Chapter 6 Inspection, Maintenance, Testing, and Training

6.1* Inspection and Tests.

6.1.1 At least semiannually, all systems shall be thoroughly inspected, tested, and documented for proper operation by trained competent personnel. Tests shall be in accordance with the appropriate NFPA or Canadian standards.

6.1.2 The documented report with recommendations shall be filed with the owner.

6.1.3 The agent quantity and pressure of refillable containers shall be checked. If a container shows a loss in net weight of more than 5 percent or a loss in pressure (adjusted for temperature) of more than 10 percent, it shall be refilled or replaced. When the amount of agent in the container is determined by special measuring devices in lieu of weighing, these devices shall be listed.

6.1.4* All halon removed from refillable containers during service or maintenance procedures shall be collected for recycling.

6.1.5 Factory-charged nonrefillable containers that do not have a means of pressure indication shall be weighed at least semiannually. If a container shows a loss in net weight of more than 5 percent, it shall be replaced. All factory-charged nonrefillable containers removed from useful service shall be returned for recycling of the agent.

6.1.6 The weight and pressure of the container shall be recorded on a tag attached to the container.

6.2 Container Test.

6.2.1 DOT, CTC, or similar design Halon 1301 cylinders shall not be recharged without a retest if more than 5 years have elapsed since the date of the last test and inspection. The retest shall be permitted to consist of a complete visual inspection as described in the CFR, Title 49, "Transportation," Parts 170–190 and Subpart C, Section 173.34(e)(10), and Section 178.36 through 178.68. In Canada, the corresponding information is set forth in the Canadian Transport Commission's *Regulations for the Transportation of Dangerous Commodities by Rail.*

6.2.2 Cylinders continuously in service without discharging shall be given a complete external visual inspection every 5 years, in accordance with Compressed Gas Association pamphlet C-6, *Standard for Visual Inspection of Steel Compressed Gas Cylinders,* Section 3, except that the cylinders need not be emptied or stamped while under pressure.

6.2.3 Where external visual inspection indicates that the container has been damaged, additional strength tests shall be required.

CAUTION: If additional tests used include hydrostatic testing,

containers should be thoroughly dried before refilling.

6.2.4 Before recharging a container, a visual inspection of its interior shall be performed.

6.3 Hose Test.

All system hoses shall be examined annually for damage. If visual examination shows any deficiency, the hose shall be immediately replaced or tested as specified in 6.3.1.

6.3.1 All hoses shall be tested at 1500 psi (10342 kPa) for 600 psi (4137 kPa) charging pressure systems, and at 900 psi (6205 kPa) for 360 psi (2482 kPa) charging pressure systems. The test shall be performed as follows:

(1) Remove the hose from any attachment.

(2) The hose assembly is then to be placed in a protective enclosure designed to permit visual observation of the test.

(3) The hose must be completely filled with water before testing.

(4) Pressure then is applied at a rate-of-pressure rise to reach the test pressure within a minimum of 1 minute. The test pressure is to be maintained for 1 full minute. Observations are then made to note any distortion or leakage.

(5) If the test pressure has not dropped or if the couplings have not moved, the pressure is released. The hose assembly is then considered to have passed the hydrostatic test if no permanent distortion has taken place.

(6) Hose assembly passing the test must be completely dried internally. If heat is used for drying, the temperature must not exceed 150°F (66°C).

(7) Hose assemblies failing a hydrostatic test must be destroyed. They shall be replaced with new assemblies.

(8) Each hose assembly passing the hydrostatic test shall be marked to show the date of test.

6.3.2 All hoses shall be tested every 5 years in accordance with 6.3.1.

6.4 Enclosure Inspection.

At least every 6 months the halon-protected enclosure shall be thoroughly inspected to determine if penetrations or other changes have occurred that could adversely affect halon leakage.

6.4.1 Where the inspection indicates that conditions exist that could result in inability to maintain the halon concentration, they shall be corrected. If uncertainty still exists, the enclosures shall be retested for integrity.

6.5 Maintenance.

6.5.1 These systems shall be maintained in full operating condition at all times. Use, impairment, and restoration of this protection shall be reported promptly to the authority having jurisdiction.

6.5.2 Any troubles or impairments shall be corrected at once by competent personnel.

6.5.3 Any penetrations made through the halon-protected enclosure shall be sealed immediately. The method of sealing shall restore the original fire resistance rating and tightness of the enclosure.

6.6 Training.

All persons who could be expected to inspect, test, maintain, operate, or decommission and remove fire extinguishing systems shall be thoroughly trained and kept thoroughly trained in the functions they are expected to perform.

6.6.1 Personnel working in a halon-protected enclosure shall receive training regarding halon safety issues.

6.7 Approval of Installations.

(See Annex L.)

6.7.1 The completed system shall be tested by qualified personnel to meet the approval of the authority having jurisdiction. Only listed or approved equipment and devices shall be used in the systems. To determine that the system has been properly installed and will function as specified, the tests in 6.7.2.1, 6.7.2.2, 6.7.2.3, and 6.7.2.4 shall be performed.

6.7.2 Installation Acceptance.

6.7.2.1 Mechanical Acceptance.

6.7.2.1.1 The piping distribution system shall be inspected to determine that it is in compliance with the system drawings and the hydraulic calculations indicated on the computer printout associated with each agent storage container piping and nozzle configuration.

6.7.2.1.2 Nozzles and pipe size shall be in accordance with system drawings. Means of pipe size reduction and attitudes of tees shall be checked for conformance to the design.

6.7.2.1.3 Piping joints, discharge nozzles, and piping supports shall be securely fastened to prevent unacceptable movement during discharge.

6.7.2.1.4 During assembly, the piping distribution system shall be inspected internally to detect the possibility of any oil or particulate matter soiling the hazard area or affecting the agent distribution due to a reduction in the effective nozzle orifice area.

6.7.2.1.5 The discharge nozzle shall be oriented in such a manner that optimum agent dispersal can be effected.

6.7.2.1.6 If nozzle deflectors are installed, they shall be positioned to obtain maximum benefit.

6.7.2.1.7 The discharge nozzles, piping, and mounting brackets shall be installed in such a manner that they will not potentially cause injury to personnel.

6.7.2.1.7.1 The liquid phase of the discharge shall not come in contact with people performing their normal tasks.

6.7.2.1.7.2 Agent shall not directly impinge on any loose objects or shelves, cabinet tops, or similar surfaces where loose objects could be present and become missiles.

6.7.2.1.8 All agent storage containers shall be properly located in accordance with an approved set of system drawings.

6.7.2.1.9 All containers and mounting brackets shall be securely fastened in accordance with the manufacturer's requirements.

6.7.2.1.10 If a discharge test is to be conducted, containers for the agent to be used shall be weighed before and after discharge. Fill weight of container shall be verified by weighing or other approved methods.

6.7.2.1.11 Adequate quantity of agent to produce the desired specified concentration shall be provided. The actual room volumes shall be checked against those indicated on the system drawings to ensure the proper quantity of agent. Fan coastdown and damper closure time shall be taken into consideration.

6.7.2.1.12 The piping shall be pneumatically tested in a closed circuit for a period of 10 minutes at 150 psig (1034 kPa). At the end of 10 minutes, the pressure drop shall not exceed 20 percent of the test pressure. When pressurizing the piping, pressure shall be increased in 50 psi (3.5 bar) increments.

> **CAUTION:** Pneumatic pressure testing creates a potential risk of injury to personnel in the area, as a result of airborne projectiles, if rupture of the piping system occurs. Prior to conducting the pneumatic pressure test, the protected area shall be evacuated and appropriate safeguards shall be provided for test personnel.

Exception: The pressure test shall be permitted to be omitted if the total piping contains no more than one change in direction fitting between the storage container and the discharge nozzle, and where all piping is physically checked for tightness.

6.7.2.1.13 A puff test with nitrogen shall be performed to check for continuous piping.

6.7.2.2* **Enclosure Integrity Acceptance.** All total flooding systems shall have the enclosure examined and tested to locate and then effectively seal any significant air leaks that could result in a failure of the enclosure to hold the specified Halon 1301 concentration level for the specified holding period.

6.7.2.3 Electrical Acceptance.

6.7.2.3.1 All wiring systems shall be properly installed in compliance with system drawings.

6.7.2.3.2 All field circuitry shall be measured for ground fault and short circuit condition. When measuring field circuitry, all electronic components (such as smoke and flame detectors or special electronic equipment for other detectors or their mounting bases) shall be removed and jumpers properly installed to prevent the possibility of damage within these devices. Components shall be replaced after measuring.

6.7.2.3.3 Power shall be supplied to the control unit from a separate dedicated source that will not be shut down on system operation.

6.7.2.3.4 Adequate and reliable primary and 24-hour minimum standby sources of energy shall be used to provide for operation of the detection, signaling, control, and actuation requirements of the system.

6.7.2.3.5 All auxiliary functions such as alarm sounding or displaying devices, remote annunciators, air handling shutdown, and power shutdown shall be checked for proper operation in accordance with system requirements and design specifications. If possible, all air-handling and power-cutoff controls shall be of the type that, once interrupted, require manual restart to restore power.

6.7.2.3.6 Silencing of alarms (if desirable) shall not affect other auxiliary functions such as air handling or power-cutoff if required in the design specification.

6.7.2.3.7 The detection devices shall be checked for proper type and location as specified on the system drawings.

6.7.2.3.8* Detectors shall not be located near obstructions or air ventilation and cooling equipment that would appreciably affect their response characteristics. Where applicable, air changes for the protected area shall be taken into consideration.

6.7.2.3.9 The detectors shall be installed in a professional manner and in accordance with technical data regarding their installation.

6.7.2.3.10 Manual pull stations shall be properly installed, readily accessible, accurately identified, and properly protected to prevent damage.

6.7.2.3.11 All manual stations used to release halon shall require two separate and distinct actions for operation. They shall be properly identified. Particular care shall be taken where manual release devices for more than one system are in close proximity and could be confused or the wrong system actuated. Manual stations in this instance shall be clearly identified as to which zone or suppression area they affect.

6.7.2.3.12 For systems with a main/reserve capability, the main/reserve switch shall be properly installed, readily accessible, and clearly identified.

6.7.2.3.13 For systems using abort switches, the switches shall be of the deadman type requiring constant manual pressure, properly installed, readily accessible within the hazard

area, and clearly identified. Switches that remain in the abort position when released shall not be used for this purpose. Manual pull stations shall always override abort switches.

6.7.2.3.14 The control unit shall be properly installed and readily accessible.

6.7.2.4 Functional Testing.

6.7.2.4.1* Preliminary functional tests shall include the following:

(1) If the system is connected to an alarm receiving office, the alarm receiving office shall be notified that the system test is to be conducted and that an emergency response by the fire department or alarm station personnel is not desired. All concerned personnel at the end user's facility shall be notified that a test is to be conducted and instructed as to the sequence of operation.

(2) Each agent storage container release mechanism shall be disabled so that activation of the release circuit will not release agent. The release circuit shall be reconnected with a functional device in lieu of each agent storage container release mechanism. For electrically actuated release mechanisms, these devices shall sometimes include 24-volt lamps, flash bulbs, or circuit breakers. Pneumatically actuated release mechanisms shall sometimes include pressure gauges.

(3) Each initiating device shall be checked for proper response.

(4) All polarized alarm devices and auxiliary relays shall be checked to ensure that polarity has been observed.

(5) All end-of-line resistors shall be checked to ensure that they have been installed across the detection and alarm bell circuits where required.

(6) All supervised circuits shall be checked for proper trouble response.

(7) All supervisory devices shall be checked for proper operation.

6.7.2.4.2 System functional operational test shall include the following:

(1) Operate detection initiating circuit(s). All alarm functions shall occur according to the design specification.

(2) Operate the necessary circuit(s) to initiate halon release.

(3) Operate manual release. Verify that manual release functions occur according to design specifications.

(4) If supplied, operate abort switch circuit. Verify that abort functions occur according to this standard *(see 4.3.5.3)*. Confirm that visual and audible supervisory signals are received at the control panel.

(5) All automatic valves shall be tested unless testing the valve will release halon or damage the valve (destructive testing).

(6) Where required, pneumatic equipment shall be checked for integrity to ensure proper operation.

6.7.2.4.3 Testing of remote monitoring operations, if applicable, shall include the following:

(1) Operate one of each type of input device while on standby power. Verify that an alarm signal is received at remote panel after device is operated. Reconnect primary power supply.

(2) Operate each type of alarm condition on each signal circuit and verify receipt of trouble condition at the remote station.

6.7.2.4.4 Testing of the control panel primary power source shall include the following:

(1) Verify that the control panel is connected to a dedicated circuit and labeled properly. This panel shall be readily accessible, yet restricted to unauthorized personnel.

(2) A primary power failure shall be tested in accordance with the manufacturer's specification with the system fully operated on standby power for the required design period.

6.7.2.4.5 When all functional testing is completed, each agent storage container shall be reconnected so that activation of the release circuit will release the agent. System shall be returned to its fully operational design condition.