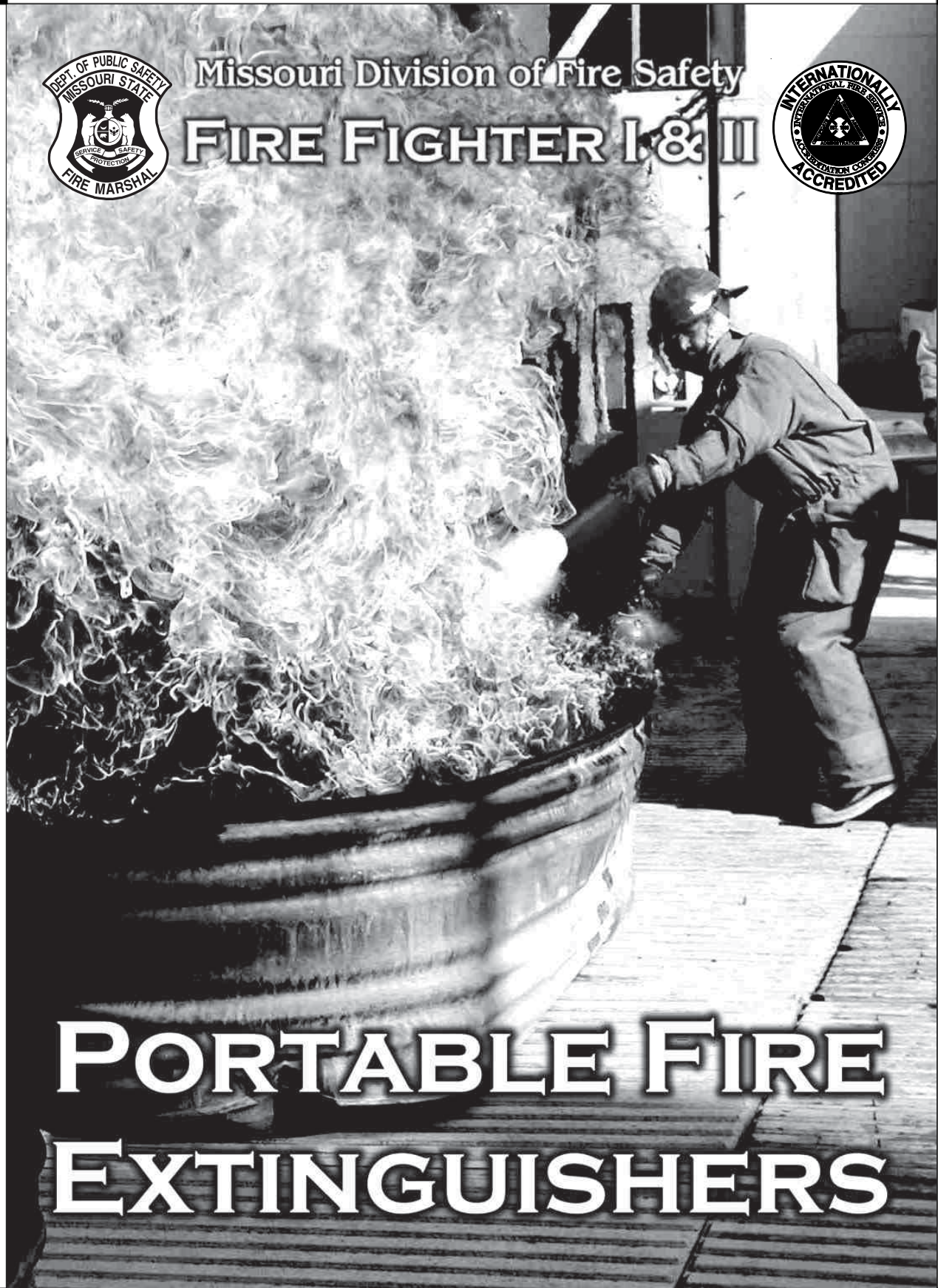




Missouri Division of Fire Safety
FIRE FIGHTER I & II



**PORTABLE FIRE
EXTINGUISHERS**



UNIT OBJECTIVES

Upon completion of this unit of study, the student should be able to:

1. Identify the classes of fire and the appropriate extinguisher symbols for the different classes.
2. Describe the rating principles for fire extinguishers.
3. Describe the most common types of extinguishing agents.
4. Describe the physical characteristics of various extinguishing agents.
5. Identify the various types of portable extinguishers and the operating principle of each type of extinguisher.
6. Describe the basic procedures for proper care and maintenance of portable extinguishers.
7. Demonstrate ability to use fire extinguishers.



NFPA STANDARDS

Successful completion of the information in this section is necessary to fulfill the requirements of the following sections of NFPA 1001-2008:

Fire Fighter I Standard

5.3.16* Extinguish incipient Class A, Class B, and Class C fires, given a selection of portable fire extinguishers, so that the correct extinguisher is chosen, the fire is completely extinguished, and correct extinguisher-handling techniques are followed.

(A) Requisite Knowledge. The classifications of fire; the types of, rating systems for, and risks associated with each class of fire; and the operating methods of and limitations of portable extinguishers.

(B) Requisite Skills. The ability to operate portable fire extinguishers, approach fire with portable fire extinguishers, select an appropriate extinguisher based on the size and type of fire, and safely carry portable fire extinguishers.

INSTRUCTORS' NOTE

All of Portable Fire Extinguisher Practical Skills involve the extinguishment of live fires. The use of fire extinguisher digital training simulators *is not approved or acceptable* for completion of these skills.

Additionally, these live burn skills *are not eligible* for completion using the "Alternative Compliance Method." Should one of these extinguisher live burn skills be included on a Fire Fighter I Certification Skills Examination, it must be completed during the exam using a live burn.

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	<p>I. Portable Fire Extinguishers (Essentials p. 233)</p> <ul style="list-style-type: none">A. Portable fire extinguishers can provide a first defense for fires of limited sizeB. Extinguishers must not be considered as a substitute for automatic suppression systemsC. To be effective an extinguisher:<ul style="list-style-type: none">1.2.3.4. Large enough to control the size fire5. User must know how to operate the extinguisherD. Fire fighters must be able to:<ul style="list-style-type: none">1. Understand the limitations and capabilities of various extinguishers2. Select the appropriate extinguisher for the size and type of fire3. Safely carry portable extinguishers4.5. Operate portable extinguishersE. Extinguishing agents put out fires by one of these methods:<ul style="list-style-type: none">1. Smothering -

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	<ul style="list-style-type: none">2. Cooling - reducing the burning material's temperature3. Chain breaking - interrupting the chemical chain reaction4. Saponification - <p>F. Fire fighters should never rely on privately owned extinguishers in an occupancy as they may be:</p> <ul style="list-style-type: none">1. Improperly maintained2. Vandalized3. Obsolete4. Fire personnel should rely only on the extinguishers carried on fire apparatus <p>G. Extinguishers must have a means of expelling the extinguishing agent</p> <ul style="list-style-type: none">1. Manual pump2. Stored pressure3. Pressure cartridge <p>H. Fire classifications</p> <ul style="list-style-type: none">1. Class A: fires involving ordinary combustibles (wood, paper, plastics and a large variety of others)<ul style="list-style-type: none">a.

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	<ul style="list-style-type: none">2. Class B: fires involving flammable and combustible liquids<ul style="list-style-type: none">a.b. These fires are extinguished blanketing and smothering or inhibiting the chain reaction of fire3. Class C: fires involving energized electrical equipment<ul style="list-style-type: none">a. They are extinguished with nonconductive agents such as carbon dioxide, halon, and dry chemicalb.4. Class D: fires involving combustible metals (aluminum, titanium, magnesium and other exotic metals)<ul style="list-style-type: none">a. The extinguishing agents are a sodium chloride material which is used to cover the material5. Class K: fires involving oils used in commercial cooking applications<ul style="list-style-type: none">a. These materials have been taken out of the Class B classificationb. Wet chemicals are used as the extinguishing agent

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NOTES	STUDENT GUIDE
	<p data-bbox="570 411 997 443">II. Types of Fire Extinguishers</p> <p data-bbox="618 491 1219 522">A. Mechanically pumped water extinguishers</p> <ol data-bbox="667 569 1349 716" style="list-style-type: none"><li data-bbox="667 569 1349 642">1. Non-pressurized container with a hand operated pump<li data-bbox="667 684 1110 716">2. Limited to small Class A fires <p data-bbox="618 758 873 789">B. Hand propelled</p> <ol data-bbox="667 835 1354 940" style="list-style-type: none"><li data-bbox="667 835 1289 867">1. Buckets or drums of water for Class A fires<li data-bbox="667 909 1354 940">2. Class D agents that can be shoveled onto the fire <p data-bbox="618 989 1138 1020">C. Stored pressure water extinguishers</p> <ol data-bbox="667 1066 1398 1629" style="list-style-type: none"><li data-bbox="667 1066 1398 1140">1. Water is stored in a tank with compressed air as the expellant<li data-bbox="667 1182 1333 1255">2. Also called air-pressurized water extinguisher (APW)<li data-bbox="667 1297 691 1329">3.<li data-bbox="667 1371 1081 1402">4. Extinguisher characteristics<ol data-bbox="716 1451 1170 1629" style="list-style-type: none"><li data-bbox="716 1451 829 1482">a. Size:<li data-bbox="716 1524 1170 1556">b. Discharge distance: 30-40 feet<li data-bbox="716 1598 1089 1629">c. Duration: 30-60 seconds <p data-bbox="618 1682 1203 1713">D. Water-mist stored-pressure extinguishers</p> <ol data-bbox="667 1759 1373 1833" style="list-style-type: none"><li data-bbox="667 1759 1373 1833">1. Similar in appearance to standard stored-pressure water extinguishers

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	<ul style="list-style-type: none">2.3. Use deionized water and nozzles which produce a fine mist making them suitable to use on energized electrical equipmentE. Wet chemical stored-pressure extinguishers<ul style="list-style-type: none">1. Specifically designed to extinguish fires involving unsaturated cooking oils in deep fryers2. Contain a special potassium-based, low-pH agentF. Aqueous film forming foam (AFFF) extinguishers<ul style="list-style-type: none">1.2. Contain AFFF concentrate mixed with water3.4. Expelled by compressed air or nitrogen stored in the tank with the solution5. Should not be applied directly into a burning fuel but allowed to gently rain down or bounced off an object onto the fuel<ul style="list-style-type: none">a. Finished foam floats on the surface of lighter-than-water fuelsb. Forms a blanket which seals the vapors to extinguish the fire and prevent re-ignition6.

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	<p data-bbox="618 411 1003 443">G. Clean agent extinguishers</p> <ol data-bbox="667 489 1406 1902" style="list-style-type: none"><li data-bbox="667 489 1406 821">1. Clean agent extinguishing agents were designed to replace halogenated extinguishing agents (Halon 1211 and Halon 1301)<ol data-bbox="716 642 1406 821" style="list-style-type: none"><li data-bbox="716 642 1406 709">a. Halon production was stopped in 1994 due to its effect on the ozone layer<li data-bbox="716 751 1406 821">b. There is still limited halon production and much of the halon in use is recycled<li data-bbox="667 867 1406 1360">2. Halon replacement agents - "clean agents"<ol data-bbox="716 947 1406 1360" style="list-style-type: none"><li data-bbox="716 947 1406 978">a. Haltron<li data-bbox="716 1020 1406 1052">b. Inergen<li data-bbox="716 1094 1406 1125">c. FE-36 hexafluoropropane<li data-bbox="716 1167 1406 1199">d. FE-24 chlorotetrafluoroethane<li data-bbox="716 1241 1406 1360">e. These replacements may require up to 20 times as much as halon to provide an equal extinguishing capacity<li data-bbox="667 1409 1406 1440">3.<li data-bbox="667 1524 1406 1598">4. Used for Class B and Class C fires and in areas with sensitive electronic equipment<li data-bbox="667 1640 1406 1902">5. Advantages<ol data-bbox="716 1724 1406 1902" style="list-style-type: none"><li data-bbox="716 1724 1406 1755">a. High expansion ratio<li data-bbox="716 1797 1406 1829">b. Needs no expellant<li data-bbox="716 1871 1406 1902">c. Nonconductive and noncorrosive

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	<p>H. Carbon dioxide extinguishers</p> <ol style="list-style-type: none">1. Found as handheld extinguishers and wheeled units<ol style="list-style-type: none">a. Wheeled units commonly found at airports and industrial facilitiesb. Wheeled units have a hose and nozzle attached to the gas cylinders2.3. Have limited reach and can be dispersed by wind4. Stored as a liquefied gas under its own pressure5. <p>I. Dry chemical extinguishers</p> <ol style="list-style-type: none">1.<ol style="list-style-type: none">a. Should not be confused with dry powder extinguishers, which are used for Class D firesb. Some may be rated only for Class B:C fires2. Commonly used dry chemicals:<ol style="list-style-type: none">a. Sodium bicarbonateb. Potassium bicarbonatec. Potassium chlorided. Monoammonium phosphatee. Usually mixed with additives for moisture-resistance and to prevent caking

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	<ul style="list-style-type: none">f. Some are not compatible with foamg. Nontoxic and safe to useh. Can reduce visibility and create respiratory problems <p>3.</p> <p>4. Handheld units</p> <ul style="list-style-type: none">a. Stored pressure: a constant pressure of about 200 psi is maintained in the agent storage tankb. Cartridge-operated<ul style="list-style-type: none">(1) A separate gas pressure cartridge is attached to the agent tank(2) The agent tank is pressurized when a plunger is pushed releasing the gas into the agent tank <p>5. Wheeled units</p> <ul style="list-style-type: none">a. The extinguishing agent is in one tank with a separate gas cylinderb. Before use, the hose must be completely stretched outc. Once the gas cylinder is opened, the nozzle should not be opened for a few seconds until the agent tank is fully pressurized

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	<p>J. Metal fire agents and extinguishers</p> <ol style="list-style-type: none">1.2. Portable extinguishers for Class D fires may be handheld or wheeled units3. Some powdered agents must be applied with a scoop or shovel4.<ol style="list-style-type: none">a. It should be applied gently to avoid breaking any crust which may form over the burning materialb. If the crust is broken, the fire may flare upc. For a small amount of burning metal<ol style="list-style-type: none">(1) First cover the fire with powder(2) Then spread a layer of powder 1 to 2 inches deep nearby(3) Shovel the burning metal onto this layer and apply more powder if needed <p>K. Obsolete extinguishers</p> <ol style="list-style-type: none">1.2. American manufacturers stopped making inverted-type extinguishers in 1969

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	<ul style="list-style-type: none">a. Inverted type had a soda water base with an acid used as an expellantb. If the shell of the extinguisher was weakened by the soda water base the shell could explode when the acid was introducedc. Could not be turned off once activated <p>3. Vaporizing liquid extinguishers became obsolete in the 1960's</p> <ul style="list-style-type: none">a. Typically was a one-quart pump gunb. Carbon tetrachloride was the common agent used - liquid carbon tetrachloride in contact with heat becomes phosgene gas <p>III. Extinguisher Rating System (<i>Essentials p. 246</i>)</p> <p>A. Class A and Class B extinguishers will have a numerical rating to designate the size fire the extinguisher should be able to extinguish when used by an untrained person</p> <ul style="list-style-type: none">1. Class A extinguishers:<ul style="list-style-type: none">a. 1-A requires 1¹/₄ gallons of waterb. 2-A will extinguish twice as much as 1-A2. Class B extinguishers:<ul style="list-style-type: none">a. Based on area of a fire involving a 2-inch layer of n-heptane that a non-expert operator can extinguish

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	<ul style="list-style-type: none"><ul style="list-style-type: none">b. Every 1B rating corresponds to 1-square-foot of flammable liquidC. Class C extinguishers<ul style="list-style-type: none">1.2. Extinguishing agent is tested for electrical conductivityD. Class D extinguishers<ul style="list-style-type: none">1. No tests are conducted for capacity ratings2. Tests are conducted for specific metals for:<ul style="list-style-type: none">a. Reactions between the metal and agentb. Toxicity of the agentc. Toxicity of any fumes producedd. Time to allow the fire to self-extinguish versus time to extinguish the fireE. Class K rating<ul style="list-style-type: none">1. Extinguishing agents must be able to extinguish a fire involving cooking oils with a surface area of 2.25 square feet for a Class K ratingF.<ul style="list-style-type: none">1. Most common are Class A-B-C, Class A-B, and Class B-C

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	<p>2. Ratings for each class do not affect each other</p> <p>a. An extinguisher with a 4-A 20-B:C rating should:</p> <ul style="list-style-type: none">(1) Extinguish a Class A fire four times larger and than a 1-A fire, and(2) Extinguish about 20 times Class B fire area as a 1-B extinguisher, and(3) Must also be nonconductive for Class C <p>G.</p> <ul style="list-style-type: none">1. One system uses colored shapes with the class letter in the shape2. NFPA 10 recommends pictographs indicated the fire class and the types of fires on which the extinguisher should not be used <p>IV. Extinguisher Selection and Use</p> <p>A. Extinguisher selection depends on:</p> <ul style="list-style-type: none">1.2. Potential severity of any fire3. Extinguisher location4.5. Personnel available to use the extinguisher

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	<ul style="list-style-type: none">6. Health and safety concerns such as exposure to heat and smokeB. Use of extinguishers<ul style="list-style-type: none">1. Safety<ul style="list-style-type: none">a. Check extinguisher before approachingb.c. Do not enter burn aread.2. A quick check should be conducted before using a portable extinguisher to ensure it is in working order:<ul style="list-style-type: none">a. No apparent external damageb. Hose and nozzle in placec. The weight feels like it contains agentd. The pressure gauge is in the operational range3. PASS method of operation<ul style="list-style-type: none">a. P -b. A -c. S -d. S - sweep the nozzle back and forth at the base of the fire

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	<ol style="list-style-type: none">4. Apply the agent from a distance that reaches the fire but does not scatter the burning materials<ol style="list-style-type: none">a. If the agent cannot reach the fuel, it is wastedb. Wind can limit the reach of the agent5.6. If the fire cannot be fully extinguished with the extinguisher, withdraw and determine another course of action7. The fire has been reduced to a smoldering stage, it can be overhauled with a tool for extinguishment <p>V. Extinguisher Inspection</p> <ol style="list-style-type: none">A. Fire codes require that extinguishers be inspected monthly by the management of the property<ol style="list-style-type: none">1. Extinguishers must be in their designated locations and operational2. Servicing of extinguishers is the responsibility of the property ownerB. Inspection points<ol style="list-style-type: none">1. Extinguishers must be conspicuously located<ol style="list-style-type: none">a.b. Must be visible or the location marked conspicuously

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	<ol style="list-style-type: none">2. The hose and nozzle should be checked for obstructions and physical damage3. The extinguishers should be inspected for corrosion or mechanical damage4.5. Check the locking pin and tamper seal to determine if it has been used or tampered with6. Make sure the operating instructions are legible7. Check the inspection tag for the dates of the previous inspections, maintenance, and recharging <p>C. Damaged extinguishers</p> <ol style="list-style-type: none">1. Damaged extinguishers can fail at any time and cause property damage and injuries2. Leaking, corroded, and damaged extinguishers should be removed from service and repaired by qualified individuals3. Damaged extinguishers may also fail when needed in an emergency <p>VI. Portable Fire Extinguishers Summary</p> <ol style="list-style-type: none">A. Fire extinguishers can provide a rapid attack against small fires faster than establishing a hoselineB. Fire fighters should rely only on those extinguishers carried on fire apparatus and not depend on those in any occupancy