EXTINGUISHING SYSTEM ACCEPTANCE TESTS

INTRODUCTION

Extinguishing system reliability cannot be overemphasized. An extinguishing system acceptance test is a complete check of the system under all operating conditions. This test may culminate in the discharge of agent or an enclosure integrity test to assess the performance of the system. This initial acceptance test is followed by periodic inspection, testing and proper maintenance. This section pertains to all special extinguishing systems.

POSITION

Test the installation as a total system, even if more than one contractor has been involved. The general contractor or, if none, the purchaser's contracting officer is responsible for the overall installation and should develop an orderly test sequence. Hold a briefing just prior to the test to clear up last minute details and to establish understanding of individual responsibilities. Discuss test procedures and safety precautions prior to testing.

Personnel Safety During Testing

Avoid undue exposure to any extinguishing agent, even though the agent may be within its acceptable exposure limits. Always be aware of escape routes and time restraints for evacuation should it become necessary. Some agents such as CO_2 may require the use of breathing apparatus for those working in protected areas.

Avoid walking through high expansion foam discharge because of the possibility of injury from falling or walking into moving equipment. To avoid breathing high expansion foam if accidentally exposed, move one's hands in front of the face, to keep an open pocket for breathing and to avoid foam ingestion.

Prohibit smoking in any area where a halocarbon agent has discharged, until the area has been adequately ventilated. In addition to protection being out of service, residual amounts of halocarbon drawn past glowing smoking materials could result in serious lung irritation.

Avoid using electronic communications equipment near control panels as it may cause unwanted system operation, especially if control panel doors are open.

Visual Inspection

Schedule an acceptance test only after the installation is complete. This includes all piping, wiring and building features associated with the protection system, such as enclosure tightness, equipment

interlocks, and door and damper closures. Visually inspect the enclosure and all components of the system, comparing the actual installation with the arrangement and materials shown in the AXA XL Risk Consulting reviewed drawings. Confirm that all system piping has been blown clean and mechanical joints have been checked for tightness prior to hydrostatic or pneumatic pressure testing. Confirm that each container is labeled with tare weight, the actual amount and type of agent used, and the weight of any gas used for pressurization of the container. Verify agent weights before discharging agent and verify the weight of replacement agent again prior to placing the protection system in service at the conclusion of any discharge test. If no major deficiencies are found, or when the deficiencies have been corrected, proceed with functional tests.

Functional Tests

Perform a static pressure test of all piping systems before they are placed in service, to ensure system integrity. Where possible, perform such tests with water to ensure safety. Introducing water in halocarbon system piping can cause internal corrosion if not properly drained and thoroughly dried. Where tests are conducted with pressurized gas, exercise care to ensure the safety of those conducting and witnessing such tests.

Test control equipment to assure that the sequence of operation follows the accepted design. All components must be tested with a representative of each contractor present. Test all equipment, including door closures, air handling shutdown and any other part of the protection system.

Test all detectors with recognized test methods prior to any discharge of agent. Each detector should alarm within one minute. **Do not test detectors in concealed spaces with actual fire products**.

Test all control instruments and releasing devices to determine proper functioning in all modes of operation. Test the power-failure arrangement to determine that the audible trouble alarm sounds and that the battery power supply takes over, by de-energizing the power supply to the controller. Check the electrical supervision of the detection and actuation by removing a wire from a terminal on the most remote detector and at the tripping head of the system. This should result in both an audible and visible trouble signals. If an abort switch has been installed, its operation should result in a trouble alarm.

When discharge testing is not conducted, test enclosure tightness using a door fan assembly on all gaseous extinguishing systems designed on a total flooded basis since the ability of the system to function properly depends on a tight enclosure. Appendix B of NFPA 12A or Appendix C of NFPA 2001 provides test guidance. A complete discussion of the test procedures is found in PRC.13.0.5.2.

Discharge Test

When a discharge test is performed, the following items apply:

- Test room in its normal condition, no temporary taping or sealing.
- Do not use tape or batting to prevent leakage of agent.
- The contractor should provide a stopwatch to confirm the duration of time delays and the concentration soak period. For carbon dioxide systems, the liquids and vapor discharge times should be recorded and compared to the predicted results from the flow calculations.
- Weigh test cylinders on site before and after the discharge test.
- Use calibrated thermal-conductivity analyzers of the multi-point, direct-reading, recording type to record agent concentration.
- Take concentration for a minimum of 10 min from at least three points in occupancies where non-deep seated fires can occur. Deep-seated hazards may require longer soak periods. Place one probe at least 2 ft (0.6 m) above equipment being protected with a second probe no closer than 8 in. (20 cm) from the ceiling, unless the hazard being protected extends into this area. Place the third probe halfway between the top probe and the floor or in any under floor space if it exists.

- Compartmented hazards and extremely large hazards require additional probe locations. If the structure or occupancy forms a barrier or obstruction to proper distribution, place a probe in each compartment. Use several three-point meters or arrange each analyzer point to read several probe locations intermittently. Prepare a sketch showing the location and the height of the probes above the floor so that the test may be duplicated.
- The automatic recording analyzer should take and record concentration readings beginning at the end of the discharge period and at approximately 15 s intervals thereafter. On each analyzer tape, note the location of the probe, the date and initials of those witnessing the test. Obtain a photocopy of these results before leaving the premises. When conducting discharge tests of inert gas systems, continuously record O_2 and CO_2 levels.
- Arrange for agent ventilation to a safe location at the completion of the test. It is recommended that a fixed ventilation system be in place to ventilate products of combustion and decomposed agent following normal system operation.

DISCUSSION

A door fan test provides a good base for comparing future periodic leakage tests to determine enclosure deterioration but does not supplant the need for other testing.

AXA XL Risk Consulting witnesses acceptance tests to ensure system reliability following the installation or renovation of any extinguishing system. Where appropriate, AXA XL Risk Consulting reviews the final installation from a property protection standpoint and to evaluate conformance with the appropriate codes and standards. Refer to the acceptance test check list found in PRC.13.0.5.A.

Due to environmental concerns about stratospheric ozone depletion, AXA XL Risk Consulting does not recommend, sanction or witness the discharging of halon during the acceptance test. However, all other parts of the acceptance test procedure must be followed.

For specific discharge requirements for other special extinguishing systems, including carbon dioxide, dry chemical and some foam systems, refer to PRC Guidelines covering the specific agent.

The acceptance test includes extensive visual inspection, piping system pressure testing, and testing of alarms, interlocks and time delays. Although the following discussion is directed towards total flooding applications, most of the test methods described apply to local application systems as well. Where local application systems are encountered, the collection of concentration data is inappropriate because the location of data collection points inordinately influences the results. Two probes in close proximity could have vastly different readings due to air-entrainment and nozzle dispersion. To confirm agent disbursement on a local application system, visually check that agent discharges from each nozzle. Care should be taken to ensure that this is done in a safe manner to avoid exposure to the agent. For carbon dioxide systems protecting large hazards, it can be difficult to safely observe the discharge from all nozzles. The use of video cameras can aid in evaluating the discharge.

Most extinguishing agents are stored and used under pressure. These high pressures could lead to flying debris or direct impingement from the agent, which could cause injury. Some agents discharged at fast rates could cause hearing damage.

Pressure testing of piping systems can be dangerous especially if these tests are conducted with compressed air rather than with water, which is noncompressible. Evacuate the protected area prior to conducting the test to avoid injury to personnel should the piping fail during the test.

Gaseous agents heavier than air may tend to settle in low-lying areas. Make sure there is an escape route that is accessible without going through the test area. Even if the initial concentration is within a safe limit, a connected reserve can discharge accidentally, doubling the concentration. To detect a malfunction of this type, test the system with the reserve connected in the usual manner.

Dry chemical exposure can cause eye and lung irritation. Although this condition is usually temporary and not considered harmful, avoid undue exposure.

Measuring equipment used in conducting discharge tests vary considerably. Some meters are calibrated by straight volumetric measure, and are not subject to inaccuracies from variations in agent and sampling tube characteristics. However, some other meters calibrated with a flow meter, and the flow rate through the meter varies with agent pressure and density and with sampling tube length and diameter. As a result, its reading can be inaccurate if the sampling tube that comes with the unit is lost. Just prior to the test, check the analyzer against a known calibration standard in the presence the AXA XL Risk Consulting representative. These field checks are not intended to take the place of lab calibration tests. However, they do give a fairly good indication of equipment performance.

ACCEPTANCE TEST CHECKLIST

CHECK AT EVERY ACCEPTANCE TEST:

- ☐ Alarm service has been notified
- ☐ The room is in its normal operating condition and ready for testing
- ☐ Replacement agent is on hand and has been weighed on site
- ☐ Installation has been checked against accepted drawings
  - ☐ Room size
  - ☐ Detector location and type
  - ☐ Wire type and specifications
  - ☐ Pipe sizes and lengths
  - ☐ Nozzle location and size
- ☐ Location of equipment: cylinders; manual releases; control panel and alarm horns
- ☐ The installation workmanship is acceptable
- ☐ All piping has been blown clear and checked for mechanical tightness and proper support
- ☐ Room has been inspected for obvious leakage
  - ☐ Door and window leaks minimal
  - ☐ Ducts properly dampered
  - ☐ Pipe chases and wiring chases sealed
- ☐ Doors, windows and dampers interlocked to close automatically
- ☐ Ceiling tiles near nozzles have been properly secured to prevent movement during discharge
- ☐ There are no obstructions to nozzle discharge
- ☐ Underfloor has been vacuumed to prevent debris from entering vital equipment
- ☐ The test agent cannot migrate to adjacent areas and discharge other systems
- ☐ System time delay exceeds any ventilation system fan coastdown time
- ☐ Detectors, alarms, actuators, dampers and closures have been tested for proper operation
- ☐ Ventilation fans will not restart when alarms are silenced
- ☐ Manual releases and aborts have been labeled for easy identification
- ☐ Electrical supervision has been tested by opening circuit at most remote unit on each loop
- ☐ Pneumatic supervision has been tested by disconnecting tubing or piping at end of system
- ☐ Manual releases have been tested
- ☐ Operation of manual release prepares room for discharge
- ☐ Back-up power has been tested
- ☐ Operation of the abort switch has been tested
- ☐ All actuation devices and selector valves have been tested
- ☐ Manual release overrides simultaneously abort switch operation
- ☐ The sequence of events is posted
- ☐ Battery standby has been tested for a 24-hour period

- ☐ The duration of all time delays has been measured
- ☐ A contract has been purchased for service and periodic tests
- ☐ Facility's personnel have been given adequate training
- ☐ All equipment restored to service including alarm service

CHECK IF PERFORMING A DISCHARGE TEST:

- ☐ All loose materials have been cleared from the room
- ☐ Three-point recorder has been field calibrated
- ☐ Sample probe locations have been properly selected
- ☐ Continuous power to the concentration recorder has been verified
- ☐ Properly sized recorder sample tubing has been provided
- ☐ Recorder is in proper mode for the agent to be tested
- ☐ Breathing apparatus is available, if necessary
- ☐ Containers have been properly labeled
- ☐ Test agent weight has been adjusted, if necessary
- ☐ Containers have been weighed before and after discharge
- ☐ Post test ventilation arrangements have been made
- ☐ All equipment restored to service including alarm service