

NOTICE OF
ADOPTION

ADOPTION NOTICE 1
4 February 1991 for
ANSI Z358.1-1990
October 5, 1989
SUPERSEDING
ANSI Z358.1-1981
23 September 1983
USED IN LIEU OF
WW-P-541/7 (IN PART)
August 1, 1980

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American National Standards Institute, Inc.
1430 Broadway
New York, NY 10018

Title of Document: Emergency Eyewash and Shower Equipment

Date of Specific Issue Adopted: October 5, 1989

Releasing Non-Government Standards Body: American National Standards Institute

Custodian:
Navy - YD
Air Force - 99

Military Coordinating Activity:
Navy - YD

Review Activities:
Army - ME
Air Force - 84
DLA - CS

(Project 4510-0232)

User Activities:
Army - CE
Navy - MC, MS

FSC 4510

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S-09-19

American National Standard

*for Emergency Eyewash
and Shower Equipment*

ANSI Z358.1-1990



American National Standards Institute

1430 Broadway
New York, New York
10018

ANSI®
Z358.1-1990
Revision of
ANSI Z358.1-1981

American National Standard
for Emergency Eyewash
and Shower Equipment

Secretariat
Industrial Safety Equipment Association

Approved October 5, 1989
American National Standards Institute, Inc

American National Standard

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Published by

American National Standards Institute
1430 Broadway, New York, New York 10018

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Printed in the United States of America

A1M490/21

Foreword (This Foreword is not part of American National Standard Z358.1-1990.)

This revision of the American National Standard for Emergency Eyewash and Shower Equipment updates ANSI Z358.1-1981.

Even though emergency eyewash and shower equipment has been in use in industry for over 60 years, the 1981 standard was the first voluntary standard in the United States dealing with the minimum performance requirements for this type of equipment. The 1981 standard and this revision were prepared by the Emergency Eyewash and Shower Group of the Industrial Safety Equipment Association, whose members are thoroughly knowledgeable in the design, installation, and use of this important safety equipment.

Suggestions for the improvement of this standard will be welcome. They should be sent to the Industrial Safety Equipment Association, 1901 N. Moore Street, Arlington, VA 22209.

This standard was processed and approved for submittal to ANSI by the Canvass Method. The following organizations were contacted prior to the approval of this standard. Inclusion in this list does not necessarily imply that the organization concurred with the submittal of the proposed standard to ANSI.

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Explanation of Standard Format

American National Standard Z358.1-1990 uses a two-column format to provide both specific requirements and supporting information.

The left column, designated "Standard Requirements," is confined solely to these requirements and is printed in bold type. Where supporting photographs or sketches are required, they are designated as "figures."

The right column, designated "Explanatory Information," contains only information which is intended to clarify the standard. This column is *not* a part of the standard. Where supplementary photographs or sketches are required, they are designated as "illustrations."

Operating rules (safe practices) are not included in either column unless they are of such a nature as to be vital safety requirements, equal in weight to other requirements, or guides to assist in compliance with the standard.

American National Standard

for Emergency Eyewash and Shower Equipment

STANDARD REQUIREMENTS

EXPLANATORY INFORMATION

(Not part of American National Standard for
Emergency Eyewash and Shower Equipment,
ANSI Z358.1-1990.)

1. Scope

This standard establishes minimum performance requirements for eyewash and shower equipment for the emergency treatment of the eyes or body of a person who has been exposed to injurious materials. It covers the following types of equipment: emergency showers, eyewash equipment, eye/face wash equipment, hand-held drench hoses, and combination shower and eyewash or eye/face wash.

2. Purpose

This standard is intended to provide uniform minimum requirements for equipment performance, installation, test procedures, and maintenance and training in order to assure the worker of a minimum level of first aid.

3. Definitions

combination unit. A unit combining a shower with an eyewash or eye/face wash, or with a drench hose, or with both, into one common assembly.

drench hose. See *hand-held drench hose*.

emergency shower. A unit that enables a user to have water cascading over the entire body.

emergency shower head. A head specially designed for use on an emergency shower.

eye/face wash. A device used to irrigate and flush both the face and the eyes.

eyewash. A device used to irrigate and flush the eyes.

flow pressure. The gauge pressure measured at the pipe wall during flow.

flow regulator. A mechanical device to control the flow of water through pipes.

flushing fluid. Potable water or other medically acceptable solution.

freeze protected. Designed to operate under freezing conditions.

gallons per minute (GPM). A measure of water flow.

hand-held drench hose. A flexible hose connected to a water supply and used to irrigate and flush eyes, face, and body areas.

iron-pipe size (IPS). A plumbing industry term for the sizing and thread system of pipe (not limited to iron pipe).

multiple-spray shower. An emergency shower using more than one head and delivering water from more than one direction.

personal eyewash. A supplementary eyewash that supports plumbed units, self-contained units, or both, by delivering immediate flushing fluid.

plumbed eyewash. An eyewash unit permanently connected to a source of potable water.

potable water. Water that is suitable for drinking.

pounds per square inch (PSI). A measure of pressure, usually identified as pump pressure or nozzle pressure.

self-closing valve. A valve that closes automatically when released.

self-contained eyewash. An eyewash device that contains its own flushing fluid and must be refilled or replaced after use.

self-contained shower. A shower that contains its own flushing fluid, and must be refilled or replaced after use.

stay-open valve. A valve that must be closed manually.

4. Plumbed and Self-Contained Emergency Showers

4.1 Performance of Shower Heads. Emergency shower heads shall be designed and located so that

E4. See Illustration 1.

E4.1. All dimensions in this section are based on Woodson, W. E., and Conover, D. W., *Human*

a water column is provided that is not less than 208.3 cm (82 inches) nor more than 243.8 cm (96 inches) in height from the surface on which the user stands. The spray pattern shall have a minimum diameter of 50.8 cm (20 inches) at 152.4 cm (60 inches) above the surface on which the user stands, and the center of the spray pattern shall be located at least 40.6 cm (16 inches) from any obstruction. Emergency shower heads should be capable of delivering a minimum of 113.6 liters per minute (30 gallons per minute) of water at a velocity low enough not to be injurious to the user. The water shall be substantially dispersed throughout the pattern.

4.2 Performance of Control Valve. The valve shall be designed so that the water flow remains on without requiring the use of the operator's hands. The valve shall be designed to remain activated until intentionally shut off. The valve shall be simple to operate and shall go from "off" to "on" in 1 second or less. The valve shall be resistant to corrosion from potable water.

4.3 Performance of Valve Actuator. Manual or automatic actuators shall be easy to locate and readily accessible to the user.

4.4 Shower Enclosures. Enclosures, if used, shall provide for a minimum unobstructed area of 86.4 cm (34 inches) in diameter.

4.5 Manufacturer's Performance Testing Procedures. The manufacturer shall test emergency shower heads as follows:

4.5.1 Plumbed Emergency Showers

(1) Connect a flowmeter to the shower to be tested, or provide other means of measuring water flow.

(2) Attach the shower to a water supply with a minimum iron pipe size (IPS) of 1 inch. The shower head's height shall be 213.4 cm (84 inches) from the surface on which the user stands. The water supply shall have a control valve or pump system that can be adjusted.

(3) Open the valve on the emergency shower and verify that it opens in one second and stays open.

(4) Adjust the control valve on the water supply to deliver a minimum of 113.6 liters per minute (30 gallons per minute), and determine that water is substantially dispersed throughout the pattern. Measure the diameter of the water pattern 152.4 cm (60 inches) above the surface on which the user

Engineering Guide to Equipment Design, Army, Navy, Air Force Steering Committee, United States Government, 1972; and on *Human Engineering Guide for Equipment Designers*, University of California Press, 1964, 2nd ed. In a combination unit, the eyewash is not considered an obstruction for the purpose of determining the distance of the center of the spray pattern. The water pressure required at the inlet shall be enough to achieve the spray pattern specified. Shower head designers usually use 113.6 liters per minute (30 gallons per minute) at 0.207 megapascal (30 pounds per square inch). A flow of 75.7 liters per minute (20 gallons per minute) can achieve the same spray pattern under the right conditions, in which case this flow is acceptable.

E4.2 In the interests of safety, the valve's remaining open is most desirable to allow the user the use of both hands for disrobing or holding the eyes open. A self-closing valve may be permitted in a school laboratory situation as a limited exception only where the enforcing authority is of the opinion that the hazard posed is not serious. See Illustration 2.

E4.3 Manual actuators should be located not more than 175.3 cm (69 inches) above the surface on which the user stands.

E4.4 The 86.4-cm (34-inch) dimension was chosen to accommodate the movement necessary in an emergency situation. A smaller enclosure could contribute to a further hazard. See Illustration 3.

E4.5.1 See explanatory note under E4.1.

stands. Visually record the diameter of the spread. This shall be a minimum of 50.8 cm (20 inches).

4.5.2 Self-Contained Emergency Showers. The manufacturer shall test emergency showers as follows:

- (1) Fill the unit with flushing solution.
- (2) Connect a flowmeter or provide other means of measuring water flow. (A five- (5-) gallon pail would require 15 seconds or less to fill in order to meet the requirement of 75.7 meters per minute (20 gallons per minute) in (4).)
- (3) Place the unit in operating position. The height of the shower head shall be 2134 cm (84 inches) from the surface on which the user stands.
- (4) The unit shall be capable of delivering a minimum of 75.7 meters per minute (20 gallons per minute) for 15 minutes. Determine that the water is substantially disbursed throughout the pattern. Measure the diameter of the water pattern 152.4 cm (60 inches) above the surface on which the user stands. Visually record the diameter of the spread. This shall be a minimum of 50.8 cm (20 inches).

4.6 Installation

4.6.1 Emergency showers shall be in accessible locations that require no more than 10 seconds to reach and should be within a travel distance no greater than 30.5 meters (100 feet) from the hazard.

4.6.2 Each emergency shower location shall be identified with a highly visible sign. The area around the emergency shower shall be well-lighted and highly visible.

4.6.3 The emergency shower shall be assembled in accordance with the manufacturer's instructions.

4.6.4 The unit shall be connected to a supply of flushing fluid capable of delivering sufficient volume to produce the required spray pattern by the method shown in the manufacturer's instructions.

4.6.5 When the shower is installed, it shall be tested in accordance with the following procedures:

E4.5.2(4) See explanatory note under E4.1.

E4.6.1 The unit should be located as close to the hazard as possible without physically causing a hazard itself, such as protruding fittings. The maximum time required to reach the shower should be determined by the potential effect of the chemical. For example, exposure to a highly corrosive chemical might require showers to be installed within 3 to 6 meters (10 to 20 feet) from the hazard. It is recommended that the consulting physician or appropriate professional be contacted for advice on the proper distances. Precautions should also be taken to protect the user under frigid conditions, including provisions for proper disposal of the water. Installation procedures should be in accordance with proper plumbing practices, with supply piping sized adequately to meet flow requirements. (See Appendix A1.)

E4.6.4 If shutoff valves are installed in the shower line for maintenance purposes, provisions should be made to prevent unauthorized shutoff.

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(1) With the unit correctly connected to the water source and the valve(s) closed, visually check the piping connections for leaks.

(2) Open the valve to the full open position. The valve shall remain open without requiring further use of the operator's hands.

(3) Measure the shower. The face of the shower head shall be not less than 208.3 cm (82 inches) nor more than 243.8 cm (96 inches) from the surface on which the user stands.

(4) With the valve in the "full on" position, measure the diameter of the spray pattern. It shall be a minimum of 50.8 cm (20 inches) at 152.4 cm (60 inches) above the standing surface. The center of the spray shall be at least 40.6 cm (16 inches) from any obstructions.

4.7 Maintenance and Training

4.7.1 Showers shall be activated weekly to flush the line and to verify proper operation.

4.7.2 All employees who might be exposed to chemical splash shall be instructed in the proper use of emergency showers.

E4.7.1 Procedures should be established to ensure compliance with 4.7.1.

E4.7.2 Medical and industrial experiences have shown that the initial first aid treatment for chemical splash should be to wash the body for 15 minutes prior to medical treatment, with the clothing removed during the showering period.

5. Plumbed and Self-Contained Eyewash Equipment

E5. See Illustrations 4, 5, and 6.

5.1 Performance of Plumbed and Self-Contained Eyewash Units

E5.1 Self-contained units allow an option for the type of flushing solution selected for use in the unit. Any effective antibacterial agent, suitable for ophthalmic use, added to tap water will help preserve the water and reduce the possibility of pathogens developing in the flushing solution. However, an isotonic saline solution (0.85% to 1.0% NaCl) buffered to a pH of 7.3 to 7.4 and preserved with a suitable antibacterial agent is less irritating to the eye over a 15-minute flush.

5.1.1 A means shall be provided to ensure that a controlled flow of flushing fluid is provided to both eyes simultaneously at a velocity low enough not to be injurious to the user. Where the possibility of freezing conditions exists, equipment shall be protected from freezing or freeze-protected equipment shall be installed.

5.1.2 There shall be no sharp projections anywhere in the operating area of the unit.

5.1.3 Nozzles shall be protected from airborne contaminants. Whatever means is used to afford such protection, its removal shall not require a separate motion by the operator when activating the unit.

5.1.4 Self-contained units shall be constructed of materials that will not corrode in the presence of the flushing fluid. The stored flushing fluid shall be protected against airborne contaminants.

5.1.5 Eyewash equipment shall be capable of delivering to the eyes not less than 1.5 liters per minute (0.4 gallon per minute) for 15 minutes.

5.1.6 The unit shall be designed to provide enough room to allow the eyelids to be held open with the hands while the eyes are in the stream of water.

5.2 Performance of Control Valve. The valve shall be designed so that the water flow remains on without requiring the use of the operator's hands. The valve shall be designed to remain activated until intentionally shut off. The valve shall be simple to operate and shall go from "off" to "on" in 1 second or less. The valve shall be resistant to corrosion from potable water. The valve actuator shall be large enough to be easily located and operated by the user.

5.3 Manufacturer's Performance Testing Procedures

5.3.1 Plumbed Units. The manufacturer shall test plumbed eyewash units as follows:

(1) Connect a flowmeter to the eyewash to be tested, or provide other means of measuring water flow.

(2) Open the valve on the eyewash unit and verify that it opens in one second and stays open.

(3) Using the flowmeter or other means, determine that the rate of flow is at least 1.5 liters per minute (0.4 gallon per minute), that the flushing streams rise to approximately equal heights, and that the water will wash both eyes simultaneously at a velocity low enough not to be injurious to the user.

E5.1.5 A wide range of materials can enter the eye and cause injury. The minimum water flow of 1.5 liters per minute (0.4 gallon per minute) for 15 minutes at a velocity low enough not to be injurious to the eye is based on medical consultation and industry experience. Specific hazardous materials may require greater flows for longer periods of time. The consulting physician should be contacted for advice.

E5.1.6 See Illustration 4.

E5.3.1 Attach the plumbed unit to a 1.3-cm (1/2-inch) water supply line at 0.207 megapascal (30 pounds per square inch) flow pressure.

E5.3.1(3) To determine that both streams are properly located for flushing simultaneously, refer to dimensions in Woodson, W. E., and Conover, D. W., *Human Engineering Guide to Equipment Design*, Army, Navy, Air Force Steering Committee, United States Government, 1972; and in *Human Engineering Guide for Equipment Designers*, University of California Press, 1964, 2nd ed.

A suitable gauge (see Illustration 7) for making the determination is a strip of transparent material 10.16 cm (4 inches) wide marked with two sets of parallel lines equidistant from the center, one set 3.18 cm (1-1/4 inches) apart and the other 8.26 cm (3-1/4 inches) apart. Place this strip on top of the stream of the eyewash; the flushing should cover

5.3.2 Self-Contained Units. The manufacturer shall test self-contained eyewash units as follows:

(1) Position the emergency eyewash unit in the operating position so that the discharged water can be collected. Fill the unit with flushing fluid.

(2) Using a 3.785-liter (1-gallon) container and a timing device, collect 3.785 liters (1 gallon) of water at the start of the flow. Record the time required to fill the container.

(3) Continue to operate the unit for 15 minutes. Using the same equipment, and with the discharge orifice maintained in the same position over the test period, collect 3.785 liters (1 gallon) of water beginning 12.5 minutes after the flow begins. Record the time required to fill the container.

(4) The elapsed time to collect 3.785 liters (1 gallon) of water shall be 2-1/2 minutes or less for each test.

5.4 Installation

5.4.1 The unit shall be positioned with the water nozzles 83.8 cm (33 inches) to 114.3 cm (45 inches) from the floor and 15.3 cm (6 inches) minimum from the wall or the nearest obstruction.

5.4.2 Eyewash units shall deliver flushing fluid. Where the possibility of freezing conditions exists, equipment shall be protected from freezing or freeze-protected equipment shall be installed. The supply line for plumbed units shall provide an uninterrupted supply of water at a minimum of 0.207 megapascal (30 pounds per square inch) of flow pressure. Units shall be installed in accordance with the manufacturer's instructions and acceptable plumbing practices.

5.4.3 When the unit is installed, the valve shall be operated to determine that both eyes will be washed simultaneously at a velocity low enough not to be injurious to the user.

5.4.4 Eyewash units shall be in accessible locations that require no more than 10 seconds to reach and should be within a travel distance no greater than 30.5 meters (100 feet) from the hazard.

the areas between the lines 3.18 cm (1-1/4 inches) apart and the lines 8.26 cm (3-1/4 inches) apart when the gauge is lowered not more than 3.81 cm (1-1/2 inches) below the water's peak. The dimensions cover from the 5th percentile female to the 95th percentile male pupillary distance plus or minus approximately 1.3 cm (1/2 inch).

E5.4 All dimensions in this section are based on Woodson, W. E., and Conover, D. W., *Human Engineering Guide to Equipment Design*, Army, Navy, Air Force Steering Committee, United States Government, 1972; and on *Human Engineering Guide for Equipment Designers*, University of California Press, 1964, 2nd ed.

E5.4.2 The minimum flow pressure has been established based on prevailing industry practice to provide adequate flushing fluid.

E5.4.4 The unit should be located as close to the hazard as possible, and on the same level. The maximum time required to reach the eyewash should be determined by the potential effect of the chemical. For a strong acid or strong caustic, the

5.4.5 Each eyewash location shall be identified with a highly visible sign. The area around the eyewash shall be well-lighted and highly visible.

5.5 Maintenance and Training

5.5.1 Plumbed eyewash units shall be activated weekly to flush the line and to verify proper operation. Self-contained units shall be inspected and maintained in accordance with the manufacturer's instructions.

5.5.2 All employees who might be exposed to chemical splash shall be instructed in the proper use of emergency eyewash units.

eyewash should be immediately adjacent to or within 3 meters (10 feet) of the hazard. It is recommended that the consulting physician or appropriate professional be contacted for advice on the proper distance.

E5.5.1 Procedures should be established to ensure compliance with 5.5.1. It is important to adhere to the manufacturer's instructions for changing flushing fluid to assure that a safe flushing fluid is available when needed.

E5.5.2 Medical and industrial experiences have shown that the initial first aid treatment for chemical splash should be to wash the eyes for 15 minutes prior to medical treatment. It is important to hold the eyelids open and roll the eyeballs so water will flow on all surfaces and in the folds surrounding the eyeballs.

6. Personal Eyewash Equipment

6.1 Performance of Personal Eyewash Units

6.1.1 Personal eyewash units shall have the capacity to deliver immediate flushing to the eyes without being injurious to the user. Personal eyewash equipment does *not* meet the criteria of plumbed or self-contained eyewash equipment. Personal eyewash equipment (see Figure 8) supports plumbed and self-contained units but shall *not* replace them.

6.1.2 Personal eyewash units shall deliver flushing fluid.

6.1.3 Instructions and expiration date, if applicable, shall be permanently affixed to the unit.

6.2 Maintenance and Training

6.2.1 Personal eyewash units shall be inspected and maintained in accordance with the manufacturer's instructions.

6.2.2 All employees who might be exposed to chemical splash shall be instructed in the proper use of personal eyewash equipment.

E6.1.1 The first few seconds following an eye injury are often critical to keeping eye injury to a minimum. A personal eyewash unit may be kept in the immediate vicinity of employees working in a potentially hazardous area. The main purpose of these units is to supply immediate flushing. With this accomplished, the injured individual may then proceed to a plumbed or self-contained eyewash and flush the eyes for the required 15-minute period.

E6.2.1 It is important to adhere to the manufacturer's instructions for changing flushing fluid to assure that a safe flushing fluid is available when needed.

7. Eye/Face Wash Equipment

7.1 Performance of Eye/Face Wash Units

7.1.1 A means shall be provided to ensure that a controlled flow of flushing fluid is provided to

E7. See Illustration 9.

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both eyes simultaneously at a velocity low enough not to be injurious to the user, and to wash the face simultaneously.

7.1.2 There shall be no sharp projections anywhere in the operating area of the unit.

7.1.3 Nozzles shall be protected from airborne contaminants. Whatever means is used to afford such protection, its removal shall not require a separate motion by the operator when activating the unit.

7.1.4 Emergency eye/face wash equipment shall be capable of delivering flushing fluid to the eyes and face not less than 11.4 liters per minute (3.0 gallons per minute) for 15 minutes.

7.1.5 The unit shall be designed to provide enough room to allow the eyelids to be held open with the hands while the eyes are in the stream of water.

7.2 Performance of Control Valve. The valve shall be designed in such a manner that the water flow remains on without requiring the use of the operator's hands. The valve shall be designed to remain activated until intentionally shut off. The valve shall be simple to operate and shall go from "off" to "on" in one second or less. The valve shall be resistant to corrosion from flushing fluid. The valve actuator shall be large enough to be easily located and operated by the user.

7.3 Manufacturer's Performance Testing Procedures. The manufacturer shall test eye/face wash units as follows:

(1) Connect a flowmeter to the eye/face wash to be tested, or provide other means of measuring water flow.

(2) Open the valve on the eye/face wash unit and verify that it opens in one second and stays open.

(3) Using the flowmeter or other means, determine that the rate of flow is at least 11.4 liters per minute (3.0 gallons per minute), that the flushing streams rise to approximately equal heights, and that the water will wash the eyes and face at a velocity low enough not to be injurious to the user.

7.4 Installation

7.4.1 The unit shall be positioned with the water nozzles 83.8 cm (33 inches) to 114.3 cm (45 inches)

E7.1.4 A flow of 11.4 liters per minute (3.0 gallons per minute) of flushing fluid is required so that the entire surface of the face may be covered. In addition to having enough force to purge the contaminants, the stream will also target the face area.

E7.1.5 See Illustrations 4 and 9.

E7.3 Attach the eye/face wash unit to a 1.3-cm (1/2-inch) water supply line at 0.207 megapascal (30 pounds per square inch) of flow pressure. All dimensions in this section are based on Woodson, W. E., and Conover, D. W., *Human Engineering Guide to Equipment Design*, Army, Navy, Air Force Steering Committee, United States Government, 1972; and on *Human Engineering Guide for Equipment Designers*, University of California Press, 1964, 2nd ed.

from the floor and 15.3 cm (6 inches) minimum from the wall or nearest obstruction.

7.4.2 Eye/face wash units shall deliver flushing fluid. The supply line shall provide an uninterrupted supply of water at 0.207 megapascal (30 pounds per square inch) of flow pressure. Where the possibility of freezing conditions exists, equipment shall be protected from freezing or freeze-protected equipment shall be installed. Units shall be installed in accordance with manufacturer's instructions and acceptable plumbing practices.

7.4.3 When the unit is installed, the valve shall be operated to determine that both eyes will be washed simultaneously at a velocity low enough not to be injurious to the user.

7.4.4 Eye/face wash units shall be in accessible locations that require no more than 10 seconds to reach and should be within a travel distance no greater than 30.5 meters (100 feet) from the hazard.

7.4.5 Each eye/face wash location shall be identified with a highly visible sign. The area around the eye/face wash shall be well-lighted and highly visible.

7.5 Maintenance and Training

7.5.1 Eye/face wash units shall be activated weekly to flush the line and to verify proper operation.

7.5.2 All employees who might be exposed to chemical splash shall be instructed in the proper use of emergency eye/face wash units.

E7.4.4 The unit should be located as close to the hazard as possible, and on the same level. The maximum time required to reach the eye/face wash should be determined by the potential effect of the chemical. For a strong acid or strong caustic, the eye/face wash should be immediately adjacent to or within 3 meters (10 feet) of the hazard. It is recommended that the consulting physician or appropriate professional be contacted for advice on the proper distance.

E7.5.1 Procedures should be established to ensure compliance with 7.5.1.

E7.5.2 Medical and industrial experiences have shown that the initial first aid treatment for chemical splash should be to wash the eyes and face for 15 minutes prior to medical treatment. It is important to hold the eyelids open and roll the eyeballs so water will flow on all surfaces and in the folds surrounding the eyeballs.

8. Hand-Held Drench Hoses

8.1 Performance of Hand-Held Drench Hoses. Drench hoses shall be designed to provide a controlled flow of water to the eye(s) or to a portion of the body at a velocity low enough not to be injurious to the user. Drench hoses shall deliver a minimum of 11.4 liters per minute (3.0 gallons per minute) of water. Hand-held drench hoses may be used in conjunction with safety shower/eyewash stations except that a drench hose is *not* a substitute for safety shower/eyewash stations.

E8.1 Hand-held drench hoses can be used in cases where the user is in an awkward position physically, or to reach parts of the face or body that are inaccessible to the fixed stream of the shower or eyewash. Eyes are usually washed with a spent stream by turning the hose skyward and washing the eye at the point where the stream begins to fall. At this point the stream's velocity is near zero. A flow of 11.4 liters per minute (3.0 gallons per minute) is required if the drench hose is to be used as

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Hand-held drench hoses (see Figure 10) support shower and eyewash units but shall *not* replace them.

8.2 Performance of Control Valve. The valve shall be simple to operate and shall go from "off" to "on" in one second or less. The valve shall be resistant to corrosion from flushing fluid. The valve actuator shall be easy to locate and operate.

8.3 Manufacturer's Performance Testing Procedures. The manufacturer shall test drench hoses as follows:

(1) Connect a flowmeter to the drench hose to be tested, or provide other means of measuring water flow.

(2) Open the valve on the drench hose and verify that it opens in one second.

(3) Using the flowmeter or other means, determine that the rate of flow is at least 11.4 liters per minute (3.0 gallons per minute) and that the flow of water is at a velocity low enough not to be injurious to the user.

8.4 Installation

8.4.1 The unit shall be connected to a supply of flushing fluid. Where the possibility of freezing conditions exists, equipment shall be protected from freezing or freeze-protected equipment shall be installed.

8.4.2 Units shall be installed in accordance with the manufacturer's instructions and acceptable plumbing practices.

8.4.3 Each separate drench hose location shall be identified with a highly visible sign. The area around the drench hose shall be well-lighted and highly visible.

8.5 Maintenance and Training

8.5.1 Drench hoses shall be activated weekly to flush the line and to verify proper operation.

8.5.2 All employees who might be exposed to chemical splash shall be instructed in the proper use of drench hoses.

an auxiliary method of showering someone in a prone position.

E8.3 Attach the drench hose to a 1.3-cm (1/2-inch) water supply line at 0.207 megapascal (30 pounds per square inch) of flow pressure.

E8.5.1 Procedures should be established to ensure compliance with 8.5.1.

E8.5.2 Medical and industrial experiences have shown that the initial first aid treatment for chemical splash should be to wash the body for 15 minutes prior to medical treatment with the clothing removed during the showering period.

9. Combination Units

E9. See Illustration 11.

9.1 Performance of Combination Units. Combination units shall be designed so all components can be operated individually.

9.1.1 Showers shall meet the performance requirements of Section 4.

9.1.2 Eyewash units shall meet the performance requirements of Section 5.

9.1.3 Eye/face wash units shall meet the performance requirements of Section 7.

9.1.4 Hand-held drench hoses shall meet the performance requirements of Section 8.

9.2 Performance of Control Valve. Each valve shall meet the applicable requirements of Sections 4, 5, 7, and 8, depending on which of the components listed in 9.1 are included.

9.3 Manufacturer's Performance Testing Procedures. The manufacturer shall test each unit individually in accordance with the procedures outlined in Sections 4, 5, 7, and 8, depending on which of the components listed in 9.1 are included.

9.4 Installation

9.4.1 Combination units shall be in accessible locations that require no more than 10 seconds to reach and should be within a travel distance no greater than 30.5 meters (100 feet) from the hazard.

9.4.2 Each combination unit location shall be identified with a highly visible sign. The area around the combination unit shall be well-lighted and highly visible.

9.4.3 Combination units shall be assembled in accordance with the manufacturer's instructions (if shipped with the components separate).

9.4.4 The unit shall be connected to a system capable of supplying adequate flushing fluid to meet the requirements of each component as outlined in Sections 4, 5, 7, and 8. It is not necessary for all components to operate simultaneously (individual conditions will dictate this requirement).

9.5 Maintenance and Training

9.5.1 Each combination unit shall be activated weekly to flush the line and to verify proper operation.

9.5.2 All employees who might be exposed to chemical splash shall be instructed in the proper use of combination units.

E9.4.1 The unit should be located as close to the hazard as possible without physically causing a hazard itself, such as protruding fittings. The maximum time required to reach the combination unit should be determined by the potential effect of the chemical. For example, exposure to a highly corrosive chemical might require showers to be installed within 3 to 6 meters (10 to 20 feet) from the hazard. It is recommended that the consulting physician or appropriate professional be contacted for advice on the proper distance. Precautions should also be taken to protect the user under frigid conditions, including provisions for the proper disposal of the water. Installation procedures should be in accordance with proper plumbing practices, with supply piping sized adequately to meet flow requirements. (See Appendix A1.)

E9.5.1 Procedures should be established to ensure compliance with 9.5.1.

E9.5.2 Medical and industrial experiences have shown that the initial first aid treatment for chemical splash should be to wash the body or eyes, or both, for 15 minutes prior to medical treatment, with the clothing removed during the showering period.

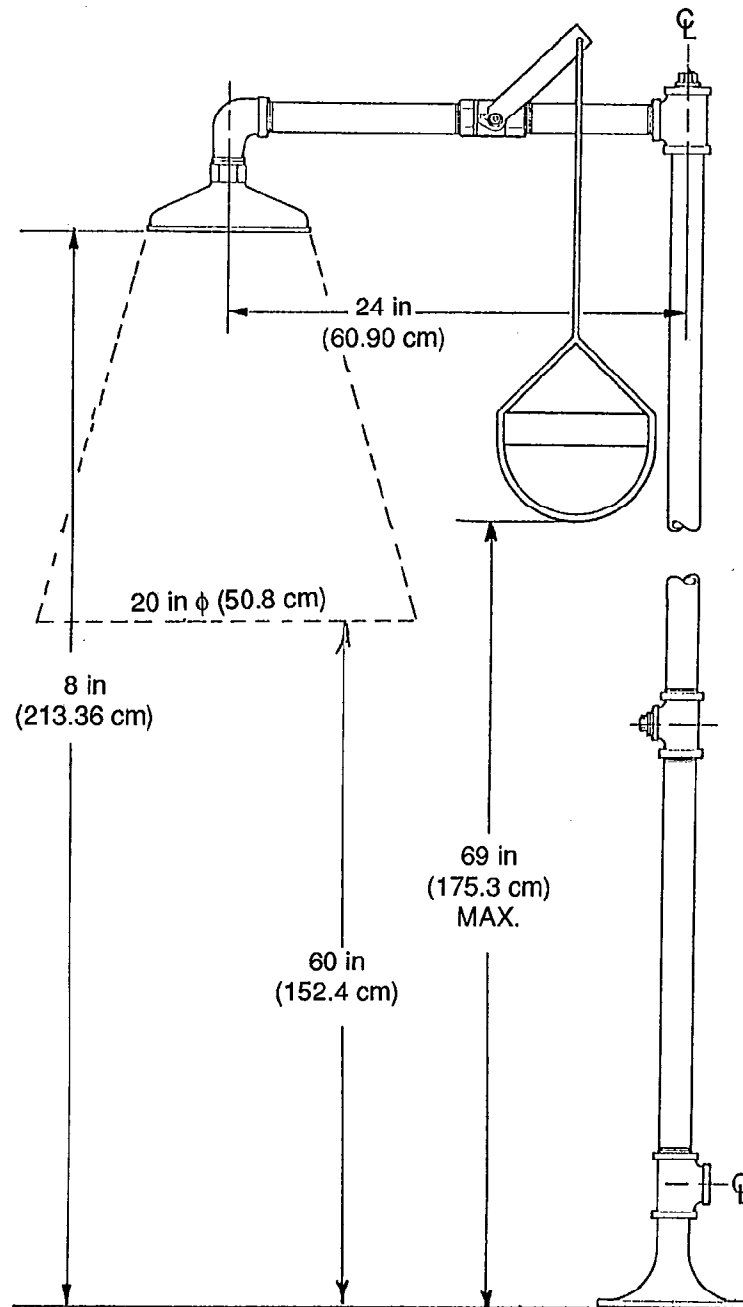


Illustration 1
Emergency Shower

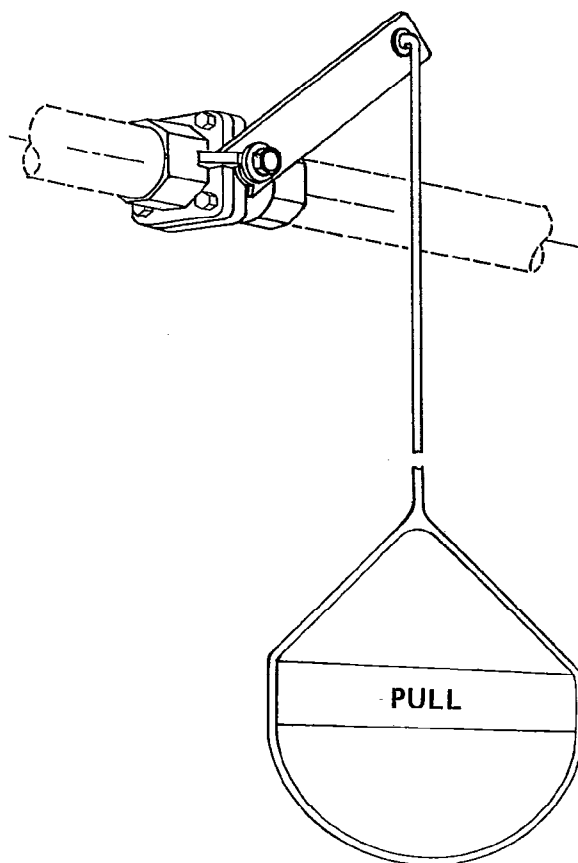
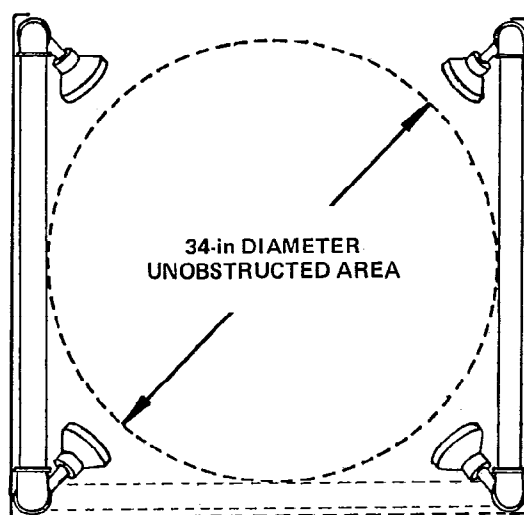


Illustration 2
Emergency Shower Stay-Open Valve and Actuator



Note: A diameter of 86.4 cm (34 inches) is critical in a 2-, 3-, or 4-wall enclosure.

Illustration 3
Shower Enclosure (2, 3, or 4 "Sides")

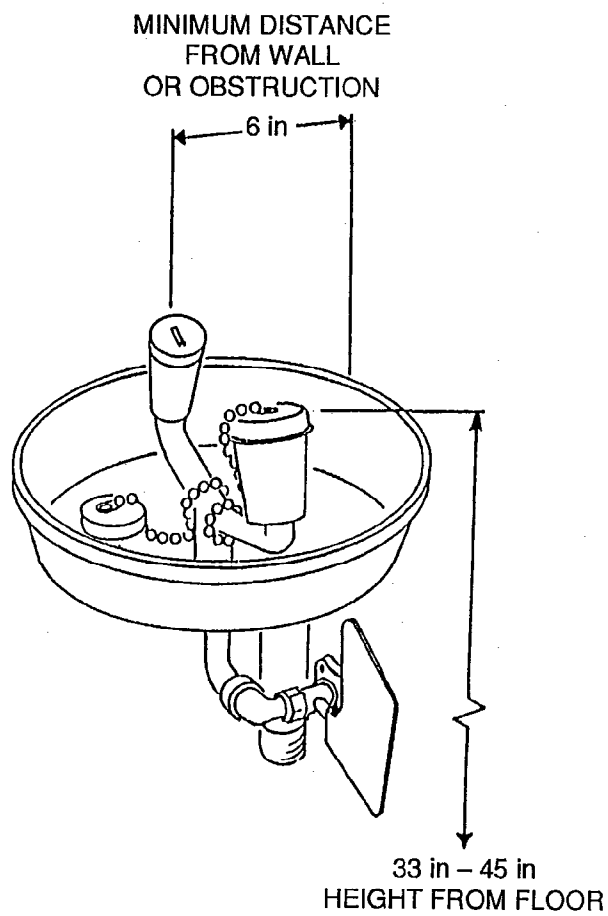


Illustration 4
Plumbed Eyewash

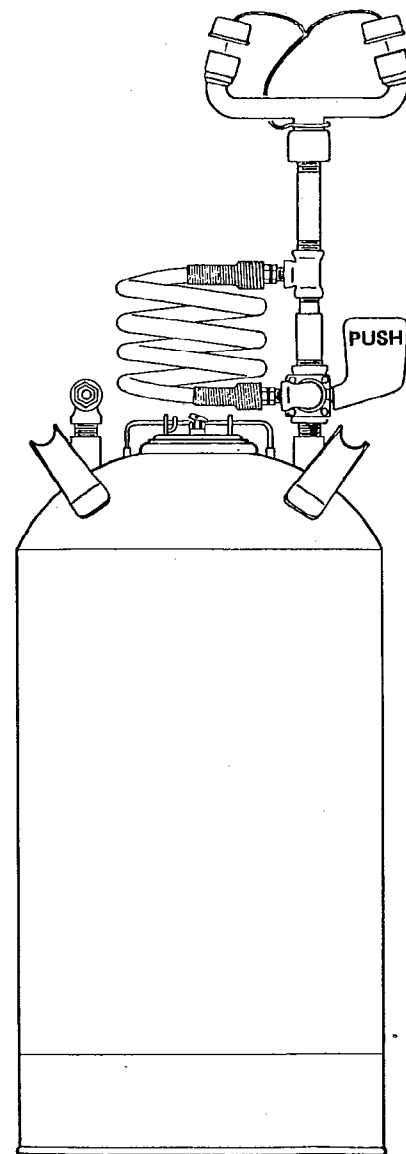


Illustration 5
Pressurized Self-Contained Eyewash

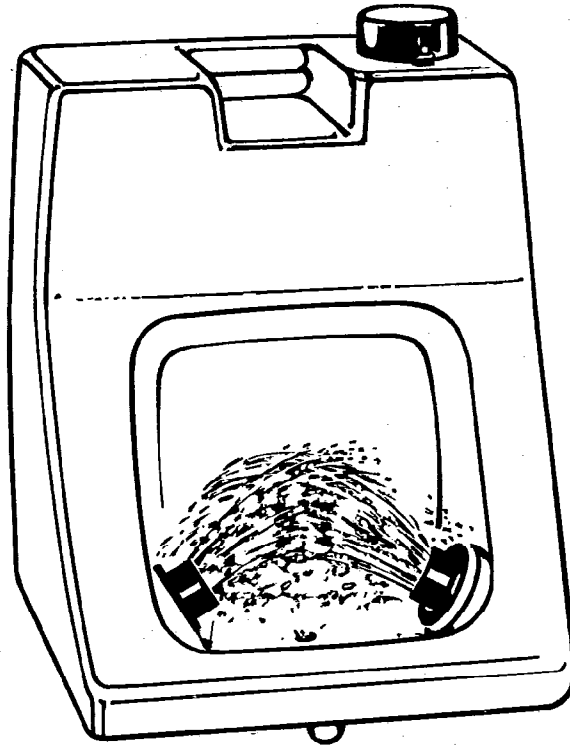


Illustration 6
Nonpressurized Self-Contained Eyewash

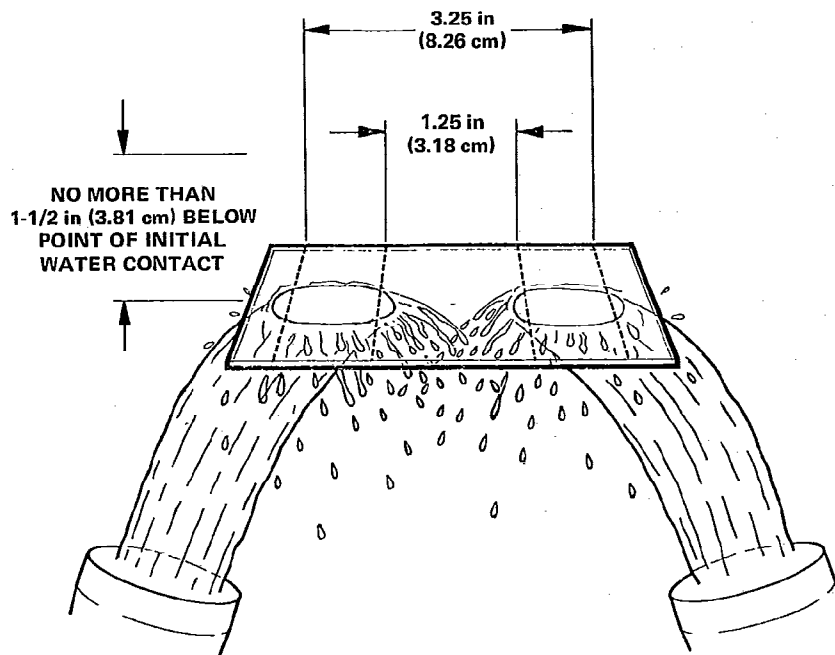


Illustration 7
Typical Eyewash Gage

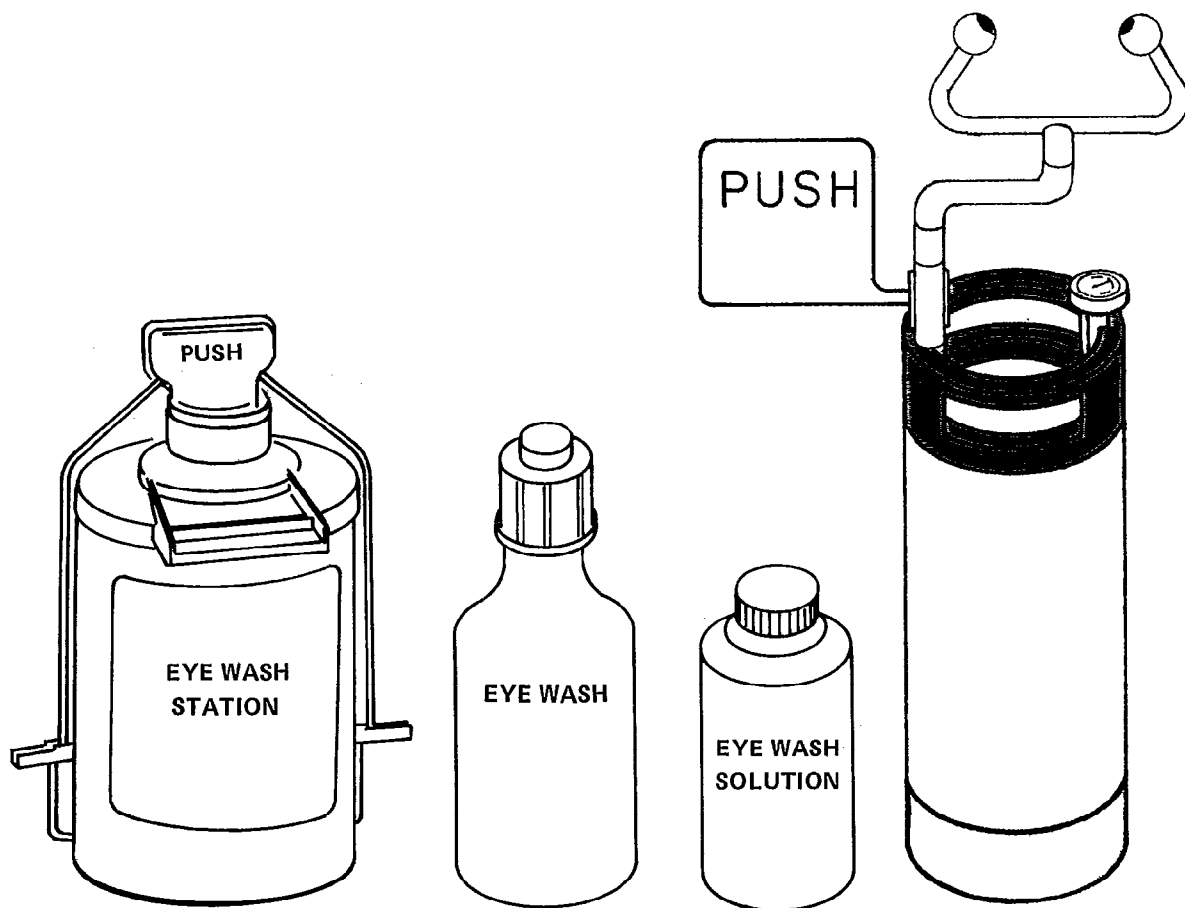


Illustration 8
Personal Eyewash Units

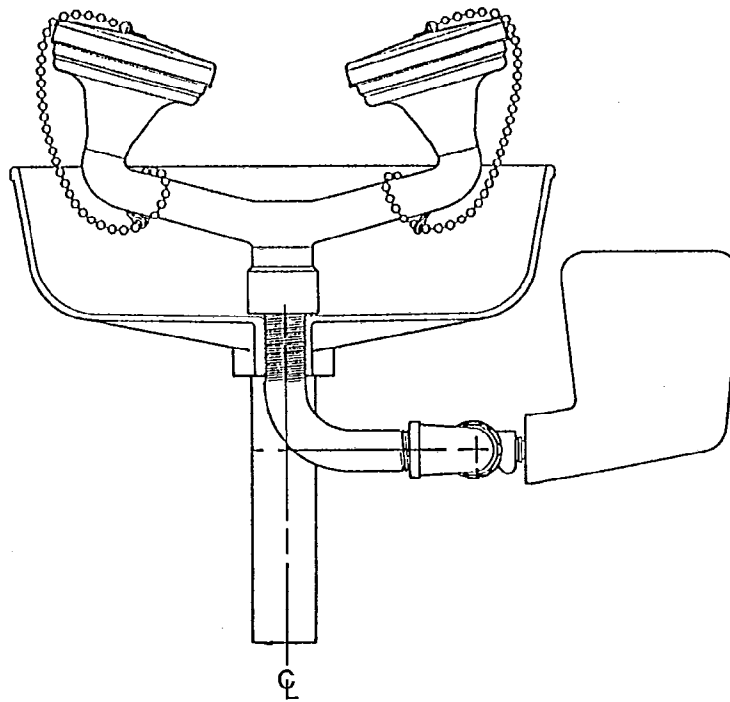


Illustration 9
Eye/Face Wash

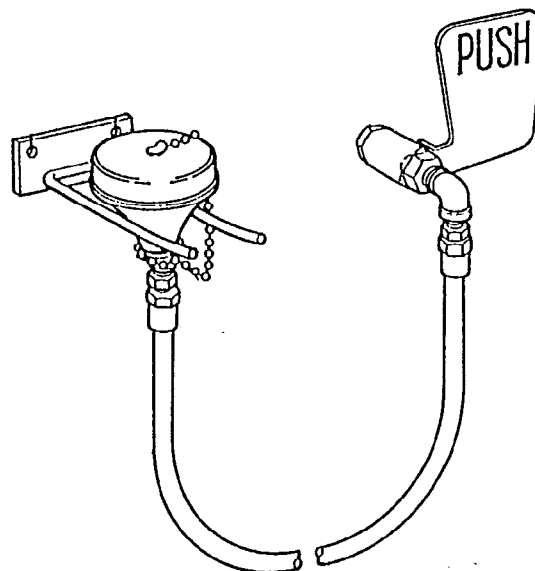


Illustration 10
Drench Hose

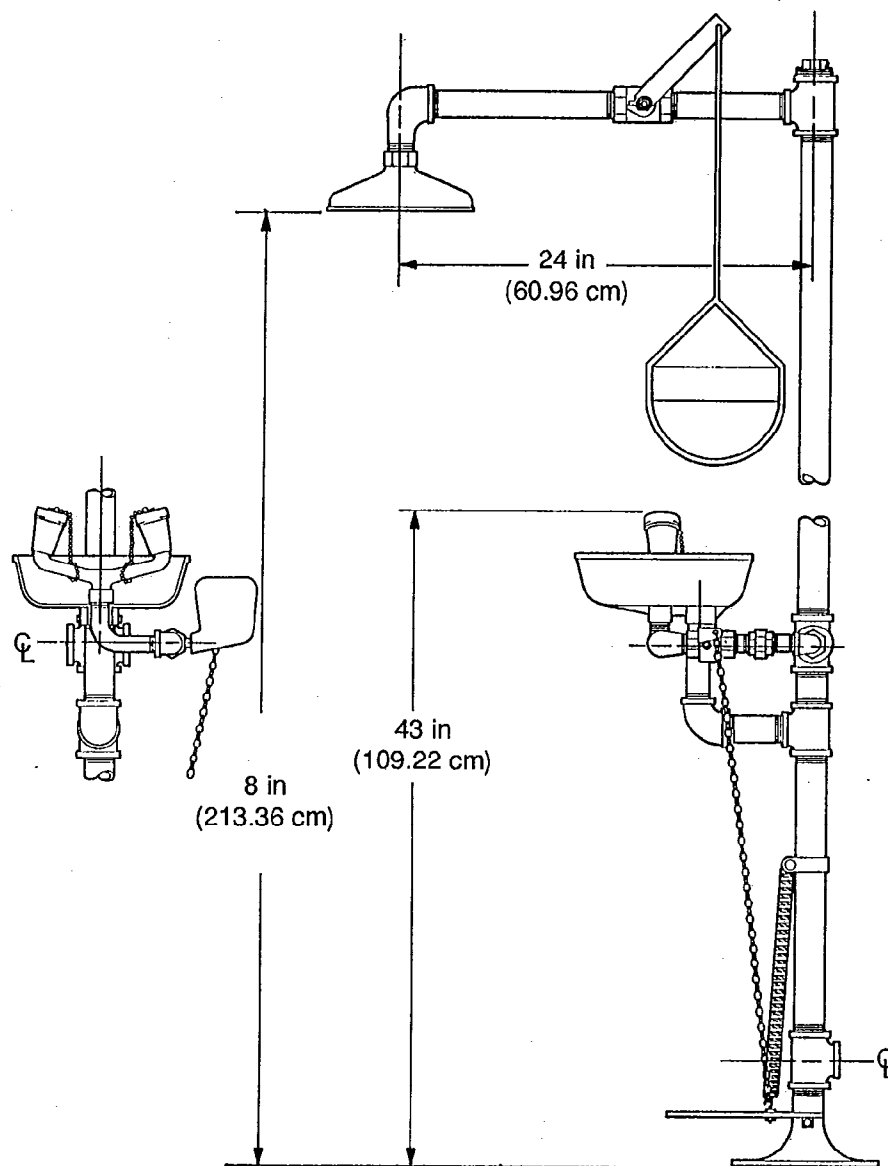


Illustration 11
Combination Shower and Eyewash

Appendixes (This Appendix is not part of American National Standard Z358.1-1990, but is included for information only.)

Appendix A

Additional Conditions for Emergency Eyewash and Shower Equipment

A1. Delivered Water Temperature

In the body of ANSI Z358.1-1990, delivered water temperatures for emergency shower and eyewash units have not been specified. This is not to suggest that this important aspect should be ignored; however, a standard of this type cannot predict the atmospheric conditions of each area where units are installed. Each specifying authority has the responsibility to determine the delivered water temperature that will be required in an area, not only to provide the flow of water as required, but also to maintain it at a temperature that will be safe for the user.

Delivered water temperature should not be at extremes that might be expected to discourage the unit's effective use under emergency conditions. A comfortable range is 15°C–35°C (60°F–95°F). In circumstances where chemical reaction is accelerated by water temperature, a medical advisor should be consulted for the optimum temperature for each application.

A2. Water Capacity

It will be noted that throughout ANSI Z358.1-1990 minimum water capacities are rated at an inlet supply pressure of 0.207 megapascal (30 pounds per square inch). This inlet pressure is below what is normally considered a proper level for design of plumbing systems (0.310 megapascal [45 pounds per square inch]), but it has been chosen because meeting the installation requirements may place units at unusual distances from and elevations higher than normal supply lines. In such cases, it is the designer's and specifier's responsibility to ensure proper flushing fluid delivery at possible points of lower pressure in the plumbing system. Excess pressure can deliver water to the equipment producing velocities that could injure the user or render the equipment inoperable. Caution should

be exercised with pressure over 0.621 megapascal (90 pounds per square inch).

A3. Primary Protective Devices

Emergency eyewash, shower, drench hose, and combination units are not a substitute for proper primary protective devices. As a defense against flying solid particles and splashing injurious liquids, workers should wear eye and face protectors and protective clothing.

A4. Alarm Devices

In addition to the equipment identification required by ANSI Z358.1-1990, users may also want to use audible alarms or blinking lights to indicate that the unit is in operation. These are particularly important in remote areas. Many companies connect valves electrically to warning lights or buzzers in central dispatch areas to alert the appropriate authorities when the unit is used.

A5. Waste Disposal

Consideration should be given to the proper disposal of waste flushing fluids from operating emergency eyewash and shower equipment. Freezing temperatures, drainage, elevated showers, and pollutants are some but not all of the considerations. Consult authorities for assistance with local, state, and federal regulations which may apply.

A6. First Aid Practices

The consulting physician should provide proper first aid practices for use with emergency eyewash and shower equipment and specific workplace hazards.

Appendix B

Government Requirements

This Appendix is not part of ANSI Z358.1-1990, but is included to assist the Federal Government in the procurement of emergency eyewash and shower equipment covered by this standard. This appendix is for Federal Government use only.

B1. Scope

This Appendix covers requirements of the civil and military agencies of the Federal Government for the procurement of emergency eyewash and shower equipment.

B2. Applicable Documents

The following documents, or the issues in effect on date of invitation for bids or request for proposal, form a part of this appendix to the extent specified herein.

Military Specification

MIL-P-12808 Plumbing Fixtures and Accessories, Packing of

Military Standard

MIL-STD-105 Sampling Procedures and Tables for Inspection by Attributes

(Copies of Government documents required by contractor in connection with specific acquisition functions should be obtained from the contracting activity or from the Commanding Officer, Naval Publication and Forms Center, 5801 Tabor Avenue, Philadelphia, PA 19120.)

B3. Requirements

B3.1 Definitive Part Number (DPN). The safety equipment covered by this standard shall be identified by a DPN. This part number is intended for cataloging and ordering purposes (see Section B6) and not for surface marking on the product. The DPN shall be written as shown in Figure B1.

B3.1.1 Part Numbers for Emergency Shower Equipment (Equipment designation = 1)

(1) First character denotes type.

- A = Emergency shower station
- B = Combination shower and eyewash station
- C = Combination shower and eye/face wash station

(2) Second character denotes stand pipe material.

- 1 = Stainless steel
- 2 = Galvanized steel

(3) Third character denotes receptor material.

- A = Stainless steel
- B = Enameled cast iron
- C = Vitreous china
- D = Plastic
- E = Not required

(4) Fourth character denotes shower head material.

- 1 = Stainless steel
- 2 = Plastic

(5) Fifth character denotes eyewash valve control.

- A = Hand
- B = Foot pedal
- C = Not required

(6) Sixth character denotes freeze protection.

- 1 = Required
- 2 = Not required

B3.1.2 Part Numbers for Plumbed Eyewash Equipment (Equipment designation = 2)

(1) First character denotes type.

- A = Eyewash station
- B = Eye and face wash station

(2) Second character denotes mounting.

- 1 = Wall hung
- 2 = Countertop
- 3 = Pedestal

(3) Third character denotes receptor material.

- A = Stainless steel
- B = Enameled cast iron
- C = Vitreous china
- D = Plastic

(4) Fourth character denotes valve control.

- 1 = Hand
- 2 = Foot pedal

(5) Fifth character denotes freeze protection.

- A = Required
- B = Not required

B3.1.3 Part Numbers for Self-Contained Eyewash Equipment (Equipment designation = 3)

(1) First character denotes type.

- A = Eyewash station
- B = Eye and face wash station
- C = Eyewash with drench hose station
- D = Eye and face wash with drench hose station

DPN designation _____ Z358.1 — X — XXXXXXXX
 ANSI document number _____
 Equipment designation _____
 Part numbers (no entry required for undesignated characters) _____

Figure B1
Definitive Part Number (DPN)

- (2) Second character denotes style.
 - 1 = Pressurized
 - 2 = Nonpressurized (Gravity)
- (3) Third character denotes tank material.
 - A = Stainless steel
 - B = Plastic
- (4) Fourth character denotes tank capacity.
 - 1 = 5 gallons
 - 2 = 6 gallons
 - 3 = 10 gallons
 - 4 = 16 gallons
 - 5 = 39 gallons
 - 6 = As specified (see B6)
- (5) Fifth character denotes freeze protection.
 - A = Required
 - B = Not required

B3.2 Standard Commercial Product. The emergency eyewash and shower equipment shall, as a minimum, be in accordance with the requirements of this standard. Additional or better features which are not specifically prohibited by this standard but which are a part of the manufacturer's standard commercial product shall be included in the equipment being furnished. A standard commercial product is a product that has been sold or is currently being offered for sale on the commercial market through advertisements or manufacturers' catalogs, or brochures, and represents the latest production model.

B4. Quality Assurance Provisions

B4.1 Responsibility for Inspection. The contractor shall be responsible for the performance of all

inspection requirements as specified herein. The contractor may use his own or any other facilities suitable for the performance of the inspection requirements unless disapproved by the Government. The Government reserves the right to perform any of the inspections set forth in the standard where such inspections are deemed necessary to ensure that supplies and services conform to prescribed requirements.

B4.2 Quality Conformance Inspection. Except as specified herein, the quality conformance inspection shall be performed on each sample selected (see B4.3) to determine compliance with this standard and shall include the following:

(1) *Examination.* This element of inspection shall encompass all visual examination and dimensional measurements. Noncompliance with any specified requirements shall constitute one defect. Examination shall be based on inspection level S-4 and an acceptable quality level (AQL) of 2.5% defective.

(2) *Test.* When testing is specified (see B6), the sampled equipment shall be tested in accordance with the applicable performance test (see Section 4 through Section 9) in this standard. Failure to pass any test constitutes one defect. The test shall be based on inspection level S-2 and an AQL of 4.0% defective. When testing is not specified, evidence that the equipment meets the test requirements shall be submitted to the contracting officer for acceptance. Acceptable evidence shall be a label or tag on the equipment marked ANSI Z358.1, or a certified test report from a recognized independent testing laboratory indicating that the equipment has been tested and conforms to this standard.

APPENDIX

(3) *Preparation for Delivery Inspection.* Preparation for delivery shall be inspected for compliance with the requirements of Section B5.

B4.3 Sampling. Sampling and inspection procedures shall be in accordance with MIL-STD-105. The unit of product shall be one complete equipment. All equipment of the same description offered for delivery at one time shall be considered a lot for the purpose of inspection. If an inspection lot is rejected, the contractor may rework it to correct the defects, or screen out the defective units, and resubmit for a complete inspection. Resubmitted lots shall be reinspected using tightened inspection. If the rejected lot was screened, reinspection shall be limited to the defect causing rejection. If the lot was reprocessed, reinspection shall be performed for all defects. Rejected lots shall be separate from new lots, and shall be clearly identified as reinspected lots.

B5. Preparation for Delivery

The packaging, packing, and marking shall be in accordance with MIL-P-12808, with the level of preservation and packing as specified (see Section B6).

B6. Ordering Data

Acquisition documents should specify the following:

- (1) Title, number, and date of this standard
- (2) DPN designation (see B3.1)
- (3) Tank capacity, gallons (see B3.1.3(4))
- (4) When test is specified (see B4.2(1))
- (5) Level of preservation and packing (see Section B5)