

LESSON ONE

FIREFIGHTER II

Foam Fire Streams

DOMAIN: COGNITIVE

LEVEL OF LEARNING: COMPREHENSION

MATERIALS

IFSTA Essentials 5th edition or Jones and Bartlett Fundamentals of Fire Fighter Skills 2nd Edition or Delmar Firefighter's Handbook 3rd Edition; overhead projector or laptop computer and multimedia projector; projection screen.

NFPA 1001 JPR, 2008 edition

6.3.1 Extinguish an ignitable liquid fire,

Junior Member Statement:

Junior Member training activities should be supervised by qualified instructors to assure that the cognitive and psychomotor skills are completed in a safe and non-evasive manner. While it is critical that instructors be constantly aware of the capabilities of all students both mentally and physically to complete certain tasks safely and successfully, the instructor should take every opportunity to discuss with departmental leaders and students the maturity and job awareness each participant has for the hazards associated with fire and rescue training.

TERMINAL OBJECTIVE

The Firefighter II candidate shall correctly define or describe in writing how foam prevents or controls a hazard, the principles of foam generation, common problems associated with foam making, and the different types of foam concentrates used on various types of fuels.

ENABLING OBJECTIVES

1. The Firefighter II candidate shall correctly define in writing the terms smothering, separating, cooling, and suppressing, as they relate to using foam fire streams to control and extinguish fires.
2. The Firefighter II candidate shall correctly describe in writing the four elements necessary to produce modern fire fighting foams.
3. The Firefighter II candidate shall correctly define in writing the terms foam solution, foam concentrate, and finished foam.
4. The Firefighter II candidate shall correctly define in writing the two major types of flammable liquids, and list at least two examples of each.
5. The Firefighter II candidate shall correctly list a minimum of five common causes of poor foam generation and the procedures that are necessary to correct each cause.

LESSON ONE

FIREFIGHTER II

Foam Fire Streams

MOTIVATION

Understanding how foam works in extinguishing different types of fires, and the principles of making different foams correctly, are essential to successful foam fire fighting operations. All too often, foam fire streams fail to accomplish their objective due to a lack of understanding and training on the part of the operator. Foam is an efficient firefighting tool that is gaining greater acceptance and use throughout the fire fighting community.

PRESENTATION

ENABLING OBJECTIVE #1

The Firefighter II candidate shall correctly define in writing the terms smothering, separating, cooling, and suppressing as they relate to using foam fire streams to control and extinguish fires.

1. Give a general explanation of how foam works.
2. Define smothering, separating, cooling, and suppressing as they relate to using foam to fight various types of fires. Be sure the students completely understand the difference between these principles.

Reference:

Delmar Handbook 3rd edition, pages 338-340
J&B Fundamentals 2nd edition, pages 521-522
IFSTA Essentials 5th edition, page 734

PRESENTATION

ENABLING OBJECTIVE #2

The Firefighter II candidate shall correctly describe in writing the four elements necessary to produce modern fire fighting foams.

1. Discuss with students how modern foams are generated mechanically. Contrast these foams with the older, chemically generated fire fighting foams.
2. List, the four elements needed to make foam.
3. Discuss how the above listed elements work together, when properly combined, to produce high quality foam.

Reference:

Delmar Handbook 3rd edition, pages 341-343
J&B Fundamentals 2nd edition, pages 521-522
IFSTA Essentials 5th edition, pages 734-736

PRESENTATION

ENABLING OBJECTIVE #3

The Firefighter II candidate shall correctly define in writing the terms foam solution, foam concentrate, and finished foam.

1. Discuss foam solution and how it is generated. Be sure to stress that the foam solution is the proportioned combination of water and concentrate in the hose line before aeration.
2. Point out that finished foam is the aerated product once it leaves the nozzle, and that foam concentrate is the raw foam concentrate liquid as it rests in the storage container.
3. Discuss the difference between regular fire fighting nozzles and foam aerating nozzles in this process.
4. List the percentages of concentrate to water in properly generated foam and the concept of expansion ratio.
5. Point out that concentrates should be proportioned only at the percentages for which they are designed. Be sure students understand the difference between

various percentages in concentrates, such as 3% or 6%.

Reference:

Delmar Handbook 3rd edition, pages 343-345

J&B Fundamentals 2nd edition, pages 521-523

IFSTA Essentials 5th edition, pages 735-736, 738, 744

PRESENTATION

ENABLING OBJECTIVE #4

The Firefighter II candidate shall correctly define in writing the two major types of flammable liquids, and list at least two examples of each.

1. Discuss hydrocarbon fuels in general and give examples that fire fighters may encounter.

NOTE: Explain that when applying foam one should never plunge the stream into the fuel.

2. Discuss polar solvent fuels in general, and give several examples.
3. Be sure students understand why a foam concentrate designed for a hydrocarbon may not be effective on polar solvents.
4. Discuss the types of concentrates that may be used effectively on each type of fuel, including the multi-purpose foam concentrate.

Reference:

Delmar Handbook 3rd edition, page 341

J&B Fundamentals 2nd edition, page 522

IFSTA Essentials 5th edition, pages 736-739

PRESENTATION

ENABLING OBJECTIVE #5

The Firefighter II candidate shall correctly list at least five common causes of poor foam generation and the procedures that are necessary to correct each cause.

1. List the ten examples of problems given. Discuss the corrective procedures for each one.
2. Create interest by citing examples of personal experiences where problems occurred in producing foam.

Reference:

Delmar Handbook 3rd edition, pages 341-343

IFSTA Essentials 5th edition, page 746

APPLICATION

Divide the class into groups and make assignments from scenarios that the instructor should prepare in advance.

Scenario #1: An overturned gasoline tanker has caused a large spill. Give apparatus placement and weather conditions.

Scenario #2: There has been a collision between a methanol tanker and an automobile, causing a spill and fire. Give apparatus placement and weather conditions. Follow the same procedures as in scenario #1.

Working in their groups, have the students determine the correct layout of hose and appliances, the correct pump pressure, type of concentrate, percentage to be used, and, depending upon the type of nozzle they chose, the expected expansion of the foam solution.

Allow a spokesperson from each group to present their information and critique as necessary.

Scenario #3: There has been an overfill of an underground tank at a gasoline service station. Give apparatus placement and weather conditions, an incorrect hose and appliance layout or incorrect pump pressure, incorrect foam concentrate percentage, a mismatched nozzle & eductor, or other incorrect information.

Have students, within their groups, determine which information is incorrect and make the correction.

SUMMARY

Review the four ways foam extinguishes fire.

Review the four elements necessary to produce mechanical foam.

Reiterate the advantages of good foam expansion.

Discuss the importance of proper proportioning.

Review the two types of flammable liquids.

LESSON TWO

FIREFIGHTER II

Foam Fire Streams

DOMAIN: COGNITIVE

LEVEL OF LEARNING: COMPREHENSION

MATERIALS

IFSTA Essentials 5th edition or Jones and Bartlett Fundamentals of Fire Fighter Skills 2nd Edition or Delmar Firefighter's Handbook 3rd Edition; overhead projector or laptop computer and multimedia projector; projection screen.

NFPA 1001 JPR, 2008 edition

6.3.1 Extinguish an ignitable liquid fire

Junior Member Statement:

Junior Member training activities should be supervised by qualified instructors to assure that the cognitive and psychomotor skills are completed in a safe and non-evasive manner. While it is critical that instructors be constantly aware of the capabilities of all students both mentally and physically to complete certain tasks safely and successfully, the instructor should take every opportunity to discuss with departmental leaders and students the maturity and job awareness each participant has for the hazards associated with fire and rescue training.

TERMINAL OBJECTIVE

The Firefighter II candidate shall correctly list and describe in writing the seven types of foam concentrates, their characteristics, and their advantages / disadvantages.

ENABLING OBJECTIVES

1. The Firefighter II candidate shall correctly list in writing the characteristics, advantages, and disadvantages of a protein type concentrate.
2. The Firefighter II candidate shall correctly define and describe in writing the characteristics, advantages, and disadvantages of a fluoroprotein type concentrate.
3. The Firefighter II candidate shall correctly define and describe in writing the characteristics, advantages, and disadvantages of a film forming fluoroprotein foam (FFFP) type concentrate.
4. The Firefighter II candidate shall correctly define and describe in writing the characteristics, advantages, and disadvantages of an aqueous film forming foam (AFFF) type concentrate.
5. The Firefighter II candidate shall correctly define and describe in writing the characteristics, advantages, and disadvantages of alcohol-resistant AFFF type of concentrate.
6. The Firefighter II candidate shall correctly define and describe in writing the characteristics, advantages, and disadvantages of medium and high expansion foam type concentrates.
7. The Firefighter II candidate shall correctly define and describe in writing the characteristics, advantages, and disadvantages of a class A type concentrate.

LESSON TWO

FIREFIGHTER II

Foam Fire Streams

MOTIVATION

Understanding the advantages and disadvantages, the characteristics, and the various types of concentrates that may be used on different types of fuels or hazardous materials is essential to successful operations at fires or spills. Using the wrong type of concentrate may cause a situation to worsen or, at the very least, to be a waste of expensive concentrate and valuable time.

PRESENTATION

ENABLING OBJECTIVE # 1

The Firefighter II candidate shall correctly list in writing the characteristics, advantages, and disadvantages of a protein type concentrate.

1. Discuss the characteristics of protein foam. Explain its derivation from hydrolyzed protein solids and discuss the history of protein foam.
2. List and discuss the advantages and disadvantages of protein type foam.

Reference:

Delmar Handbook 3rd edition, pages 339

J&B Fundamentals 2nd edition, pages 521-522

IFSTA Essentials 5th edition, pages 736-737

PRESENTATION

ENABLING OBJECTIVE # 2

The Firefighter II candidate shall correctly define and describe in writing the characteristics, advantages, and disadvantages of a fluoro-protein type concentrate.

1. Discuss how fluoro-protein concentrate is made and relate its place in history of foam fire suppression.
2. List and discuss the characteristics, advantages and disadvantages of fluoro-protein foam.

Reference:

Delmar Handbook 3rd edition, pages 339

PRESENTATION

ENABLING OBJECTIVE # 3

The Firefighter II candidate shall correctly define and describe in writing the characteristics, advantages, and disadvantages of a film forming fluoro-protein foam (FFFP) type concentrate.

1. Discuss the characteristics, advantages, and disadvantages of FFFP.
2. Compare the advantages of the FFFP type foam over those previously discussed.

Reference:

Delmar Handbook 3rd edition, pages 339-340

J&B Fundamentals 2nd edition, page 522

IFSTA Essentials 5th edition, page 737

PRESENTATION

ENABLING OBJECTIVE #4

The Firefighter II candidate shall correctly define and describe in writing the characteristics, advantages and disadvantages of an aqueous film forming foam (AFFF) type concentrate.

1. Discuss the characteristics, advantages and disadvantages of AFFF.
2. Discuss the very short drain time of AFFF and the effects this can have on fire fighting tactics.

Reference:

Delmar Handbook 3rd edition, page 339

J&B Fundamentals 2nd edition, page 522
IFSTA Essentials 5th edition, page 737

PRESENTATION

ENABLING OBJECTIVE #5

The Firefighter II candidate shall correctly define and describe in writing the characteristics, advantages, and disadvantages of alcohol-resistant AFFF type of concentrate.

1. Explain characteristics, advantages, and disadvantages of alcohol-resistant AFFF type concentrate.
2. Explain its use on unignited spills.
3. List and discuss the several types of alcohol-resistant AFFF foams that are available.
4. Point out that AFFF reduces the rate of liquid fuel evaporation.

Reference:

Delmar Handbook 3rd edition, page 339
J&B Fundamentals 2nd edition, page 522

PRESENTATION

ENABLING OBJECTIVE #6

The Firefighter II candidate shall correctly define and describe in writing the characteristics, advantages, and disadvantages of medium and high expansion foam type concentrates.

1. List the characteristics, advantages, and disadvantages of medium and high expansion foam.
2. Discuss how the foam's low water content minimizes water damage.
3. List the major uses of these foams. Explain why it is generally not recommended for outdoors.

4. List the expansion ratios of typical medium and high expansion foams.
 - a) Medium: 20:1 to 200:1 ratio.
 - b) High: 200:1 to 1000:1 ratio.
5. Discuss precautions to be taken when using medium and high expansion foam to extinguish structural fires.

Reference:

Delmar Handbook 3rd edition, pages 343

J&B Fundamentals 2nd edition, pages 521-523

IFSTA Essentials 5th edition, pages 745-746

PRESENTATION

ENABLING OBJECTIVE #7

The Firefighter II candidate shall correctly define and describe in writing the characteristics, advantages, and disadvantages of a class 'A' type concentrate.

1. List and discuss the characteristics, advantages, and disadvantages of class A foam concentrate.
2. Discuss the major uses of Class A type foam.

Reference:

Delmar Handbook 3rd edition, page 338

J&B Fundamentals 2nd edition, pages 521-522

IFSTA Essentials 5th edition, page 736

APPLICATION

Prepare several scenarios before class to allow students an opportunity to apply knowledge learned during the presentation.

Which type of concentrate would work best in the following situations?

Scenario #1: A gasoline tanker and an automobile collide at an intersection. The automobile is under the belly of the tanker with gasoline leaking at the rate of approximately 10 gallons per minute. Two people in the car are pinned and injured, requiring extrication. Just as you begin to set up, the gasoline ignites.

Scenario #2: A difficult and dangerous basement fire in a structure.

Scenario #3: A fire in baled cardboard storage.

Devise more scenarios to cover all the types of foam concentrates.

SUMMARY

Review each of the seven types of foam concentrates and discuss the situations in which each type of foam would be used. Point out the advantages and disadvantages of each type of foam concentrate.

LESSON THREE

FIREFIGHTER II

Foam Fire Streams

DOMAIN: COGNITIVE / PSYCHOMOTOR

LEVEL OF LEARNING: COMPREHENSION /
APPLICATION

MATERIALS

Foam appliances used by the department; foam concentrate; fog nozzles; foam nozzles; hose; fire pumper; IFSTA Essentials 5th edition or Jones and Bartlett Fundamentals of Fire Fighter Skills 2nd Edition or Delmar Firefighter's Handbook 3rd Edition; The Akron Brass Handout 2600-B1, Akron Brass Company, P.O. Box 86, Wooster, Ohio 44691. Overhead projector or laptop computer and multimedia projector; projection screen.

NFPA 1001 JPR, 2008 edition

6.3.1 Extinguish an ignitable liquid fire

Junior Member Statement:

Junior Member training activities should be supervised by qualified instructors to assure that the cognitive and psychomotor skills are completed in a safe and non-evasive manner. While it is critical that instructors be constantly aware of the capabilities of all students both mentally and physically to complete certain tasks safely and successfully, the instructor should take every opportunity to discuss with departmental leaders and students the maturity and job awareness each participant has for the hazards associated with fire and rescue training.

TERMINAL OBJECTIVE

Given the appropriate equipment, the Firefighter II candidate shall correctly assemble and operate a foam fire stream and shall correctly demonstrate the methods for applying a foam fire stream.

ENABLING OBJECTIVES

1. The Firefighter II candidate shall correctly identify and describe in writing the use of each foam-making appliance used within the department.
2. The Firefighter II candidate shall select the correct appliances from those provided and shall correctly assemble a foam fire stream system.
3. The Firefighter II candidate, given the necessary appliances, shall correctly demonstrate the methods for applying a foam fire stream.

LESSON THREE

FIREFIGHTER II

Foam Fire Streams

MOTIVATION

The proficient use of foam fire streams and appliances are an essential part of many fire ground applications. It takes time and knowledge to set-up and discharge a foam fire stream. Quick and decisive action by firefighters to put a foam stream into action may make the difference as to whether or not an operation is successful. Constant training using foam fire streams and their appliances is essential to maintain a proficiency in foam use. This proficiency will enhance the efficiency and safety of any fire ground operation. The instructor must demonstrate the use of various foam appliances, and improvise using detergent and water where necessary to accomplish his / her training objectives.

PRESENTATION

ENABLING OBJECTIVE #1

The Firefighter II candidate shall correctly identify and describe in writing the use of each foam-making appliance used within the department.

1. Point out that the proper mixture of foam concentrate and water is accomplished through the use of a proportioner.
2. Define and discuss the types of proportioners commonly used in the fire service: line eductors, balanced pressure proportioners, back pressure proportioners, and around-the-pump proportioners.
3. Point out that in-line eductors are the simplest. They may be attached in the hose line or may be part of the nozzle. There are two types of line eductors: the in-line eductor and the self-educting nozzle. Both types use the venturi principle.

NOTE: Explain that when establishing a foam fire stream, nozzle elevation can be increased if the distance between the nozzle and the eductor is shortened.

4. Discuss the venturi principle.
5. Discuss the in-line eductor. It can be attached directly to the pump panel discharge or in the hose line. Follow the manufacturers recommendations regarding the amount of hose from the eductor to the nozzle.
6. Explain that eductors are rated in gpm, and a matching gpm nozzle must be used.
7. Briefly discuss that balanced pressure eductors are most commonly used in fixed systems at large refineries or on airport crash rescue trucks.
8. Briefly discuss that around-the-pump proportioners is the most common type of built-in device on fire apparatus today.
9. Explain how the low expansion foam nozzle works. It is effective for good expansion while still enabling good reach.
10. Explain the major differences between the self-educting nozzle and an in-line eductor with a separate nozzle. List such obvious disadvantages as immobility (i.e., the concentrate containers must be moved with the nozzle).
11. Discuss the following information: Standard fixed flow fog nozzles can be used with AFFF or class 'A' type foams. However, they produce a minimum of aeration and relatively low quality foam. These nozzles cannot be used with protein or fluoro-protein concentrates.
12. Point out that automatic nozzles operate in the same way as fixed flow fog nozzles.
13. Discuss High-expansion foam generators. The two basic types are the mechanical blower and the water-powered generator. Explain the basic operation of these two types of foam devices.

14. Explain the difference between placing the eductor at the nozzle, at the pump, and somewhere in the line.

Reference:

Delmar Handbook 3rd edition, pages 341-344

J&B Fundamentals 2nd edition, pages 522-525

IFSTA Essentials 5th edition, pages 741-744

PRESENTATION

ENABLING OBJECTIVE #2

The Firefighter II candidate shall select the correct appliances from those provided and shall correctly assemble a foam fire stream system.

1. Thoroughly explain the proper procedure for assembling a foam fire stream system.
 - a) Back pressure cannot exceed 70% inlet pressure.
2. Demonstrate the proper assembly of a foam fire stream system using the equipment of the respective department.

Reference:

Delmar Handbook 3rd edition, pages 341-344

J&B Fundamentals 2nd edition, pages 522-523

IFSTA Essentials 5th edition, page 746

APPLICATION

Divide the class into groups of no more than five. Assign each group to practice assembling the equipment until everyone can do it proficiently.

PRESENTATION

ENABLING OBJECTIVE #3

The Firefighter II candidate, given the necessary appliances, shall correctly demonstrate the methods for applying a foam fire stream.

1. Discuss the methods for applying low expansion foam.
 - a) Roll-on method.

- b) Rain-down method.
- c) Bank-down method.

Reference:

Delmar Handbook 3rd edition, pages 343-346
J&B Fundamentals 2nd edition, pages 523-525
IFSTA Essentials 5th edition, page 747

APPLICATION

Using the department's equipment, have the teams from the previous application practice applying a foam fire stream correctly. If this option is chosen, use only known products that you know are not contaminated. Use full PPE and SCBA during this application.

NOTE: Provide practice concentrate, old concentrate, or make a practice concentrate by mixing a small container of cheap liquid dish detergent in five gallons of water.

Flammable liquid pits may be used to add to the realism of the practice session.

SUMMARY

Review each type of eductor and / or proportioner utilized by the fire department.

Review the various types of foam nozzles utilized in the fire service.

Reiterate the importance of correctly assembling foam systems and the common causes of operational failure.

Highlight the methods for the proper application of foam streams.