



Examination Standard for Sprinkler Valve Supervisory Devices – Standard Security and Enhanced Security

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Foreword

This standard is intended to verify that the products and services described will meet stated conditions of performance, safety and quality useful to the ends of property conservation. The purpose of this standard is to present the criteria for examination of various types of products and services.

Examination in accordance with this standard shall demonstrate compliance and verify that quality control in manufacturing shall ensure a consistent and reliable product.

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1 INTRODUCTION

1.1 Purpose

- 1.1.1 This standard states testing and certification requirements for Standard and Enhanced Security sprinkler valve supervisory devices.
- 1.1.2 Testing and certification criteria may include, but are not limited to, performance requirements, marking requirements, examination of manufacturing facility(ies), audit of quality assurance procedures, and a surveillance program.

1.2 Scope

- 1.2.1 This standard is concerned with operation, performance and reliability of sprinkler valve supervisory devices. These supervisory devices are used to indicate the position status of a sprinkler shutoff valve and relay the status information to the local fire alarm panel. The requirements of this standard shall be used to measure and describe the performance, security and reliability of sprinkler valve supervisory devices in a controlled test environment.

1.3 Basis for Requirements

- 1.3.1 The requirements of this standard are based on experience, research and testing, and/or the standards of other organizations. The advice of manufacturers, users, trade associations, jurisdictions and/or loss control specialists was also considered.
- 1.3.2 The requirements of this standard reflect tests and practices used to examine characteristics of sprinkler valve supervisory devices for the purpose of obtaining certification. Such products having characteristics not anticipated by this standard may be certified if performance equal, or superior, to that required by this standard is demonstrated

1.4 Basis for Certification

Certification is based upon satisfactory evaluation of the product and the manufacturer in the following major areas:

- 1.4.1 Examination and tests on production samples shall be performed to evaluate
 - the suitability of the product;
 - the performance of the product as specified by the manufacturer and required for certification; and
 - as far as practical, the durability and reliability of the product.
- 1.4.2 An examination of the manufacturing facilities and audit of quality control procedures may be made to evaluate the manufacturer's ability to consistently produce the product, which is examined and tested, and the marking procedures used to identify the product. Subsequent surveillance may be required by the certification agency in accordance with the certification scheme to ensure ongoing compliance.

1.5 Basis for Continued Certification

The basis for continual certification may include, but is not limited to, the following based upon the certification scheme and requirements of the certification agency:

- production or availability of the product as currently certified;
- the continued use of acceptable quality assurance procedures;
- satisfactory field experience;
- compliance with the terms stipulated by the certification;
- satisfactory re-examination of production samples for continued conformity to requirements; and
- satisfactory Surveillance Audits conducted as part of the certification agency's product surveillance program.

1.6 Effective Date

The effective date of this certification standard mandates that all products tested for certification after the effective date shall satisfy the requirements of this standard.

The effective date of this standard is eighteen (18) months after the publication date of the standard for compliance with all requirements.

1.7 System of Units

Units of measurement used in this Standard are United States (U.S.) customary units. These are followed by their arithmetic equivalents in International System (SI) units, enclosed in parentheses. The first value stated shall be regarded as the requirement. The converted equivalent value may be approximate. Conversion of U.S. customary units is in accordance with ANSI/IEEE/ASTM SI 10.

1.8 Normative References

The following referenced documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the cited edition applies.

ANSI/NFPA 72 *National Fire Alarm & Signaling Code*
ANSI/NFPA 70 *National Electrical Code*
NEMA 250 *Enclosures for Electrical Equipment*
ANSI/IEC 60529 *Degrees of Protection provided by Enclosures (IP Code)*
ANSI/UL 864 *Standard for Control Units and Accessories for Fire Alarm Systems*
ANSI/IEEE/ASTM SI 10 *American National Standard for Metric Practice*

1.9 Terms and Definitions

For purposes of this standard, the following terms and definitions apply:

ASME – American Society of Mechanical Engineers

FACP – Fire Alarm Control Panel

NFPA – National Fire Protection Association

PIV – Post Indicator Valve

OS&Y – Outside Screw & Yoke Valve

Normal – normal position of monitor device, sprinkler valve open

Off-normal –indicates not normal position location, sprinkler valve partially or totally closed

2 GENERAL INFORMATION

2.1 Product Information

Supervisory devices are generally supplied as individual units for installation on sprinkler control valves. They are usually constructed of a housing, which contains the valve position sensing element. There are provisions for mounting the supervisory monitor to the valve, especially those that are designed for in-field installation. A method of communication to the fire alarm control panel must be specified in the installation manual. This is commonly hard wired (conventional initiating circuit or signaling line circuit) or RF wireless.

Supervisory devices may be supplied to fit any sprinkler shutoff valves (standard and wall types) that limit the operation of any automatic sprinkler system or other fire extinguishing system(s).

2.2 Certification Application Requirements

The manufacturer shall provide the following preliminary information with any request for certification consideration:

- a complete list of all models, types, sizes, and options for the products or services being submitted for certification consideration;
- general assembly drawings, complete set of manufacturing drawings, materials list, anticipated marking format, piping and electrical schematics, nameplate format, brochures, sales literature, spec. sheets, installation, operation and maintenance procedures, etc.; and
- the number and location of manufacturing facilities.

All documents shall identify the manufacturer's name, document number or other form of reference, title, date of last revision, and revision level. All documents shall be provided with English translation.

2.3 Requirements for Samples for Examination

2.3.1 Following authorization of a certification examination, the manufacturer shall submit samples for examination and testing based on the following:

- Samples shall include at least one complete functional unit. Certain tests may be performed on particular subassemblies or components if test conditions can be maintained as they would appear under operation of a complete unit.
- Detailed sample requirements to be determined by the certification agency

2.3.2 Requirements for samples may vary depending on design features, results of prior or similar testing, and results of any foregoing tests.

2.3.3 The manufacturer shall submit samples representative of production. Any decision to use data generated using prototypes is at the discretion of the certification agency.

2.3.4 It is the manufacturer's responsibility to provide any necessary test fixtures, such as those which may be required to conduct particular tests.

3 GENERAL REQUIREMENTS

3.1 Review of Documentation

- 3.1.1 During the initial investigation and prior to physical testing, the manufacturer's specifications and details shall be reviewed to assess the ease and practicality of installation and use. The certification investigation shall define the limits of the final certification.

3.2 Physical or Structural Features

- 3.2.1 The supervisory device shall be able to withstand the normal conditions of vibration and atmospheres encountered in manufacturing, storage or public assembly occupancies.
- 3.2.2 The supervisory device shall be able to operate reliably without excessive maintenance throughout a reasonable service life.
- 3.2.3 The supervisory device shall have any operating members, which would otherwise be damaged or whose efficiency would be affected, enclosed in a housing which reasonably protects these parts from dirt, dust, water or corrosive atmospheres.
- 3.2.4 The materials used in the construction of the switch shall be suitable for the intended application and conform in all respects to the manufacturer's specifications.
- 3.2.5 The materials in the device shall be capable of withstanding ambient temperature range of 0°C to 49°C for indoor applications and -40°C to 60°C for outdoor applications or specified by the manufacturer indefinitely without change in the operating characteristics.
- 3.2.6 The electrical components – switches, wiring, etc. shall conform to the applicable standards of the National Fire Protection Association (ANSI/NFPA 70 and ANSI/NFPA 72) and NEMA 250. Other national or international codes will be evaluated on a case by case basis.
- 3.2.7 For a device with an electrical switch as the external interface device, the current carrying capacity of the electrical contacts shall be consistent with the manufacturer's ratings.
- 3.2.8 There are two distinct states associated with valve position, one indicating movement from the normal position (to off-normal) and another indicating return to normal position (from off-normal).
- 3.2.9 The off-normal state shall be initiated during the first two revolutions of the hand wheel or during one fifth of the total travel distance of the control valve from its fully open position, whichever corresponds to the lesser amount of valve opening.
- 3.2.10 The off-normal state for a supervisory device without latching functionality shall not be restored at any position other than normal. For supervisory devices with latching functionality, the off normal signal shall be latched until acknowledged and reset at the alarm panel, and the supervisory device is back in the normal position.
- 3.2.11 A device for supervising position of a sprinkler valve shall not interfere with operation of the valve, obstruct the view of the indicator or prevent access to valve maintenance.
- 3.2.12 Duplicate terminals, leads, or connectors that provide for the connection of installation wiring shall be provided on each device for the expressed purpose of connecting to the FACP that monitors the integrity of the signaling and power wiring.
- 3.2.13 A supervisory device shall be designed and installed so it cannot be subject to tampering, which would adversely affect its monitoring capability. This may be accomplished by mechanical

fasteners, which require a special tool to gain access to the interior of the device and its mounting to the valve, or by active monitoring of the method of access to the interior of the device and its mounting to the valve. Depending upon the extent of tamper resistance, this standard classifies supervisory devices into two categories: “Standard” or “Enhanced Security” Supervisory Device as detailed in 4.12 and 4.13, respectively.

- 3.2.14 All methods of communication to the FACP shall meet the applicable sections of ANSI/NFPA 72 (Circuits & Pathways and Special Requirements for Low Power Radio Systems). The classification for wired interfaces shall be such that there can be no disconnection of the supervisory device without a Trouble condition being displayed at the FACP.

3.3 Markings

- 3.3.1 Marking on the product or, if not possible due to size, placed on its packaging or label accompanying the product, shall include the following information:
- name and address of the manufacturer or marking traceable to the manufacturer;
 - date and location of manufacture or code traceable to date of manufacture or lot identification;
 - model number, size and ratings;
 - interconnected wiring diagrams

When hazard warnings are needed, the markings should be universally recognizable.

- 3.3.2 The model or type identification shall correspond with the manufacturer's catalog designation and shall uniquely identify the certification agency's mark of conformity.
- 3.3.3 The certification agency's mark of conformity shall be displayed visibly and permanently on the product and/or packaging as appropriate and in accordance with the requirements of the certification agency. The manufacturer shall exercise control of this mark as specified by the certification agency and the certification scheme.
- 3.3.4 All markings shall be legible and durable.

3.4 Manufacturer's Installation and Operation Instructions (as appropriate)

- 3.4.1 The manufacturer shall:
- prepare instructions for the installation, maintenance, and operation of the product;
 - provide facilities for repair of the product and supply replacement parts; and
 - provide services to ensure proper installation, inspection, or maintenance for products of such nature that it would not be reasonable to expect the average user to be able to provide such installation, inspection, or maintenance.
- 3.4.2 The installation, operating and maintenance instructions shall be provided with each device and/or installation.

3.5 Calibration

- 3.5.1 Each piece of equipment used to verify the test parameters shall be calibrated within an interval determined on the basis of stability, purpose, and usage. A copy of the calibration certificate for each piece of test equipment is required. The certificate shall indicate that the calibration was performed against working standards whose calibration is certified as traceable to acceptable reference standards and certified by an ISO/IEC 17025 accredited calibration laboratory. The test

equipment shall be clearly identified by label or sticker showing the last date of the calibration and the next due date. A copy of the service provider's accreditation certificate as an ISO/IEC 17025 accredited calibration laboratory should be available.

- 3.5.2 When the inspection equipment and/or environment is not suitable for labels or stickers, other methods such as etching of control numbers on the measuring device are allowed, provided documentation is maintained on the calibration status of this equipment.

4 PERFORMANCE REQUIREMENTS

4.1 Normal Operations

4.1.1 Requirement

Representative samples of the equipment shall operate in accordance with the manufacturer's specifications and certification requirements.

4.1.2 Test/Verification

The sample shall be wired per manufacturer's specifications and installed on intended sprinkler valves as it would be installed by end user. Off-normal signal indication should occur during first two (2) revolutions of hand wheel or at one fifth (1/5) of total travel distance of valve control device from its fully open position, whichever corresponds to the lesser amount of valve opening.

The off-normal signal shall not be restored at any other position than the designated for transition to normal. See 4.13 for specific Test/Verification requirements for supervisory devices with latching operation.

4.2 Environmental Conditioning

4.2.1 Requirement

It shall be verified that the supervisory device maintains the normal operational capability and functionality throughout temperature extremes and high humidity conditions that are typical of equipment intended for indoor and outdoor applications. If the manufacturer specifies a temperature range beyond those typical for indoor / outdoor applications, the equipment will be tested using the values specified by the manufacturer.

4.2.2 Tests/Verification

As a minimum, the equipment shall be subject to the following temperature extreme. If the rated extremes are beyond these values, the equipment will be tested using those values specified by the manufacturer. At each extreme of temperature, the device shall be exercised during the last hour of conditioning to demonstrate normal operation.

- For a period of 4 hours at -40°C (-40°F) and 60°C (140°F) for outdoor applications
- For a period of 4 hours at 0°C (32°F) and 49°C (120°F) for indoor applications.
- For a period of 24 hours at a relative humidity of 90% and ambient temperature of 37.8°C (100°F)

4.3 Endurance

4.3.1 Requirement

The supervisory device, shall be tested for 6,000 normal and off-normal cycles at rated voltage and current.

4.3.2 Tests/Verification

The supervisory device and its components shall operate as intended at the conclusion of the test and shall not exhibit breakdown or failure to operate when subjected to the required endurance test.

4.4 Dielectric

4.4.1 Requirement

The equipment shall withstand for one (1) minute the application of AC voltage, or a DC voltage applied between live parts and the enclosure and dead metal parts.

Circuit Ratings	Dielectric Test Voltage
$X \leq 30 \text{ Vac (42.4 Vdc)}$	500 Vac (707 Vdc)
$X \geq 30 \text{ Vac (42.4 Vdc)}$	1,000 Vac + 2 x rated voltage (for Vdc multiply this value by 1.414)

4.4.2 Tests/Verification

There shall be no indication of dielectric breakdown or leakage current greater than 0.5mA during the one (1) minute test exposure.

4.5 Vibration

4.5.1 Requirement

The supervisory device enclosure and assemblies shall be tested to verify their mechanical strength and ability to withstand the vibration as defined in this section. As a result of this testing, there shall be no loosening of parts or visible signs of permanent deformation.

4.5.2 Tests/Verification

With the equipment powered and installed in accordance with the manufacturer's instructions, the equipment shall be subjected to a vertical movement as described below.

Duration	4 hours
Displacement	0.022 in. (0.55 mm)
Sweep Frequency Range	10 Hz-30 Hz-10 Hz
Sweep Rate	2 cycles/min.

Following the 4 hour vibration exposure, the equipment shall:

- have no loose parts;
- have no visible signs of permanent deformation that would compromise the electrical safety of the equipment;
- sample shall operate as intended (see section 4.1 Normal Operations).

4.6 Enclosure Requirements (including polymeric housings)

4.6.1 Requirement

The enclosure must meet the ingress protection requirement for a NEMA 250, Type 1 or ANSI/IEC 60529, IP33 enclosure ratings as a minimum for indoor applications and NEMA 4 / IP65 for outdoor applications. It is not necessary to mark the product for Type 1 enclosures. Additional claims made by the manufacturer will be verified according to specified enclosure classifications.

Polymeric Materials used as an enclosure (or the sole support of current carrying parts) shall not warp to an extent that it impairs the intended operation or exposes high voltage components.

4.6.2 Test/Verification

The appliance enclosure (three samples) shall be evaluated according to acceptable national, regional or international electrical codes.

When constructed of Polymeric Materials, an enclosure sample shall be mounted as intended and placed in a circulating air-oven, shall be aged at 194°F (90°C) for seven days or at 158°F (70°C) for twenty eight days. Following the aging tests, the samples are to be viewed for:

- no evidence of warping and distortion;
- no exposure to high voltage components;
- sample shall operate as intended (see section 4.1 Normal Operations).

4.7 Jarring

4.7.1 Requirement

The appliance assembly (one sample), including housing and mounting hardware, shall withstand the jarring resulting from an impact as might be expected during normal installation.

4.7.1 Test/Verification

When energized at its rated voltage and mounted in its intended orientation, the appliance shall be subjected to a 3 foot-pound (4.08 Joules) impact. There shall be no loosening of parts or permanent deformation as a result of this test. Following the impact, the test sample shall operate normally and not exhibit any false alarms.

4.8 Signal Line Transient Tests

4.8.1 Requirement

Protection against line surge transients shall be a requirement for each sprinkler supervisory device that contains electronic components (excluding mechanical switches).

4.8.2 Test/Verification

A powered sample appliance shall be subjected to transient waveforms having peak levels of 100, 500, 1000, and 2400 V dc, as delivered into a 200 ohm load. The waveforms shall be calibrated according to the curves described in ANSI/UL 864, figures 77.1-77.4. This test applies to all field wiring terminals that have a possibility of being subjected to line-induced voltage (i.e., notification appliance circuits). The appliance is required to perform satisfactorily at the conclusion of the test, and it must not exhibit any instability such as false alarm signals and non-self-restoring trouble signals during testing.

4.9 Protective Grounding/Bonding

4.9.1 Requirement

Any equipment that contains or connects to a high voltage circuit shall provide a positive grounding system for all exposed dead metal parts to reduce the risk of electrical shock.

4.9.2 Tests/Verification

The grounding system shall consist of a dedicated (green head) screw or terminal and clearly marked (G, GR, GND, Ground, International Ground Symbol or the like), or dedicated, flexible green (or green and yellow) bonding conductors.

- The bonding resistance shall be measured at ≤ 0.1 ohm.
- All bonding conductors shall be 14 AWG minimum.

Exception: Metal-foil markings, screws, handles, etc., which are located on the outside of the enclosure and isolated from electrical components or wiring by grounded metal parts so that they are not liable to become energized or those which are positively separated from wiring and un-insulated live parts.

4.10 Equipment Load Rating

4.10.1 Requirement

The standby or alarm current necessary to power the equipment shall not exceed 110% of the rated value over the entire voltage range that the equipment is rated or intended for.

4.10.2 Tests/Verification

With the equipment configured for its maximum rated current draw (outputs at full rated load). At no time shall the current value measured exceed 110% of that rated on the nameplate or the manufacturers installation instructions.

4.11 Marking Requirements

4.11.1 Requirement

The equipment shall be plainly and permanently marked so it is visible after installation and identifiable. Any information not directly affixed to the equipment must be referenced on a label affixed to the equipment. This includes references to Wiring Diagrams and Installation Instructions if not affixed to the installed system.

4.11.2 Tests/Verification

The product, as well as the installation, operating, and maintenance instructions shall be reviewed for each type and model examined; the instructions shall be complete and appropriate for the equipment. The installation instructions or manual shall be marked with a document name, number, revision, and date. The following information is required with each system:

- Name (or Trademark) and Model designation.
- Environmental suitability (Operating temperature, humidity)
- All switches and indicators must be clearly marked as to the function of each
- Electrical ratings
- Enclosure ratings beyond normal suitability
- Applicable NFPA references.
- Instructions for the installation, maintenance, and operation of the product;
- Facilities for repair of the product and supply replacement parts;
- Services to ensure proper installation, inspection, or maintenance for products of such nature that it would not be reasonable to expect the average user to be able to provide such installation, inspection, or maintenance
- All terminals and field serviceable components shall be identified

4.12 Tamper Resistance – (Standard Security)

4.12.1 Requirement

A device classified as “Standard Security Supervisory Device” shall meet the following requirement:

- 1) Be of limited access, such that specialized mechanical fasteners and tools are required for the access to the field wiring terminations or interior of the device, or where removal of the cover results in a Trouble or Supervisory condition being communicated to the FACP.

4.12.2 Tests/Verification

The sample shall be wired per the manufacturer’s specifications and installed on intended sprinkler valves as it would be installed by the end user. Connect the sample to a suitable FACP or monitoring equipment.

- 1) The method of access to the field wiring terminations or interior of the device shall be removed. Successful access to the interior of the device shall result in the indication of a Trouble condition at the FACP / monitoring equipment within 200 s or a Supervisory condition within 90 s.
- 2) In lieu of the method above, specialized security fasteners that limited access to the interior field wiring are acceptable.

4.13 Tamper Resistance – (Enhanced Security)

4.13.1 Requirement

A device classified as “Enhanced Security Supervisory Device” shall meet the following requirements:

- 1) Removal of the method of access to the field wiring terminations or the interior of the device shall result in a Trouble or Supervisory condition being communicated to the FACP.
- 2) Removal of the Supervisory device from the valve to the extent that its monitoring capability is adversely affected shall result in a Trouble or Supervisory condition being communicated to the FACP.
- 3) Shall provide a visual indication at the Supervisory device when the device senses an off-normal valve condition as defined by 4.1.4, to facilitate quick identification of the off-normal condition. The visual indication shall not be extinguished but latched on when the valve is restored to its normal condition and only extinguished after the alarm is acknowledged at the FACP and reset. For applications where each Supervisory Device can be identified individually by the FACP for addressable interfaces, this requirement need not apply.

4.13.1 Tests/Verification

The sample shall be wired per the manufacturer’s specifications and installed on intended sprinkler valves as it would be installed by the end user. Connect the sample to a suitable FACP or monitoring equipment.

- 1) The method of access to the field wiring terminations or the interior of the device shall be removed. Successful access to the interior of the device shall result in the indication of a Trouble condition at the FACP / monitoring equipment within 200 s or a Supervisory condition within 90 s.

- 2) The sample shall be removed from the sprinkler valve. Successful removal of the device shall result in the indication of a Trouble condition at the FACP / monitoring equipment within 200 s, or a Supervisory condition within 90 s.
- 3) The sprinkler valve shall be set to the off-normal position as defined by 4.1.4. A visual indication shall be observed on the supervisory device. The visual indication shall not be extinguished when the valve is restored to its normal condition. The off-normal state shall be indicated until the state is acknowledged and reset at the FACP, at which point the normal state is restored and the visual indication is extinguished.

5 OPERATIONS REQUIREMENTS

5.1 Demonstrated Quality Control Program

5.1.1 A quality assurance program is required to assure that subsequent sprinkler valve supervisory device(s) produced by the manufacturer shall present the same quality and reliability as the specific sample(s) examined. Design quality, conformance to design, and performance are the areas of primary concern.

- Design quality is determined during the examination and tests, and may be documented in the certification report.
- Continued conformance to this standard is verified by the certifier's surveillance program.
- Quality of performance is determined by field performance and by periodic re-examination and testing

5.1.2 The manufacturer shall demonstrate a quality assurance program which specifies controls for at least the following areas:

- existence of corporate quality assurance guidelines;
- incoming quality assurance, including testing;
- in-process quality assurance, including testing;
- final inspection and tests;
- equipment calibration;
- drawing and change control;
- packaging and shipping; and
- handling and disposition of non-conforming materials.

5.1.3 Documentation/Manual

There should be an authoritative collection of procedures/policies. It should provide an accurate description of the quality management system while serving as a permanent reference for implementation and maintenance of that system. The system should require that sufficient records are maintained to demonstrate achievement of the required quality and verify operation of the quality system.

5.1.4 Records

To assure adequate traceability of materials and products, the manufacturer shall maintain a record of all quality assurance tests performed, for a minimum period of two years from the date of manufacture.

5.1.5 Drawing and Change Control

- The manufacturer shall establish a system of product configuration control that shall allow no unauthorized changes to the product. Changes to critical documents, identified in the certification report, must be reported to, and authorized by the certification agency prior to implementation for production.
- Records of all revisions to all certified products shall be maintained.

5.2 Surveillance Audit

5.2.1 An audit of the manufacturing facility may be part of the certification agency investigation to verify implementation of the quality assurance program. Its purpose is to determine that the manufacturer's equipment, procedures, and quality program are maintained to ensure a uniform product consistent with that which was tested and certified.

5.2.2 Certified products or services shall be produced or provided at or from the location(s) disclosed as part of the certification examination. Manufacture of products bearing a certification mark is not permitted at any other location without prior written authorization by FM Approvals.

5.3 Installation Inspections

Field inspections may be conducted to review an installation. The inspections are conducted to assess ease of application, and conformance to written specifications. When more than one application technique is used, one or all may be inspected at the discretion of the certification agency.

5.4 Manufacturer's Responsibilities

The manufacturer shall notify the certification agency of changes in product construction, components, raw materials, physical characteristics, coatings, component formulation or quality assurance procedures prior to implementation.

6 BIBLIOGRAPHY

ISO/IEC 17025: 2017 *General Requirements for the Competence of Testing and Calibration Laboratories*.

APPENDIX A: Tolerances

LENGTH:	$\pm 2\%$ of value
TEMPERATURE:	$\pm 4^{\circ}\text{F}$ ($\pm 2^{\circ}\text{C}$)
Time:	Hours ± 5 minutes Seconds ± 5 seconds
VOLTAGE:	$\pm 2\%$ of value
CURRENT:	$\pm 2\%$ of value
FREQUENCY:	$\pm 5\%$ of value
ENERGY:	$\pm 5\%$ of value
RESISTANCE:	$\pm 5\%$ of value