



State Fire Marshal's Office
Virginia Department of Fire Programs
Inspection Check List



Flame Effects INSIDE State-owned buildings and OUTDOORS on State-owned Property Before a Proximate Audience

160

This check list is intended to be used as a guide by SFMO personnel to ensure the design, setup and conducting of Flame Effects on state-owned property is in compliance with the Statewide Fire Prevention Code. **The use of this checklist is not mandatory.** The list is not all inclusive or will cover every conceivable setup or aspect that may be encountered. Therefore, some additional research, expertise or insight that is not specifically covered or listed here may have to be employed for ensuring code compliance.

It's suggested that the reviewer place a check mark for each item that is found to be correct or has been satisfied. If an item is not applicable, it's suggested that the reviewer mark it as "N/A", meaning "Not Applicable". Some listed items may have parentheses within which are section number(s) and unless otherwise noted, it is the NFPA 160 section number. Its recommended SFMO personnel have copies of the SFPC and NFPA 160-06 readily available for reference or to conduct further research.



Application review.

Date of display:

Location of display:

Application (plan) review conducted by:

- Line 1.** Provides the name of person or company applying for a permit.
- Line 2.** Lists the telephone number where an applicant may be reached.
- Line 3.** The mailing address the applicant provided where they expect the quickest mail service.
- Line 4.** The physical address (location) of the permit applicant if it's different from the mailing address given.
- Line 5.** The city, state and zip code for a completed mailing address.
- Line 6.** The applicant's Federal Identification Number as provided by the IRS. This will be the applicant's unique identifying number when incorporated into a database.
- Line 7.** The name of the person who is representing the applicant as listed on Line 1 and whose signature appears on Line 16.
- Line 8.** The use of flame effects before an audience is governed by provisions contained in the Virginia Statewide Fire Prevention Code (SFPC) and its incorporated NFPA 160-06 standard. **This application is for a permit to use flame effects on a temporary basis. (5.1.2.2)** For flame effects that are to be used for a period greater than 180 days, the applicant should consult with the SFMO for further direction or information on permanent flame effects. Consultation with the SFMO may or will most likely result being a referral to the appropriate local building official for the design and installation of permanent flame effects. The building official will likely be governed by the same NFPA standard and/or mechanical code.
 A permit to use flame effects does not confer approval to use fireworks or pyrotechnics. The use of fireworks or pyrotechnics in tandem with flame effects will require a separate application for fireworks that's to be completed and submitted as a package with the flame effect application. (1.3.3[1] & [2])
- Line 9.1 through 9.3.** Provides the name and address of the venue at which flame effects will be used along with the name and telephone number of the venue manager.
- Line 10 and 10.1.** Provides the date and time-frame the use of flame effects will occur. If multiple dates are planned, a labeled list should be attached providing the additional dates and times. (5.1.3.2.1)

- **Line 11.** The SFPC provides an opportunity for the operator to prove by demonstration to the fire official, sponsor and venue manager that the flame effects and devices will operate as planned and within the safety parameters established by the SFPC. The designated date and time for a walk-through and representative demonstration should be noted. The demonstration shall be scheduled early enough to allow resetting of the flame effects prior to the audience arrival. (5.4.1 and 5.4.2)
- **Line 12.** NFPA 160 classifies flame effects systems as they're described in NFPA 160.(5.3.1.2[5] and 3.3.19)
- **Lines 13.1 and 13.2.** Provides the name and age of the operator who will be in responsible charge of the flame effects along with the names and ages of any assistants. (8.4)
- **Line 14 through 14.6.** Through the SFPC, the standard requires a plan for the use of flame effects. The items listed are but just a few select elements to be incorporated or addressed in the plan. The approved plan is to be readily accessible at the venue where flame effects will be used and is subject to inspection. (5.2.2.1)

It is the content of the approved plan upon which an evaluation is to be made and if appropriate, issue a permit. (5.3 and B.1)

- Once accepted, approved and a permit is issued, all subsequent additions or modifications that were not part of the previously approved plan are to be approved prior to their use or implementation. (5.2.2.2)
- The plan should account for each appropriate item for the circumstance the effect will be used.
 - Line 14.1 contains items that should be addressed in the plan and are common between indoor and outdoor flame effects. This includes emergency operations. (5.3.1.2; 6.2.1; 7.9; B.1)
 - Line 14.2 contains items that should be addressed and are specific to the outdoors. (B.1.1.1)
 - Line 14.3 contains items that should be addressed and are specific to the indoors. (B.1.1.2)
 - Line 14.4 lists items the plan should address as they relate to the operator's knowledge, skills and abilities. It should also address the level of control the operator or performer have on the flame effects. (B.1.2)
 - Line 14.5 lists items that deal with unattended effects. (B.1.2.2)
 - Line 14.6 deals with the certification of costumes, set, scenery, and rigging materials being inherently flame-retardant or have been treated to achieve flame retardancy when exposed to flame effects when such items are exposed to or are in the area affected by a flame effect device. (7.10.1; 7.10.2; 7.10.3; B.1.1.1)
- **Line 15.** Attestation that's largely self-explanatory but should be read carefully. Attention should be given to the "special instructions" in the box above Line 15 along with the timeliness of submitting the application and its affect on determining the correct permit fee.

If flame effects are used in tandem with fireworks or pyrotechnic devices, the flame effects permit becomes secondary to the fireworks permit for the purpose of determining the correct permit fee.

Examples of the correct permit fee when flame effects are used in tandem with fireworks or pyrotechnic devices are listed below.

	<u>One day – Indoor</u>	<u>One day - Outdoor</u>
Pyro	\$350	\$250
Flame	<u>\$100</u>	<u>\$100</u>
Total	\$450	\$350
 <u>Identical Multi-day – Indoor</u>		
	1 st day	plus Each consecutive day
Pyro	\$350	\$150
Flame	<u>\$100</u>	<u>\$ 75</u>
Total	\$450	\$225
 <u>Identical Multi-day – Outdoor</u>		
	1 st day	plus Each consecutive day
Pyro	\$250	\$150
Flame	<u>\$100</u>	<u>\$ 75</u>
Total	\$350	\$225

Site Inspection.

Date of display:

Location of display:

Application (plan) review conducted by:

Administration.

- A copy of the permit and approved plan are readily available. (5.2.2.1)
 - Demonstration successfully conducted with sufficient time allotted afterwards to reset flame effect devices prior to audience arrival. (5.4.1 and 5.4.2)
 - Adjustments were necessary as proven or justified by demonstration. [] No. [] Yes, and were as follows:
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- Holding area for flame effect fuel is suitable, secure and contains only that amount needed for one day. (4.2.1.1 and 4.2.2. See 4.2.1.2 for excess quantities.)
 - The operator does not appear to be under the influence of any intoxicating beverages, prescription or nonprescription drugs, narcotics or other controlled substances. (8.3)

Equipment.

- Flame effect systems are stored and secured when not in use. (7.11.2)
- All flame effects have written operating instructions and are available to the operator. (6.2.1 and 6.2.2)
- Where flame effects use piping, the piping is to be pressure tested for signs of leakage. (10.2)
- The maximum quantity of flammable flame effects materials readily available for use shall not exceed the quantity used in one day. (4.2.1.1)
- The maximum amount of single LPG cylinders used as flame effect fuel supply shall be 20 pound nominal propane capacity. (NFPA 58-08, Section 6.19.10.2)
 - o If more than one LPG cylinder is located within a room, they shall be separated by not less than 20 feet. (NFPA 58-08, Section 6.19.10.3)
 - o LPG cylinders shall not be connected or disconnected during the flame effect or performance. (NFPA 58-08, Section 6.19.10.5)

Fire Protection.

- Portions of fire protection and life safety systems may be interrupted during the operation of the flame effects if **ALL** of the following are satisfied (5.5.1):
 - SFMO approval.
 - Approval of the owner or owner's agent.
 - Presence of a fire watch capable of directing the operation of the building's fire protection and life safety systems.
 - Performers, operators and assistants are protected by clothing or other means suitable for their exposure to flame effects. (7.10.1)
 - Four or more properly classified fire extinguishers are to be readily accessible while a flame effect performance is being conducted with the minimum being two (2) Class 2-A pressurized water and two (2) Class 10-BC extinguishers. (11.3.2 and 11.3.2.1)

- At least one each of the extinguishers are located on opposing sides of the performance where flame are being used. (11.3.2.2)
- As determined by the fire hazards evaluation, standby fire personnel shall be present and supplied by additional operational equipment. (11.4.1)

Flame Effect Operations.

- Group 3, 6 and 7 flame effect control systems are not left unattended when connected to a fuel source. (9.1.3.1)
- Group 2 through 7 control systems are designed to ensure against accidental firing by having at least a removable activator, key switch, or coded arming system to prevent control power from being applied unless the operator intentionally enables or arms the system, and deliberately applies control power. (9.1.2)
- Control systems that are disconnected from their power source or de-energized by means of a removable activator, key switch, or coded arming system is permitted to be left unattended while connect to a fuel source. (9.1.3.2)
- Unless otherwise approved, flame effect control system components shall be listed. (9.1.4.2 and 9.1.5.1)
- Control systems components and protective devices including sensors, valves, and switches are located and protected against tampering and physical damage. (9.1.6)
- All flame effect control systems are designed to implement the following:
 - Emergency stop capability.
 - Fuel management.
 - Controlled enabling of flame effect.
 - Controlled arming of flame effect.
 - Controlled and repeatable firing of the flame effect.
- The hazard area is under the direct observation of the operator or assistants for the entire time the effect(s) is enabled and fired. (9.3.5.4.1)

Post Show Operations.

- Fire and life safety systems that were interrupted have been (will be) restored immediately after completion of the flame effect by persons trained in the operation of all aspects of the systems. (7.7.1)
- Immediately following the firing of any flame effect, the enable and arming signals are to be removed, all fuel and auxiliary services are to be secured and a visual inspection made of all effect hazard areas. (9.3.6)

The following page is an extract from NFPA 160 specific to the required control functions. Not all items may apply to every situation, setup or device used.

9.3 Implementation of the Required Control Functions.

9.3.1 Emergency Stop.

9.3.1.1 One of the following conditions shall be met prior to the use of flame effects:

- (1) Approval of a plan to extinguish the flame effect as required in 9.3.1.4
- (2) Approval of a supervisory control system for the emergency stop and complete shutdown of the flame effect and any interrelated safety-critical system as required in 9.3.1.5

9.3.1.2 Interrelated safety-critical system and flame effect control system safety considerations shall extend to safety-critical effects, allied equipment, and other proximate equipment to avoid additional or contributory hazards.

9.3.1.3 Where the hazards described in 9.3.1.2 exist, the effects safety controller shall have a direct validated means of confirming the status or other information from the other systems before the safety-critical effect is enabled or triggered.

9.3.1.4 Manually controlled flame effects (Group I and manually controlled Group VII) shall have a plan for the emergency stop and complete shutdown of the operation of the effects through one or more of the following:

- (1) Manual fuel shutoff valve(s)
- (2) Manual turn-off of control power
- (3) Fire containment devices
- (4) Other devices acceptable to the authority having jurisdiction

9.3.1.5 Automatically controlled flame effects (Group II through Group VI and automatically controlled Group VII) shall have provisions for the emergency stop and complete shutdown of the operation of the effects installed according to the following criteria:

- (1) The flame effect control system shall not be capable of operation unless the emergency stop is reset.
- (2) The actuation of the emergency stop shall bring the flame effect control system to a safe state.
- (3) The emergency stop shall require manual reset.
- (4) The emergency stop shall actuate both manually and automatically upon the detection of an unsafe condition, including power failure.
- (5) The emergency stop shall be fail-safe.
- (6) The emergency stop shall be automatically actuated when a monitored condition exceeds a preset limit of operation.

9.3.1.6 Manual Emergency Stop Control Stations.

9.3.1.6.1 Manually operated emergency stop control stations shall be clearly identified and placed in accessible locations and shall maintain the actuated state until manually reset.

9.3.1.6.2 Operation of a manual emergency stop station shall actuate the emergency stop.

9.3.2 Fuel Management.

9.3.2.1 The fuel supply for the operation of the flame effect shall be available only during operation.

9.3.2.2 Fuels not provided through a central distribution system and that are supplied to the flame effect shall be limited to that amount necessary for operation.

9.3.2.3 Minimum tank size for liquefied flammable gas flame effects shall be determined by the surface area required to prevent reduced fuel delivery to the burner during the effect.

9.3.2.4 Fuel Delivery.

9.3.2.4.1 Fuels delivered through a central distribution system shall be in accordance with the following:

- (1) A manual fuel shutoff valve shall be installed as follows:
 - (a) It shall be installed in an accessible location at the point of delivery and upstream of any other flame effect control system components that, when closed, will shut off all fuel supplied to

the flame effect control system.

(b) Where the point of delivery is outside a building containing the flame effect control system, the valve shall be located outside of the building.

(2) The following shall apply to fuel pressure:

(a) Where low fuel pressure could cause the flame effect control system to malfunction, devices to provide low-fuel-pressure supervision shall be installed.

(b) Where high fuel pressure could cause the flame system to malfunction, devices to provide high-fuel-pressure supervision shall be installed.

(3) A supervisor station shall be installed and shall meet the following criteria:

(a) It shall be installed downstream of the manual fuel shutoff valve.

(b) It shall shut off all fuel supplied to the flame effect control system when closed.

(c) When opened during the enable process, it shall be held open by a maintained signal from the flame effect control system.

9.3.2.4.2 The supervisor station shall be provided with a means to test the seat-tightness of the shutoff valve at the operating pressure

9.3.2.5 Effect Valve.

9.3.2.5.1 Each flame effect shall be provided with an automatic fuel shutoff valve (the effect valve), installed upstream of the burner.

9.3.2.5.2 The effect valve shall shut off all fuel to the burner when closed.

9.3.2.5.3 The effect valve shall be opened only at the time of firing the flame effect and shall be held open by a maintained signal from the flame effect control system.

9.3.2.5.4 The effect valve shall close on loss of the hold-open signal.

9.3.2.6 Systems Using Fuel Accumulators. Fuel accumulators used in flame effect control systems shall meet the following requirements:

(1) Accumulator tanks shall be designed, manufactured, and certified as unfired pressure vessels.

(a) Accumulators for use with flammable or liquefied gas shall be designed, manufactured, and tested in accordance with the *ASME Boiler Pressure Vessel Code* or the Department of Transportation for the pressure of the gas in use.

(2) The volume of fuel stored in an accumulator tank shall be no more than what is required to produce the desired flame effect.

(3) Each accumulator shall have a manual fuel shutoff valve at the connection to the inlet of the tank, and when closed, this valve shall shut off all fuel supplied to the accumulator tank.

(4) An accumulator charge valve that charges the accumulator when opened shall be installed at the connection to the inlet of the tank.

(5) The accumulator shall be charged as close to the time of the actual arming and firing of the effect as is practical.

(6) Each accumulator shall be designed and installed so that the fuel can be safely removed, as follows:

(a) Accumulators fixed in location shall be provided with a permanently installed means of conveying the fuel to a safe point of discharge.

(b) Portable accumulators shall be allowed to be moved to a safe location for discharge.

(7) The mixing of air or any other oxidizing media with fuel that creates a flammable mixture within an accumulator tank shall be prohibited.