nuclear safety-related and nonnuclear safety-related instrumentation.

This Standard addresses the pressure boundary integrity of an instrument sensing line in accordance with the appropriate parts of Section III, *Boiler and Pressure Vessel Code*, American Society of Mechanical Engineers (ASME) or American National Standards Institute (ANSI) B31.1, as applicable and the assurance that the protection function of the nuclear safety-related instruments is available.

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## 3 Definitions

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**3.1 accessible isolation valve:** The isolation valve nearest the measured process on an instrument sensing line, which is available to personnel during normal plant operation. The root valve may or may not perform the function of the accessible isolation valve, dependent on its location.

**3.2 instrument channel:** An arrangement of components and modules as required to generate a single protective-action signal when required by a plant condition. A channel loses its identity where single protective action signals are combined. The definition is further modified as follows: A collection of instrument loops, including their sensing lines, that may be treated or routed as a group while being separated from instrument loops assigned to other redundant groups.

**3.3 instrument shutoff valve:** The valve or valve manifold nearest the instrument.

**3.4 loop:** A combination of one or more interconnected instruments arranged to measure and/or control a process variable.

**3.5 nonnuclear-safety related (NNS):** Any instrument not included in *nuclear safety-related* (3.6).

**3.6 nuclear safety-related (NSR):** That which is essential to the following:

- a) Provide emergency reactor shutdown.
- b) Provide containment isolation.
- c) Provide reactor core cooling.
- d) Provide for containment or reactor heat removal.
- e) Prevent or mitigate a significant release of radioactive material to the environment or is otherwise essential to provide reasonable assurance that a nuclear power plant can be operated without undue risk to the health and safety of the public.
- f) Provide for maintaining safe shutdown condition.

Where the term “Nuclear Safety-Related” is used in this Standard, it refers to meeting the requirements of Title 10, Part 50, Code of Federal Regulations (10 CFR 50), Appendix A.

**3.7 redundant sensing line(s):** Sensing lines for redundant instruments as used in this Standard are defined as a sensing line or group of lines that are provided to duplicate the function of another sensing line; e.g., sensing lines that transfer pressure energy for measurement of the same pressure energy for the same process.

**3.8 root valve:** The first valve located on the instrument sensing line after it taps off the main process.

**3.9 sensing line:** For the purpose of this Standard, a pipe or tube of relatively static fluid that connects the process being sensed to the sensor (transducer).

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## 4 Pressure boundary and mechanical design requirements

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### 4.1 Summary of requirements

Tables 1 and 2 summarize the minimum pressure boundary and mechanical design requirements for nuclear safety-related instrument sensing lines utilized in nuclear power plants. Table 1 applies to instrument sensing lines that do not penetrate the primary reactor containment, and Table 2 applies to instrument sensing lines that penetrate the primary reactor containment.

Tables 1 and 2 are divided into four columns. Column 1 refers the user to the applicable figure(s) that graphically show the mechanical design requirements specified in Columns 2, 3, and 4. The figure referenced in Column 1 also indicates the pressure boundary scope of this Standard. Column 2 indicates the process system code classification. Column 3 indicates the instrument sensing line seismic category. Where more than one seismic category is listed, the seismic category change is shown on the figure(s) referenced in Column 1. Column 4 indicates the applicable design code for the instrument sensing line. Where more than one design code is listed, the design code change is shown on the figure(s) referenced in Column 1.

## 4.2 Mechanical design requirements

The design of components, parts, and appurtenances utilized in the instrument sensing lines under the scope of this Standard shall, as a minimum, be in accordance with the design code(s) specified in Column 4 of [Tables 1 and 2](#). [Figures 1 through 6](#) illustrate typical applications of these requirements.

### 4.2.1 Instrument sensing lines in accordance with ANSI B31.1 power piping

Where ANSI B31.1 is required by this Standard in [Clause 4](#), the user shall comply with ANSI B31.1, paragraph 122.3 requirements for materials, design, fabrication, examination, and testing.

Where instrument sensing lines identified as ANSI B31.1 are interconnected with process piping systems classified as ASME Class 1, 2, or 3 and are identified as Seismic Category I in [Tables 1 and 2](#), the following additional requirements shall apply:

- a) A material manufacturer's certificate of compliance with the material specification shall be furnished for all pressure boundary items.
- b) All pressure boundary items shall be pressure tested in accordance with the applicable ANSI/ASME Code.
- c) Design and service limits for instrument sensing lines identified as ANSI B31.1 and Seismic Category I by this Standard shall be in accordance with ANSI B31.1, paragraph 104.8. Moments due to earthquakes and other transient dynamic loading shall be included.
- d) The connection between ASME Section III and ANSI B31.1 components shall be in accordance with ASME Section III.

### 4.2.2 Media isolation devices, bellows or diaphragms, and permanently filled capillaries

This subclause applies to capillary instrumentation that are not furnished preassembled by the instrument manufacturer.

#### 4.2.2.1 Bellows or diaphragms

Where bellows or diaphragms are identified as ANSI B31.1 by this Standard, these devices shall be designed in accordance with ANSI B31.1, paragraph 104.7. The requirements of [4.2.1](#) of this Standard shall also apply.

#### 4.2.2.2 Permanently filled capillary tubes

Where permanently filled capillary tubes are identified as ANSI B31.1 by this Standard, the pressure design and minimum wall thickness shall be established in accordance with ANSI B31.1, or the pressure design shall be established by proof tests in accordance with ASME Section I, paragraph A-22.

#### 4.2.2.3 Pressure testing

Each permanently filled capillary tube and media isolation device shall be pressure tested in accordance with the applicable ANSI/ASME Code.

#### 4.2.2.4 Fill fluid

The fill fluid used shall not shorten the life of or prevent the piping or tubing wetted parts from performing their required functions. Mercury shall not be used as a fill fluid.

**Table 1 — Minimum mechanical design requirements for instrument piping and tubing that do not penetrate the primary reactor containment**

<b>Illustration</b>	<b>Process Piping ASME Code Class</b>	<b>Instrument Sensing Line Seismic Category</b>	<b>Applicable Design Code as invoked by this Standard in Clause 4</b>
<b>Figure 1</b>			
Water-filled instrument sensing lines for water, gas, or steam service  ASME Class 1 and 2 processes	1 and 2	Category I	ASME III, Class 2 ANSI B31.1
<b>Figure 2</b>			
Water-filled instrument sensing lines for water, gas, or steam service  ASME Class 3 process	3	Category I	ASME III, Class 3 ANSI B31.1
<b>Figure 3</b>			
Water-filled instrument sensing lines for water, gas, or steam service nonsafety, process nuclear safety-related instrument	N/A	Category I	ANSI B31.1

#### NOTES

1. This Table and associated Figures do not contain physics of application or containment isolation requirements.
2. See referenced Figure(s) for seismic category and design-code boundaries.

**Table 2 — Minimum mechanical design requirements for instrument piping and tubing that penetrate the primary reactor containment**

<b>Illustration</b>	<b>Process Piping ASME Code Class</b>	<b>Instrument Sensing Line Seismic Category</b>	<b>Applicable Design Code as invoked by this Standard in Section 4</b>
<b>Figure 4</b>			
Containment atmosphere instrument sensing lines, instruments outside containment	N/A	Category I	ASME Section III, Class 2 and ANSI B31.1
<b>Figure 5</b>			
Containment atmosphere instrument sensing lines, capillary-filled instruments outside containment	N/A	Category I	ASME Section III, Class 2
<b>Figure 6</b>			
Containment atmosphere instrument sensing lines, diaphragm with filled instruments outside containment	N/A	Category I	See 4.2.2.

**NOTES**

1. This Table and associated Figures do not contain physics of application or containment isolation requirements.
2. See referenced Figure(s) for seismic category and design-code boundaries.

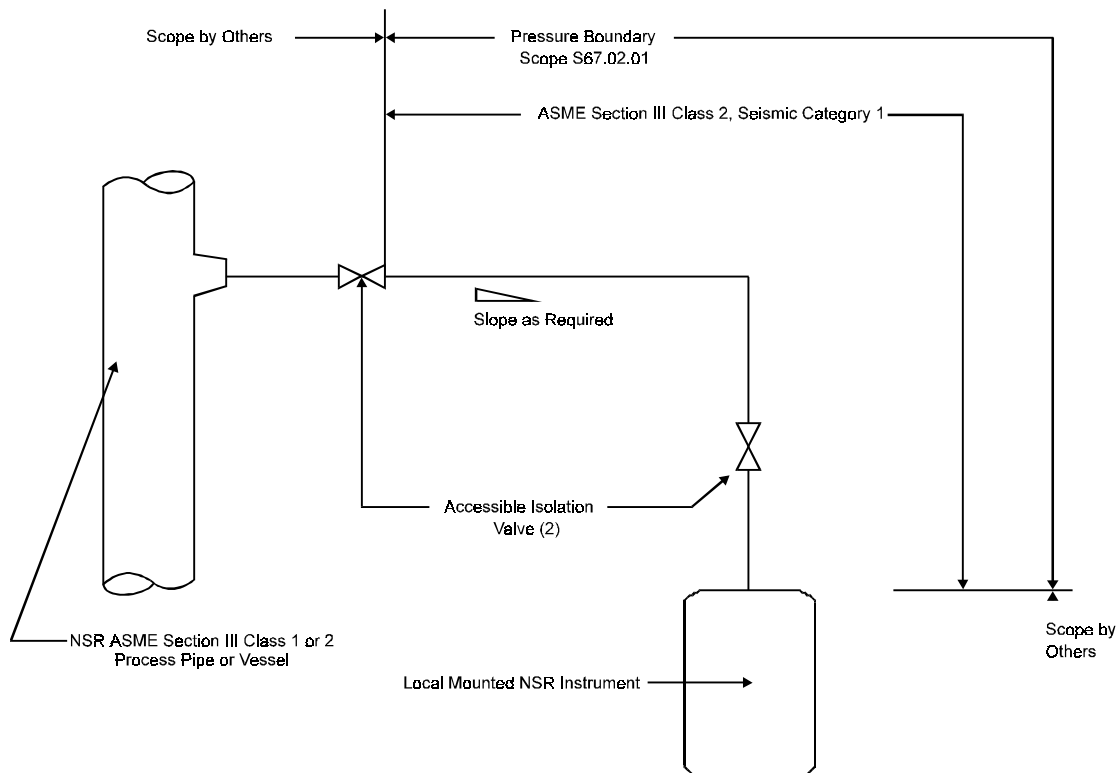


Figure 1a --- NSR Instrument

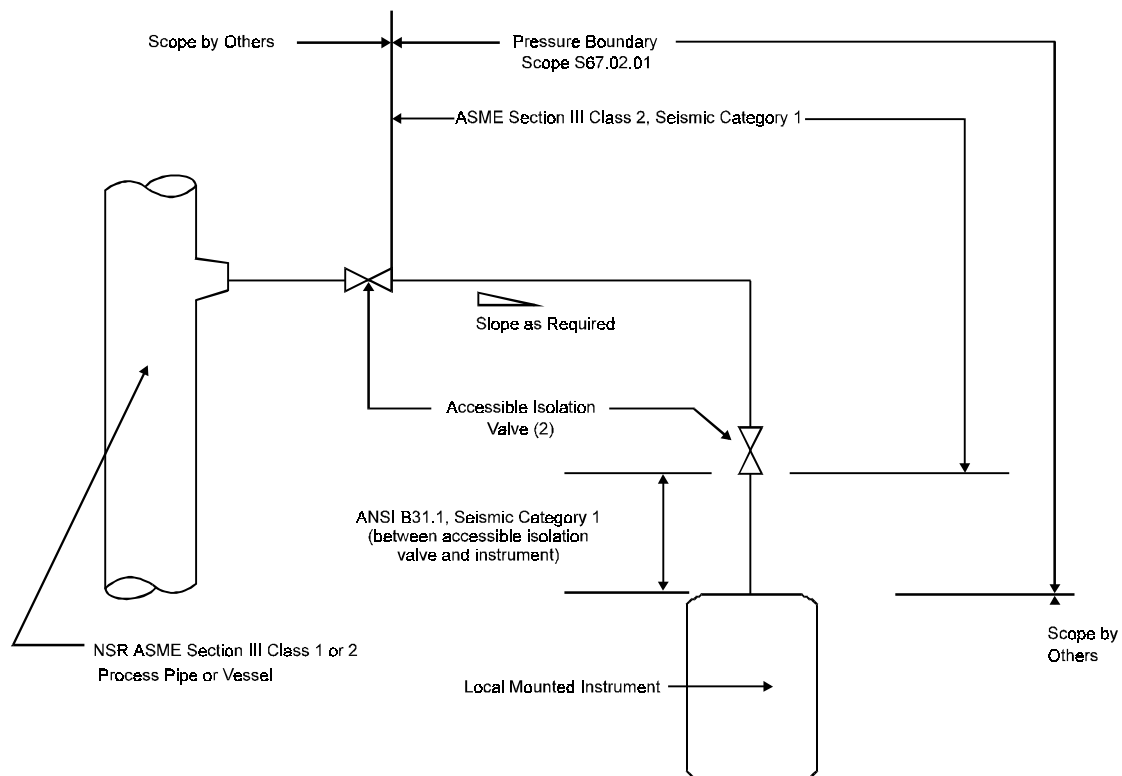


Figure 1b --- NNS Instrument

**Figures 1a & 1b — Water-filled instrument sensing lines for water, gas, or steam services ASME Class 1 or 2 process**

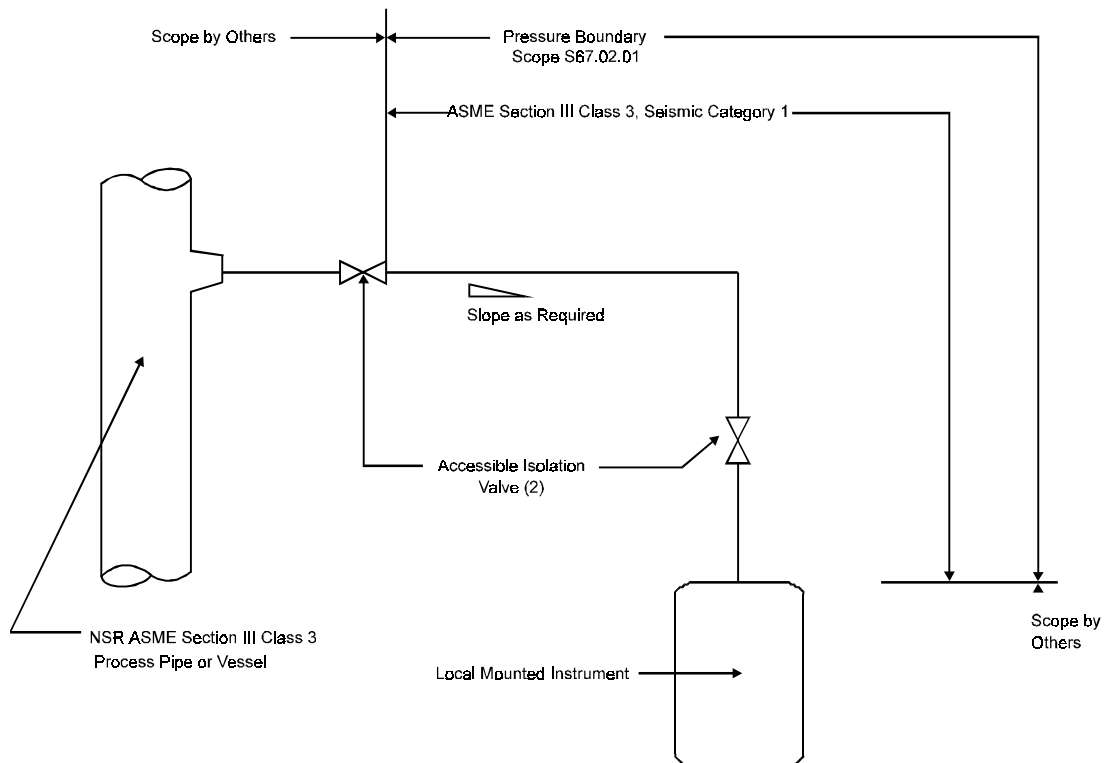


Figure 2a --- NSR Instrument

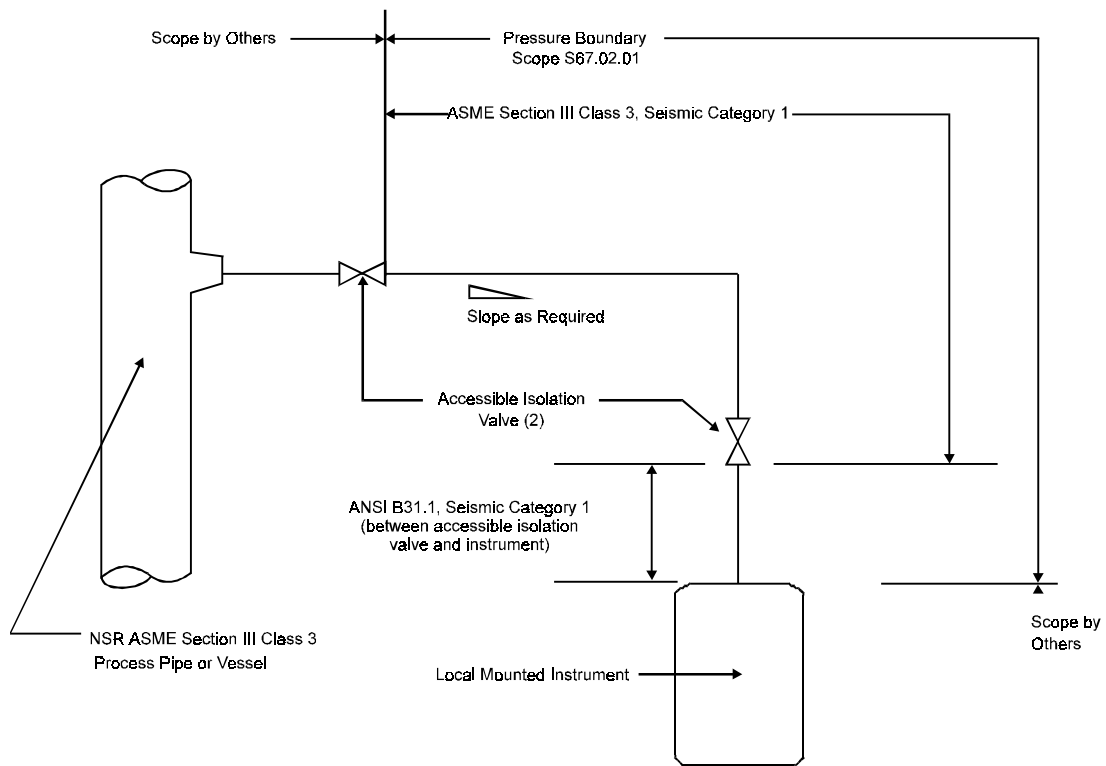
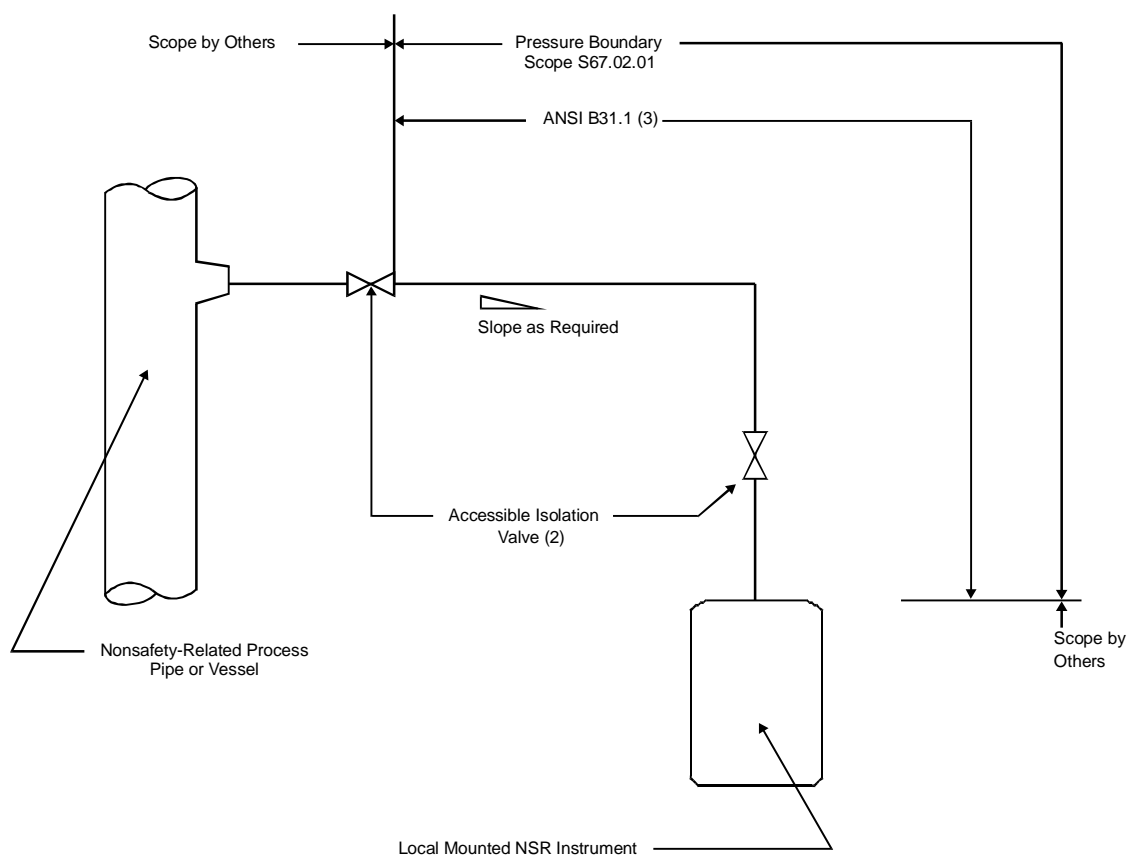
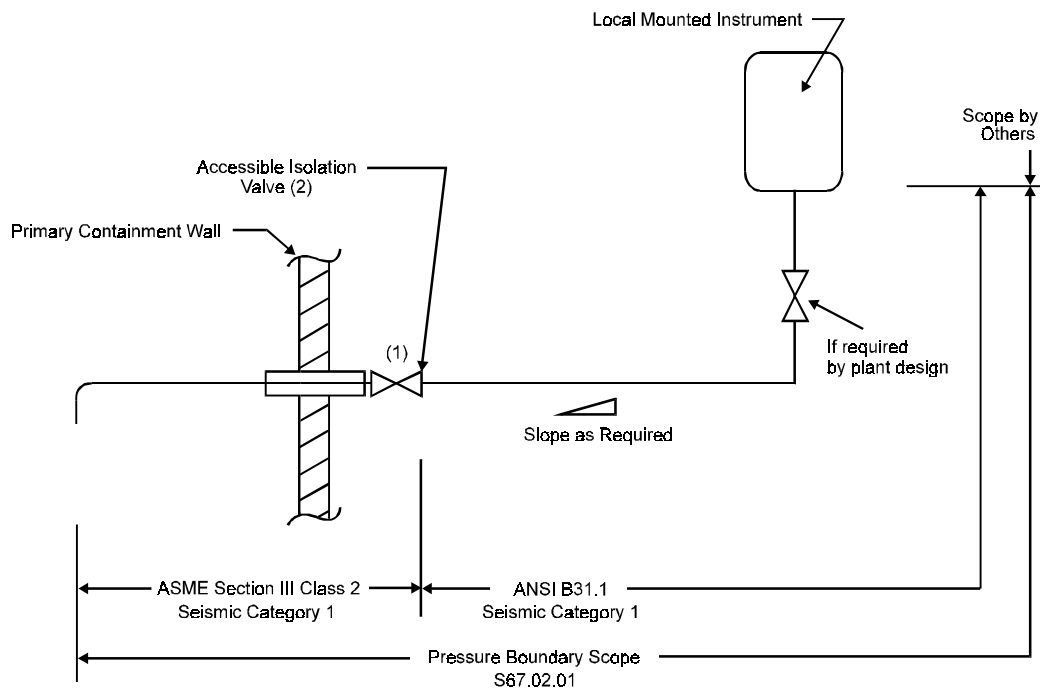


Figure 2a --- NNS Instrument

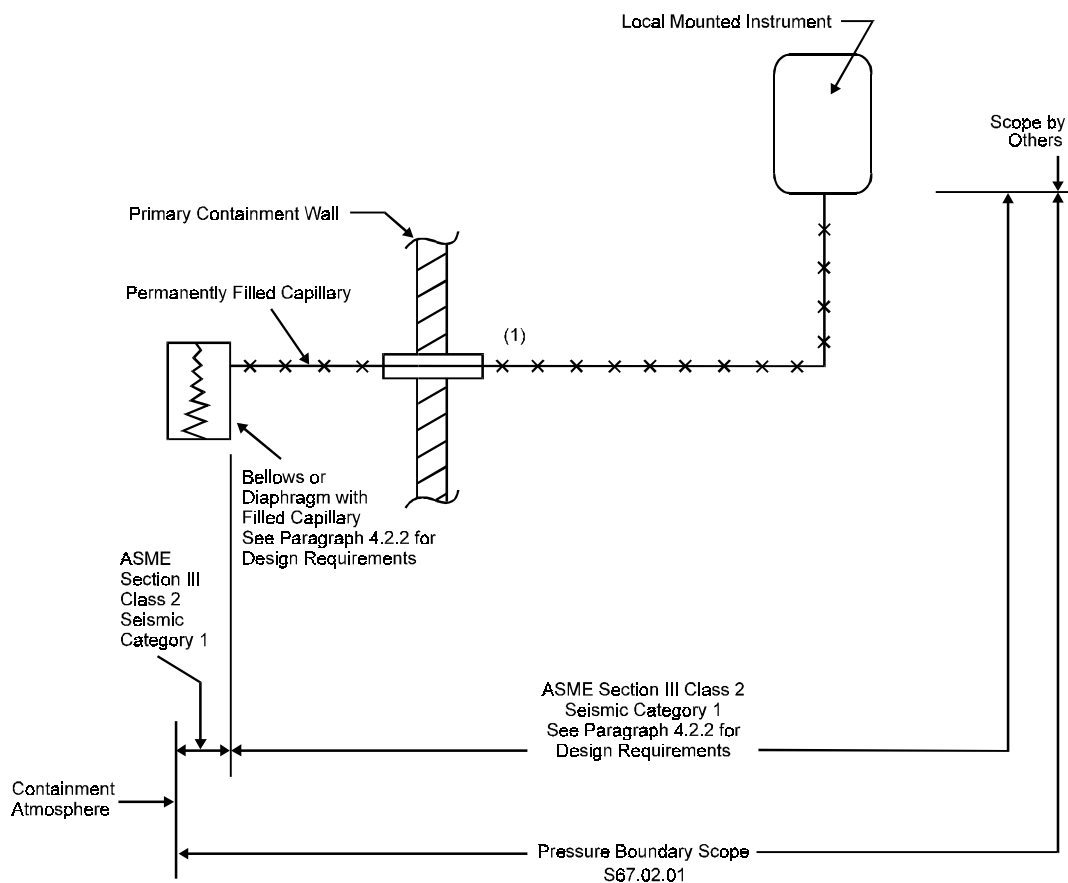
**Figures 2a & 2b — Water-filled instrument sensing lines for water, gas, or steam service ASME Class 3 process nuclear safety-related instrument**



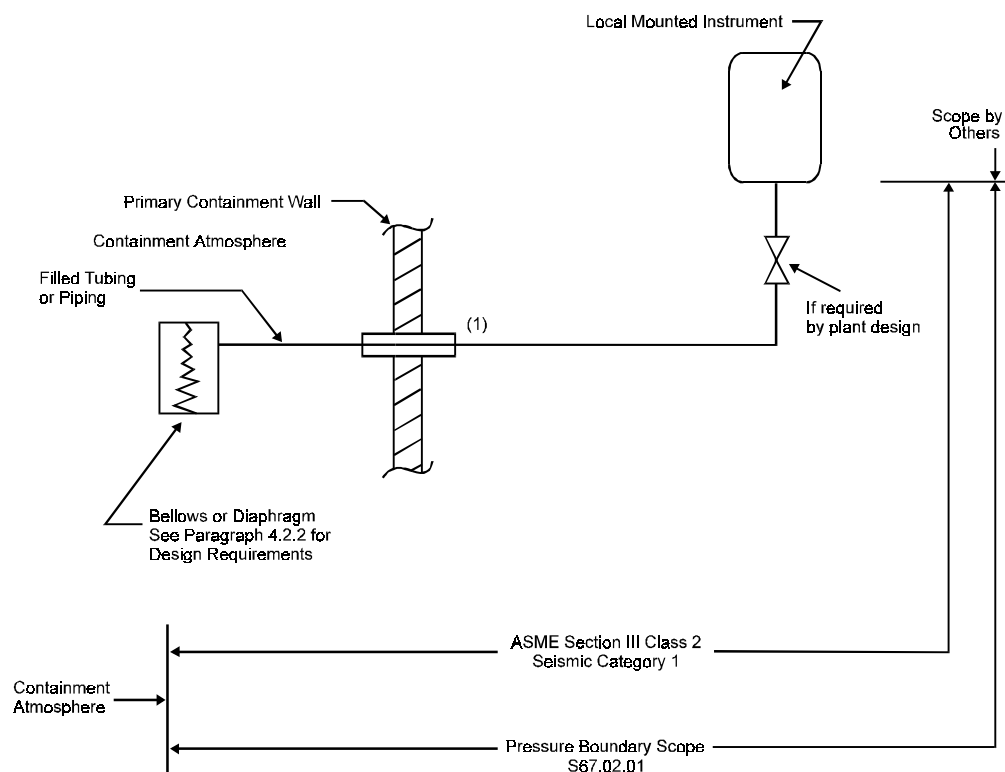
**Figure 3 — Water-filled instrument sensing line for water, gas, or steam service nonsafety process nuclear safety-related instrument**



**Figure 4 — Containment atmosphere instrument sensing lines, instruments outside containment**



**Figure 5 — Containment atmosphere instrument sensing lines, capillary filled instruments outside containment**



**Figure 6 — Containment atmosphere instrument sensing lines, diaphragm with filled instruments outside containment**

**Notes for Figures 1 through 6:** These notes are part of this Standard.

1. Penetration.
2. Accessible isolation valve (may be the root valve, as well). (See 6.2.)
3. Seismic category to be the same as the process seismic design category.

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## 5 Protection of nuclear safety-related instrument sensing lines

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Redundant instrumentation sensing lines shall be routed and protected so that any credible effects (consequences) of any design-basis event that is to be mitigated by signals sensed through those sensing lines shall not render any of these redundant sensing lines inoperable unless it can be demonstrated that the protective function is still accomplished. This level of protection shall ensure that after the event, a single failure shall not prevent mitigation of that event. Credible effects of design-basis events that do not depend on a given group of redundant instrument sensing lines for mitigation or accident prevention may render inoperable any or all of that group of sensing lines without violating this criterion—provided that the overall protective function is accomplished. All nuclear safety-related instrument sensing lines should be protected from damage during normal operational activities and occurrences.

### 5.1 Redundant instrument taps

A single process pipe tap to connect process signals to redundant instruments should not be used. If a single process connection cannot be avoided, justification shall be provided to permit its use.

### 5.2 Routing instrument sensing lines

#### 5.2.1 General considerations

- a) Instrument sensing lines shall be routed such that no single failure can cause the failure of more than one redundant sensing line.
- b) In hostile areas subject to high energy jet stream, missiles, and pipe whip, the routing of redundant sensing lines shall be documented with analysis or calculations as necessary to prove that the routing protects the redundant sensing lines from failure due to a common cause. The analysis or calculations shall be maintained as part of the plant design records.
- c) Instrument sensing lines shall be run along walls, columns, or ceilings whenever practical, avoiding open or exposed areas, to decrease the likelihood of persons supporting themselves on the lines or of damage to the sensing lines by pipe whip, missiles, jet forces, or falling objects.
- d) Supports, brackets, clips, or hangers shall not be fastened to the instrument sensing lines for the purpose of supporting cable trays or any other equipment.
- e) Routing of the nuclear safety-related instrument sensing lines shall ensure that the function of the lines is not affected by vibration, abnormal heat, or stress. (See [Section 6](#), which covers installation hardware.)

- f) Routing of the nuclear safety-related sensing lines except capillary lines shall ensure that the function of these lines is not affected by the entrapment of gas (liquid sensing lines) or liquid (gas sensing lines). One of the following methods shall be used to ensure that the sensing line function is not affected:
- 1) For liquid measurements, the sensing lines shall slope downward from the process connection to the instrument. For gas measurements, the sensing lines shall slope upward from the process connection to the instrument.
  - 2) High point vents for liquid measurement and low point drains for gas measurement shall be provided to ensure that all entrapped gas or liquid has been purged from the sensing line before the instrument is placed in service.
  - 3) A combination of (1) and (2), where the recommended minimum amount of slope shall be one inch per foot, or more, unless otherwise specified by the designer of the installation.
- g) All sensing lines including trays, supports, instrumentation, valving, and other in-line devices shall be installed to avoid contact interferences caused by relative motion between the sensing line and other adjacent equipment or devices. Sources of relative motion that shall be considered are thermal expansion, seismic motions, vibrations, and design-basis accidents or events. The Code classification of the sensing line will determine the requirements for relative motion that shall be considered. The clearance values used shall be determined by the designer.
- h) Bends rather than fittings should be used to change the direction of a run of piping or tubing. The minimum bending radius for cold-bending of tubing shall be established by the designer in accordance with the applicable ASME code. A bending tool should be used when cold bending tubing. Fittings are permitted where the use of bends is not practical.
- i) Sensing lines shall be routed to avoid environmental extremes wherever practical. Sensing lines routed outdoors or exposed to low-temperature areas shall be heat-traced as necessary to prevent freezing ([see 5.2.2.4](#)). Lines shall be routed away from significant sources of heat, if the source of heat will have a detrimental effect on the sensing line or if the rating of the sensing lines may be exceeded by additional heating. Sensing line for differential pressure (D/P) instruments should be routed together to avoid environmentally induced heat changes in either sensing line.
- j) Routing of the nuclear safety-related sensing lines shall ensure that the function of these lines is not affected by thermal motions due to “hot blowdown” of the sensing lines. One of the following methods shall be used to ensure that the sensing-line function is not affected:
- 1) Demonstrate by documented analysis or calculations that the majority of the sensing line routing is at ambient temperature, and “hot blowdown” is not a design loading.
- Or
- 2) Design the sensing line routing using the process design temperature as the temperature value used in the design analysis.

- k) Routing of the nuclear safety-related sensing lines shall ensure that the function of these lines is not affected by the movement of the main process (piping, ductwork, equipment, etc.) to which the sensing line is connected. One of the following methods shall be used to ensure that the sensing line function is not affected:
- 1) Demonstrate by documented analysis or calculations that the process movements are negligible.
- Or
- 2) Demonstrate by documented analysis or calculations that sufficient flexibility has been provided to accommodate the process movements.
- l) Flexible hose may be used in sensing lines to accommodate the process thermal, seismic, and vibrational movements if its ratings equal or exceed the design requirements, including service life. Installation considerations shall include maintaining slope and no low points.
- m) Instrument sensing lines and accessories inside the Containment Building shall withstand the pressure profile during containment leak-rate testing. The design and installation shall be so engineered that such components show no visible damage, and their operability is not compromised. If this is not feasible, such components shall be identified clearly and installed in a manner so that dismantle and removal can be accomplished with minimum labor.
- For Radioactive Fluid applications, the use of cobalt-bearing alloys in the instrument lines and accessories shall be kept to a minimum.
- The preceding criteria also shall apply to sensing lines routed between structures having differential movements.
- n) Potential inaccuracies in water level indication during and after rapid depressurization events have been identified as industry concerns and shall be considered. Inaccuracies result from non-condensable gases collecting in the condensate pot (chamber) of instrument reference legs and migrating down the reference leg.

## **5.2.2 Special considerations**

### **5.2.2.1 Tubing penetrating walls and floors**

Where redundant instrument sensing lines penetrate a wall or floor, care shall be taken to ensure that the tubing or piping does not rest on or against any abrasive surface.

Where tubing penetrates a radiation, fire, water, or air seal, care shall be taken to ensure that the seal is not degraded by the sensing line's seismic or thermal movements. In addition, the mechanical properties of the seal shall be reviewed to ensure that the seal does not anchor the sensing line when a guide is required.

### **5.2.2.2 Tubing, piping, and capillary tubes penetrating shielding walls**

Care shall be taken to avoid personnel exposure to radiation "streaming" from radioactive sources to the surrounding areas through instrument sensing line penetrations in the shield walls.

**5.2.2.3** Any taps, piping, and tubing provided for testing that are permanently installed and valved in shall comply with this Standard.

**5.2.2.4** The following shall apply to safety-related sensing lines that can be exposed to cold weather conditions:

- a) Instrument sensing lines that can be exposed to freezing temperatures and that contain or can be expected to contain a condensable mixture or fluid that can freeze should be provided with an environmental control system (heating and ventilation or heat tracing) to protect the lines from freezing during extremely cold weather.
- b) The environment associated with those safety-related instrument sensing lines should be monitored and alarmed, so that appropriate corrective action can be taken to prevent the loss of or damage to the lines from freezing in the event of loss of the environmental control system.
- c) The environmental control system recommended in (a) and for which (b) applies should be electrically independent of the monitoring and alarm system, so that a single failure in either system, including their power sources, does not affect the capability of the other system.
- d) The environmental control and monitoring systems should be designed to standards commensurate with their importance to safety and with administrative controls that are implemented to address events or conditions that could render the systems inoperable.

### **5.3 Identification and channel coding**

The instrument sensing tubing or piping runs pertaining to a nuclear safety-related instrument channel shall be identified and coded so as to identify its channel. Each instrument-sensing line and associated valving in this channel shall have an identification tag showing the channel and unique line or valve identification number. If multiple sensing lines are installed in a single tray, the tray shall be identified with the appropriate sensing line numbers, colors, etc.

A list of these line and valve numbers and their associated channel numbers shall be kept for record. Each instrument sensing line, as a minimum, shall be tagged at its process line root-valve connection, at the instrument, and at any point in between where the sensing line passes through a wall or a floor (on both sides of such penetration). Each valve also shall be tagged.

### **5.4 Sharing of sensing lines**

A single instrument sensing line should not be used to perform both a safety-related function and a nonsafety-related function unless the following can be shown:

- a) The failure of the common sensing line would not simultaneously (1) cause an action in a non-safety-related system that results in a plant condition requiring protective action and (2) also prevent proper action of a protection system channel designed to protect against the condition.
- b) If the failure of the common sensing line can cause an action in a nonsafety-related system that results in a plant condition requiring protective action and also can prevent proper action of a protection-system channel designed to protect against the condition, the remaining redundant protection channels are capable of providing the protective action even when degraded by a second random failure. The rupture of a second instrument sensing line need not be considered as a second random failure.

Provisions should be included so that this requirement can still be met if a channel is bypassed or removed from service for test or maintenance purposes. Acceptance provisions include reducing

the required coincidence, defeating the signals taken from the same sensing line in nonsafety-related systems, or initiating a protective action from a bypassed channel.

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## 6 Auxiliary devices, fittings, and supports

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### 6.1 Types of sensing line connections within the scope of this Standard

Flareless or welded tube or pipe fittings may be used for tube sizes not exceeding one inch (25.4 mm) outside diameter or three-quarter inch nominal pipe (19 mm) and in accordance with the following requirements:

- a) Fittings shall be of a compatible material with the tubing or pipe material on which they are used to avoid electrolysis and to provide acceptable weld joints.
- b) Tube fittings shall be used at pressure-temperature ratings not exceeding the recommendation of the tube fitting manufacturer and to meet the environmental and process system requirements.
- c) Piping, tubing, tube fittings, pipe fittings, valves, restrictor devices, and other appurtenances shall meet the same requirements as defined in [Clause 4](#).
- d) Tube fittings shall be installed in accordance with manufacturer's recommendations.
- e) In the absence of any existing standards, the designer shall determine that the type of fitting selected is qualified for design conditions (including vibration, pressure, and thermal shock and applicable environmental conditions) or shall demonstrate this by testing the fitting's ability to perform its intended function. The fittings selected shall not degrade the inherent strength of the tubing specified.
- f) Screwed joints in which pipe threads provide the only seal may be used, as long as they are in compliance with the appropriate code and system temperature and pressure requirements.
- g) Thread sealant shall be suitable for the required service conditions considering the process media, radiation environment, and compatibility with the materials of construction.

### 6.2 Restriction devices and instrument response

**6.2.1** When restriction devices are utilized to prevent excessive process leakage in the event of a ruptured instrument sensing line, they shall be installed as close to the process as practical. The preferred method of construction is a permanently welded fitting. Where the required diameter of the restriction is not less than that required for free drain-back to the process, the restrictor may be installed upstream of a condensate pot. The restriction device shall not prevent orderly reactor shutdown assuming makeup is only by the normal makeup systems, or that the blowdown from one ruptured instrument sensing line shall not prevent the process system from performing its

intended safety function.

**6.2.2** If restriction-device sizing requirements prevent the achievement of the required response characteristic of a nuclear safety-related instrument or where the drainback of condensate in a sensing line to the process is required for instrument operation, the restriction devices shall not be installed, and the safety classification of the instrument-sensing line shall remain the same as that of the process system.

**6.2.3** Where instrument sensing lines penetrate the primary containment wall, restriction devices shall be installed in addition to any self-actuated excess flow-check valves unless covered otherwise in this Standard ([See Clause 4](#)).

### **6.3 Instrument sensing line supports**

**6.3.1** Within Clause 4 of this Standard where Seismic Category I hangers and supports are specified, they shall be attached to Seismic Category I structures or other Seismic Category I supports.

**6.3.2** Hanger and support design shall consider provisions for seismic, jet impingement, pipe whip, include missiles, and thermal expansion of the process tap and instrument sensing line to which the hangers or supports may be subjected during normal operation, seismic event, or other credible event.

**6.3.3** Material selection for hangers, clamps, pads, and spacers in contact with the sensing lines shall be compatible to avoid corrosion.

**6.3.4** Sensing line valves should not be supported by the sensing line tubing in an open run of tubing. Sensing line isolation valves may be supported by tubing justified by structural analysis. Valves on flexible metal hose shall be independently supported.

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## **7 Materials**

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Materials of instrument sensing lines, valves, and fittings that are part of the pressure boundary shall be in accordance with the applicable code.

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## **8 Documentation and quality assurance**

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Sufficient documentation and quality control procedures shall exist and be implemented to assure a satisfactory nuclear safety-related instrument sensing line installation in accordance with the provisions of this Standard.



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## Annex A — Interface standards and documents

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The documents listed in **A.1** were considered in the development of this Standard. Annex A is not part of ISA-S67.02.01.

### A.1

#### AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

B31.1	Power Piping, paragraphs 104.8 and 122.3 through 122.3.9, 1989. N18.2a - (ANSI 51.8) - Nuclear Safety Criteria for the Design of Stationary Pressurized Water Reactor Plants, 1975, American Nuclear Society, Hinsdale, IL 60521.
N45.2	Quality Assurance Program Requirements for Nuclear Facilities, 1977
N45.2.11	Quality Assurance Requirements for Design of Nuclear Power Plants, 1974
N212 (ANSI 52.1)	Nuclear Safety Criteria for the Design of Stationary Boiling Water Reactor Plants, 1983, American Nuclear Society, Hinsdale, IL 60521.
N271 (ANSI 56.2)	Containment Isolation Provisions for Fluid Systems, 1984, American Nuclear Society, Hinsdale, IL 60521.
ANSI 51.1	Nuclear Safety Criteria for Design of Stationary Pressurized Water Reactor Plants, 1983
N658(ANSI 51.7)	Single Failure Criteria for PWR Fluid Systems, 1976
<b>Available from:</b>	<b>ANSI</b> 11 West 42nd Street New York, NY 10036 Tel: (212) 642-4900

#### AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

Boiler and Pressure Vessel Code, Section III, Nuclear Power Plant Components  
Division 1 and Division 2, Subsection NCA, 1980 with Summer 1981 Addenda  
Division 1, Subsection NB, 1980 with Summer 1981 Addenda  
Division 1, Subsection NC, 1980 with Summer 1981 Addenda  
Division 1, Subsection ND, 1980 with Summer 1981 Addenda  
Division 1, Subsection NE, paragraph NE1132, 1977 with Winter 1977 Addenda  
Division 1, Subsection NF, 1977 with Summer 1978 Addenda

Fluid Meters, Sixth Edition, 1971, paragraph II-II-14

Power Test Code PTC 19.2, 1964, paragraph 2.08 and Figure 2.4

**Available from:**

**ASME**

345 East 47th Street  
New York, NY 10017

Tel: (212) 705-7722

**INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)**

- |     |  |
|-----|--|
| 279 | Criteria for Protection Systems for Nuclear Power Generating Stations, 1971  |
| 336 | Installation, Inspection, and Testing Requirements for Power, Instrumentation, and Control Equipment at Nuclear Facilities, 1985 |
| 379 | Guide to Application of Single Failure Criterion of Nuclear Power Generating Stations Class 1E Systems, 1988                     |
| 384 | Criteria for Independence of Class 1E Equipment and Circuits, 1981   |
| 603 | Criteria for Safety Systems for Nuclear Power Generating Stations, 1991  |

**Available from:**

**IEEE**

445 Hoes Lane  
P.O. Box 1331  
Piscataway, NJ 08855-1331

Tel: (800) 678-4333

**ISA**

- |                 |   |
|-----------------|---|
| ANSI/ISA-S67.01 | Transducer and Transmitter Installation for Nuclear Safety Applications, 1994 |
|-----------------|---|

**Available from:**

**ISA**

67 Alexander Drive  
P.O. Box 12277  
Research Triangle Park, NC 27709

Tel: (919) 549-8411

**UNITED STATES CODE OF FEDERAL REGULATIONS**

10 CFR 50, Appendix A, January 1, 1990

10 CFR 50, Appendix B, January 1, 1990

Criterion 4 - Environmental and Dynamic Effects Design Bases

Criterion 24 - Separation of Protection and Control Systems

Criterion 33 - Reactor Coolant Makeup

Criterion 53 - Provisions for Containment Testing and Inspection

Criterion 54 - Systems Penetrating Containment  
Criterion 55 - Reactor Coolant Pressure Boundary Penetrating Containment  
Criterion 56 - Primary Containment Isolation  
Criterion 57 - Closed System Isolation Valves  
Quality Assurance Criteria for Nuclear Power Plants

**Available from:**                **Superintendent of Documents**  
U.S. Government Printing Office  
Washington, D.C. 20402

## **UNITED STATES NUCLEAR REGULATORY COMMISSION**

1.11	Instrument Lines Penetrating Primary Reactor Containment, March 1971 and Supplement 1972
1.26	Quality Group Classification and Standards, February 1976
1.29	Seismic Design Classification, August 1973
1.64	Quality Assurance Requirements for the Design of Nuclear Power Plants, June 1976
1.75	Physical Independence of Electric Systems - Rev. 2, September 1978
1.151	Instrument-sensing lines, July 1983

### **A.2 Additional interface standards and documents**

U.S. Nuclear Regulatory Commission Bulletin 93-03, Resolution of Issues Related to Reactor Vessel Instrumentation in BWRs

U.S. Nuclear Regulatory Commission Information Notice 92-54, Level Instrumentation: Inaccuracies Caused by Rapid Depressurization





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