

Approval Standard

**Fuel Gas and Oil
Safety Shutoff Valves**

Class Number 7400

October 8, 1976



Factory Mutual Research

APPROVAL STANDARD

FUEL GAS AND OIL SAFETY SHUTOFF VALVES

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1151 Boston-Providence Turnpike
Norwood, Massachusetts 02062

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I INTRODUCTION

1.1 A safety shutoff valve is installed in the fuel supply piping of industrial heating equipment to control fuel flow. The valve is relied on to maintain fuel shutoff during idle periods. In the event that any medium holding the valve open (electricity or pressure) is removed, the valve is relied on to close within a specified time interval.

1.2 These are Factory Mutual requirements for safety shutoff valves. The tests conducted to demonstrate the operating characteristics of the equipment defined in this standard are described in the Factory Mutual Test Procedures for Safety Shutoff Valves. Valves for controlling the flow of fluids other than fuels may be examined and tested according to the intent of this standard for the rated medium.

1.3 Factory Mutual approval is based on satisfactory evaluation of the product and the manufacturer in three major areas:

- Examinations and tests on production samples are performed to evaluate (1) the suitability of the product, (2) the proper operation and performance of the product as specified by the manufacturer and required by Factory Mutual, and (3) as far as practical, the durability and reliability of the product.

- An examination of manufacturing facilities and quality control procedures is conducted to evaluate the manufacturer's ability to produce the product which is examined and tested. These examinations are periodically repeated as part of Factory Mutual's approved product follow-up program.

- Satisfactory field experience is the final test of approval. Unsatisfactory field experience may result in withdrawal of Factory Mutual approval.

1.4 The requirements of this standard are intended as guidelines reflecting current Factory Mutual approval tests and practices. Valves which do not precisely conform to these requirements may be approved if they meet the intent of this standard. Similarly, those that do conform to these requirements may not be approved if they do not meet the intent of these requirements or if other conditions govern.

II REQUIREMENTS

2.1 General (Gas and Oil Safety Shutoff Valves)

A safety shutoff valve shall:

- have all necessary operating components mounted on the valve to result in an integrated unit for the intended use.

- be capable of withstanding the normal conditions of vibration, atmospheres, and temperatures encountered in industrial applications.

- conform in all respects with the manufacturer's specifications and applicable ratings.
 - be of such design that it will operate reliably and with no noticeable change in operating characteristics throughout not less than 20,000 complete cycles of operation under rated conditions. The design will be considered satisfactory as such with no further cycling. With change in operating characteristics, increased leakage for example, the design shall be such that after additional cycling, the condition levels off or 100,000 cycles are completed. In no case shall the valve leakage or other operational characteristics be other than as described in subsequent paragraphs.
 - have electrical contacts, terminals, and vulnerable operating members enclosed to afford adequate protection against damage or atmosphere.
 - not be readily by-passed or blocked open externally.
 - provide a means visible from at least 5 ft. (1.52m) to show whether the main valve is open or closed.
- An electric solenoid operated safety shutoff valve having no provision for position indication may be examined and tested for possible approval up to size $\frac{3}{4}$ in. NPS. The requirement in these solenoid valve sizes is waived due to the valve design characteristics and the usually inherent restrictive (critical) valve operating forces.

2.2 Valve Closure

2.2.1 A safety shutoff valve shall close:

- without manual action in 5 sec or less after any holding medium has been cut off abruptly or reduced slowly to the tripping point under all pressure conditions within its rating.
- upon accidental escape of the actuating media.
- consistent and reliably against pressures up to 150% of the rated fuel pressure.

Note: Closed considered to be a continuous leakage rate through the valve not exceeding $1 \text{ ft}^3/\text{hr}$ $0.028 \text{ m}^3/\text{hr}$ gas or $1/300 \text{ ths gal/hr}$ (12.6 cc/hr) oil at up to 150% of rated fuel pressure.

2.2.2 When closed, the valve shall remain closed on a sudden change of upstream pressure equivalent to from 0 to 150% of rated pressure in $\frac{1}{2}$ sec. Upstream fuel pressure shall have a net effect of forcing the main valve disc or equivalent tighter on its seat. In the case of a 3-way valve, the port-to-burner disc shall be similarly affected. Where another valve is an operating component controlling a main valve, the design of the control valve shall be such that when de-energized, inlet pressure increase to 150 psi or 200% of the manufacturer's maximum rated actuator operating pressure, whichever is greater, does not tend to open the main valve.

2.3 Valve Opening

A valve shall open by either manual or automatic action as applicable only when all holding media are above their respective tripping point. In addition, the valve shall open reliably against 125% of rated pressure.

2.4 Electrical Components

A safety shutoff valve shall:

- electrically conform with the applicable standards of the IEEE or NEMA and with the National Electrical Code, ANSI C1.
- operate properly over a voltage range of 85% to 110% of rated.

— be consistent with rated voltage, be capable of withstanding for 1 min 1000 volts, 60 Hz plus twice rated voltage between all current carrying parts and the body or enclosure with no arcing or breakdown resulting in a current in excess of 5 mA.

2.5 *Auxiliary Switches*

2.5.1 Electrical switches actuated by the valve for use in external circuits shall be examined and tested as a component of the valve.

2.5.2 When the switch is provided on the valve as an interlock to supervise (prove) the closed position of the valve, this switch shall indicate closed only when the valve is closed. It shall include at least one set of contacts which close only after the valve port is closed and open before the valve port opens. The additional movement to actuate the switch while the port is closed shall be provided by the disc or equivalent port closing element. The additional movement provided shall be consistent with the switch differential to provide reliable switch operation. The port will be considered closed when leakage through the valve does not exceed $1 \text{ ft}^3/\text{hr}$ ($0.028 \text{ m}^3/\text{hr}$) gas or $1/300\text{ths gal/hr}$ (12.6 cc/hr) oil at up to 150% of rated fuel pressure. Distinctive markings shall be provided to identify this switch. The switch setting shall be factory set. If field adjustment is provided, then the arrangement shall minimize the possibility of tampering and, installation and operating instructions should identify proper switch setting procedures. This will be the subject of special investigation and tests as considered necessary.

2.6 *Components Under Pressure*

Any part of the safety shutoff valve which is subject to fuel pressure shall withstand 200% of rated pressure without external leakage or damage to the assembly.

III MARKINGS

A safety shutoff valve shall:

- be provided permanent labelling giving the manufacturer's name and address, distinctive identification numbers, pertinent operating ratings and rated fuel (s).
- be provided with fuel flow direction indication as applicable.

IV ADDITIONAL REQUIREMENTS FOR MANUAL-OPENING SAFETY SHUTOFF VALVES

4.1 The handle, or equivalent, shall be readily accessible, but when any holding medium is below the tripping point, operation of the handle shall not cause the valve to open or prevent its closure.

4.2 The manual effort required to operate the valve under rated conditions shall be within reasonable strength limits.