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PUBLIC DISPLAY OF FIREWORKS 1978

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See Official NFPA Definitions at the back of this pamphlet.

Standard for

Public Display of Fireworks

NFPA 1123–1978

1978 Edition of NFPA 1123

This document was prepared by the Committee on Pyrotechnics and this present edition was adopted by the Association on November 14, 1978, at its Fall Meeting in Montreal, Quebec, Canada. It was released by the Standards Council for publication on December 4, 1978

Origin and Development of NFPA 1123

Development of this standard began in October, 1975 and was initiated by a proposal from the American Pyrotechnics Association. The original proposal was redrafted twice, culminating in the present document.

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Standard for
Public Display of Fireworks

NFPA 1123-1978

Chapter 1 General

NOTICE: An asterisk (*) following the number or letter designating a subsection indicates explanatory material on that section in Appendix A. Information on referenced publications can be found in Appendix C.

1-1 Scope.

1-1.1 This standard shall apply to the construction, handling, and use of fireworks intended solely for public display. It shall also apply to the general conduct and operation of the display. (*See definition of Public Display.*)

1-1.2 This standard shall not apply to the manufacture, transportation, or storage of fireworks. (*See Code for the Manufacture, Transportation, and Storage of Fireworks, NFPA 44A.*)

1-1.3 This standard shall not apply to the use of Class C fireworks by the general public.

1-1.4 This standard shall not apply to the transportation, handling, or use of fireworks by the Armed Forces of the United States.

1-1.5 This standard shall not apply to the transportation, handling, or use of industrial pyrotechnic devices or fireworks, such as railroad torpedoes, fusees and automotive, aeronautical, and marine flares and smoke signals.

1-2 Purpose.

1-2.1 The purpose of this standard is to provide reasonable protection, as detailed in this standard, to the general public when viewing a public fireworks display.

1-2.2 The purpose of this standard is also to provide reasonable safety, as detailed in this standard, to the operator of a public fireworks display.

1-3 Definitions. For the purpose of this standard, the following terms shall have the meanings shown below:

Black Match. A fuse made from thread impregnated with black powder and used for igniting pyrotechnic devices.

Boxed Finale. A number of mortars grouped closely together and contained by a suitable frame. The mortars are loaded prior to the display and fused for rapid sequence firing.

Break. An individual effect from an aerial shell; generally either color (stars) or noise (salute). Aerial shells can be single-break (having only one effect) or multiple-break (having two or more effects).

Colored Pot. A paper tube containing pyrotechnic composition that produces a colored flame on ignition. Colored pots are used in the construction of ground display pieces.

Discharge Site. The area immediately surrounding the mortars used to fire the aerial shells.

Finale Rack. A row of closely spaced 2-in. (51-mm) or 3-in. (76-mm) (inside diameter) mortars held in a wooden frame. It is similar to a boxed finale.

Fireworks. Any composition or device for the purpose of producing visible or audible effects by combustion, deflagration, or detonation and classified as "common" or "special" fireworks by the U.S. Department of Transportation.[1] Propelling or expelling charges consisting of a mixture of sulfur, charcoal, and saltpeter are not considered as designed to produce audible effects.

Exception: The following are not considered to be fireworks:

(a) Toy pistols, toy canes, toy guns, or other devices in which paper and/or plastic caps, manufactured in accordance with Department of Transportation regulations for packing and shipment, are used, and toy paper and plastic caps manufactured as provided therein, the sale and use of which shall be permitted at all times.[2]

(b) Model rockets and model rocket motors designed, sold, and used for the purpose of propelling recoverable aero models.[3]

Class B Fireworks. Fireworks designed primarily to produce visible or audible effects by combustion or explosion. Class B fireworks includes, but is not limited to, firecrackers and salutes containing more than 2.0 grams of explosive composition, aerial shells containing more than 40.0 grams of pyrotechnic composition, and other display pieces that exceed the limits for classification as Class C fireworks. The definition of Class B fireworks is based on the definition of "special fireworks" which appears in the Code of Federal Regulations, 49CFR173.88(d).

[1]The regulations referred to are the Hazardous Materials Regulations contained in the Code of Federal Regulations, Title 49–Transportation, Parts 171–177. The regulations classify explosive materials and devices as Class A, B, or C. Class A explosives are high explosives, such as those used in blasting operations.

[2]The regulations referred to limit the explosive content to not more than an average of 0.25 grams per cap. Also, each package containing toy caps must be labeled to indicate the maximum explosive content per cap.

[3]See *Code for Unmanned Rockets*, NFPA 1122L.

Class C Fireworks. Fireworks designed primarily to produce visible effects by combustion. Some small devices designed to produce audible effects are included, such as whistle devices and explosive devices containing 2.0 grains (0.13 grams) or less of pyrotechnic composition. Class C fireworks include:

(a) Roman candles, not exceeding 10 balls, with total pyrotechnic composition not exceeding 20 grams in weight and inside tube diameter not exceeding ⅜ in. (9.5 mm).

(b) Sky rockets with sticks, total pyrotechnic composition not exceeding 20 grams in weight and inside tube diameter not exceeding ½ in. (12.7 mm).

(c) Helicopter type rockets, total pyrotechnic composition not exceeding 20 grams in weight and inside tube diameter not exceeding ½ in. (12.7 mm).

(d) Cylindrical fountains with total pyrotechnic composition not exceeding 75 grams in weight and inside tube diameter not exceeding ¾ in. (19.0 mm).

(e) Cone fountains with total pyrotechnic composition not exceeding 50 grams each in weight.

(f) Wheels with total pyrotechnic composition not exceeding 60 grams for each driver unit or 240 grams for each wheel and with inside tube diameter of driver units not exceeding ½ in. (12.7 mm).

(g) Illuminating torches and colored fire in any form with total pyrotechnic composition not exceeding 100 grams each.

(h) Dipped sticks and sparklers, the pyrotechnic composition of which does not exceed 100 grams each in weight. Those devices containing any chlorate or perchlorate are not to exceed 5 grams in total pyrotechnic composition per item. (Sparklers which contain no magnesium and which contain less than 100 grams of composition per item are not subject to the above-mentioned regulations.)

(i) Mines and shells of which the mortar is an integral part, total pyrotechnic composition not exceeding 40 grams in weight.

(j) Firecrackers and salutes with casing external dimensions not exceeding 1½ in. (38.1 mm) in length or ¼ in. (6.4 mm) in diameter and total pyrotechnic composition not exceeding 2 grains (0.13 grams) each in weight.

(k) Novelties consisting of two or more devices listed in (a) through (j) of this definition.

Ground Display Piece. A pyrotechnic device that functions on the ground (as opposed to an aerial shell which functions in the air). Typical ground display pieces include fountains, roman candles, wheels, and "set pieces."

Lance. A thin cardboard tube packed with color-producing pyrotechnic composition used to construct ground display pieces. Lances are mounted on a wooden frame and fused so that ignition of all tubes is simultaneous.

Lift Charge. That part of an aerial shell which actually lifts the shell into the air. It usually consists of a black powder charge ignited by a quick match fuse. (A delay fuse then ignites the main part of the shell, producing the desired effect.)

Monitor. A person designated by the sponsors of the display to keep the audience in the intended viewing area and out of the discharge site and potential landing area.

Mortar. A metal or heavy cardboard tube from which aerial shells are fired.

Movable Ground Piece. A ground display piece having movable parts, such as a revolving wheel.

Operator. The person responsible for setting up and firing a public fireworks display.

Potential Landing Area. The area over which aerial shells are fired. The shells will normally burst over this area, but debris and malfunctions will fall into this area; therefore, it must be kept clear of spectators.

Public Display. An outdoor display of aerial pyrotechnic shells (*see Shell [Aerial]*) and/or ground display pieces (*see Ground Display Piece*).

Quick Match. Black match that is encased in a loose-fitting paper sheath. While exposed black match burns slowly, quick match propagates flame extremely rapidly, almost instantaneously. Quick match is used in fuses for aerial shells and for simultaneous ignition of a number of pyrotechnic devices, such as lances in a ground display piece.

Safety Cap. A paper tube, closed at one end, that is placed over the end of the fuse of an aerial shell to protect from accidental ignition. The cap is not removed until just before firing of the shell.

Shell (Aerial). A cylindrical or spherical cartridge containing pyrotechnic composition, a long fuse, and a black powder lift charge. The shells are most commonly 3 in. (76 mm) to 6 in. (152 mm) outside diameter and are fired from mortars. Upon firing, the fuse and lift charge are consumed.

Shooter. (*See Operator.*)

Chapter 2 Requirements for Shells and Mortars

2-1 Construction of Shells.

2-1.1 Shells shall be classified and described only in terms of the inside diameter of the mortar in which they can be safely used. (e.g., 3 in. (76 mm) shells are only for use in 3 in. (76 mm) mortars).

2-1.2* Shells shall be constructed so that the difference between the inside diameter of the mortar and the outside diameter of the shell is no less than ⅛ in. (3.2 mm) and no more than ¼ in. (6.4 mm) for 2-in. (51-mm) and 3-in. (76-mm) shells or ½ in. (12.7 mm) for shells larger than 3 in. (76 mm).

2-1.3 Shells shall be labeled with the type of shell, the diameter measurement, and the name of the manufacturer or distributor. Shells shall also carry a warning label, as described in Figure B2-1.3, Appendix B.

2-1.4 The length of the internal delay fuse and the amount of lift charge shall be sized to insure proper functioning of the shells in their mortars. Quick match fuse shall be long enough to allow not less than 6 in. (152 mm) of fuse to protrude from the mortar after the shell has been properly inserted.

2-1.5 The length of exposed black match on a shell shall not be less than 3 in. (76 mm) and the fuse shall not be folded or doubled back under the safety cap. Also, the time delay between ignition of the tip of the exposed black match and ignition of the lift charge shall not be less than four seconds to allow the operator to retreat safely.

2-1.6 A safety cap shall be installed over the exposed end of the fuse. The safety cap shall be of a different color than that used for the paper of the fuse.

2-2 Storage of Shells.

2-2.1 All fireworks shall be stored and transported according to the requirements of the *Code for the Manufacture, Transportation, and Storage of Fireworks,* NFPA 44A, prior to reaching the display site.[1]

[1]See also Code of Federal Regulations, Title 27, Part 18, Subparts J and JJ.

2-2.2 As soon as the fireworks have been delivered to the display site, they shall not be left unattended nor shall they be allowed to become wet.

2-2.3 All shells shall be inspected upon delivery to the display site by the display operators. Any shells having tears, leaks, broken fuses, or showing signs of having been wet shall be set aside and shall not be fired. After the display, any such shells shall either be returned to the supplier or be destroyed according to the supplier's instructions.

2-2.4 All shells shall be separated according to diameter and stored in tightly covered containers of metal, wood, or plastic or in fiber drums or corrugated cardboard cartons meeting U.S. Department of Transportation specifications for transportation of fireworks. A flame-resistant tarpaulin meeting the requirements of *Standard Methods of Fire Tests for Flame-Resistant Textiles and Films,* NFPA 701, shall be permitted to be used as a covering over the containers, if additional protection is desired.

2-2.5* The shell storage area shall be located at a minimum distance of not less than 25 ft. (7.6 m) from the discharge site.

Exception: Where acceptable to the authority having jurisdiction, alternate protective measures may be used in lieu of the above requirement.

2-2.6 During the display, shells shall be stored upwind from the discharge site. If the wind should shift during the display, the shell storage area shall be relocated so as again to be upwind from the discharge site.

Exception: Where conditions do not permit locating the shell storage area upwind from the discharge site.

2-3 Installation of Mortars.

2-3.1 Mortars shall be inspected for dents, bent ends, and cracked or broken plugs prior to ground placement. Mortars found to be defective in any way shall not be used. Any scale on the inside surface of the mortars shall be removed.

2-3.2 Mortars shall be positioned so that the shells are carried away from spectators and into a clear area acceptable to the authority having jurisdiction. (*See Section 3-2.*)

2-3.3* Mortars shall be either buried securely into the ground to a depth of ⅔ to ¾ of their length or fastened securely in mortar boxes or drums. In soft ground, heavy timber (e.g., 4-in. (102-mm) thick) or rock slabs shall be placed beneath the mortars to prevent their sinking or being driven into the ground during firing.

Exception: Boxed finales and finale racks.

2-3.3.1 In damp ground, a weather-resistant bag shall be placed under the bottom of the mortar prior to placement in the ground to protect the mortar against moisture.

2-3.3.2 Weather-resistant bags shall be placed over the open end of the mortar in damp weather to keep moisture from accumulating on the inside surface of the mortar.

2-3.4* Sand bags, dirt boxes, or other suitable protection shall be placed around the mortars to protect the operator from ground bursts. This requirement shall not apply to the down-range side of the discharge site.

2-3.5 Mortars shall be inspected before the first shells are loaded to be certain that no water or debris has accumulated in the bottom of the mortar.

2-3.6 Metal mortars shall be deemed acceptable for use with all shells. Paper mortars shall only be used for discharge of single- and double-break shells. A 30 second cooling period shall be allowed between firing and reloading of paper mortars.

2-3.6.1 Paper mortars shall be constructed of convolute wound paper, except that spiral wound paper shall be permitted for 3-in. (76-mm) diameter mortars only. Wall thickness of paper mortars shall conform to Table 2-3.6.

Table 2-3.6 Wall Thickness of Paper Mortars

Mortar Type	Mortar Diameter, in.	(mm)	Wall Thickness, in.	(mm)
Convolute	2 in.	(51)	¼ in.	(6.4)
Convolute or Spiral	3 in.	(76)	⅜ in.	(9.5)
Convolute	4 in.	(102)	½ in.	(12.7)
Convolute	5 in.	(127)	¾ in.	(19.0)
Convolute	6 in.	(152)	¾ in.	(19.0)

Exception: For 3-in. (76-mm) single-fire mortars, such as used in finales, a wall thickness of ¼ in. (6.4 mm) shall be permitted.

2-3.8 A cleaning tool shall be provided for cleaning debris out of the mortars between firings. An acceptable tool is shown in Figure 2-3.8.

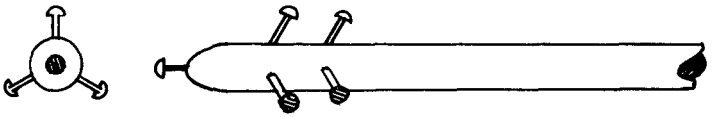

Figure 2-3.8 A mortar cleaning tool made from a broom handle.

Chapter 3 Site Selection

3-1 General.

3-1.1 The intent of this chapter is to provide minimum clearances upon which the authority having jurisdiction may base his approval of the display site. Where unusual conditions exist, the authority having jurisdiction may increase the minimum clearances as he deems necessary.

3-1.2 The areas selected for the discharge site, spectator viewing area, parking areas, and the potential landing area shall be inspected and approved by the authority having jurisdiction.

3-2 Discharge Site.

3-2.1 The area selected for the discharge of aerial shells shall be located so that the trajectory of the shells will not come within 25 ft (7.6 m) of any overhead object.

3-2.2 Ground display pieces shall be located at a minimum distance of 75 ft (22.9 m) from spectator viewing areas and parking areas.

Exception: For movable ground pieces, such as wheels, this minimum distance shall be increased to 150 ft (45.7 m).

3-2.3 Mortars shall be separated from spectator viewing areas and parking areas, from health care and penal facilities, from storage of hazardous materials, and from residential occupancies by the minimum distances specified in Table 3-2.3.

Table 3-2.3 Mortar Separation Distances

Mortar Sizes	Spectator Viewing Areas Parking Areas 1 & 2-family Dwellings[1]	Health Care & Penal Facilities[1]	Storage of Hazardous Materials[2]	Clear Landing Area
2 in. (51 mm)	50 ft (15.2 m)	500 ft (152.4 m)	500 ft (152.4 m)	150 ft (45.7 m)
3 in. (76 mm)	75 ft (22.9 m)	500 ft (152.4 m)	500 ft (152.4 m)	150 ft (45.7 m)
4 in. (102 mm)	75 ft (22.9 m)	500 ft (152.4 m)	500 ft (152.4 m)	150 ft (45.7 m)
5 in. (127 mm)	100 ft (30.5 m)	500 ft (152.4 m)	500 ft (152.4 m)	150 ft (45.7 m)
6 in. (152 mm) & larger	150 ft (45.7 m)	500 ft (152.4 m)	500 ft (152.4 m)	150 ft (45.7 m)

NOTE 1: As defined in *Life Safety Code, NFPA 101.*

NOTE 2: See the following for aid in determining whether materials are to be considered hazardous.

Fire Hazard Properties of Flammable Liquids, Gases and Volatile Solids, NFPA 325M.

Hazardous Chemicals Data, NFPA 49.

3-2.4 Fireworks shall not be discharged within 100 ft (30.5 m) of any tent or canvas shelter.

3-3 Potential Landing Area.

3-3.1 The potential landing area shall be a large, clear, open area acceptable to the authority having jurisdiction.

3-3.2 Spectators, vehicles, or any readily combustible materials shall not be located within the potential landing area during the display.

3-3.3 The potential landing area shall be located according to the distances specified in Table 3-2.3 and shall also comply with the requirements of 3-2.4.

Chapter 4 Operation of the Display

4-1 General Requirements.

4-1.1* The sponsor of the display shall provide adequate fire protection for the display, as required by the authority having jurisdiction.

4-1.1.1 The sponsor shall consult with the authority having jurisdiction to determine the level of fire protection required.

4-1.2* Monitors whose sole duty shall be the enforcement of crowd control shall be located around the display area by the sponsor. The authority having jurisdiction shall determine the number of monitors needed and their placement.

4-1.2.1 Monitors shall be located around the discharge site to prevent spectators or any other unauthorized persons from entering the discharge site. The discharge site shall be so restricted throughout the display and until the discharge site has been inspected after the display. Where practical, fences and rope barriers shall be used to aid in crowd control.

4-1.3 If, in the opinion of the authority having jurisdiction or the display operator, lack of crowd control should pose a danger, the display shall be immediately discontinued until such time as the situation is corrected.

4-1.4 If, at any time, high winds or unusually wet weather prevail, such that in the opinion of either the authority having jurisdiction or the display operator, a definite danger exists, the public display shall be postponed until weather conditions improve to an acceptable level.

4-1.4.1 Light snow or mist need not cause cancellation of the display; however, all materials used in the display shall be protected from the weather by suitable means until immediately prior to use.

4-1.5 Display operators and assistants shall use only flashlights or electric lighting for artificial illumination.

4-1.6 No smoking or open flames shall be allowed in the shell storage area as long as shells are present. Signs to this effect shall be conspicuously posted.

4-2 Firing of Shells.

4-2.1 Shells shall be carried from the storage area to the discharge site only by their bodies; *never* by their fuses.

Exception: As specified in subsection 4-2.3.

4-2.2 Shells shall be checked for proper fit in their mortars prior to the display.

4-2.3* When loaded into the mortars, shells shall be held by the thick portion of their fuses and carefully lowered into the mortar. At no time shall the operator place any part of his body over the throat of the mortar.

4-2.4* The operator shall be certain that the shell is properly seated in the mortar.

4-2.5 Shells shall not, under any circumstances, be forced into a mortar too small to accept them. Shells that do not fit properly into the mortars shall not be fired; they shall be disposed of according to the procedure described in 4-2.8.

4-2.6 Shells shall be ignited by lighting the tip of the fuse with a fusee, torch, portfire, or similar device. The operator shall never place any part of his body over the mortar at any time. As soon as the fuse is ignited, the operator shall retreat from the mortar area.

Exception: Alternatively, electrical ignition may be used.

4-2.6.1 The safety cap protecting the fuse shall not be removed by the operator responsible for igniting the fuse until immediately before the shell is to be fired.

Exception: Where electrical ignition is used.

4-2.7 The first shell fired shall be carefully observed to determine that its trajectory will carry it into the intended firing range and that the shell functions over, and any debris falls into, the potential landing area.

4-2.7.1 The mortars shall be re-angled or reset if necessary at any time during the display.

4-2.8* In event of a shell failing to ignite in the mortar, the mortar shall be left alone for a minimum of five minutes, then carefully flooded with water. Immediately following the display, the mortar shall be emptied into a bucket of water. The supplier shall be contacted as soon as possible for proper disposal instructions.

4-2.9 Operators shall never attempt to repair a damaged shell nor shall they attempt to dismantle a dry shell. In all such cases, the supplier shall be contacted as soon as possible for proper disposal instructions.

4-2.10 Operators shall never dry a wet shell, lance, or pot for reuse. In such cases, the shell, lance, or pot shall be handled according to the procedure in 4-2.8.

4-2.11 The entire firing range shall be inspected immediately following the display for the purpose of locating any defective shells. Any shells found shall be immediately doused with water before handling. The shells shall then be placed in a bucket of water. The supplier shall then be contacted as soon as possible for proper disposal instructions.

4-2.11.1 When fireworks are displayed at night, the sponsor shall insure that the firing range is inspected early the following morning.

4-2.11.2 The operator of the display shall keep a record, on a form provided by the supplier, of all shells that fail to ignite or fail to function. The form shall be completed and returned to the supplier. (*See Appendix B.*)

4-3 Ground Pieces.

4-3.1 All ground pieces shall be positioned out of the firing range of aerial displays. Mortars shall be positioned so that they do not fire towards any ground pieces.

4-3.2 No dry grass or combustible material shall be located beneath ground pieces. If dry, the area shall be thoroughly wet down before the display.

4-3.3 Poles for ground pieces shall be securely placed and firmly braced so that they will not fall over when they function.

4-3.4 Specific instructions from the supplier shall accompany all ground pieces. A list of required accessories shall also be supplied.

Chapter 5 Operator Qualifications

5-1 Public display operators shall be licensed or approved in accordance with any and all applicable state, county, or municipal laws.

5-1.1 All operators shall be at least 21 years old. Assistants shall be at least 18 years old.

5-1.2 Applicants for licensing as operators and assistants shall successfully complete a written examination of laws, regulations, and safety practices administered by the state fire marshal's office or other authority, or otherwise demonstrate proficiency.

5-2* An adequate number of operators, assistants, and monitors shall be on hand to conduct the display.

5-3 No person shall handle or be involved in the firing of fireworks while under the influence of alcohol, narcotics, or drugs which could adversely affect judgment, movements, or stability.

Appendix A

This Appendix is not a part of this NFPA standard, but is included for informational purposes only.

A-2-1.2 These dimensions insure proper operation of and optimum lift for the shell. If the fit is too loose, the shell may not lift into the intended firing range or may not lift off at all. If the fit is too tight, the shell may bind in the mortar.

A-2-2.5 An example of additional protection would be the use of a flame-resistant tarpaulin meeting the requirements of *Standard Methods of Fire Tests for Flame-Resistant Textiles and Films,* NFPA 701.

A-2-3.3 All mortars of the same diameter should be grouped together to minimize the possibility of shells being placed in the wrong mortars. Mortars should be spaced apart by at least twice their diameters.

A-2-3.4 Care should be taken to remove loose gravel, rocks, and other loose solid objects from the area, to prevent such items from being thrown from ground bursts during firing.

A-4-1.1 The authority having jurisdiction should be consulted well enough in advance so that the required fire protection may be arranged for. Fire protection may include portable fire extinguishers for the discharge area and standby fire apparatus for protection down range.

A-4-1.2 Monitors should wear some distinctive identification, e.g., badges, brightly colored vests, etc.

A-4-2.3 The operator should crouch alongside the mortar when loading the shell into the mortar.

A-4-2.4 A *gentle* tug on the fuse will usually determine this.

A-4-2.8 The operator should use extreme caution in destroying the shell.

A-5-2 Normally, only one operator is required. Assistants may be used to aid in loading mortars, operating ground pieces, and performing other duties.

Appendix B

This Appendix is not a part of this NFPA Standard, but is included for informational purposes only.

B-2-1.3 Labeling of Shells.

B-2-1.3.1 Each shell should bear a label containing the following information:

a description of the size of the shell (e.g. "3-in. shell");
a description of the type of shell (e.g. "2-break with report");
a warning statement reading:

WARNING: DANGEROUS EXPLOSIVE
If found, do not handle —
Contact local fire or
police department

the name and place of business of the manufacturer, importer or distributor.

B-2-1.3.2 Conspicuousness.

(a) The statement "WARNING — DANGEROUS EXPLOSIVE" should be printed in capital letters having a printed image of at least ⅛ in. and should be underlined.
(b) The remaining printed matter need not be printed in capital letters but should be in the same size type as the foregoing statement.
(c) The required statements should be printed in a color contrasting sharply with the background and should be printed within a borderline.
(d) The label should be at least 3 in. x 3 in., unless the size of the shell is too small to accommodate such size, in which case the size may be reduced, but to a size no smaller than necessary.