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Examination Standard for Indicator Posts and Post Indicator Valve Assemblies

Class Numbers 1110/1111

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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 indicator posts and post indicator valve assembly products.

1.1.2 Testing and certification criteria may include 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 sets performance requirements for indicator posts used with non-rising stem (NRS) gate valves.

1.2.2 This standard also sets performance requirements for post indicator valve assemblies. Post indicator valve assemblies are intended as a complete valve/post indicator assembly and do not apply to gate valves.

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 national and international organizations. The advice of manufacturers, users, trade associations and loss control specialists was also considered.

1.3.2 The requirements of this standard reflect tests and practices used to examine characteristics of indicator posts and post indicator valve assemblies for the purpose of obtaining certification.

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;
- the durability and reliability of the product.

1.4.2 An examination of the manufacturing facilities and audit of quality control procedures shall be made to evaluate the manufacturer's ability to 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 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;
- 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 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/IEEE/ASTM SI 10, *American National Standard for Metric Practice*

ASTM A536, *Standard Specification for Ductile Iron Castings*

FM 1112, *Indicating Valves (Butterfly or Ball Type)*

1.9 Terms and Definitions

For purposes of this standard, the following terms apply:

Indicator Post - Used to control the flow of water by connection to a non-rising stem (NRS) gate valve. The indicator post consists of a barrel, a flanged extension which adjusts the barrel height, a stem which operates the valve and simultaneously moves the target, and a target indicator which displays the valve's position. The target indicator is visible through an opening in the post. To permit turning of the stem from a constant height, a telescoping union is commonly employed.

Post Indicator Valve Assembly - A post indicator valve assembly (PIVA) consists of a valve, hollow post, power train, power transmission, indicator, and operator. The valve directly controls the flow of water. The hollow post houses the power train and supports the power transmission and indicator. The power train connects the power transmission to the valve. The power transmission controls the valve's opening speed, closing speed, and ease of operation. The indicator visually displays the valve's position. The operator connects the input power and power transmission. A person uses the operator to open and close the valve.

2 GENERAL INFORMATION

2.1 Product Information

Indicator posts and PIVAs typically operate valves for fire protection systems when the valves are located out of sight, such as underground, outside of buildings, or within building walls. Indicator posts typically extend vertically aboveground or horizontally through building walls. A PIVA's power transmission, indicator, and operator are generally located above-grade.

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:

- 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.

2.3.4 It is the manufacturer's responsibility to provide any necessary test fixtures, such as those which may be required to evaluate the indicator post or PIVA.

3 GENERAL REQUIREMENTS

3.1 Materials

All materials used in the construction of indicator posts and post indicator valve assemblies shall be suitable for the intended application. Parts exposed to water shall be resistant to corrosion. Materials used in the construction of parts above grade shall have good resistance to weathering. Nonmetallic components shall be considered for non-stress-bearing applications if tested to the requirements of Paragraph 4.5.

3.2 Indicator Posts

3.2.1 Barrel

3.2.1.1 The barrel shall be of such material and thickness as to provide adequate strength and corrosion resistance. A typical material is cast ductile iron defined by ASTM A536 or a similar alloy. Typical barrel wall thickness is approximately 3/8" (9.5mm) and is defined by the manufacturer.

3.2.1.2 Sufficient clearance between the post inside the wall and the operating stem, target mechanism, valve operating nut and other moving parts shall be provided.

3.2.1.3 The length of the barrel for underground valves shall be such that the middle of the target windows shall be at least 30 in. (762 mm) above the intended ground level.

3.2.1.4 A suitable seal shall be provided to minimize the possibility of water entering between two telescoping sections that form an adjustable barrel for application with underground valves. This may be accomplished by extending the upper part below the ground a distance of not less than 10 in. (254 mm) and telescoping over the lower part which projects above the bury line.

3.2.1.5 To prevent separation from or rotation of the upper part of the telescoping sections, the parts shall be securely attached.

3.2.1.6 To minimize the lifting action of frost, the upper portion of telescoping sections shall be constructed such that there is no projection, flange or taper.

3.2.1.7 The indicator post shall be provided with a base flange which has been designed to provide attachment to the gate valve using bolts or other suitable means. The flange shall accept four bolts (minimum size 5⁄8 in. [16 mm]) 90 degrees apart on a bolt circle of 10.5 in. (267 mm).

3.2.1.8 For a wall-mounted indicator post, the barrel shall be provided with an integral flange or other suitable means for attachment to the outside of the wall.

3.2.1.9 Where target assemblies are internal to the barrel, there shall be adequate visibility of such targets through at least two openings 180 degrees apart and near the top. Typical openings are at least 1 1⁄3 in. (31.7 mm) high and 1⁄2 in. (12.7 mm) wider than any wording appearing on the targets.

3.2.1.10 The windows for the openings shall be of suitable transparent material and held in place using a corrosion-resistant frame, grating or other suitable means.

3.2.1.11 To provide protection for indicator post windows that are of such material and have been installed in such locations that they are susceptible to breakage, the manufacturer shall make a protection grating available. Typical gratings incorporate bars with cross sections of 1⁄8 in. (3.2 mm) wide by 1/4 in. (6.4 mm) deep, attached with one central horizontal bar and several

vertical members positioned between the target letters. Such gratings are positioned at least 1⁄4 in. (6.4 mm) from the transparent material (on the outside of each window) and shall be provided with whatever necessary mounting hardware is appropriate to install said gratings. Other forms of grating are acceptable provided they meet the intent of the requirement.

3.2.2 Post Cap

The post cap shall be of suitable material and coating to be reasonably weatherproof and shall be secured to the barrel. The cap shall contain a bearing, or provide a suitable bearing feature that may be integral to the cap or another component, to ensure ease of operation of the operating stem against the cap. The cap and / or related component that houses the bearing, or comprises the bearing feature, shall include provision for lubrication of the bearing or bearing feature as part of routine maintenance of the post indicator.

3.2.3 Operating Stem

3.2.3.1 The operating stem shall be made of suitable corrosion-resistant material such as bronze, with adequate provision for attachment to the valve extension rod. This may be accomplished by providing a core at least 4 in. (101.6 mm) deep and designed to fit freely over the extension rod. The operating stem shall be so designed that it will turn freely in its bearing and not be prevented from turning regardless of the target nut or target position.

3.2.3.2 The upper end of the stem shall be provided with a nut or other suitable means of stem operation. A typical nut is 1 1⁄4 in. (31.8 mm) square by 1 in. (25.4 mm) high. Sizes and shapes may vary to conform with other indicator posts at a specific location.

3.2.4 Target Mechanism

3.2.4.1 The target mechanism shall be designed and constructed so that it will not be subject to incorrect assembly or give incorrect indication during operation. The target plate material shall be aluminum or suitable corrosion-resistant material.

3.2.4.2 For targets incorporating the words “OPEN” and “SHUT”, the letters shall be of sufficient size that the requirements of Paragraph 4.1 are met. Typical letters are at least 1 in. (25.4 mm) high and raised at least 1⁄8 in. (3.2 mm). The words are at least 3 in. (76.2 mm) long with the face of the letters finished smooth 1⁄8 in. (3.2 mm) wide. Target letters shall be light in color and contrast a dark background or vice versa.

3.2.4.3 When properly adjusted, the proper word shall be visible at all windows indicating when the valve is open or shut. To provide identification of possible malfunction, the target mechanism shall be such that, when properly adjusted, the words “OPEN” and “SHUT” or other suitable means of valve position identification will become visible if the target nut travels off the thread at the top or bottom of the operating stem.

3.2.4.4 The target plate shall be interchangeable to suit valves opening either clockwise (left hand) or counter- clockwise (right hand). The target plates shall be adjustable relative to each other to suit the number of turns required by the different sizes of the make of valve for which the post is designed.

3.2.4.5 The target nut threads shall be made of corrosion-resistant material, such as bronze.

3.2.4.6 Techniques of valve position identification other than a target assembly of the type described in Paragraphs 3.5.1, 3.5.2 and 3.5.3, may be acceptable, provided the requirements of Paragraph 4.1 are met.

3.2.5 Extension Rod

3.2.5.1 The extension rod shall be of sufficient strength as to meet the requirements of Paragraph 4.3.

3.2.5.2 The extension rod shall be secured to the valve stem nut in such a manner as to permit the axis of the extension rod to swing in any direction at least 5 degrees off the vertical, thus allowing for non-alignment of parts.

3.2.5.3 A satisfactory method of meeting the requirement above is to provide a coupling, cored to fit the turning members loosely, with two corrosion-resistant cotter pins at least 1⁄4 in. (6.4 mm) in diameter, one through the coupling and stem nut and the other with axis at right angles to the former through the coupling and extension rod. Both pins are tight in the coupling, but loose in the other members. The strength of the joint in torsion shall not be made dependent upon the shearing strength of the pins.

3.2.6 Wrench or Handwheel

3.2.6.1 Either a wrench or handwheel of suitable strength shall be provided with each indicator post.

a.) The wrench shall not be less than 12 in. (304.8 mm) long from center of operating nut to the end.

b.) In the stored position, one end of the wrench fits over the stem nut. The other end fits over the hasp against the barrel. The hasp slot in the wrench shall be of limited size, so that it is not possible to raise the top end of the wrench off the stem nut and turn the stem nut by any means.

c.) Wrenches made from ductile material such as carbon steel, which could be pried off the stem nut, are not acceptable.

3.2.6.2 Wall indicator posts are normally operated by a handwheel. A chain and padlock are usually used to minimize unauthorized operation of the post. The handwheel shall not be less than 14 in. (355 mm) in diameter.

3.2.6.3 The handwheel shall be fastened to the post in such manner that it is not possible to remove it without first removing the chain. A typical method employs an eyebolt to fasten the handwheel to the post. The hole in the eyebolt shall be 13⁄8 in. (35 mm) minimum, and the wall thickness 1⁄4 in. (6 mm) minimum. For padlocking purposes, the chain is passed through the hasp on the barrel, a spoke of the handwheel and the hole in the eyebolt.

3.2.7 Locking and Sealing

3.2.7.1 Suitable provision shall be made for locking either type of indicator post in the open position.

3.2.7.2 Where mechanical linkages, such as a wrench, are employed with a lock to prevent rotation of the operating stem, rotation of such stem shall not be possible without obvious physical damage to the post and/or lock linkages.

3.2.7.3 The indicator post shall also be designed to permit the indicator post to be sealed in the open position with a common lead seal and twisted wire, in such a manner that it is necessary to break the seal before the operating stem can be turned more than two complete turns, or before the post cap can be removed.

3.2.7.4 The hole for the sealing wire in the operating stem shall be so located that the sealing wire will not become frayed or broken by repeated applications of the wrench or handwheel to the operating nut during inspection testing of the valve.

3.2.7.5 Where cap screws are used to fasten the post cap to the barrel, a drilled hole shall be provided through one of the screws near the locking arrangement.

3.2.7.6 Where bolts having removable nuts are used, a drilled hole shall be provided through one nut and its bolt.

3.2.7.7 All drilled holes shall be large enough to accommodate a 0.05 in. (1.3 mm) diameter twisted wire.

3.3 Post Indicator Valve Assemblies

3.3.1 Valves used as part of a post indicator valve assembly shall have independent certification to FM 1112, by the manufacturer applying for certification for the post indicator valve assembly. At the discretion of the certification agency, a manufacturer may apply for certification with a non-certified valve and test the valve as part of the post indicator valve assembly to the requirements of FM 1112.

3.3.2 Orientation

All parts concerned with orientation shall go together in a unique manner to maintain a single correct orientation between valve and indicator. A readily available section of weakness shall be provided at the beginning of the power transmission or power train. A second, but stronger, section of weakness shall be concealed within the assembly. Both shall fracture upon application of a force less than that required to deform the power train permanently. These fractures shall leave the true indication unaffected and make it obvious that something is wrong and needs attention.

3.3.3 Loss of Power Transmission Control

The removal of one, or more, strategic parts from the power train shall not affect the valve's ability to remain in position (e.g. valve cannot change position).

3.3.4 Design Factors of Safety

The manufacturer shall provide a minimum and maximum operating torque range for the PIVA The manufacturer shall take into consideration the failure torque for the deliberate failure points when determining this torque range.

3.3.5 Operation

If rotary motion is employed to operate the valve, the direction to open shall be counterclockwise. The operator shall be removable.

3.3.6 Ease of Operation

The assembly shall be designed to operate easily by hand without tools after being in service for 5 years. It is acceptable that normal maintenance and minor repair that does not require replacement of the entire valve be performed during that time. The operating torque or leverage resulting from a force of 60 lb. applied at the normal operating point shall be ample to operate the valve but less than that required to shear the first weakness section in the power train. The length of the post shall be such that the operator is at a reasonable height above grade after the valve is installed.

3.3.7 Serviceability

The arrangement of parts shall make it difficult for unauthorized personnel to tamper with the unit. Replacement of parts by qualified personnel shall be easy.

3.3.8 Impact Resistance (Shock Loading)

Exposed parts shall have sufficient strength to resist the normal abuse expected in service. Impacts sufficiently hard to do serious damage shall result in a fracture above grade before any other part fails and the valve shall remain intact.

3.3.9 Locking

Suitable means shall be provided for locking the valve in the wide open position. It shall be designed so that the lock must be removed to close the valve or to remove any indicator parts.

3.3.10 Post Design

The post shall be designed so that ground frost will not lift the post and separate the power train from the valve. Means shall be provided to drain water which may enter the post.

3.4 Markings

3.4.1 The indicator post or post indicator valve assembly shall be permanently marked with the following information which may be cast onto the body or inscribed on a securely attached corrosion-resistant metal nameplate:

- manufacturer's name and location;
- model or type designation;
- rated working pressure (post indicator valve assembly only);
- valves size (post indicator valve assembly only);
- year of manufacture;
- the certification agency's mark of conformity.

Ample room shall be provided on the barrel for stenciling or marking, to indicate the service which the indicator post/valve assembly controls, for example, the number of a building.

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

3.4.2 To indicate which direction of wrench or handwheel rotation is required to open the valve, readily visible instructions shall be provided as an integral part of the post assembly. The instructions shall be large enough to be easily read by a person with normal vision standing 3 ft (0.9 m) from the post. Typical instructions may include an arrow on the post cap showing the direction to open plus the word "OPEN" with letters and figures approximately 3⁄4 in. (19.1 mm) high and raised 1⁄8 in. (3.2 mm).

3.4.3 The model or type identification shall correspond with the manufacturer's catalog designation and shall uniquely identify the certification agency's mark of conformity.

3.4.4 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.

3.4.5 All markings shall be legible and durable.

3.5 Drawings/Plans/Specifications Required

3.5.1 Indicator posts or PIVAs submitted for testing shall be true production samples, and shall be free of sharp edges, burrs or other imperfections liable to injure the installer or interfere with proper installation of the unit.

3.5.2 A comparison of detail and assembly drawings shall be made with samples submitted to the certification agency, in order to evaluate material compatibility. Also, items defined under General Information and General Requirements are to be reviewed by visual examination and/or desk review prior to the start of certification testing.

3.6 Calibration

3.6.1 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 and traceable to an acceptable reference standard 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.

3.6.2 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 thus equipment.

4 PERFORMANCE REQUIREMENTS

4.1 General

4.1.1 The following performance requirements apply to indicator posts**:** sections 4.2, 4.3, 4.4, 4.5, and 4.8, as applicable to product design.

4.1.2 The following performance requirements apply to post indicator valve assemblies**:** Sections 4.2, 4.6, 4.7, and 4.8, as applicable to product design.

4.2 Visibility

4.2.1 Requirement

The indicator shall be of such size and shape that an informed observer, when standing 40 ft (12.2 m) away, at any of at least two positions which are 180 degrees apart, will be able to tell if the valve is open.

4.2.2 Test/Verification

Two informed observers with 20/20 vision (corrected) shall be placed 40 ft (12.2 m) from an indicator post and their observations recorded as to position of the target. The observations shall correspond to the actual position of the targets.

4.3 Weatherability

4.3.1 Requirement

An indicator post in the vertical position shall withstand exposure to simulated rain and freezing conditions.

4.3.2 Test/Verification

An upright indicator post sample shall be subjected to a water spray at a rate of 0.6 in./min. (15 mm/min.) for an elapsed time of 30 minutes to observe the collection of water, if any, within the post. This is to simulate exposure to a heavy rainstorm. If an examination of the interior of the indicator post after the spray test shows that the interior is completely dry, the freeze test shall be waived.

If moisture has accumulated inside the indicator post, then the assembly shall be reassembled and immediately subjected to an exposure of -40°F (-40°C) for 72 hours. At the conclusion of the cold exposure, the operating mechanism of the post shall still function normally. Failure to operate because of freezing is grounds for rejection.

4.4 Torque, Vertical Indicator Posts

4.4.1 Requirement

The indicator post shall withstand the following torque test without evidence of impending failure.

4.4.2 Test/Verification

A representative sample post shall be firmly supported. The extension rod that is normally engaged in the nut of the valve shall be secured against turning. For indicator posts intended for use with valves up to and including 14 in. (350 mm), a torque of 900 lb□ft (1220 N□m) shall be applied in both the clockwise and counter-clockwise direction to the stem nut. For indicator posts intended for use with valves up to and including 24 in. (600 mm), a torque of 1575 lb□ft (2135 N□m) shall be applied in both the clockwise and counter-clockwise direction to the stem nut. The indicator post shall not show signs of impending failure following the test.

4.5 Torque, Wall Type Indicator Posts

4.5.1 Requirement

Wall type indicators intended for use with valves up to and including 10 in. (250 mm) shall be subjected to a torque of 600 lb□ft (815 N□m) as described in Paragraph 4.4.2.

4.5.2 Test/Verification

The indicator shall be capable of normal operation following the test and shall not show signs of impending failure.

4.6 Torque, Post Indicator Valve Assemblies

4.6.1 Requirement

Post indicator valve assemblies shall be capable of withstanding a 200 lb (91 kg) tangential force applied to the handwheel or crank, or two times the maximum operating torque specified by the manufacturer, whichever is greater, without damage or impact to normal operation.

4.6.2 Test/Verification

With the post indicator valve assembly held rigidly, a 200 lb (91 kg) tangential force, or two times the maximum operating torque specified by the manufacturer, whichever is greater, shall be applied to the handwheel or crank in such a manner as to stress the open and closed stops within the operating mechanisms without ensuing damage. After the 200 lb (91 kg) tangential force, or two times the maximum operating torque specified by the manufacturer, whichever is greater, has been released, the assembly shall be capable of its full range of travel without sticking, binding, etc.

4.7 Impact Test

4.7.1 Requirement

See Section 3.3.8.

4.7.2 Test/Verification

With the post indicator valve assembly held rigidly, a horizontal load will be applied to the post until it fractures. The load may be applied at any suitable distance above the intended section of weakness. As a result of this test, other assembly members may be ruptured or permanently deformed, but no permanent deformation or rupture shall occur in the valve which would allow serious water leakage or impairment of sprinkler protection.

The indicator will be tested by dropping a 5 lb., 2 in. diameter, cylindrical steel weight from a height of 10 ft. onto the indicator. The indicator will be placed in the most unfavorable position with respect to the weight. No fracture or breakage shall occur.

4.8 Nonmetallic Components

4.8.1 Requirement

An indicator post or PIVA with plastic components shall withstand high temperature exposures without impaired operation.

4.8.2 Test/Verification

a.) A fully assembled indicator post or PIVA (with plastic components installed) shall be subjected to a temperature of 800°F (427°C) for 2 hours, cooled to room temperature, then operated. The

indicator post shall be capable of full operation upon completion of this test.

b.) Two additional indicator posts or PIVAs with plastic components installed shall be subjected to temperatures which induce partial melting, cooled to room temperature, and then operated. The indicator posts or PIVA shall be capable of full operation upon completion of the tests.

c.) Additional tests, some of which may require utilization of fully-assembled indicator posts or PIVAs with their respective plastic components installed, may be required at the discretion of the certification agency.

d.) Upon completion of any of the aforementioned tests, a melted plastic component which has re-solidified may cause an initial "freezing" of the indicator post or PIVA, which would necessitate increased initial torque in order to "free" the indicator post or PIVA and allow it to operate. An indicator post or PIVA found in this condition, which requires an initial torque in excess of that which can be reasonably applied by one person using the wrench provided, is considered to be inoperative. Any condition which renders the indicator post or PIVA inoperative shall be grounds for rejecting the use of the particular plastic component in question.

5 MANUFACTURER'S REQUIREMENTS

5.1 Demonstrated Quality Control Program

5.1.1 A quality assurance program is required to assure that subsequent products produced by the manufacturer shall present the same quality and reliability as the specific products 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, may be required to 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 agencies surveillance requirements 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 Unannounced follow-up inspections shall be conducted to assure continued quality control

and product uniformity.

5.3 Product Modifications

5.3.1 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.

5.4 Manufacturing and Production Tests

5.4.1 *Test Requirement No. 1 - Operation Test*

The manufacturer shall perform an operation test on 100 percent of production indicator posts and post indicator valve assemblies to ensure proper and smooth operation throughout complete range of travel.

5.4.2 *Test Requirement No. 2 - Seat Leakage Test (Post Indicator Valve Assemblies Only)*

The manufacturer shall test 100 percent of production indicating valves for seat leakage to the rated working pressure. The test pressure shall be applied on the seat of a closed valve for a minimum of 15 seconds with leakage not exceeding 0.5 cm^3 for metal-seated valves, and zero leakage for resilient-seated valves.

5.4.3 *Test Requirement No. 3 - Hydrostatic Test (Post Indicator Valve Assemblies Only)*

The manufacturer shall test 100 percent of production indicating valves for body leakage to twice the rated working pressure. The pressure shall be held for a minimum 1 minute with no evidence of body leakage or distortion.

6 BIBLIOGRAPHY

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