



Member of the FM Global Group

Approval Standard for Indicating Valves (Butterfly or Ball Type)

Class Number 1112

August 2006

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Foreword

The FM Approvals certification mark is intended to verify that the products and services described will meet FM Approvals' stated conditions of performance, safety and quality useful to the ends of property conservation. The purpose of Approval Standards is to present the criteria for FM Approval of various types of products and services, as guidance for FM Approvals personnel, manufacturers, users and authorities having jurisdiction.

Products submitted for certification by FM Approvals shall demonstrate that they meet the intent of the Approval Standard, and that quality control in manufacturing shall ensure a consistently uniform and reliable product. Approval Standards strive to be performance-oriented. They are intended to facilitate technological development.

For examining equipment, materials and services, Approval Standards:

- a) must be useful to the ends of property conservation by preventing, limiting or not causing damage under the conditions stated by the Approval listing; and
- b) must be readily identifiable.

Continuance of Approval and listing depends on compliance with the Approval Agreement, satisfactory performance in the field, on successful re-examinations of equipment, materials, and services as appropriate, and on periodic follow-up audits of the manufacturing facility.

FM Approvals LLC reserves the right in its sole judgment to change or revise its standards, criteria, methods, or procedures.

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1. INTRODUCTION

1.1 Purpose

- 1.1.1 This standard states Approval criteria for manually operated indicating valves that control the water supply to a fire protection system.
- 1.1.2 Approval criteria include, but are not limited to, performance requirements, marking requirements, examination of manufacturing facility(ies), audit of quality assurance procedures, and a follow-up program.

1.2 Scope

- 1.2.1 This standard encompasses the design and performance requirements for indicating valves for their intended application of long term water flow control. Indicating valves are usually installed above ground and indoors. They are constructed so that an informed observer can visually determine the position of the valve ball or disc indicating if the valve is open or closed.
- 1.2.2 This standard encompasses the design and performance requirements for indicating valves in the following sizes: 1, 1-1/4, 1-1/2, 2, 2-1/2, 3, 4, 5, 6, 8, 10 and 12 in. nominal pipe sizes (NPS) and equivalent metric sizes. Other sizes will be evaluated on a case-by-case basis.
- 1.2.3 This standard defines the requirements for indicating valves in either butterfly or ball valve configurations. Typical end connections for butterfly valves are: grooved end, lug style, wafer style, flanged or threaded. Typical end connections for ball valves are: grooved end and threaded. Other styles of end connection shall be evaluated on a case-by-case basis.
- 1.2.4 Approval Standards are intended to verify that the product described will meet stated conditions of performance, safety, and quality useful to the ends of property conservation.

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 indicating valves for the purpose of obtaining Approval. Indicating valves having characteristics not anticipated by this standard may be FM Approved if performance equal, or superior, to that required by this standard is demonstrated, or if the intent of the standard is met. Alternatively, indicating valves which meet all of the requirements identified in this standard may not be FM Approved if other conditions which adversely affect performance exist or if the intent of this standard is not met.

1.4 Basis for Approval

Approval 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 by FM Approvals; and as far as practical,
- The durability and reliability of the product.

1.4.2 An initial facilities and procedures audit shall be conducted to evaluate the manufacturer's ability to consistently produce the product which was examined and tested as part of the Approval project. The audit will review the facility and in-place quality control procedures used in the manufacturing of the product. Typically areas of review are: incoming inspection, work in progress, production testing, final quality control, marking, calibration of equipment, shipping procedures and drawing control. These examinations are repeated periodically as part of the FM Approvals' product follow-up program, (Refer to Section 5.2, Facilities and Procedures Audits).

1.5 Basis for Continued Approval

1.5.1 Continued Approval is based upon:

- Production or availability of the product as currently FM Approved;
- The continued use of acceptable quality assurance procedures;
- Satisfactory field experience;
- Compliance with the terms stipulated in the Master Agreement; or Approval Agreement;
- Satisfactory re-examination of production samples for continued conformity to requirements; and,
- Satisfactory Facilities and Procedures Audits (F&PAs) conducted as part of the FM Approvals' product follow-up program.

1.5.2 Also, as a condition of retaining Approval, manufacturers may not change an FM Approved product or service without prior authorization by FM Approvals, (Refer to Section 5.1.3 Drawing and Change Control).

1.6 Effective Date

The effective date of an Approval standard mandates that all products tested for Approval after the effective date shall satisfy the requirements of that standard. Products FM Approved under a previous edition shall comply with the new version by the effective date or forfeit Approval.

The effective date of this standard is **July 31, 2008** 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. Appendix A lists the selected units and conversions to SI units for measures appearing in this standard. Conversion of U.S. customary units is in accordance with the Institute of Electrical and Electronics Engineers (IEEE)/American Society for Testing and Materials (ASTM) SI 10-2002, *American National Standard for Use of the*

International System of Units (SI): The Modern Metric System. One unit of measurement (liters), outside of, but recognized by SI, is commonly used in international fire protection and is used in this standard.

1.8 Applicable Documents

The latest versions of the following standards, test methods, and practices are referenced in this standard:

IEEE/ASTM SI 10-2002, *American National Standard for Use of the International System of Units (SI): The Modern Metric System*
ANSI/American Society of Mechanical Engineers (ASME) B16.3 - 1998, *Malleable Iron Threaded Fittings*
ANSI/ASME B16.5 - 1988, *Pipe Flanges and Flanged Fittings*
ASME/ANSI B1.20.1 - 2001, *Pipe Threads, General Purpose (Inch) Revision and Redesignation of ASME/ANSI B2.1-1968 R(2001)*
ASME B36.10M - 2000, *Welded and Seamless Wrought Steel Pipe*
ASTM D471 - 1997, *Standard Test Method for Rubber Property - Effect of Liquids*
ASTM D572 - 1988 (Re-approved 1994), *Standard Test Method for Rubber - Deterioration by Heat and Oxygen*
ASTM D2444 - 1999, *Standard Test Method for Determination of the Impact Resistance of Thermoplastic Pipe and Fittings By Means of A Tup (Falling Weight)*
American Water Works Association (AWWA) C606-2004, *Joints, Grooved and Shouldered Type Approval Standard Class 3810 - March 1989, Electrical and Electronic Test, Measuring, and Process control Equipment*
FM Global Property Loss Prevention Data Sheets
National Electrical Manufacturers Association (NEMA) Standards Publication 250-1997, *Enclosures for Electrical Equipment (1000 Volts Maximum)*
National Fire Protection Association (NFPA) 72®, *National Fire Alarm Code® 2002 Edition*

1.9 Definitions

For purposes of this standard, the following terms apply:

Accepted

This term refers to installations acceptable to the authority enforcing the applicable installation rules. When the authority is FM Global, such locations are termed “FM Global Accepted.” Acceptance is based upon an overall evaluation of the installation. Factors other than the use of FM Approved equipment impact upon the decision to accept, or not to accept. Acceptance is not a characteristic of a product. It is installation specific. A product accepted for one installation may not be acceptable elsewhere. (Contrast with FM Approved.)

Corrosion Resistant

Having resistance to corrosion equal to or exceeding that of bronze alloy having a minimum copper content of 80 percent, or constructed of 300 or 400 Series Stainless Steel.

Flanged End Valves

Valves having flanged ends per the dimensional values shown in ANSI/ASME B16.5, *Pipe Flanges and Flanged Fittings*, as a default. Flanges to other national or international standards shall be evaluated on a case-by-case basis.

FM Approved Mark

The FM Approved Mark is detailed in Appendix B. Its use is mandatory on all units of FM Approved indicating valves. These registered marks cannot be used except as authorized by FM Approvals via the granting of Approval to a specific product.

FM Approved

This term refers to products FM Approved by FM Approvals. Such products are listed in the Approval Guide, a publication of FM Approvals, issued annually, or one of the supplements. All products so listed have been successfully examined by FM Approvals, and their manufacturers have signed and returned a Master Agreement to FM Approvals. These forms obligate the manufacturer to allow re-examination of the product and audit of facilities and procedures at FM Approvals discretion. It further requires the manufacturer not to deviate from the as-FM Approved configuration of the product without review by and agreement of FM Approvals. Approval is product specific.

Grooved End Valves

A grooved end valve is characterized by having grooved ends cast or subsequently machined on the inlet and outlets of the valve body; such that the valve may be installed in the sprinkler system piping using FM Approved grooved end couplings. Manufacturers are allowed to define their own dimensional values in order to achieve higher performance for the assembled joint. However, most grooved end connections follow the dimensional values shown in AWWA C606, *Joints, Grooved and Shouldered Type*, for IPS Pipe.

Indicating Valve

An indicating valve is a valve that indicates orientation of the ball or disc by visual observation. The position of the valve ball or disc may also be monitored by the use of supervisory switches.

Lug Style Valves

This valve type refers to a butterfly valve design wherein tapped holes are machined into “lugs” found around the circumference of the valve body. This allows for flange bolting to connect to each side of the valve during installation in the sprinkler system piping. For the purposes of this standard, lug style valves shall comply with the dimensional values shown in ANSI/ASME B16.5, *Pipe Flanges and Flanged Fittings*. Lug style valves manufactured to other national or international standards shall be evaluated on a case-by-case basis.

Maximum Operating Torque

The maximum torque required to either open or close a valve. The opening maximum operating torque is the maximum torque, measured at the handwheel shaft, necessary to translate a closed valve (against the valve stops) to the full open position. While closed, the valve will be subjected to an upstream pressure equal to the rated working pressure. The closing maximum operating torque is the maximum torque necessary to translate a full open valve to the full closed position. The torque shall be measured as the valve is closed against the flow rate developed by a fluid velocity of 20 ft/sec (6.1 m/sec) in Schedule 40 steel pipe.

Rated Working Pressure

This is the maximum sustained pressure at or below which the valve shall operate trouble free. This also sets the basis for the testing described in Section 4, Performance Requirements.

Schedule 40 Steel Pipe

For the purposes of this Approval Standard, references have been made to “Schedule 40” steel sprinkler pipe. In all cases, the reference is made to the pipe dimensions outlined in ASME B36.10, *Welded and Seamless Wrought Steel Pipe*. It is important to note that other national or international standards also make reference to “Schedule 40” pipe but may in fact have different dimensions for the same nominal pipe size.

Threaded End Valves

A threaded end valve is characterized by having threads machined into the valve body and endplate such that the valve may be installed in a threaded pipe system. For the purposes of this standard, threaded end refers to ASME/ANSI B1.20.1, *Pipe Threads, General Purpose (Inch) Revision and Redesignation of ASME/ANSI B2.1-1968 R(2001)*, for tapered pipe threads. Other thread forms may be acceptable on a case-by-case basis.

Ultimate Operator Torque (UOT)

The ultimate operator torque (UOT) is defined as the input torque applied to the operator handwheel or crank, with the disc or ball blocked in the open position that causes a component inside the gear operator to fail.

Wafer Style Valves

This valve type refers to a butterfly valve design wherein the valve is placed between two pipe flanges and held in place by the flange bolting. In this style of valve, the flange bolts surround the valve but do not connect to the valve directly.

2. GENERAL INFORMATION

2.1 Product Information

- 2.1.1 These valves usually have six major components: a body, valve operator, drive shaft, resilient or metal seat, disc or ball, and visual indicator.
- 2.1.2 The valve operator is a gear box mechanism that is mounted on top of the valve body. A handwheel or crank provides the input torque to the operator that rotates the disc or ball through the valve drive shaft. The gear box provides a torque multiplier ratio, such that the output torque to the disc is several multiples of the input (handwheel or crank) torque. This ratio also results in an incremental turn of the valve element for every full turn of the handwheel or crank. This prevents closing the disc or ball rapidly, and therefore precludes water hammer.
- 2.1.3 The disc or ball is mounted in the waterway of the valve body and controls waterflow when it is rotated between 0° and 90° (fully opened to fully closed).
- 2.1.4 The indicator is the top most component of the valve operator and is assembled directly to the drive shaft. It shows the position of the disc or ball in the waterway at all times, even after the determination of the Ultimate Operator Torque.
- 2.1.5 In order to meet the intent of this standard, indicating valves must be examined on a model-by-model, type-by-type, manufacturer-by-manufacturer, and plant-by-plant basis. This is predicated on the basis that identical designs, fabricated in identical materials by different manufacturers or, even by different plants of the same manufacturer, have been seen to perform differently in testing. Sample indicating valves, selected in conformance to this criterion, shall satisfy all of the requirements of this standard.

2.2 Approval Application Requirements

- 2.2.1 To apply for an Approval examination the manufacturer, or its authorized representative, should submit a request to:

Hydraulics Group Manager
FM ApprovalsSM
Hydraulics Laboratory
Member of the FM Global Group
743A Reynolds Road
West Glocester, RI 02814 U.S.A.

2.2.2 The manufacturer shall provide, at a minimum, the following preliminary information with any request for Approval consideration:

- A complete list of all models, types, sizes, and options for the products or services being submitted for Approval consideration;
- General assembly drawings, one complete set of manufacturing drawings, materials list(s) and physical property specifications, anticipated marking format, brochures, sales literature, specification sheets, installation, operation and maintenance procedures; and,
- The number and location of manufacturing facilities.

2.2.3 All documents shall be controlled by the manufacturer's Quality Assurance procedures and shall identify the manufacturer's name, document number or other form of reference, title, date of last revision, and revision level. All foreign language documents shall be provided with English translation.

2.3 Requirements for Samples for Examination

Following set-up and authorization of an Approval examination, the manufacturer shall prepare samples for examination and testing. Sample requirements are to be determined by FM Approvals following review of the preliminary information. Sample requirements may vary depending on design features, results of prior testing, and results of the foregoing tests. It is the manufacturer's responsibility to submit samples representative of production. Any decision to use data generated utilizing prototypes is at the discretion of FM Approvals.

3. GENERAL REQUIREMENTS

3.1 Review of Documentation

During the initial investigation and prior to physical testing, the manufacturer's specifications, technical data sheets, and design details shall be reviewed to assess the ease and practicality of installation and use. The product shall be capable of being used within the limits of the Approval investigation.

3.2 Physical or Structural Features - Valve

- 3.2.1 Indicating valves shall be designed for a minimum rated working pressure of 175 psi (1205 kPa).
- 3.2.2 Indicating valves shall have wafer, lug, flanged, grooved or threaded end connections. Other types of end connections shall be evaluated on a case-by-case basis.
- 3.2.3 The indicating valve shall provide either a single or double waterway when it is in the wide open position. The total area of this waterway shall not be less than 60 percent of the internal cross-sectional area of the connecting pipe.
- 3.2.4 The disc or ball assembly and disc or ball shaft shall be capable of withstanding a torque applied to the handwheel or crank of at least three times the torque required to open the valve against a hydrostatic pressure differential equal to the rated working pressure.
- 3.2.5 The valve shall have a stem seal which prevents water within the body from escaping to atmosphere.

- 3.2.6 Valves 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 assembly of the unit.

3.3 Physical or Structural Features - Gear Operator

- 3.3.1 It shall be possible to lock or chain the valve or operator so that the valve disc or ball cannot be moved from the fully open position without use of bolt cutters. A chain or cable and padlock are an acceptable locking method. Once locked, the valve shall not travel more than 5 percent of its full travel.
- 3.3.2 The valve operator, and associated body and operator support components, shall be capable of withstanding a torque applied to the handwheel or crank of at least three times the torque required to open the valve against a hydrostatic pressure differential equal to the rated working pressure.
- 3.3.3 If rotary motion is employed to operate the valve, the direction to open shall be counterclockwise.
- 3.3.4 Stops shall be provided to ensure that the disc or ball is properly positioned in the waterway at fully open and closed positions. Externally adjustable stops are acceptable.
- 3.3.5 The handwheel or crank shall be pinned or permanently assembled to the operator drive shaft.
- 3.3.6 The indicator flag shall indicate the position of the disc/ball at all times, (See Section 4.7.1).
- 3.3.7 Valves submitted for evaluation with supervisory switches shall have a wiring diagram and electrical voltage/ampere requirements labeled on the operator cover. The markings shall be cast or provided on a permanently-marked, legible, corrosion-resistant nameplate, permanently fastened to the operator cover. Alternative markings shall be reviewed on a case-by-case basis.
- 3.3.8 Indicating valves submitted for outdoor service shall be equipped with an enclosure that is resistant to incidental contact with the enclosed equipment, rain, external icing, and dust. The enclosure gaskets shall not be damaged when the enclosure is opened for servicing as needed.

3.4 Markings

- 3.4.1 The following minimum information shall be in cast characters on the valve and/or shown on a permanently-marked, legible, corrosion-resistant nameplate, permanently fastened to the valve. External adhesive labels are not permitted for use as valve markings.
- Manufacturer's name or trademark;
 - Valve size;
 - Manufacturers date code, (i.e. mm/yy);
 - Rated working pressure;
 - Model designation;
 - FM Approved Mark, (see Appendix B);
 - Manufacturing source code where necessary; and
 - Valves with supervisory switches shall have a wiring diagram and electrical voltage/ampere requirements labeled on the operator cover. (Please refer to Section 3.3.7 for more information on this requirement.)
- 3.4.2 The words "OPEN" and "CLOSED" (or "SHUT") shall be in cast letters or stamped on the cover of the valve operator. The indicator shall point to these words when the valve is fully open or closed. Raised arrowheads or similar symbols may be placed near these words to show more precisely the extreme positions of the valve.