NFPA®

1410

Standard on Training for Emergency Scene Operations

2020

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NFPA® 1410

Standard on

Training for Emergency Scene Operations

2020 Edition

This edition of NFPA 1410, *Standard on Training for Emergency Scene Operations*, was prepared by the Technical Committee on Fire Service Training. It was issued by the Standards Council on November 4, 2019, with an effective date of November 24, 2019, and supersedes all previous editions.

This edition of NFPA 1410 was approved as an American National Standard on November 24, 2019.

Origin and Development of NFPA 1410

The first edition of this standard on initial fire attack was officially adopted as NFPA 197 at the 1966 NFPA Annual Meeting. Prepared by the Committee on Fire Service Training, it had been tentatively adopted at the 1964 Annual Meeting. The 1966 edition was revised in 1979. The 1995 edition included the results of comprehensive and extensive field tests that were performed to validate the recommended maximum times for fireground evolutions in Appendix A. In deliberations during development of the 1995 edition of this standard, the committee did not choose the "best" times recorded in the field tests, but chose times that it felt were reasonably achieved with an appropriate effort of organization and training.

A new Chapter 7, Required Performance for Truck Company Operations, was included in the 2000 edition of the standard.

The 2005 edition of this standard featured changes to the previous edition's numbering of chapters and paragraphs to reflect requirements in the 2004 edition of the *Manual of Style for NFPA Technical Committee Documents*.

The 2010 edition added Chapter 10, Required Performance for Rapid Intervention Crews (RIC), for consistency with requirements found in NFPA 1710 and NFPA 1720.

For the 2015 edition, the committee removed the word *initial* from the document since evolutions can happen after initial arrival. It added a new chapter, Evolution Preparation (Chapter 4), to provide a basic overview of fire behavior and how it relates to each evolution. Also added was a new chapter on incident command, Chapter 6. Ladder company operations in Chapter 11 were changed, as others may perform some of those functions.

For the 2020 edition, the committee went through the document and updated all referenced material and ensured the references were still relevant to the document. The committee also updated some of the definitions to ensure the terms that were defined were actually used in the document, following the *Manual of Style for NFPA Technical Committee Documents*. The committee moved the requirements for the correct use of personal protective equipment (PPE) and self-contained breathing apparatus (SCBA) from Chapter 11 to Chapter 4. The committee also included new requirements for the verification of full SCBA cylinders and personal alert safety systems (PASS) device operation. Many of the other changes that were made to the document were for the purposes of document and project consistency based on changes already discussed.

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Committee Scope: This Committee shall have primary responsibility for all fire service training techniques, operations, and procedures to develop maximum efficiency and proper utilization of available personnel. Such activities can include training guides for fire prevention, fire suppression, and other missions for which the fire service has responsibility.

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Standard on

Training for Emergency Scene Operations

2020 Edition

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NOTICE: An asterisk (*) following the number or letter designating a paragraph indicates that explanatory material on the paragraph can be found in Annex A.

A reference in brackets [ ] following a section or paragraph indicates material that has been extracted from another NFPA document. Extracted text may be edited for consistency and style and may include the revision of internal paragraph references and other references as appropriate. Requests for interpretations or revisions of extracted text shall be sent to the technical committee responsible for the source document.

Information on referenced and extracted publications can be found in Chapter 2 and Annex C.

Chapter 1 Administration

1.1 Scope.

1.1.1* This standard contains the context and minimum requirements for evaluating training for fire suppression and rescue procedures used by fire department personnel engaged in emergency scene operations.

1.1.2 This standard specifies basic evolutions that shall be adapted to local conditions and serves as a standard mechanism for the evaluation of minimum acceptable performance during training for fire suppression and rescue activities.

1.2 Purpose.

1.2.1* This document is a training standard designed to provide fire departments with an objective method of measuring performance for fire suppression and rescue procedures using available personnel and equipment.

1.2.2 Nothing herein is intended to restrict any jurisdiction from exceeding these minimum requirements.

1.3 Units. In this standard, values for measurements are followed by an equivalent in parentheses, but only the first stated value should be regarded as the requirement, because the equivalent values might be approximate.

Chapter 2 Referenced Publications

2.1 General. The documents or portions thereof listed in this chapter are referenced within this standard and shall be considered part of the requirements of this document.

2.2 NFPA Publications. National Fire Protection Association, 1 Batterymarch Park, Quincy, MA 02169-7471.

NFPA 1500™, *Standard on Fire Department Occupational Safety, Health, and Wellness Program,* 2020 edition.

NFPA 1801, *Standard on Thermal Imagers for the Fire Service,* 2018 edition.

NFPA 1964, *Standard for Spray Nozzles and Appliances,* 2018 edition.

NFPA 1971, *Standard on Protective Ensembles for Structural Fire Fighting and Proximity Fire Fighting,* 2018 edition.

NFPA 1981, *Standard on Open-Circuit Self-Contained Breathing Apparatus (SCBA) for Emergency Services,* 2019 edition.

NFPA 1982, *Standard on Personal Alert Safety Systems (PASS),* 2018 edition.

2.3 Other Publications.

Merriam-Webster's Collegiate Dictionary, 11th edition, Merriam-Webster, Inc., Springfield, MA, 2003.

2.4 References for Extracts in Mandatory Sections.

NFPA 472, *Standard for Competence of Responders to Hazardous Materials/Weapons of Mass Destruction Incidents,* 2018 edition.

NFPA 1500™, *Standard on Fire Department Occupational Safety, Health, and Wellness Program,* 2020 edition.

NFPA 1561, *Standard on Emergency Services Incident Management System and Command Safety,* 2020 edition.

NFPA 1670, *Standard on Operations and Training for Technical Search and Rescue Incidents,* 2017 edition.

NFPA 1710, *Standard for the Organization and Deployment of Fire Suppression Operations, Emergency Medical Operations, and Special Operations to the Public by Career Fire Departments,* 2020 edition.

NFPA 1901, *Standard for Automotive Fire Apparatus,* 2016 edition.

Chapter 3 Definitions

3.1 General. The definitions contained in this chapter shall apply to the terms used in this standard. Where terms are not defined in this chapter or within another chapter, they shall be defined using their ordinarily accepted meanings within the context in which they are used. *Merriam-Webster's Collegiate Dictionary,* 11th edition, shall be the source for the ordinarily accepted meaning.

3.2 NFPA Official Definitions.

3.2.1* Approved. Acceptable to the authority having jurisdiction.

3.2.2* Authority Having Jurisdiction (AHJ). An organization, office, or individual responsible for enforcing the requirements

of a code or standard, or for approving equipment, materials, an installation, or a procedure.

3.2.3 Shall. Indicates a mandatory requirement.

3.2.4 Should. Indicates a recommendation or that which is advised but not required.

3.2.5 Standard. An NFPA Standard, the main text of which contains only mandatory provisions using the word "shall" to indicate requirements and that is in a form generally suitable for mandatory reference by another standard or code or for adoption into law. Nonmandatory provisions are not to be considered a part of the requirements of a standard and shall be located in an appendix, annex, footnote, informational note, or other means as permitted in the NFPA Manuals of Style. When used in a generic sense, such as in the phrase "standards development process" or "standards development activities," the term "standards" includes all NFPA Standards, including Codes, Standards, Recommended Practices, and Guides.

3.3 General Definitions.

3.3.1 Apparatus.

3.3.1.1 ***Aerial Fire Apparatus.*** A vehicle equipped with an aerial ladder, elevating platform, or water tower that is designed and equipped to support fire fighting and rescue operations by positioning personnel, handling materials, providing continuous egress, or discharging water at positions elevated from the ground. [**1901,** 2016]

3.3.1.2 ***Mobile Water Supply Apparatus (Tanker, Tender).*** A vehicle designed primarily for transporting (pickup, transporting, and delivering) water to fire emergency scenes to be applied by other vehicles or pumping equipment. [**1901,** 2016]

3.3.2 Backdraft. A deflagration resulting from the sudden introduction of air into a confined space containing oxygen deficient products of incomplete combustion.

3.3.3* Combustible. Capable of burning, generally in air under normal conditions of ambient temperature and pressure, unless otherwise specified.

3.3.4 Company. The basic fire-fighting organizational unit staffed by various grades of fire fighters under the supervision of an officer and assigned to one or more specific pieces of apparatus.

3.3.4.1 ***Engine Company.*** A group of fire fighters who work as a unit and are equipped with one or more pumping engines that have rated capacities of 750 gpm (2840 L/min) or more.

3.3.4.2 ***Rescue Company.*** A group of fire fighters who work as a unit and are equipped with one or more rescue vehicles.

3.3.4.3 ***Truck Company.*** A group of fire fighters who work as a unit and are equipped with one or more pieces of aerial fire apparatus.

3.3.5 Conduction. Heat transfer to another body or within a body by direct contact.

3.3.6 Convection. Heat transfer by circulation within a medium such as a gas or a liquid.

3.3.7 Decay Stage. The stage of fire development within a structure characterized by either a decrease in the fuel load or available oxygen to support combustion, resulting in lower temperatures and lower pressure in the fire area.

3.3.8 Deflagration. Propagation of a combustion zone at a velocity that is less than the speed of sound in the unreacted medium.

3.3.9* Door Control. The process of ensuring the entrance door providing access to the fire area is controlled and closed as much as possible after the search team enters without the protection of a hose line.

3.3.10 Effective Operation. The accomplishment of or ability to accomplish the intended task.

3.3.11 Effective Stream. A fire stream that has achieved and sustained the proper flow.

3.3.12 Engine. A fire department pumper that has a rated capacity of 750 gpm (2840 L/min) or more.

3.3.13 Evolution. A set of prescribed actions that result in an effective fireground activity.

3.3.14 Fire Growth Potential. The potential size or intensity of a fire based on the available fuel load.

3.3.15* Flameover (Rollover). The condition in which unburned fuel (pyrolysate) from the originating fire has accumulated in the ceiling layer to a sufficient concentration (i.e., at or above the lower flammable limit) that it ignites and burns. Flameover can occur without ignition of or prior to the ignition of other fuels separate from the origin.

3.3.16 Flashover. A transition phase in the development of a compartment fire in which surfaces exposed to thermal radiation reach ignition temperature more or less simultaneously and fire spreads rapidly throughout the space, resulting in full room involvement or total involvement of the compartment or enclosed space.

3.3.17* Flow Path. The movement of heat and smoke from the higher pressure within the fire area towards the lower pressure areas accessible via doors, window openings, and roof structures.

3.3.18 Flow Path Control. The tactic of controlling or closing ventilation points to limit additional oxygen into the space thereby limiting fire development, heat release rate, and smoke production, and to control the movement of the heat and smoke conditions out of the fire area to the exterior and to other areas within the building.

3.3.19 Fuel-Limited Fire. A fire in which the heat release rate and fire growth are controlled by the characteristics of the fuel because there is adequate oxygen available for combustion.

3.3.20* Fuel Load. The total quantity of combustible contents of a building, space, or fire area, including interior finish and trim, expressed in terms of heat release rate.

3.3.21* Fully Developed Stage. The stage of fire development where heat release rate has reached its peak within a compartment.

3.3.22 gpm. Gallons per minute.

3.3.23 Growth Stage. The stage of fire development where the heat release rate from an incipient fire has increased to the

point where heat transferred from the fire and the combustion products are pyrolyzing adjacent fuel sources and the fire begins to spread across the ceiling of the fire compartment (rollover).

3.3.24* Heat Release Rate. The rate at which energy is generated by the burning of a fuel and oxygen mixture. As the heat release rate increases, the heat, smoke production, and pressure within the area will increase and spread along available flow paths toward low-pressure areas (such as open doors, windows, and roof openings).

3.3.25 Immediately Dangerous to Life or Health (IDLH). Any condition that would pose an immediate or delayed threat to life, cause irreversible adverse health effects, or interfere with an individual's ability to escape unaided from a hazardous environment. [**1670,** 2017]

3.3.26 Incident Action Plan. The objectives reflecting the overall incident strategy, tactics, risk management, and member safety that are developed by the incident commander. Incident action plans are updated throughout the incident. [**1500,** 2020]

3.3.27 Incident Commander (IC). The individual responsible for all incident activities, including the development of strategies and tactics and the ordering and the release of resources. [**472,** 2018]

3.3.28 Incident Management System (IMS). A system that defines the roles and responsibilities to be assumed by responders and the standard operating procedures to be used in the management and direction of emergency incidents and other functions. [**1561,** 2020]

3.3.29 Incipient Stage. The early stage of fire development where the fire's progression is limited to a fuel source and the thermal hazard is localized to the area of the burning material.

3.3.30 Initial Safety Team (IST). A dedicated crew of a minimum of two fire fighters, located outside the IDLH, assigned to rescue injured or trapped fire fighters prior to the assignment of a rapid intervention crew (RIC).

3.3.31 kPa. Kilopascals.

3.3.32 Large-Diameter Hose. A hose 3.5 in. (89 mm) or larger that is designed to move large volumes of water to supply master stream appliances, portable hydrants, manifolds, standpipe and sprinkler systems, and fire department pumpers from hydrants and in relay.

3.3.33 Line. One or more lengths of connected fire hose.

3.3.33.1 ***Attack Line.*** A hose line used primarily to apply water directly onto a fire and operated by a sufficient number of personnel so that it can be maneuvered effectively and safely.

3.3.33.2 ***Backup Line.*** An additional hose line used to reinforce and protect personnel in the event the initial attack proves inadequate.

3.3.33.3 ***Initial Attack Line.*** The first hose stream placed in service by a company at the scene of a fire in order to protect lives or to prevent further extension of fire while additional lines are laid and placed in position.

3.3.33.4* ***Leader Line.*** A hose line supplying one or more smaller lines, as in a wyed line.

3.3.33.5 ***Preconnected Line.*** A discharge hose line already attached to an engine outlet.

3.3.33.6 ***Supply Line.*** One or more lengths of connected fire hose, also called a leader line, used to provide water to wyed lines or to the intake of a pump.

3.3.34 L/min. Liters per minute.

3.3.35 psi. Pounds per square inch gauge.

3.3.36 Pyrolysate. Product of decomposition through heat; a product of a chemical change caused by heating.

3.3.37* Pyrolysis. The breakdown of fuels such as wood and foam plastics into their basic compound when subjected to heat.

3.3.38 Radiation. Heat transfer by way of electromagnetic energy.

3.3.39* Rapid Intervention Crew (RIC). A dedicated crew of fire fighters who are assigned for rapid deployment to rescue lost or trapped members. [**1710,** 2020]

3.3.40 Rescue. Those activities directed at locating endangered persons at an emergency incident, removing those persons from danger, treating the injured, and providing for transport to an appropriate health care facility. [**1500,** 2020]

3.3.41 Rescue Vehicle. A special vehicle, also known as a heavy rescue or squad, equipped with tools and equipment to perform one or more types of special rescue such as building collapse, confined space, high angle, vehicle extrication, and water rescue.

3.3.42 Residual Pressure. The pressure that exists in the distribution system, measured at the residual hydrant at the time the flow readings are taken at the flow hydrants.

3.3.43* Situational Awareness. The ongoing activity of assessing what is going on around you during the complex and dynamic environment of a fire incident.

3.3.44 Size-Up. The process of gathering and analyzing information to help fire officers make decisions regarding the deployment of resources and the implementation of tactics.

3.3.45* Smoke. The combination of airborne solid particulates, liquid particulates, and gases emitted when a material undergoes pyrolysis or combustion.

3.3.46 Truck. A common fire service term for aerial fire apparatus.

Δ **3.3.47* Vent, Entry, Isolate, Search (VEIS).** The approved tactic for entering a structure through an opening (door or window) to locate possible victims.

3.3.48* Ventilation. The controlled and coordinated removal of heat and smoke from a structure, replacing the escaping gases with fresh air.

3.3.48.1 ***Horizontal Ventilation.*** The opening or removal of windows or doors on any floor of a fire building to create flow paths for fire conditions.

3.3.48.2 ***Mechanical Ventilation.*** The use of mechanical fans to accelerate air flow or reverse air flow to assist in the movement of smoke throughout a structure.

3.3.48.3 ***Vertical Ventilation.*** The vertical venting of structures involving the opening of bulkhead doors, skylights, scuttles, and roof cutting operations to release smoke and heat from inside the fire building.

3.3.49 Ventilation-Controlled Fire. A fire in which the heat release rate or growth is controlled by the amount of air available to the fire.

3.3.50 Ventilation for Extinguishment. The controlled and coordinated ventilation tactic that should coincide with the engine company extinguishment of the fire.

3.3.51 Ventilation for Search. The controlled and coordinated ventilation tactic performed to facilitate the movement of a firefighter into an area to conduct a search for victims.

3.3.52* Ventilation-Induced Flashover. A flashover initiated by the introduction of oxygen into a preheated, fuel-rich (smoke filled), oxygen-deficient area.

3.3.53 Ventilation-Limited Fire. A fire in which the heat release rate and fire growth are regulated by the available oxygen within the space.

3.3.54 Ventilation Profile. The appearance of the fire building's ventilation points showing the flow paths of heat and smoke out of the structure as well as any air movement into the structure.

3.3.55 Ventilation Tactics. The coordinated and controlled opening of ventilation points in a structure to facilitate fire operations.

Chapter 4 Evolution Preparation

4.1* General. The initial responding crew has the responsibility of sizing up the incident, assessing the hazard, determining the risk benefit of potential initial actions, and then implementing the chosen tactics.

4.1.1 The company members undergoing evaluation shall receive a briefing and evaluation to review information essential to the conduct of effective initial emergency scene operations.

4.2 Fire Behavior.

4.2.1* Company members shall be able to describe the components of a fire and the definition of a fire.

4.2.2* Company members shall be able to describe the stages of fire growth for a fuel-limited fire.

4.2.3* Company members shall be able to describe the stages of fire growth for a ventilation-limited fire.

4.2.4 Company members shall be able to describe the conditions needed for a flashover to occur.

4.2.5* Company members shall be able to describe the three mechanisms of heat transfer — conduction, convection, and radiation.

4.3 Protective Personnel Ensemble.

4.3.1* Company members shall be able to describe the components of their protective clothing and equipment required for use during the operational evolutions.

4.3.2* Company members shall be able to describe the capabilities and limitations of their protective clothing and equipment based on the following test standards: NFPA 1801, NFPA 1971, NFPA 1981, and NFPA 1982.

N **4.3.3** The required performance shall consist of the company donning their SCBA correctly, and the designated evaluator shall determine whether they donned their protective gear correctly and within the prescribed time.

N **4.3.4** The evolution shall begin when the evaluator initiates the evaluation and conclude when the evaluator determines that each member's SCBA is operating correctly, all belts and straps are fastened, the facepiece is sealed as required, the cylinder is verified as full, the PASS has been activated, and all protective clothing is being worn correctly and with no skin exposed.

4.4 Fire Control.

4.4.1* Company members shall be able to describe the need for size-up.

4.4.2* Company members shall be able to describe the need for coordination between ventilation, rescue, and suppression operations.

4.4.3* Company members shall be able to describe the need for communication as part of emergency scene operations.

4.5* Training in Context.

4.5.1 Training evolutions shall occur in the context and sequence of field tactical operations; size-up, locate the fire, identify the flow path, cool to reduce the thermal hazard, and extinguish the fire.

4.5.1.1 Where the department has thermal imagers (TIs), company members shall be trained in their proper use and shall demonstrate the ability to use TIs during training as described in 4.5.1.

4.5.2 Rescue and salvage operations shall occur at any point in the sequence of operations.

Chapter 5 Methods of Evaluation

5.1 Standard Evolutions.

5.1.1* The evolutions specified in this standard shall be used to measure the initial capability of a department's first responding unit(s) and personnel.

5.1.2 The evolutions used shall be those the department normally uses in its regular fire suppression and rescue operations.

5.1.3 The hose layouts and hydrant connections used shall provide the flow necessary to supply the requirements of each evolution, and correct hose connections shall be made between the hydrant(s) or other water source(s) and the engine(s) and inlets.

5.1.4 The engine and truck company operations shall provide a mechanism to measure the performance of routine tasks that are required to support an effective fire suppression operation in a structure.

5.2 Hose Loads and Layouts.

5.2.1 Hose shall be loaded in the manner utilized by the department, and hose lays and carries used during the evolutions shall be those normally used by the department.

5.2.2 The initial attack lines shall be preconnected to an engine outlet, supplied through a wye from another line, or connected to an engine outlet at the scene.

5.2.3* Direct hydrant streams shall not be used unless the desired flow is available at the hydrant with a residual pressure of 100 psi (700 kPa) or greater.

5.2.4 Depending on the size of the hose lines to be used and the quantity of water to be delivered, the number of personnel shall be assigned to ensure the safety of all personnel involved, and the number shall be in compliance with Section 8.5 of NFPA 1500.

5.2.5 A minimum of two fire fighters shall be assigned to each hose line to keep interior attack lines under control.

5.3 Ground Ladders.

5.3.1 Ladders shall be loaded or carried on the apparatus in the manner utilized by the department, and ladder raises and carries used during the evolutions shall be those normally used by the department.

5.3.2* Depending on the size of the ladder to be used and the evolution to be performed, the correct number of personnel shall be assigned to ensure the safety of all personnel involved.

Chapter 6 Incident Command for Emergency Scene Operations

6.1* Command. The command function of the incident management system shall be established before emergency mitigation commences.

6.2* Incident Command. The incident commander shall have the overall responsibility for the deployment of resources to mitigate the emergency.

6.3 NIMS. The system used to manage the incident shall be compliant with the guidance established by the Incident Command System (ICS) of the National Incident Management System (NIMS) and the AHJ.

Chapter 7 Logistics

7.1 Facilities.

7.1.1 Evolutions shall be conducted in an area of sufficient size so that supply hose can be laid to or from the water source and attack lines can be laid from an engine or wye.

7.1.2 Where evolutions are not conducted at the fire department training facility or in another controlled area, non–fire department vehicular and pedestrian traffic shall be excluded from the area or shall be under the control of authorized traffic control persons.

7.1.3 Evolutions that involve the use of ladders shall be performed in an area free of overhead power lines and other obstructions.

7.2 Equipment and Personnel.

7.2.1 Clothing.

7.2.1.1 All personnel involved in evolutions shall wear approved protective clothing and shall use approved equipment for their respective functions.

7.2.1.2 All personnel participating in extending or operating handlines or extending support lines or who are involved in other operational functions of the evolutions shall wear full protective clothing, equipment, and self-contained breathing apparatus (SCBA) as specified in Sections 7.2 and 7.10 of NFPA 1500.

7.2.2* In addition to the requirements set forth in 7.2.1, the company officer shall ensure that the following are accomplished in interior structural fires:

(1) At least two fire fighters enter the immediately dangerous to life and health (IDLH) atmosphere and remain in visual or voice contact with each other at all times.
(2)* Prior to the assignment of a rapid intervention crew, an initial safety team is established.
(3) All fire fighters engaged in interior structural fire fighting use SCBA.

7.2.3* All drivers/operators of fire department vehicles participating in evolutions shall comply with the requirements of Section 6.2 of NFPA 1500.

7.2.4 All personnel riding on fire department vehicles and participating in evolutions shall comply with the requirements of Section 6.3 of NFPA 1500.

7.2.5* Number of Response Personnel.

7.2.5.1 The number of units and personnel normally assigned to respond on an initial alarm shall report to the evaluator at the assigned area.

7.2.5.2 In volunteer or call departments, the number of personnel utilized shall be limited to the average staffing level that normally responds.

7.2.6* The number of apparatus to be deployed shall not exceed the total belonging to all companies that are normally assigned to respond on the initial alarm.

7.2.7 Nozzles and other equipment used shall be of the type provided on the apparatus.

7.3 Water Supply.

7.3.1 The water supply shall consist of a water source capable of supplying the flow required for operations.

7.3.2 The water supply shall consist of one or more of the following:

(1) One or more hydrants
(2) A drafting location
(3) A water supply apparatus

7.4* Communications.

7.4.1 Communication equipment and methods used by the fire department shall be employed during the evolutions.

7.4.2 Evaluations shall include the effectiveness of communication among members.

Chapter 8 Required Performance for Handlines

8.1 General.

8.1.1* The required performance for handlines shall consist of obtaining a water supply through one or two supply lines, placing one initial attack line into operation, and providing immediate backup with another line.

8.1.2 Handline evolutions shall be performed by the first arriving unit(s), staffed with the average number of personnel that ordinarily respond.

8.1.3* For evolutions involving two or more companies, there shall be a delay of at least 30 seconds between the arrival of each company.

8.2 Required Flow.

8.2.1 The total flow of the required streams shall be a minimum of 300 gpm (1135 L/min).

8.2.2 The initial attack line shall provide a minimum flow of 100 gpm (379 L/min) from the nozzle.

8.2.3 The required flow from the backup line shall be a minimum of 200 gpm (757 L/min).

8.2.4* The evaluator shall determine whether required pressure and flows, in accordance with 8.2.1 through 8.2.3, are provided at each nozzle.

8.2.4.1 Where solid stream nozzles are used, the nozzle pressure shall be at least 50 psi (350 kPa).

8.2.4.2 Where spray nozzles as defined in NFPA 1964 are used, the nozzle pressure shall be at least 100 psi (700 kPa), unless it is designed for operation at a pressure other than 100 psi (700 kPa).

8.2.4.3 Pressures shall be within a range of ±10 percent.

8.3 Hose Evolutions.

8.3.1 Supply Line.

8.3.1.1 The supply line(s) shall be laid by an engine for a distance of 300 ft (90 m) to or from the water source.

8.3.1.2 Where large-diameter hose is used, a single line shall be permitted.

8.3.2* The initial attack line and backup line shall be advanced by hand for a minimum distance of 150 ft (45 m) before streams are activated.

8.3.3* Where an apparatus water tank supply is used to supply the initial attack line, the backup line shall not be charged until the required water supply is established.

8.4* Handline Operations.

8.4.1 Stream Placement. Company members manning attack lines shall aim the nozzle at the target indicated by the officer, open the nozzle fully, and flow water on the target until the officer requests that the nozzle be closed.

8.5 Method of Evaluation.

8.5.1 When the order to begin the evolution is given, one or more supply lines, one initial attack line, and one backup line shall be advanced and placed in operation, using the required pressures and flows within the recommended time period.

8.5.2 The evaluation shall be based on the following considerations:

(1) The ability to place one or two supply lines, one initial attack line, and one backup line into service without delay
(2) The ability to deliver a minimum of 300 gpm (1135 L/min) through two handlines to produce effective streams
(3) The ability to control the handline and hit the target from a minimum of 20 ft (6 m) away

8.5.3 Once streams are placed into service, the flows shall continue until the evaluation is complete.

8.5.4* Failure to supply an engine shall be considered a serious deficiency in operations.

8.5.5* Interruptions.

8.5.5.1 Failure to maintain water pressure in any line until all lines are operating as required shall be considered an unacceptable interruption of the attack.

8.5.5.2 Interruptions of less than 10 seconds shall be considered acceptable.

8.5.6 The evolution shall not be concluded until the evaluator is satisfied that the required stream has been obtained at each nozzle.

8.6* Evaluation. Performance shall be evaluated in accordance with Figure 8.6.

	Satisfactory	Unsatisfactory
Was the full protective clothing, including SCBA, donned correctly?	❑	❑
Was a minimum of 300 gpm (1135 L/min) delivered?	❑	❑
Were nozzle pressures and flows correct?	❑	❑
Were required streams in service within the recommended time?	❑	❑
Were the hose layouts from the water source adequate to supply engines?	❑	❑
Were streams operated without major interruption?	❑	❑

Δ **FIGURE 8.6 Example of Evaluation Form for Handlines.**

Chapter 9 Required Performance for Master Streams

9.1 General.

9.1.1* The required performance for master streams shall consist of laying one or more supply lines and placing a master stream appliance in operation.

9.1.2 Master stream evolutions shall be performed by the first arriving unit(s) staffed with the average number of personnel that ordinarily respond.

9.1.3* For evolutions involving two or more companies, there shall be a 30-second delay between the arrival of each company.

9.2 Required Flow.

9.2.1 The total flow of the required master stream shall be a minimum of 500 gpm (1900 L/min).

9.2.2* The evaluator shall determine that required pressures and flows, in accordance with 9.2.1 through 9.2.2.3, are provided at the master stream appliance nozzle.

9.2.2.1 Where solid stream nozzles are used, the nozzle pressure shall be at least 80 psi (551 kPa).

9.2.2.2 Where spray nozzles as defined in NFPA 1964 are used, the nozzle pressure shall be at least 100 psi (700 kPa).

9.2.2.3 Pressures shall be within a range of ±10 percent.

9.3 Hose Evolutions.

9.3.1 Supply Lines.

9.3.1.1 Where engine supply lines are laid from a water source to supply an engine-mounted master stream appliance, two engine supply lines shall be laid by the engine for a distance of 300 ft (90 m).

9.3.1.2 Where large-diameter hose is used, a single engine supply line shall be permitted.

9.3.2 Master Stream Supply Lines.

9.3.2.1 Where master stream supply lines are laid from a demounted, portable master stream appliance to an engine at a water source, two master stream supply lines shall be laid by the engine for a distance of 300 ft (90 m).

9.3.2.2 Where large-diameter hose is used, a single master stream supply line shall be permitted.

9.4 Method of Evaluation.

9.4.1 When the order to begin the evolution is given, one or more supply lines shall be laid to supply the engine(s), and, if required by the evolution, one or more supply lines shall be laid to supply the master stream appliance.

9.4.2 The master stream appliance shall be placed into operation, with the stream at the required pressures and flows within the recommended time period.

9.4.3 The evaluation shall be based on the following considerations:

(1) The ability to supply the master stream appliance without delay
(2) The ability to deliver a minimum of 500 gpm (1900 L/min) and produce the required master stream
(3) The ability to hit a target designated by the evaluator

9.4.4 Once streams are placed into service, the flows shall continue until the evaluation is complete.

9.4.5* Failure to supply an engine shall be considered a serious deficiency in operations.

9.4.6* Interruptions.

9.4.6.1 Failure to maintain water pressure in any line until all lines are operating as required shall be considered an unacceptable interruption of the attack.

9.4.6.2 Interruptions of less than 10 seconds shall be considered acceptable.

9.4.7 The evolution shall not be concluded until the evaluator is satisfied that an effective stream has been obtained.

9.5* Evaluation. Performance shall be evaluated in accordance with Figure 9.5.

	Satisfactory	Unsatisfactory
Was a minimum of 500 gpm (1900 L/min) delivered?	❑	❑
Were nozzle pressures and flows correct?	❑	❑
Were required streams in service within the recommended time?	❑	❑
Were the hose layouts adequate to supply the nozzles?	❑	❑
Were streams operated without major interruption?	❑	❑

FIGURE 9.5 Example of an Evaluation Form for Master Streams.

Chapter 10 Required Performance for Automatic Sprinkler System Support

10.1 General.

10.1.1 The required performance for automatic sprinkler system support shall consist of providing two supply lines to an automatic sprinkler connection.

10.1.2 Automatic sprinkler system support evolutions shall be performed by the first arriving unit(s) staffed with the average number of personnel that ordinarily respond.

10.1.3 For evolutions employing two or more companies, there shall be a 30-second delay between the arrival of each company.

10.2 Required Flow.

10.2.1 The total flow of the required lines to the sprinkler connection shall be 500 gpm (1900 L/min).

10.2.2 The evaluator shall determine that required pressures and flows, in accordance with 10.2.1 and 10.2.2.1, are provided to the sprinkler connections.

10.2.2.1 A minimum of 150 psi (1035 kPa) pump discharge pressure shall be used to supply the sprinkler system.

10.2.2.2 Pressures shall be within a range of ±10 percent.

10.3 Hose Evolutions.

10.3.1 The supply lines shall be laid by an engine for a distance of 300 ft (90 m) to or from the water source, and for a distance of 100 ft (30 m) from an engine to the sprinkler connection.

10.3.2 Apparatus water tanks shall not be used as a water supply for these evolutions.

10.4 Method of Evaluation.

10.4.1 When the order to begin the evolution is given, a water supply shall be established for the engine(s) and two supply lines laid to the sprinkler connection.

10.4.2 The evaluation shall be based on the ability to deliver a minimum of 500 gpm (1900 L/min) through two supply lines to the sprinkler connections.

10.4.3 The flows shall continue until the evaluation is complete.

10.4.4 Failure to supply the sprinkler system shall be considered a serious deficiency in operations.

10.4.5 Interruptions.

10.4.5.1 Failure to maintain water pressure in any line until all lines are operating as required shall be considered an unacceptable interruption.

10.4.5.2 Interruptions of less than 10 seconds shall be considered acceptable.

10.4.6 The evolution shall not be concluded until the evaluator is satisfied that the required flows have been provided.

10.5 Evaluation. Performance shall be evaluated in accordance with Figure 10.5.

	Satisfactory	Unsatisfactory
Was a minimum of 300 gpm (1135 L/min) delivered?	❑	❑
Was the pump discharge pressure correct?	❑	❑
Were flows obtained within the recommended time?	❑	❑
Were the hose layouts from the water source adequate?	❑	❑
Were flows obtained without major interruption?	❑	❑

FIGURE 10.5 Example of an Evaluation Form for Automatic Sprinkler System Support.

Chapter 11 Required Performance for Truck Company Operations

11.1 General.

11.1.1 The required performance for truck company/quint/special service operations shall consist of raising ladders, transporting equipment, setting up lights and fans, and carrying out other routine truck company duties.

11.1.2 Truck company/quint/special service operations shall be performed by the first arriving company assigned truck company duties staffed with the average number of personnel that ordinarily respond.

11.1.3 If the unit assigned to perform truck company/quint/special service operations does not routinely arrive at the same time as the first engine company, a 30-second delay shall be implemented.

11.2 Ladder Evolutions.

11.2.1 The required performance for ground ladder evolutions shall consist of removing the correct ladder from the apparatus and correctly positioning and raising a straight ladder, a 24 ft (7 m) extension ladder, and a 35 ft (10 m) extension ladder.

11.2.2 The method used to raise a ladder shall be consistent with the method normally used by the department.

11.2.3 Ladder evolutions shall be performed by the first arriving unit(s) staffed with the average number of personnel that ordinarily respond.

11.2.4 For evolutions involving two or more companies, there shall be a 30-second delay between the arrival of each company.

11.2.5 Time measurement shall begin when the evaluator initiates the evaluation and shall conclude when the ladder is ready to be climbed.

11.3 Forcible Entry Evolutions.

11.3.1 The required performance for forcible entry evolutions shall consist of the proper selection of tools for forcible entry on inward, outward, and vertically and horizontally operated doors.

11.3.2 The ability of company members to correctly identify and perform forcible entry procedures shall include:

(1) Forcible entry procedures on wood frame inward and outward opening doors
(2) Forcible entry procedures on metal frame inward and outward opening doors
(3) Forcible entry procedures on vertically and horizontally operated doors

11.3.3 The ability of company members to identify the impact of forcible entry procedures on ventilation and properly control the door shall be evaluated.

11.3.4 The evolution shall begin when the evaluator initiates the evaluation and conclude when the evaluator determines that all of the assigned tasks have been performed correctly.

11.4 Search and Rescue.

11.4.1 The required performance for search and rescue evolutions shall consist of members prioritizing the area of search, selecting and performing the proper search technique, and performing proper rescue of trapped victims.

11.4.2 The ability of company members to correctly prioritize the area of search, selecting and performing the proper search technique, and performing proper rescue of trapped victims shall include:

(1) Identifying the areas of the immediate fire area, the area directly above the fire area, and the area where a trapped person is identified as the highest priority for initial search and rescue operations
(2) Performing search and rescue techniques in a two-team operation
(3) Performing search and rescue techniques utilizing a rope or tagline
(4) Performing the Vent, Enter, Isolate, Search (VEIS) technique
(5) Performing the removal of a trapped occupant via the drag technique, up and down stairwells, and out of a window

11.4.3 The evolution shall begin when the evaluator initiates the evaluation and conclude when the evaluator determines that all of the assigned tasks have been performed correctly.

11.5 Ventilation Operations Evolutions.

11.5.1 The required performance for ventilation operation evolutions shall consist of members identifying when and how to perform horizontal, vertical, and mechanical ventilation.

11.5.2 Members shall identify one person to order the initiation of ventilation practices.

11.5.3 Members shall identify when and how to perform ventilation for fire extinguishment and ventilation for search and rescue.

11.5.4 The ability of company members to identify correct coordinated ventilation operations between engine and truck company/quint/special service operating.

11.5.5 The evolution shall begin when the evaluator initiates the evaluation and conclude when the evaluator determines that all of the assigned tasks have been performed correctly.

11.6 Hoisting Tools and Appliances.

11.6.1 The ability of company members to tie the representative knots, bends, or hitches for the following purposes shall be evaluated:

(1) End-of-line loop
(2) Midline loop
(3) Securing rope around desired objects
(4) Joining rope or webbing ends together
(5) Gripping rope

11.6.2 The evaluator shall select a minimum of two hoisting evolutions.

11.6.3 The evolution shall begin when the evaluator initiates the evaluation and conclude when the evaluator is satisfied that the knot or hitch has been tied correctly and the tools or appliance have been hoisted a minimum of 14 ft (5 m).

•

11.7 Illumination of an Incident.

11.7.1 The required performance for this evolution shall consist of starting an auxiliary generator, advancing portable floodlights to the second floor of a building, and illuminating the exterior of the structure.

11.7.2 The evolution shall begin when the evaluator initiates the evaluation and conclude when the evaluator determines that all of the assigned tasks have been performed correctly.

11.8 Method of Evaluation.

11.8.1 When the order is given to begin the evolution, the correct ladder, tool, or piece of equipment shall be removed from the apparatus and shall be raised or deployed as prescribed for the evolution to be performed.

11.8.2 Evaluations of hoisting evolutions shall be based on the company's ability to correctly perform the assigned task within the prescribed time period.

11.8.3 Evolutions shall not be concluded until the evaluator is satisfied that the correct tasks have been performed.

11.9 Evaluation. Performance shall be evaluated in accordance with Figure 11.9.

	Satisfactory	Unsatisfactory
Was the full protective clothing, including SCBA, donned correctly?	❑	❑
Were the ladders raised and set correctly?	❑	❑
Was the correct light, saw, fan, tool, or piece of equipment used correctly?	❑	❑
Was the applicable knot or hitch tied correctly?	❑	❑
Were the evolutions performed within the designated times?	❑	❑

Δ **FIGURE 11.9 Example of an Evaluation Form for Truck Company Operations.**

Chapter 12 Required Performance for Rapid Intervention Crews (RIC)

12.1 General.

12.1.1 The required performance for establishing a fire fighter rescue team shall consist of assembling the necessary staffing, assembling the minimum number of tools, maintaining crew integrity and accountability, and locating and removing a fire fighter from a hazardous environment.

12.1.2 RIC operations shall be conducted by the unit designated by the AHJ.

12.1.3 The required staffing shall be consistent with the definition of rapid intervention crew.

12.1.4 A safety officer shall be appointed for all rapid intervention crew evolutions.

12.2 Methods of Evaluation.

12.2.1* The rapid intervention crew will be staged in an area designated by the evaluator prior to the start of the evolution.

12.2.2 A simulated downed fire fighter shall be placed in a location determined by the evaluator prior to the start of the evolution.

12.2.3 Simulated "safe areas" will be identified by the evaluator prior to the start of the evolution. These areas serve as locations where the rapid intervention crew can move the downed fire fighter to end the evolution.

12.2.4 When the order is given to begin the evolution, the rapid intervention crew can deploy to initiate the rescue.

12.2.5 The evolution will conclude when the downed fire fighter is removed to the designated safe area.

12.2.6 The time to complete the evolution will be documented by the evaluator.

Annex A Explanatory Material

Annex A is not a part of the requirements of this NFPA document but is included for informational purposes only. This annex contains explanatory material, numbered to correspond with the applicable text paragraphs.

A.1.1.1 It is recognized that most successful emergency scene operations efforts involve a coordinated engine, ladder, and rescue company operation. When performing the evolutions included in this standard for the purpose of training, departments should use the number of personnel normally assigned to perform the initial operations at the scene of an emergency incident.

A.1.2.1 The following two aspects of initial fire attack are covered in this standard:

(1) Engine company operations, including handline operations, supply and operation of master streams, and automatic fire sprinkler system support
(2) Truck company operations, including ladder evolutions, the use of hoisting tools and appliances, the use of SCBA, and ventilation and illumination of an incident

Individual fire-fighting evolutions involving the placement and connection of hose lines, the operation of hose streams and apparatus, the setting of ground ladders, the use of hoisting tools and appliances, the use of SCBA, and ventilation and illumination of an incident are the essentials of good fire department procedures. This standard provides the fire chief and other department officers with a method of measuring the effectiveness of evolutions that involve fire suppression and related tasks based on their normal first alarm engine and truck company response.

With the exception of very small communities and isolated rural areas, the standard response to an emergency incident on the initial alarm is generally a minimum of two engine companies and a truck company. This practice is followed for several reasons. First, one engine company ordinarily cannot be expected to both operate the proper streams promptly for fast attack and provide the necessary backup stream(s). Frequently, experience has shown that small streams prove to be inadequate. Second, fires commonly necessitate prompt application of hose streams from at least two positions. Finally, the possibility that an accident or mechanical failure will delay the arrival of one company is always present.

A.3.2.1 Approved. The National Fire Protection Association does not approve, inspect, or certify any installations, procedures, equipment, or materials; nor does it approve or evaluate testing laboratories. In determining the acceptability of installations, procedures, equipment, or materials, the authority having jurisdiction may base acceptance on compliance with NFPA or other appropriate standards. In the absence of such standards, said authority may require evidence of proper installation, procedure, or use. The authority having jurisdiction may also refer to the listings or labeling practices of an organization that is concerned with product evaluations and is thus in a position to determine compliance with appropriate standards for the current production of listed items.

A.3.2.2 Authority Having Jurisdiction (AHJ). The phrase "authority having jurisdiction," or its acronym AHJ, is used in NFPA documents in a broad manner, since jurisdictions and approval agencies vary, as do their responsibilities. Where public safety is primary, the AHJ may be a federal, state, local, or other regional department or individual such as a fire chief; fire marshal; chief of a fire prevention bureau, labor department, or health department; building official; electrical inspector; or others having statutory authority. For insurance purposes, an insurance inspection department, rating bureau, or other insurance company representative may be the AHJ. In many circumstances, the property owner or his or her designated agent assumes the role of the AHJ; at government installations, the commanding officer or departmental official may be the AHJ.

A.3.3.3 Combustible. Combustion can occur in cases where an oxidizer other than oxygen in air is present.

A.3.3.9 Door Control. Steps should be taken to prevent the door from locking behind the entering members. By controlling the door, we are controlling the flow path of fire conditions from the high pressure of the fire area toward the low-pressure area on the other side of the door. Door control also limits fire development by controlling the flow path of fresh air at the lower level of the open door toward the seat of the fire.

A.3.3.15 Flameover (Rollover). Flameover occurs in the growth stage when sufficient fuel, heat, and oxygen are available to allow flame spread in the upper hot gas layer inside the compartment. When observed at the ceiling level, rollover should be taken as an indicator that fire conditions are rapidly deteriorating and flashover could be imminent.

A.3.3.17 Flow Path. As the heated fire gases are moving away from the fire toward the low-pressure areas, the fire is pulling in additional oxygen from the low-pressure areas. Based on varying building design and the available ventilation openings (doors, windows, etc.), there can be several flow paths within a structure. Any operations conducted in the flow path, between the fire and an exhaust vent, can place members at significant risk due to the increased flow of fire, heat, and smoke toward their position.

A.3.3.20 Fuel Load. Fires that involve hydrocarbon and synthetic-based contents such as foam plastics, polyesters, polypropylenes, and nylons have a relatively high heat release rate when compared to natural fiber products. Structure fires fueled with common household furnishings composed of synthetic materials have been shown to increase in size and heat release rate due to increased ventilation and the in-flow of additional oxygen.

A.3.3.21 Fully Developed Stage. This usually occurs after flashover, resulting in floor to ceiling burning within the compartment, creating heat conditions untenable for members.

A.3.3.24 Heat Release Rate. As the heat release rate increases, the heat, smoke production, and pressure within the area will increase and spread along available flow paths toward low-pressure areas (such as open doors, windows, and roof openings).

A.3.3.33.4 Leader Line. A leader line can also be called a supply line.

A.3.3.37 Pyrolysis. Fuels will continue to off-gas (produce pyrolysate) and add to the flammable fuel load within the compartment as long as the material is subjected to elevated temperatures.

A.3.3.39 Rapid Intervention Crew (RIC). The AHJ is responsible for evaluating the need and resources for team members and additional teams.

A.3.3.43 Situational Awareness. Operations are more effective and safer with continual observance of surroundings, communicating conditions to other members, and monitoring communications.

A.3.3.45 Smoke. Smoke is a heated fuel source; a toxic mixture that contains numerous poisonous gases such as carbon monoxide, hydrogen cyanide, and phosgene.

Δ **A.3.3.47 Vent, Entry, Isolate, Search (VEIS).** The priority upon entering the area via a window is to close the door to that room or area to isolate that area being searched from the fire area. When entering a fire area via a doorway entrance, the door needs to be controlled until the fire area is further isolated. Isolating the area controls the flow path of the fire, heat, and smoke toward the ventilation point and controls the air flow from the ventilation point toward the fire area.

A.3.3.48 Ventilation. This exchange is bi-directional with heat and smoke exhausting at the top and air flowing in toward the fire at the bottom of horizontal vents. The fire can pull the additional air flow into the building toward the fire, which can increase the fire size and heat release rate. This exchange can occur by opening doors, windows, or roof structures. Coordinated and controlled ventilation can facilitate quicker extinguishment and limit fire spread.

A.3.3.52 Ventilation-Induced Flashover. This phenomenon has become more prevalent with well-insulated homes. Synthetic fuel loads rapidly consume more of the available oxygen within the fire area and produce fuel-rich combustion products creating conditions favorable to a possible ventilation-induced flashover.

A.4.1 Prior to conducting the hands-on evolutions, classroom instruction on fire behavior, heat transfer, personal protective equipment, fire control, and hazards specific to the incident should ensure that the students understand the interactions of fuel, ventilation, suppression, weather on the fire, and the capabilities of their equipment. This base knowledge is required to conduct effective initial emergency scene operations in accordance with the requisite knowledge required in NFPA 1001.

A.4.2.1 A fire is a gas-phase, chemical reaction that emits heat and sometimes light. The chemical reaction requires fuel, an oxidizer, and heat. Two idealized fire development models that should be considered are the fuel-limited fire and the ventilation-limited fire.

A.4.2.2 The development of fuel-limited fires can be described by the following four stages *(see Figure A.4.2.2)*:

(1) Incipient
(2) Growth
(3) Fully developed
(4) Decay

A.4.2.3 Fires inside structures, vehicles, or other containers have the potential to become ventilation-limited fires. Ventilation-limited fires create an excess of gaseous fuels in the form of smoke inside the containment. The fire growth is then dependent on the addition of oxygen. The following fire development can follow the curve shown in Figure A.4.2.3:

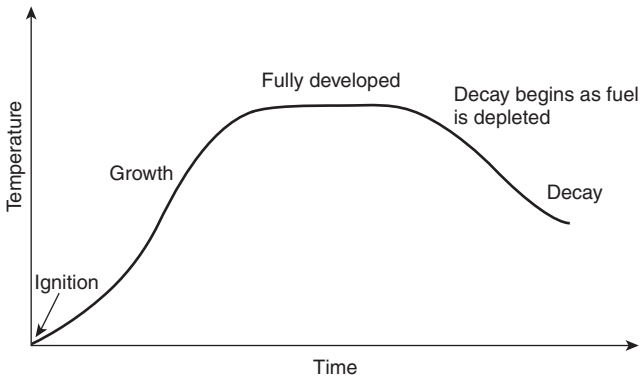


FIGURE A.4.2.2 Stages of Fires.

(1) The incipient stage is the early stage.
(2) A rapid growth stage consumes the available oxygen very quickly.
(3) Once the fire has consumed the available oxygen within the fire area, the fire enters an oxygen-limited decay stage and remains in the decay stage if no additional oxygen is added to the fire area.
(4) When fire fighters encounter the earlier decay stage, the signs of the fire might be diminished. Changes to ventilation that allow oxygen to reach the fire can result in increased heat release rate and fire growth. Tactics such as door control or flow path control can limit the in-flow of additional air into the fire area. The fire can pull the in-flow of any additional air toward the fire area. Wind blowing in toward a ventilation opening can increase the air flow toward the fire area. If additional oxygen is admitted to the heated atmosphere through ventilation openings, the following can occur:
   (a) The fire regains its energy, increases its heat release rate, and enters into a rapid second growth stage, generating more heat and increased smoke production.
   (b) This can be followed by a ventilation-induced flashover and transition into the fully developed stage.
   (c) It ends in a second decay stage as the fuel load is depleted or the fire is extinguished.

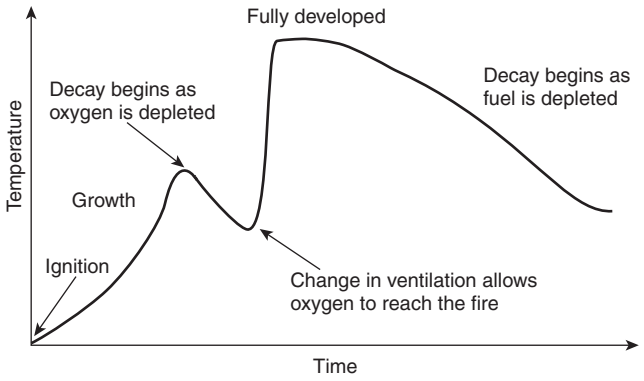


FIGURE A.4.2.3 Fire Development.

A.4.2.5 Fire growth increases the amount of thermal energy (the heat release rate of the fire) that is being transferred by conduction, convection, and radiation to any other fuels or fire fighters in the fire area. The energy that is transferred to a fire fighter by radiation adds to any energy that is transferred by convection and conduction.

A.4.3.1 This would include approved protective clothing such as bunker pants, coats, gloves, boots, hoods, and helmets; and approved protective equipment such as self-contained breathing apparatus and PASS devices.

Δ **A.4.3.2** Structural fire-fighting protective clothing absorbs energy and slows the heat transfer rate providing a limited safe operation time under given thermal conditions. Fire conditions in the fully developed stage can result in temperatures in excess of 1100°F (593°C) and heat fluxes in excess of 4.4 Btu/(s.ft^2) (50 kW/m^2). Under these conditions the fire fighter would have the potential to receive second-degree burns within seconds. Limits of the protective clothing and equipment based on NFPA 1971, NFPA 1981, and NFPA 1982 should be discussed.

Personal protective equipment (PPE) has evolved to provide greater overall thermal protection. However, it can often make it difficult to detect deteriorating and unsafe conditions. This can result in members penetrating farther into and remaining longer in an area with thermal hazards. It is critical for members to conduct a proper size-up of the fire conditions prior to entering an IDLH environment. PPE was not designed for extended exposure under fire conditions; it was designed to protect members in the event that conditions quickly transitioned to an untenable situation. Units need to slow down, operate in a controlled manner, continually maintain situational awareness, assess conditions of the incident, and communicate within and between units. *(See Figure A.4.3.2.)*

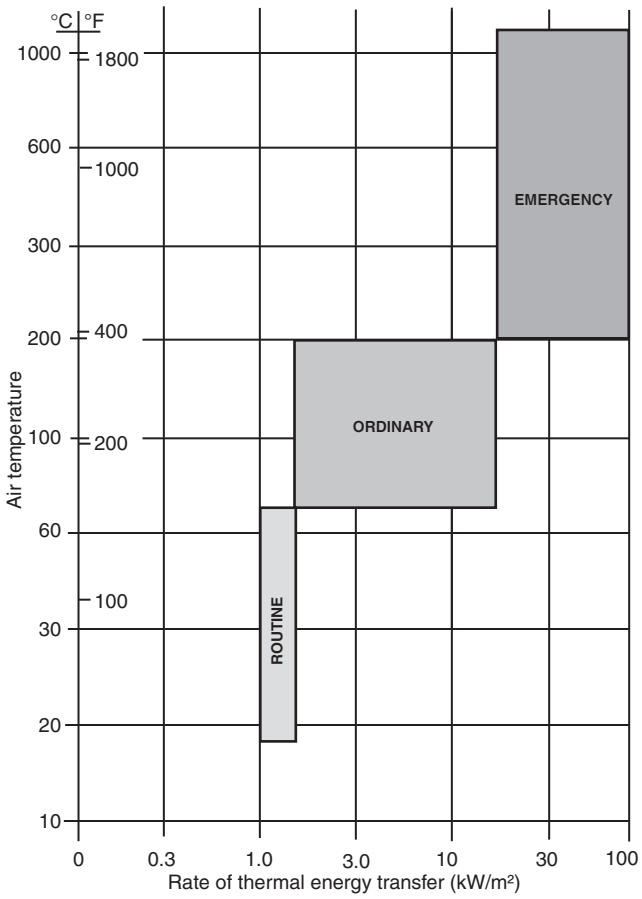


FIGURE A.4.3.2 Fire Fighter Thermal Environments.

A.4.4.1 Size-up includes many variables that the officers and fire fighters observe from the time of alarm, during response, and upon arrival in order to develop an initial plan to control an emergency incident. These observations can include building type and occupancy, fire location and level of involvement, number of occupants, mechanisms of injury, materials spilled or involved in fire, wind direction, topography, and demographics.

On each response, officers and fire fighters should conduct an initial size-up that includes the conditions on arrival. Part of this initial size-up includes a ventilation profile of the fire conditions. This ventilation profile should note the following:

(1) The location where smoke or fire is venting from the building.
(2) Evaluation of the volume, pressure, and velocity of the smoke venting from the building.
(3) Amount of fire venting from the building, including where fire or smoke is not venting out open windows.
(4) Fire and smoke should be venting outward and upward. If the smoke and fire are venting downward, horizontally, or pulsing from an opening in the building, this indicates the fire conditions could be wind impacted. Any unusual ventilation profile should be immediately communicated to the ladder company officer inside the fire area to be vented and the IC.
(5) Any change to the fire conditions as the incident progresses or as the result of ventilation tactics performed by members should be communicated to the IC. For example, when heavy smoke venting from an opening changes to visible fire.

A.4.4.2 Actions between the different crews and fire fighters involved in the initial response should be directed and coordinated. In many fire incidents, even the ventilation from an open door will result in fire growth that could lead to a ventilation-induced flashover. Therefore, coordination between ventilation and suppression should occur. Vents should not be made prior to the charged hose line being in place and ready for operation at the vent. Fire venting from an opening such as a door or window provides an opportunity for suppressing the fire through that vent and improving the thermal environment within the structure for both the fire fighters and any viable victims, prior to any tactical ventilation and entry. Specifics of the incident used for training should be discussed and tactical options developed and shared with the officers and fire fighters.

A.4.4.3 Many factors impact the growth of a fire and therefore it is critical to control, communicate, and coordinate tactics with interior operations. Proper communications can increase the situational awareness and safety of all operating members thereby allowing them to anticipate changing conditions.

A.4.5 Training evolution includes the following:

(1) *Size-Up.* Size-up includes many variables that the officers and fire fighters observe from the time of alarm, during

response, and upon arrival in order to develop an initial plan to control an emergency incident. These observations can include building type and occupancy, fire location and level of involvement, number of occupants, mechanisms of injury, materials spilled or involved in fire, wind direction, topography, and demographics.

(2) *Locate the Fire.* The initial incident commander should determine the location of the fire using visual and technical cues to determine the location of the fire.

(3) *Identify the Flow Path.* Given the location of the fire, determine if a flow path is present and identify steps to manage it.

(4) *Cool to Reduce Thermal Hazard.* Given the location and flow path information, cool the environment from the safest position possible to reduce the thermal threat.

(5) *Extinguish the Fire.* After the thermal threat has been reduced, move to the seat of the fire for final extinguishment.

(6) *Rescue.* Occurs at any point in the suppression sequence.

(7) *Salvage.* Occurs at any point in the suppression sequence.

Size-up

Locate the fire

Identify and manage the flow path

Cool to reduce thermal hazard

Extinguish the fire

Rescue

Salvage

A.5.1.1 With the exception of those evolutions that use aerial trucks, only the number of personnel who normally respond on the initial alarm and are assigned to perform engine company operations should perform the evolutions required by this standard. Personnel normally assigned to perform ladder operations on alarms should also be included for evolutions involving aerial trucks.

A.5.2.3 The purpose of these evolutions is to test the fire department's ability to promptly place into service fire suppression streams with correct flows and nozzle pressures. Direct streams other than from high-pressure hydrants usually do not provide the proper flows and nozzle pressures. Where such streams are used, serious delays often are encountered before effective streams are in service. Therefore, this practice is not considered valid by this standard.

A.5.3.2 Departments should adopt standard operating procedures that identify the types of ladder raises to be used by the department and to specify the minimum number of personnel to raise the various ground ladders used by the department. For example, one person is required to raise a 14 ft (5 m) straight ladder or a 24 ft (7 m) extension ladder, while three persons are required to raise a 35 ft (10 m) extension ladder.

A.6.1 Local standard operating procedures will dictate how the role of the incident commander will be filled.

A.6.2 Refer to Chapter 5 of NFPA 1561 for the evaluation criteria for incident commanders.

A.7.2.2 One of the two individuals located outside the IDLH atmosphere could be assigned an additional role, such as incident commander in charge of the emergency or safety officer, as long as this individual is able to perform assistance or rescue activities without jeopardizing the safety or health of any fire fighter working at the incident. Nothing in this section is intended to preclude fire fighters from performing rescue activities before an entire team has been assembled.

A.7.2.2(2) The assignment of an initial safety team would apply to fire-fighting operations in IDLH atmospheres where there is no possibility of emergency rescue activities. This would include fully involved structures with no expectancy of survivability and commercial structures with a low probability of occupancy at the time of the emergency. The initial safety team would consist of two or more members and would place themselves in the most advantageous position outside the IDLH atmosphere to do the following:

(1) Protect the interior team and egress
(2) Rescue the interior attack team
(3) Gain early awareness of a catastrophic event or collapse

A.7.2.3 Conducting formal training for members assigned to drive apparatus is recommended for fire departments. A comprehensive training program is outlined in NFPA 1451.

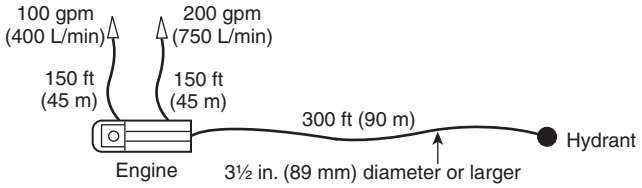
A.7.2.5 Limiting emergency scene operations to those that can be safely conducted by the number of personnel on the scene is intended to reduce the risk of fire fighter death or injury due to understaffing. Although members can be assigned and can arrive at an incident scene in many ways, it is strongly recommended that interior fire-fighting operations not be conducted without an adequate number of qualified fire fighters operating in companies under the supervision of company officers available on the scene.

The minimum recommended staffing level for a fire company responding to any type of fire consists of four members responding on or arriving with each engine or aerial ladder company. Companies responding in high fire risk areas should have a minimum acceptable staffing of six fire fighters on ladder companies and five fire fighters on engine companies. These recommendations are based on data from actual fires and in-depth fire simulations wherein fire company effectiveness was critically and objectively evaluated. These studies indicate significant reductions in performance and safety when crews have fewer members than recommended. Overall, five-member crews were found to provide a more coordinated approach for search and rescue and fire suppression tasks. *(See A.8.5.1.1 of NFPA 1500.)*

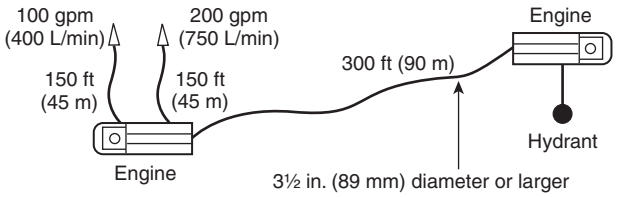
A.7.2.6 For example, where companies are equipped with two pieces of apparatus, they should operate in the normal manner, using both pieces.

A.7.4 Proper communication is essential to the efficiency and safety of fire department operations. Several methods are used by fire departments at incident scenes. These methods include two-way radios, hand signals, and audible devices. Communication is an integral component of training, and it should be included as part of the evaluation process.

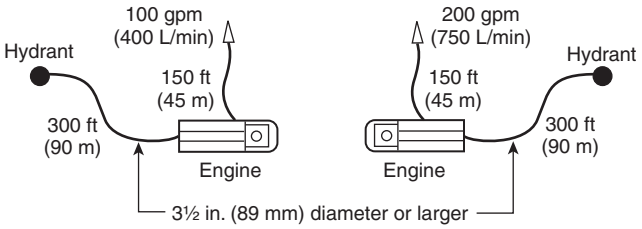
A.8.1.1 Illustrations of handline evolutions that engine companies can use are given in Figure A.8.1.1(a) through Figure A.8.1.1(f).



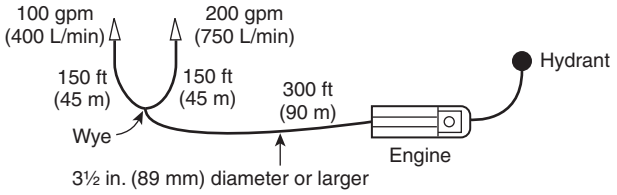
Δ FIGURE A.8.1.1(a) Forward Lay Using One Engine and One Supply Line — Recommended Maximum Time Is 3 Minutes.



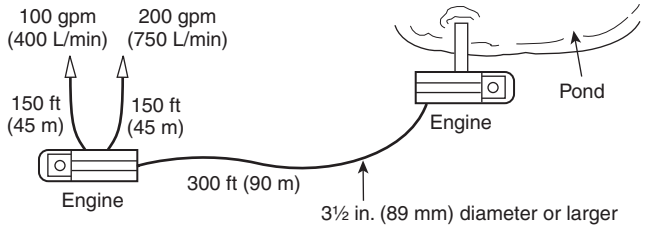
Δ FIGURE A.8.1.1(b) Reverse Lay from First Engine to Second Engine — Recommended Maximum Time Is 4 Minutes.



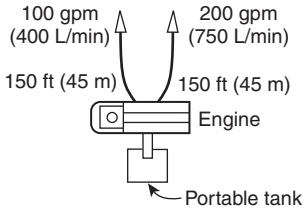
Δ FIGURE A.8.1.1(c) Forward Lays Using Two Engines — Recommended Maximum Time Is 3.5 Minutes.



Δ FIGURE A.8.1.1(d) Reverse Lay with One Engine Using a Wye — Recommended Maximum Time Is 4 Minutes.



Δ FIGURE A.8.1.1(e) Drafting Operation Using Two Engines — Recommended Maximum Time Is 6 Minutes.



Δ FIGURE A.8.1.1(f) Portable Water Supply Tank Using One Engine and Water Supply Apparatus — Recommended Maximum Time Is 5 Minutes.

A.8.1.3 Delaying the placement of the second and additional companies into service recognizes the fact that, in many cases, the companies do not arrive simultaneously. Delay can be due to factors such as volunteer response and traffic conditions. Additionally, this delay provides the evaluator with a greater opportunity to check the operations of second and additional companies. The 30-second delay is a suggested time interval for the purposes of the test. The evaluator can increase the time interval to simulate conditions in which responding companies are located at great distances from one another.

A.8.2.4 Pressure and flow can be determined by either pitot gauge measurement, piezometer gauge readings, flowmeter readings, or pump discharge gauge readings, based on known pressure requirements for the particular nozzles. Spray nozzles can be estimated based on their rated delivery if the proper pump pressure is provided.

A.8.3.2 The purpose of this evaluation is to demonstrate the ability to advance hose lines to necessary positions of operation. The evaluator should designate the positions from which streams will be operated.

A.8.3.3 Establishing an adequate water supply is a primary consideration of the pump operator, and charging the backup line without an adequate water supply can jeopardize the safety of the initial attack crew. There could be instances when the backup line has to be charged from the booster tank; however, in these instances, the pump operator should be acutely aware of the flow rates of the lines in service and the capacity of the booster tank. Where units have booster tanks of 1000 gal (4000 L) or more or where multiple units are available to provide additional water, charging the backup line from a booster tank could be permitted.

A.8.4 Fire conditions might dictate a variety of hose stream applications. Therefore, the ability to control and direct a hose stream is critical to a safe and successful evolution. Applying water to a remote target from a distance is a starting point for developing this skill. If a structure has a well-developed fire, the ability to place the stream into the fire compartment through a vent such as an open window or doorway might be required. For interior operations, applying water to the seat of the fire or using the stream to cool the fire gases might be necessary. Use of the handline requires practice.

A.8.5.4 Failure to make required connections to promptly utilize the available water supply is one of the most serious errors made during an initial attack on a fire. Placing streams into service quickly when they lack adequate volume and pressure cannot be considered as furnishing a standard initial fire attack. The most common cause of failure is dependence on a single 2½ in. (65 mm) supply line to provide the necessary flow.

A.8.5.5 Up to 10 seconds of interruption can be permitted to manage situations such as transferring from tank to water supply or shifting lines from hydrants to pumps. Failure to obtain water from a hydrant before the booster tank is empty or to maintain flow when transferring from tank to hydrant supply is unacceptable.

A.8.6 Evaluation results should be useful to the evaluator determining which areas require additional training to provide a standard initial fire attack capability. It would not be surprising if the first test of these evolutions produced less-than-satisfactory performance. Effective teamwork between companies for initial attack develops with practice.

A.9.1.1 Illustrations of master stream evolutions are given in Figure A.9.1.1(a) through Figure A.9.1.1(e).

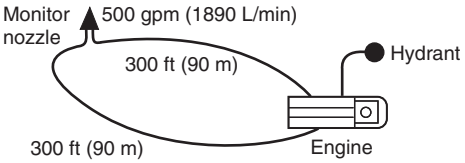


FIGURE A.9.1.1(a) Reverse Lay from Portable Monitor Nozzle Using One Engine — Recommended Maximum Time Is 5 Minutes.

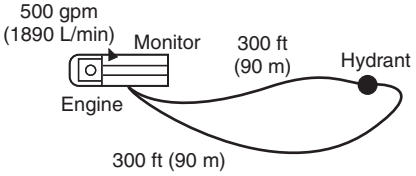


FIGURE A.9.1.1(b) Forward Lay with One Engine Using Engine Monitor — Recommended Maximum Time Is 3 Minutes.

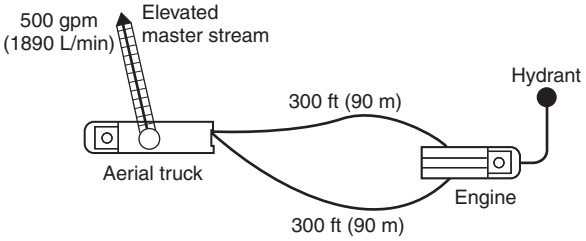


FIGURE A.9.1.1(c) Reverse Lay from Elevated Master Stream Using One Engine — Recommended Maximum Time Is 4 Minutes.

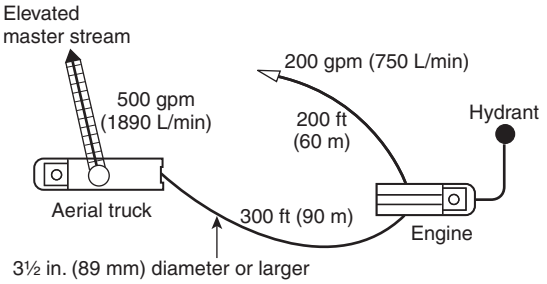


FIGURE A.9.1.1(d) Reverse Lay from Elevated Master Stream Using One Engine and Supplying One Handline — Recommended Maximum Time Is 5.5 Minutes.

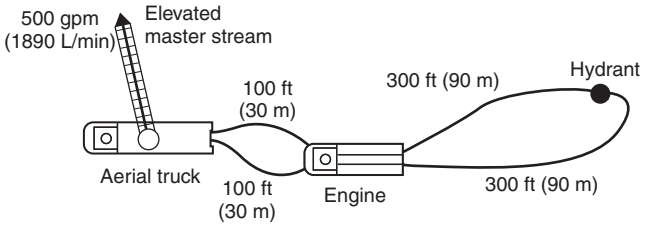


FIGURE A.9.1.1(e) Forward Lay Using One Engine to Supply an Elevated Master Stream with Two Lines — Recommended Maximum Time Is 5 Minutes.

A.9.1.3 Delaying the placement of second and additional companies into service recognizes the fact that, in many cases, the companies do not arrive simultaneously. Delay can be due to factors such as volunteer response and traffic conditions. Additionally, this delay also provides the evaluator with a greater opportunity to check the operations of second and additional companies. The 30-second delay is only a suggested interval for the purposes of the test. The evaluator can increase the time interval to simulate conditions in which responding companies are located at great distances from one another.

A.9.2.2 Pressure and flow can be determined by either pitot gauge measurement, piezometer gauge readings, flowmeter readings, or pump discharge gauge readings, based on known pressure requirements for the particular nozzles. Spray nozzles can be estimated based on their rated delivery if the proper pump pressure is provided.

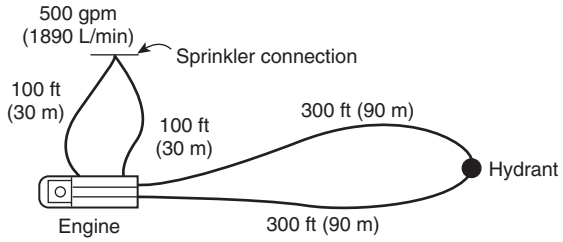
A.9.4.5 Failure to make required connections to promptly utilize the available water supply is one of the most serious errors made during an initial attack on a fire. Placing streams into service quickly when they lack adequate volume and pressure cannot be considered as furnishing a standard initial fire attack. The most common cause of failure is dependence on a single 2½ in. (65 mm) supply line to provide the necessary flow. At least two 2½ in. (65 mm) supply lines or one large supply hose would be necessary to carry the needed flows at the necessary pressures.

A.9.4.6 Up to 10 seconds of interruption can be permitted to manage situations such as transferring from tank to water supply or shifting lines from hydrants to pumps. Failure to obtain water from a hydrant before the booster tank is empty or to maintain flow when transferring from tank to hydrant supply is unacceptable.

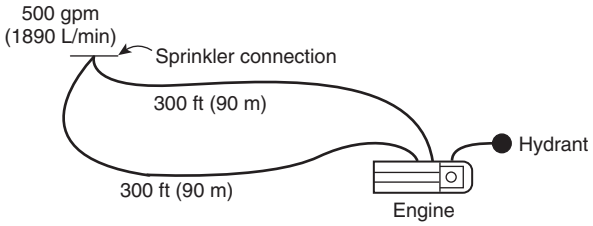
A.9.5 Evaluation results should be useful to the evaluator determining which areas require additional training in aerial ladder setup or in providing a high-volume, limited-duration offensive attack (i.e., a blitz attack). It would not be surprising if the first test of these evolutions produced less-than-satisfactory performance. Effective teamwork between companies for a blitz attack develops with practice.

A.10.1.1 Illustrations of evolutions for automatic sprinkler system support are given in Figure A.10.1.1(a) through Figure A.10.1.1(c).

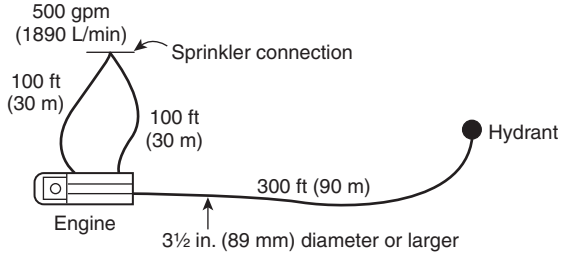
A.10.1.3 Delaying the placement of the second and additional companies into service recognizes the fact that, in many cases, the companies do not arrive simultaneously. Delay can be due to factors such as volunteer response and traffic conditions. Additionally, this delay provides the evaluator with a greater opportunity to check the operations of second and any addi-



Δ FIGURE A.10.1.1(a) Forward Lay to the Sprinkler Connection Using Two Supply Lines — Recommended Maximum Time Is 3.5 Minutes.



Δ FIGURE A.10.1.1(b) Reverse Lay from the Sprinkler Connection Using Two Supply Lines — Recommended Maximum Time Is 3.5 Minutes.



Δ FIGURE A.10.1.1(c) Forward Lay to the Sprinkler Connection Using Large-Diameter Hose — Recommended Maximum Time Is 3.5 Minutes.

tional companies. The 30-second delay is only a suggested interval for the purposes of the test. The evaluator can increase the time interval to simulate conditions in which responding companies are located at great distances from one another.

A.10.2.2 Pressure and flow can be determined by either pitot gauge measurement, piezometer gauge readings, flowmeter readings, or pump discharge gauge readings.

A.10.4.2 Failure to make required connections to promptly utilize the available water supply is one of the most serious errors made when supplying an automatic sprinkler system. The most common cause of failure is dependence on a single 2½ in. (65 mm) supply line to provide the necessary flow.

A.10.4.5 Up to 10 seconds of interruption can be permitted to manage situations such as transferring from tank to water supply or shifting lines from hydrants to pumps. Failure to obtain water from a hydrant before the booster tank is empty or to maintain flow when transferring from tank to hydrant supply is unacceptable.

A.10.5 Evaluation results should be useful to the evaluator determining which areas require additional training to provide water supply to an automatic sprinkler system. It would not be surprising if the first test of these evolutions produced less-than-satisfactory performance. Effective teamwork between companies for initial attack develops with practice.

A.12.2.1 The single evolution (12.2.2 through 12.2.6) is recommended as general guidance for establishing a RIC at the scene. Designate and assemble qualified personnel with tools in a designated area. Specific training would be conducted using NFPA 1407.

Annex B Evaluation Outlines and Instructions

This annex is not a part of the requirements of this NFPA document but is included for informational purposes only.

Δ B.1 Guidelines for Use of Outlines in Evolutions. These outlines are provided to assist training personnel using the evolutions illustrated in Annex A. All personnel involved in the evolutions should be clothed in the correct safety gear or fire-fighting protective clothing and equipment as specified in 7.2.1.

The total number of personnel used for each evolution should not exceed the number of persons who normally respond on the initial alarm in accordance with 8.1.2, 9.1.2, and 10.1.2. For those evolutions that use one engine company, the number of personnel assigned should be limited to a single engine company, unless more than one unit responds as part of that engine company on the initial alarm. All personnel over the number that normally staff the first engine company should be delayed 30 seconds before entering the evolutions.

Δ B.1.1 Evolution No. 1. Evolution No. 1 uses one engine company, one supply line, and two handlines *(see Figure B.1.1)*. If the number of personnel used to perform this evolution exceeds the normal single-engine company staffing, the additional personnel should be delayed 30 seconds before becoming involved in the evolution. The procedures are as follows:

(1) Stage engine company and assigned personnel away from the hydrant. When personnel are ready, give signal for engine to proceed to hydrant.
(2) Start recording time when engine stops at the hydrant. (Do not allow additional personnel to start for 30 seconds.)
(3) Steps of operation are as follows:
   (a) Lay one supply line from the hydrant a distance of 300 ft (90 m).
   (b) Advance one attack line from the engine a distance of 150 ft (45 m).
   (c) Advance one backup line from the engine a distance of 150 ft (45 m).
   (d) Operate all lines at proper pressures and flows.
(4) Stop time when all lines are supplied properly. [Record time in B.1.1(6).]
(5) Note equipment and personnel used in the test as follows:
   (a) Size of supply line used?
   (b) Size of attack line used?
   (c) Size of backup line used?
   (d) Number of persons used?
(6) Record total time of evolution.

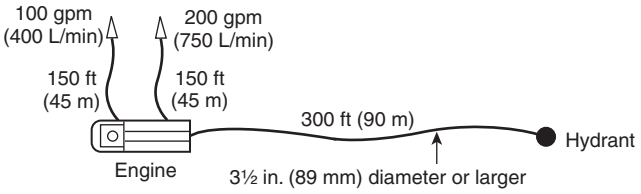


FIGURE B.1.1 Forward Lay Using One Engine and One Supply Line.

Δ **B.1.2 Evolution No. 2.** Evolution No. 2 uses two engines, one supply line, and two handlines *(see Figure B.1.2)*. A 30-second delay should be used to start the second engine company and all personnel over the normal staffing of the first engine company. The procedures are as follows:

(1) Stage engines and assigned personnel away from the simulated fire area. When personnel are ready, give signal for first engine company to proceed to the fire area.
(2) Start recording time when first engine stops at the fire area. (Do not allow second engine and additional personnel to start for 30 seconds.)
(3) Steps of operation are as follows:
   (a) At the fire area, remove and advance one attack line and one backup line a minimum distance of 150 ft (45 m) from the first engine.
   (b) After a 30-second delay, give signal for second engine to proceed to location of first engine.
   (c) When second engine is stopped at first engine, remove supply hose from second engine, which then proceeds to hydrant location.
   (d) Connect supply hose to first engine and connect either supply hose or second engine to hydrant.
   (e) Operate all lines at proper pressures and flows.
(4) Stop time when all lines are supplied properly. [Record time in B.1.2(6).]
(5) Note equipment and personnel used in test as follows:
   (a) Size of supply line used?
   (b) Size of attack line used?
   (c) Size of backup line used?
   (d) Number of persons used?
(6) Record total time of evolution.

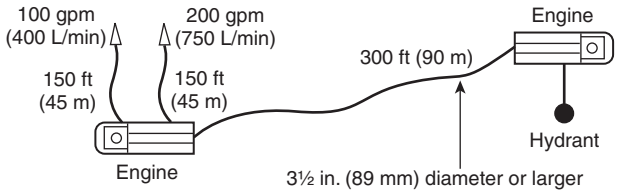


FIGURE B.1.2 Reverse Lay from First Engine to Second Engine; Connecting Second Engine to Hydrant Is Optional.

Δ **B.1.3 Evolution No. 3.** Evolution No. 3 uses two engines, two hydrants, two supply lines, and two handlines *(see Figure B.1.3)*. A 30-second delay should be used to start the second engine company and all personnel over the normal staffing of the first engine company. The procedures are as follows:

(1) Stage engine companies and assigned personnel away from the hydrants. When personnel are ready, give signal for first engine company to proceed to hydrant.
(2) Start recording time when engine stops at the hydrant. (Do not allow additional personnel to start for 30 seconds.)
(3) Steps of operation are as follows:
   (a) First engine lays one supply line from the hydrant a distance of 300 ft (90 m).
   (b) Advance one attack line from the first engine a distance of 150 ft (45 m).
   (c) Second engine lays one supply line from the hydrant a distance of 300 ft (90 m).
   (d) Advance one backup line from the second engine a distance of 150 ft (45 m).
   (e) Operate all lines at correct pressures and flows.
(4) Stop time when all lines are supplied correctly. [Record time in B.1.3(6).]
(5) Note equipment and personnel used in test as follows:
   (a) Size of supply line used?
   (b) Size of attack line used?
   (c) Size of backup line used?
   (d) Number of persons used?
(6) Record total time of evolution.

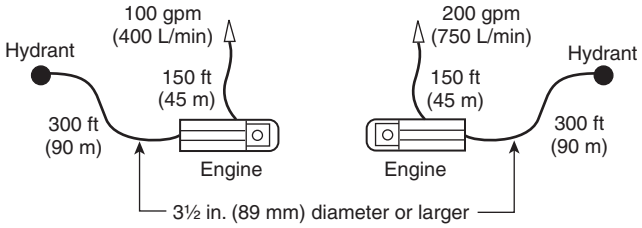


FIGURE B.1.3 Forward Lays Using Two Engines.

Δ **B.1.4 Evolution No. 4.** Evolution No. 4 uses one engine company, one supply line, and two handlines operated from a wye *(see Figure B.1.4)*. If the number of personnel used to perform this evolution exceeds the staffing for a normal single-engine company, the additional personnel should be delayed 30 seconds before becoming involved in the evolution. The procedures are as follows:

(1) Stage engine company and assigned personnel away from the simulated fire area. When personnel are ready, give signal for engine to proceed to the fire area.
(2) Start recording time when engine stops at the fire area. (Do not allow additional personnel to start for 30 seconds.)
(3) Steps of operation are as follows:
   (a) At the fire area, remove two attack lines, wye, and leader line from the engine.
   (b) Lay leader line to hydrant a distance of 300 ft (90 m) and connect engine to hydrant.
   (c) At the fire area, connect attack line and backup line to wye and advance 150 ft (45 m).
   (d) Operate all lines at proper pressures and flows.
(4) Stop time when all lines are supplied properly. [Record time in B.1.4(6).]
(5) Note equipment and personnel used in test as follows:
   (a) Size of supply line used?
   (b) Size of attack line used?
   (c) Size of backup line used?
   (d) Number of persons used?
(6) Record total time of evolution.

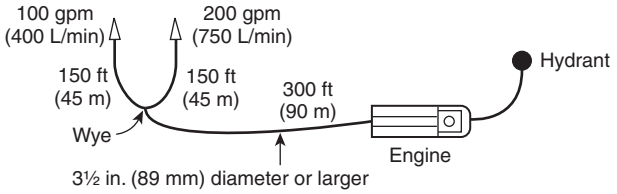


FIGURE B.1.4 Reverse Lay with One Engine Using a Wye.

Δ **B.1.5 Evolution No. 5.** Evolution No. 5 uses two engines, one supply line, and two handlines *(see Figure B.1.5)*. A 30-second delay should be used to start the second engine and all personnel over the normal staffing of the first engine. The procedures are as follows:

(1) Stage engines and assigned personnel away from the simulated fire area. When personnel are ready, give signal for engine to proceed to the fire area.
(2) Start recording time when engine stops at the fire area. (Do not allow additional personnel to start for 30 seconds.)
(3) Steps of operation are as follows:
   (a) At the fire area, remove and advance one attack line and one backup line a minimum distance of 150 ft (45 m) from the first engine.
   (b) After a 30-second delay, give signal for second engine to proceed to location of first engine.
   (c) When second engine is stopped at first engine, remove supply hose from second engine, which then proceeds to water source and sets up for drafting operations.
   (d) Operate all lines at correct pressures and flows.
(4) Stop time when all lines are supplied correctly. [Record time in B.1.5(6).]
(5) Note equipment and personnel used in test as follows:
   (a) Size of supply line used?
   (b) Size of attack line used?
   (c) Size of backup line used?
   (d) Number of persons used?
(6) Record total time of evolution.

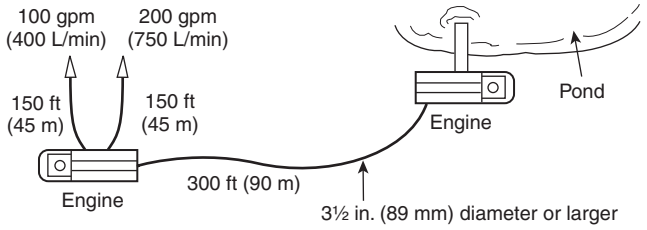


FIGURE B.1.5 Drafting Operation Using Two Engines.

Δ **B.1.6 Evolution No. 6.** Evolution No. 6 uses one engine operating from a water supply tank, two handlines, and water supply apparatus *(see Figure B.1.6)*. If the number of personnel used to perform this evolution exceeds the staffing for a normal single-engine company and a water supply apparatus, the additional personnel should be delayed 30 seconds before becoming involved in the evolution. The procedures are as follows:

(1) Stage engine company, water supply apparatus, and assigned personnel away from the simulated fire area. When personnel are ready, give signal for engine to proceed to fire area.
(2) Start recording time when engine stops at the fire area. (Do not allow additional personnel to start for 30 seconds.)
(3) Steps of operation are as follows:
   (a) At the fire area, remove and advance one attack line and one backup line a minimum distance of 150 ft (45 m) from the engine.
   (b) After a 30-second delay, locate water supply tank at fire area, fill tank, and establish water supply to engine.
   (c) Maintain water supply through continuous tender operations for a minimum time of 30 minutes or as otherwise required by the AHJ.
   (d) Operate all lines at proper pressures and flows.
(4) Stop time when all lines are supplied correctly. [Record time in B.1.6(6).]
(5) Note equipment and personnel used in test as follows:
   (a) Size of supply line used?
   (b) Size of attack line used?
   (c) Size of backup line used?
   (d) Number of persons used?
(6) Record total time of evolution.

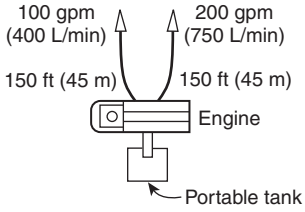


FIGURE B.1.6 Portable Water Supply Tank Using One Engine and Water Supply Apparatus.

Δ **B.1.7 Evolution No. 7.** Evolution No. 7 uses one engine, one portable master stream appliance, and two supply lines *(see Figure B.1.7)*. If the number of personnel used to perform this evolution exceeds the normal single-engine staffing, the additional personnel should be delayed 30 seconds before becoming involved in the evolution. The procedures are as follows:

(1) Stage engine company and assigned personnel away from the simulated fire area. When personnel are ready, give signal for engine to proceed to fire area.
(2) Start recording time when engine stops at the fire area. (Do not allow additional personnel to start for 30 seconds.)
(3) Steps of operation are as follows:
   (a) At the fire area, remove two supply lines from engine, locate the monitor device, and connect supply lines to the demounted, portable master stream appliance.
   (b) Lay two supply lines a distance of 300 ft (90 m) and connect engine to the hydrant.
   (c) Supply the master stream appliance at correct pressures and flows.
(4) Stop time when the master stream appliance is supplied correctly. [Record time in B.1.7(6).]
(5) Note equipment and personnel used in test as follows:
   (a) Size of supply line used?
   (b) Size of attack line used?
   (c) Size of backup line used?
   (d) Number of persons used?
(6) Record total time of evolution.

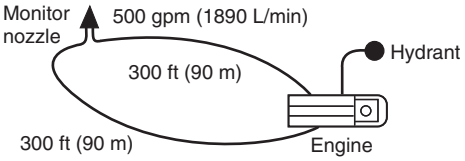


FIGURE B.1.7 Reverse Lay from Portable Master Stream Appliance Using One Engine.

Δ **B.1.8 Evolution No. 8.** Evolution No. 8 uses one engine, an engine-mounted master stream appliance, and two supply lines *(see Figure B.1.8)*. If the number of personnel used to perform this evolution exceeds the normal single-engine staffing, the additional personnel should be delayed 30 seconds before becoming involved in the evolution. The procedures are as follows:

(1) Stage engine company and assigned personnel away from the hydrant. When personnel are ready, give signal for engine to proceed to the hydrant.
(2) Start recording time when engine stops at the hydrant. (Do not allow additional personnel to start for 30 seconds.)
(3) Steps of operation are as follows:
   (a) Lay two supply lines from the hydrant a distance of 300 ft (90 m).
   (b) Place engine-mounted master stream appliance in operation and operate at correct pressures and flows.
(4) Stop time when the master stream appliance is supplied correctly. [Record time in B.1.8(6).]
(5) Note equipment and personnel used in test as follows:
   (a) Size of supply line used?
   (b) Size of attack line used?
   (c) Size of backup line used?
   (d) Number of persons used?
(6) Record total time of evolution.

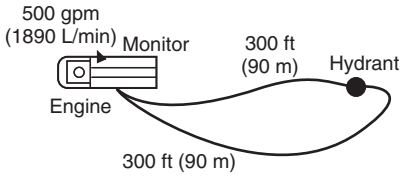


FIGURE B.1.8 Forward Lay Using One Engine and an Engine-Mounted Master Stream Appliance.

Δ **B.1.9 Evolution No. 9.** Evolution No. 9 uses one aerial truck with an elevated master stream appliance, one engine, and two supply lines *(see Figure B.1.9)*. The number of personnel used to perform this evolution should not exceed the normal engine and ladder company staffing. The procedures are as follows:

(1) Stage all apparatus and assigned personnel away from the simulated fire area. When personnel are ready, give signal for engine to proceed to the fire area.
(2) Start recording time when first vehicle stops at the fire area. (Do not allow additional personnel to start for 30 seconds.)
(3) Steps of operation are as follows:
   (a) Position apparatus and prepare elevated master stream for service.
   (b) Lay two supply lines a distance of 300 ft (90 m) and connect engine to the hydrant.
   (c) Connect supply lines to elevated master stream appliance intake and operate the master stream at correct pressures and flows.
(4) Stop time when the elevated master stream appliance is supplied correctly. [Record time in B.1.9(6).]
(5) Note equipment and personnel used in test as follows:
   (a) Size of supply line used?
   (b) Size of attack line used?
   (c) Size of backup line used?
   (d) Number of persons used?
(6) Record total time of evolution.

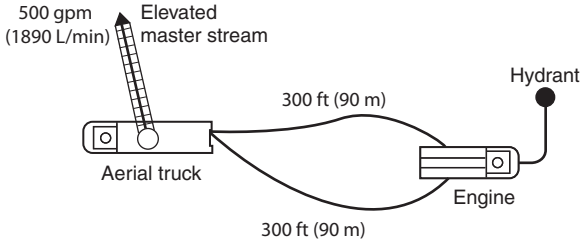


FIGURE B.1.9 Reverse Lay from Apparatus Equipped with an Elevated Master Stream Appliance Using One Engine.

Δ **B.1.10 Evolution No. 10.** Evolution No. 10 uses one apparatus equipped with an elevated master stream device, one engine company, one large-diameter supply line, and one handline *(see Figure B.1.10)*. The number of personnel used to perform this evolution should not exceed the normal engine and ladder company staffing. The procedures are as follows:

(1) Stage all apparatus and assigned personnel away from the simulated fire area. When personnel are ready, give signal for engine to proceed to the fire area.
(2) Start recording time when first vehicle stops at the fire area. (Do not allow additional personnel to start for 30 seconds.)
(3) Steps of operation are as follows:
   (a) Position apparatus and prepare elevated master stream for service.
   (b) Remove large-diameter supply line and 200 ft (60 m) of handline from engine. Engine lays both lines a distance of 300 ft (90 m) and connects to the hydrant.
   (c) Operate master stream and handline at correct pressures and flows.
(4) Stop time when the elevated master stream appliance and handline are supplied correctly. [Record time in B.1.10(6).]
(5) Note equipment and personnel used in test as follows:
   (a) Size of supply line used?
   (b) Size of master stream nozzle used?
   (c) Size of handline used?
   (d) Amount of water flowed?
   (e) Number of persons used?
(6) Record total time of evolution.

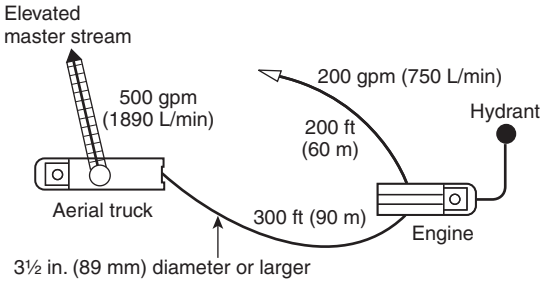


FIGURE B.1.10 Reverse Lay from Apparatus Equipped with Elevated Master Stream Device Using One Engine and Supplying One Handline.

Δ **B.1.11 Evolution No. 11.** Evolution No. 11 uses one apparatus equipped with an elevated master stream appliance, one engine, and four supply lines (two supply lines between the hydrant and the engine and two supply lines between the engine and the elevated master stream appliance intake) *(see Figure B.1.11)*. The number of personnel used to perform this evolution should not exceed the normal engine and ladder company staffing. The procedures are as follows:

(1) Stage all apparatus and assigned personnel away from the hydrant. When personnel are ready, give signal for the apparatus equipped with the elevated master stream appliance to proceed to simulated fire area and for the engine to proceed to the hydrant.
(2) Start recording time when engine stops at the hydrant. (Do not allow additional personnel to start for 30 seconds.)
(3) Steps of operation are as follows:
   (a) Lay two supply lines from the hydrant a distance of 300 ft (90 m).
   (b) Position apparatus and prepare elevated master stream appliance for service.
   (c) Lay two 100 ft (30 m) supply lines from the engine to the elevated master stream appliance intake.
   (d) Place elevated master stream in operation and operate at correct pressures and flows.
(4) Stop time when elevated master stream is supplied correctly. [Record time in B.1.11(6).]
(5) Note equipment and personnel used in test as follows:
   (a) Size of aerial supply line used?
   (b) Size of master stream nozzle used?
   (c) Number of persons used?
(6) Record total time of evolution.

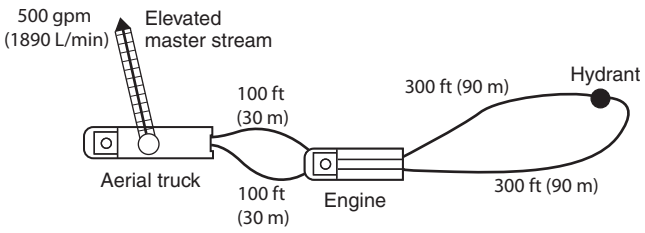


FIGURE B.1.11 Forward Lay Using One Engine to Supply an Apparatus Equipped with an Elevated Master Stream Appliance with Two Lines.

Δ **B.1.12 Evolution No. 12.** Evolution No. 12 uses a simulated sprinkler connection, one engine, and four supply lines (two supply lines between the hydrant and engine and two supply lines between the engine and sprinkler connection) *(see Figure B.1.12)*. If the number of personnel used to perform this evolution exceeds the normal single-engine staffing, the additional personnel should be delayed 30 seconds before becoming involved in the evolution. The procedures are as follows:

(1) Stage the engine company and assigned personnel away from the hydrant. When personnel are ready, give signal for the engine to proceed to the hydrant.
(2) Start recording time when engine stops at the hydrant. (Do not allow additional personnel to start for 30 seconds.)
(3) Steps of operation are as follows:
   (a) Lay two supply lines from the hydrant a distance of 300 ft (90 m).
   (b) Lay two 100 ft (30 m) supply lines from the engine to the sprinkler connection.
   (c) Operate at correct pressures and flows.
(4) Stop time when all lines are supplied correctly. [Record time in B.1.12(6).]
(5) Note equipment and personnel used in test as follows:
   (a) Size of supply lines used between engine and hydrant?
   (b) Size of supply lines used between engine and sprinkler?
   (c) Amount of water flowed?
   (d) Number of persons used?
(6) Record total time of evolution.

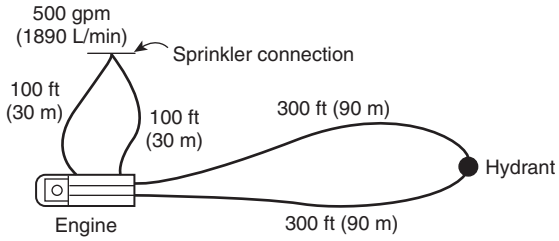


FIGURE B.1.12 Forward Lay to the Sprinkler Connection Using Two Supply Lines.

Δ **B.1.13 Evolution No. 13.** Evolution No. 13 uses a simulated sprinkler connection, one engine company, and two supply lines *(see Figure B.1.13)*. If the number of personnel used to perform this evolution exceeds the normal single-engine staffing, the additional personnel should be delayed 30 seconds before becoming involved in the evolution. The procedures are as follows:

(1) Stage the engine company and assigned personnel away from the sprinkler connection. When personnel are ready, give signal for engine to proceed to the sprinkler connection.
(2) Start recording time when engine stops at the sprinkler connection. (Do not allow additional personnel to start for 30 seconds.)
(3) Steps of operation are as follows:
   (a) Lay two supply lines a distance of 300 ft (90 m) from the sprinkler connection to the hydrant and connect engine to the hydrant.
   (b) Connect supply lines to the sprinkler connection.
   (c) Operate at correct pressures and flows.
(4) Stop time when all lines are supplied correctly. [Record time in B.1.13(6).]

(5) Note equipment and personnel used in test as follows:
   (a) Size of supply lines used?
   (b) Amount of water flowed?
   (c) Number of persons used?
(6) Record total time of evolution.

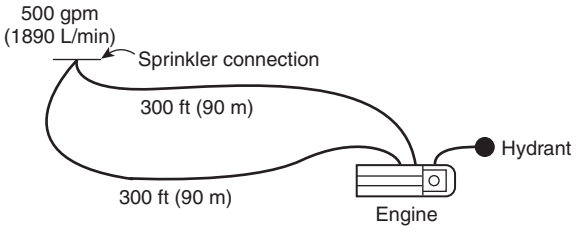


FIGURE B.1.13 Reverse Lay from the Sprinkler Connection Using Two Supply Lines.

Δ **B.1.14 Evolution No. 14.** Evolution No. 14 uses a simulated sprinkler connection, one engine company, and three supply lines (one large-diameter supply line between the hydrant and engine and two supply lines between the engine and sprinkler connection) *(see Figure B.1.14)*. If the number of personnel used to perform this evolution exceeds the normal single-engine staffing, the additional personnel should be delayed 30 seconds before becoming involved in the evolution. The procedures are as follows:

(1) Stage the engine company and assigned personnel away from the hydrant. When personnel are ready, give signal for the engine to proceed to the hydrant.
(2) Start recording time when engine stops at the hydrant. (Do not allow additional personnel to start for 30 seconds.)
(3) Steps of operation are as follows:
   (a) Lay one large-diameter supply line from the hydrant a distance of 300 ft (90 m).
   (b) Lay two supply lines a distance of 100 ft (30 m) from the engine to the sprinkler connection.
   (c) Operate at correct pressures and flows.
(4) Stop time when all lines are supplied correctly. [Record time in B.1.14(6).]
(5) Note equipment and personnel used in test as follows:
   (a) Size of supply line used between hydrant and engine?
   (b) Size of supply lines used between engine and sprinkler connection?
   (c) Amount of water flowed?
   (d) Number of persons used?
(6) Record total time of evolution.

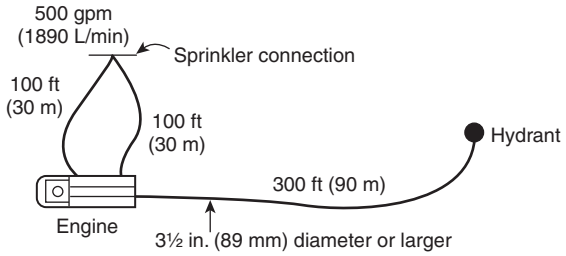


FIGURE B.1.14 Forward Lay to the Sprinkler Connection Using Large-Diameter Hose.

Annex C Informational References

Δ **C.1 Referenced Publications.** The documents or portions thereof listed in this annex are referenced within the informational sections of this standard and are not part of the requirements of this document unless also listed in Chapter 2 for other reasons.

Δ **C.1.1 NFPA Publications.** National Fire Protection Association, 1 Batterymarch Park, Quincy, MA 02169-7471.

NFPA 1001, *Standard for Fire Fighter Professional Qualifications*, 2019 edition.

NFPA 1407, *Standard for Training Fire Service Rapid Intervention Crews*, 2020 edition.

NFPA 1451, *Standard for a Fire and Emergency Service Vehicle Operations Training Program*, 2018 edition.

NFPA 1500™, *Standard on Fire Department Occupational Safety, Health, and Wellness Program*, 2020 edition.

NFPA 1561, *Standard on Emergency Services Incident Management System and Command Safety*, 2020 edition.

NFPA 1971, *Standard on Protective Ensembles for Structural Fire Fighting and Proximity Fire Fighting*, 2018 edition.

NFPA 1981, *Standard on Open-Circuit Self-Contained Breathing Apparatus (SCBA) for Emergency Services*, 2019 edition.

NFPA 1982, *Standard on Personal Alert Safety Systems (PASS)*, 2018 edition.

C.1.2 Other Publications. (Reserved)

C.2 Informational References. (Reserved)

C.3 References for Extracts in Informational Sections. (Reserved)