

Fire Engineering®

Construction Concerns: Fire Extinguisher Testing

Article and photos by Gregory Havel

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In firefighter certification classes, we are taught how to operate [portable](#) fire extinguishers for the different classes of fire. In fire inspector classes, we are taught how to determine the number, distribution, and location of fire extinguishers for different classes of fire throughout the building they protect. Yet, we learn little about the capabilities of any specific type or size of portable fire extinguisher.

Underwriters Laboratories (UL®) has developed standards by which fire extinguishers are tested and their capacities rated. These standards include fire extinguishers using water-based agents, carbon dioxide, dry [chemicals](#), and dry power for combustible metal fires. For example, UL 8 is the standard for water-based agent portable fire extinguishers (photo 1).



(1)

These standards provide detailed information on the design, performance, and testing of the construction of the fire extinguisher cylinders, caps, valves, [pressure](#) relief devices, pressure gauges, locking devices, hoses, nozzles, mounting devices, expellant gases, extinguishing agents, agent discharge rates and volumes, hydrostatic testing; tests for resistance to vibration, temperature extremes, rough usage, and corrosion; tests for the durability of labels and nameplates; and all other details.

UL[®] has also developed ANSI/UL 711, *Rating and Fire Testing of Fire Extinguishers*. This [standard](#) describes in detail the test methods and volume of fire that a portable fire extinguisher of a certain type must extinguish to achieve a specific rating.

In the remainder of this article, we will use the testing of a Class A water-based [agent](#) portable fire extinguisher rated at 3A as an example.

The fire [performance](#) test of a Class A portable fire extinguisher is in two parts: the vertical wood panel (Table 1) and the test crib (Table 2).

Vertical Test Panel				
Extinguisher	Test Panel	Test Panel	Accelerant	Excelsior Windrow
Rating	Size	Size	No. 2 Fuel Oil	Material
	meters	feet		
1-A	2.45 x 2.45	8 x 8	3.8 l 1 gallon	4.5 kg 10 pounds
2-A	3.05 x 3.05	10 x 10	7.55 l 2 gallons	9.06 kg 20 pounds
3-A	3.65 x 3.65	12 x 12	11.35 l 3 gallons	13.6 kg 30 pounds
4-A	4.25 x 4.25	14 x 14	15.15 l 4 gallons	19.15 kg 40 pounds
6-A	5.20 x 5.20	17 x 17	22.70 l 6 gallons	27.20 kg 60 pounds

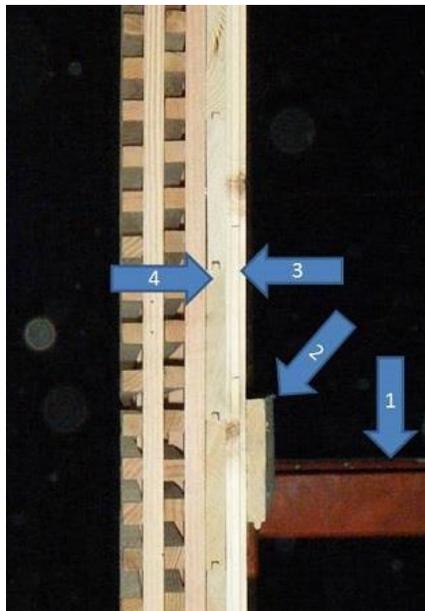
Test Crib				
Extinguisher	Number of	Trade size and length of wood members		Arrangement of wood
Rating	Wood Members	millimeters	inches	members in crib
1-A	72	38 x 38 x 500	2 x 2 x 20	12 layers of 6
2-A	112	38 x 38 x 635	2 x 2 x 25	16 layers of 7
3-A	144	38 x 38 x 735	2 x 2 x 29	18 layers of 8
4-A	180	38 x 38 x 800	2 x 2 x 32	20 layers of 9
6-A	230	38 x 38 x 925	2 x 2 x 36	23 layers of 10

The [vertical](#) wood panel for a 3A fire extinguisher test is 12 × 12 feet (3.65 × 3.65 meters) (photo 2) and is built of tongue-and-groove 1 x 6 pine boards faced with four layers of uniformly-spaced ¾-inch square boards with the first and third layers vertical and the second and fourth layers horizontal (Figure 1). It is held vertical by steel bracing at the back. The bottom of the panel is sealed against the concrete floor with a layer of Class B fire extinguishing agent.



(2)

FIGURE 1.



Vertical Panel Cross-Section

1. Steel brace
2. Horizontal stiffener
3. Vertical stiffener
4. Tongue-and-groove boards

The [test](#) panel is sprayed with three gallons (11.35 liters) of Number 2 fuel oil before ignition. Four windrows of excelsior, weighing a total of 30 pounds (13.6 kilograms), are spread on the floor; the first at the base of the panel, and the remaining three at a distance from it.

The first windrow of excelsior, at the base of the panel, is ignited at one side of the panel. At specified time intervals, the remaining windrows of excelsior are pushed to the base of the burning panel one at a time to ensure that the entire face of the panel is fully involved in fire. Once the four windrows of excelsior have been burned at the base of the panel and the panel is fully involved in fire, any remaining excelsior will be pushed away from the base of the panel to provide a safe walking surface for the fire extinguisher operator. While the panel is being ignited, and while it is [burning](#), laboratory technicians monitor the panel and extinguish with small water streams any fire that attempts to wrap around the edges or the back of the test panel.

At this point, a laboratory technician will begin discharging the test fire extinguisher onto the burning test panel, sweeping the stream from side to side and bottom to top (photo 3). The fire extinguisher valve is completely open, and the total time of extinguishing agent application is recorded. To be rated as 3A, the contents of a single 3A portable extinguisher must completely put out the fire without reignition (photo 4).



(3)



(4)

In addition, test records will include the moisture content of the wood in the panel, the precise weight of the Class A fuels, and the precise volume of the accelerant. The test record will also include digital video and still photos.

The test crib for a 3A portable fire extinguisher test is built from 144 pieces of wood, each 2 x 2 x 29 inches (38 x 38 x 735 millimeters) in 18 layers of eight pieces, each layered perpendicular to the adjacent layers. Photo 5 shows two Class A test cribs stacked on a pallet, ready for use. For the test, a single test crib is placed on a support frame over an ignition pan with an accelerant. The fire is ignited, and when the wood crib is fully involved, a laboratory technician will put out the fire with a single portable extinguisher. To be rated as 3A, the contents of a single 3A portable extinguisher must completely put out the fire without reignition.



(5)

For rating as 3A, the portable fire extinguisher must pass the vertical panel and test crib, as described above. For ratings other than 3A, the vertical panel and test cribs have different dimensions, as shown in Tables 1 and 2. ANSI/UL 711 rates Class A fire extinguishers up to 60-A.

The same tests are used for dry chemical fire extinguishers with an A rating such as ABC dry chemical. These portable fire extinguishers must also pass the Class B test, which is a separate topic.

Portable fire extinguishers are often regarded as only fire code requirements and are only useful on small fires. Yet, in the hands of a skilled operator, a fire extinguisher can be effective on large and deep-seated fires for the protection of persons and property before the arrival of the fire department.

Despite the capabilities of portable fire extinguishers, public fire educators must emphasize to building occupants and owners that their primary responsibilities during a

fire are to call the fire department's emergency number and evacuate the building. The RACE acronym described below is used by health care facilities is applicable to most other types of facilities as well.

- **Rescue** anyone who is directly threatened by the fire, its flames, or its smoke.
- **Alarm.** Activate the building fire alarm, and call the fire department's emergency number (911 in most areas in the United States).
- **Confine** the fire by closing doors to slow the spread of smoke and flames.
- **Extinguish** the fire only if the fire is small and you have training in fire extinguisher operation and only after threatened individuals have been rescued and the fire department has been notified.

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