

NFPA 1583

Standard on Health-Related Fitness Programs for Fire Fighters

2000 Edition



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An International Codes and Standards Organization

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NFPA 1583

Standard on

Health-Related Fitness Programs for Fire Fighters

2000 Edition

This edition of NFPA 1583, *Standard on Health-Related Fitness Programs for Fire Fighters*, was prepared by the Technical Committee on Fire Service Occupational Medical and Health and acted on by the National Fire Protection Association, Inc., at its World Fire Safety Congress and Exposition™ held May 14–17, 2000, in Denver, CO. It was issued by the Standards Council on July 20, 2000, with an effective date of August 18, 2000.

This edition of NFPA 1583 was approved as an American National Standard on August 18, 2000.

Origin and Development of NFPA 1583

In the initial development of NFPA 1500, *Standard on Fire Department Occupational Safety and Health Program*, the document contained language regarding the development of a fire department physical fitness program. This requirement has remained in subsequent editions of NFPA 1500, without explanatory material or reference to fire service occupational safety and health.

In the standards-making process, this technical committee struggled with the development of a specific document and worked to include it as a standard in the suite of occupational safety and health documents. The first proposed document was voted on by the Association membership and passed in Chicago in 1996. It was subsequently appealed and later withdrawn from the NFPA system by the technical committee.

In June 1997 the new Technical Committee on Fire Service Occupational Medical and Health revived the project, but with a new focus. That focus was based on the intent that a fire fighter should have a comprehensive document based on a healthy lifestyle, with a fitness component. The committee members felt that other areas of fire fighter health and safety (i.e., protective equipment and clothing, fire apparatus, and incident command) had evolved to address specific areas of occupational safety, but had not focused on health.

NFPA statistics continue to show that almost 50 percent of fire fighter fatalities are heart attacks, and almost 50 percent of those who died had heart-related problems. The development and issuance of NFPA 1582, *Standard on Medical Requirements for Fire Fighters and Information for Fire Department Physicians*, in 1992, with subsequent editions, emphasizes the need for annual medical evaluations. The technical committee believes that a health-related fitness program will contribute significantly to reducing fire fighter fatalities and injuries. Overweight, out-of-shape fire fighters are an accident waiting to happen. The multiple stress factors and rigors of the profession require fire fighters to be medically and physically fit in order to perform the required tasks.

The committee considers this standard to be a companion document to NFPA 1582, and that, if used by fire departments, it will reduce fire fighter fatalities and injuries. Furthermore, the committee considers this standard to be a tool to be used in conjunction with the Joint Labor-Management Wellness Initiative, developed by the International Association of Fire Fighters (IAFF) and the International Association of Fire Chiefs (IAFC). The work done by the fire department physicians in the development of this standard, as well as their ongoing contributions to fire service occupational health and safety, are to be commended.

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NOTE: Membership on a committee shall not in and of itself constitute an endorsement of the Association or any document developed by the committee on which the member serves.

Committee Scope: This Committee shall have primary responsibility for documents on occupational medicine and health in the working environment of the fire service.

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NFPA 1583**Standard on****Health-Related Fitness Programs
for Fire Fighters****2000 Edition**

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

Information on referenced publications can be found in Chapter 8 and Appendix C.

Chapter 1 Administration**1.1 Scope.**

1.1.1 The requirements in this standard are the minimum requirements of the development, implementation, and management for a health-related fitness program (HRFP).

1.1.2 These requirements are applicable to public, governmental, military, private, and industrial fire department organizations providing rescue, fire suppression, emergency medical services, hazardous materials mitigation, special operations, and other emergency services.

1.1.3 This standard is not applicable to industrial fire brigades or to industrial fire departments meeting the requirements of NFPA 600, *Standard on Industrial Fire Brigades*. Industrial fire brigades or fire departments shall also be permitted to be known as emergency brigades, emergency response teams, fire teams, plant emergency organizations, or mine emergency response teams.

1.2 Purpose.

1.2.1* The purpose of this standard is to provide the minimum requirements for a health-related fitness program for fire department members who are involved in rescue, fire suppression, emergency medical services, hazardous materials operations, special operations, and related activities.

1.2.2 Implementation of this document shall promote the members' ability to perform occupational activities with vigor and to demonstrate the traits and capacities normally associated with a low risk of premature development of injury, morbidity, and mortality.

1.2.3 Nothing herein shall be intended to restrict any jurisdiction from exceeding these requirements.

1.2.4 This document is not intended to establish physical performance criteria.

1.3 Application.

1.3.1 When this standard is adopted by a jurisdiction, the authority having jurisdiction shall set a date or dates for achieving compliance with the requirements of this standard and shall be permitted to establish a phase-in schedule for compliance with specific requirements of this standard.

1.3.2 The fire department shall incorporate the requirements of this standard in their risk management plan.

1.4 Definitions.

1.4.1* **Approved.** Acceptable to the authority having jurisdiction.

1.4.2* **Authority Having Jurisdiction.** The organization, office, or individual responsible for approving equipment, materials, an installation, or a procedure.

1.4.3 Candidate. A person who has submitted an application to become a member of the fire department.

1.4.4 Communicable Disease. A disease, sometimes known as a contagious disease, that can be transmitted from one person to another.

1.4.5 Component. An element of a larger system or program.

1.4.6 Composite Program. A program made up of distinct components or elements.

1.4.7 Confidential Data. Information, especially information organized for analysis or used as the basis for decision making, that is communicated only in a restricted manner.

1.4.8 Debilitating Illness or Injury. A condition that temporarily or permanently prevents a member of the fire department from engaging in normal duties and activities as a result of illness or injury.

1.4.9 Drug. Any substance, chemical, over-the-counter medication, or prescribed medication that can affect the performance of the fire fighter.

1.4.10 Emergency Operations. Activities of the fire department relating to rescue, fire suppression, emergency medical care, and special operations, including response to the scene of an incident and all functions performed at the scene.

1.4.11 Facility. See definition 1.4.14, Fire Department Facility.

1.4.12 Fire Chief. The highest ranking officer in charge of a fire department.

1.4.13* **Fire Department.** An organization providing rescue, fire suppression, and related activities and, in many cases, emergency medical services, hazardous materials operations, and special operations.

1.4.14* **Fire Department Facility.** Any building or area owned, operated, occupied, or used by a fire department on a routine basis.

1.4.15 Fire Department Member. See definition 1.4.28, Member.

1.4.16 Fire Department Physician. The licensed doctor of medicine or osteopathy who has been designated by the fire department to provide professional expertise in the areas of occupational safety and health as they relate to emergency services.

1.4.17* **Fire Suppression.** The activities involved in controlling and extinguishing fires.

1.4.18* **Hazard.** The potential for harm or damage to people, property, or the environment.

1.4.19 Health and Fitness Coordinator. The person who, under the supervision of the fire department physician, has been designated by the department to coordinate and be responsible for the health and fitness programs of the department.

1.4.20* **Health and Safety Officer.** The member of the fire department assigned and authorized by the fire chief as the manager of the safety and health program and who performs the duties and responsibilities specified in this standard.

1.4.21 Health Database. A compilation of records and data that relates to the health experience of a group of individuals and is maintained in a manner such that it is retrievable for study and analysis over a period of time.

1.4.22 Health Promotion. Preventive activities that identify real and potential health risks in the work environment and that inform, motivate, and otherwise help people to adopt and maintain healthy practices and lifestyles.

1.4.23* Health-Related Fitness Program (HRFP). A comprehensive program designed to promote the member's ability to perform occupational activities with vigor, and to assist the member in the attainment and maintenance of the premature traits or capacities normally associated with premature development of injury, morbidity, and mortality.

1.4.24 Infection Control Program. The fire department's formal policy and implementation of procedures relating to the control of infectious and communicable disease hazards where employees, patients, or the general public could be exposed to blood, body fluids, or other potentially infectious materials in the fire department work environment.

1.4.25 Infectious Disease. An illness or disease resulting from invasion of a host by disease-producing organisms such as bacteria, viruses, fungi, or parasites.

1.4.26 Medical Evaluation. The analysis of information, sometimes obtained from a medical examination, for the purpose of making a determination of medical certification.

1.4.27 Medical Examination. An examination performed or directed by the fire department physician.

1.4.28* Member. A person involved in performing the duties and responsibilities of a fire department, under the auspices of the organization.

1.4.29 Member Assistance Program (MAP). A generic term used to describe the various methods used in the fire department for the control of alcohol and other substance abuse, stress, and personal problems that adversely affect member performance.

1.4.30* Member Organization. An organization formed to represent the collective and individual rights and interests of the members of the fire department, such as a labor union or fire fighters' association.

1.4.31* Morbidity. The state of being diseased.

1.4.32 Mortality. The death rate, or the ratio of the number of deaths to a given population.

1.4.33 Occasionally Assigned. The infrequent fire-fighting responsibility in a given jurisdiction, district, or area, or fire-fighting situations that are less likely to occur or that occur on an infrequent basis within the response area.

1.4.34 Occupational Illness. An illness or disease contracted through or aggravated by the performance of the duties, responsibilities, and functions of a fire department member.

1.4.35 Occupational Injury. An injury sustained during the performance of the duties, responsibilities, and functions of a fire department member.

1.4.36 Primarily Assigned. The principal fire-fighting responsibility in a given jurisdiction, district, or area, or the fire-fighting situations that are most likely to occur within the response area.

1.4.37 Procedure. An organizational directive issued by the authority having jurisdiction or by the department that establishes a specific policy that must be followed.

1.4.38 Punitive. Inflicting or aiming to inflict punishment.

1.4.39 Qualified Person. A person who, by possession of a recognized degree, certificate, professional standing, or skill, and who, by knowledge, training, and experience, has demonstrated the ability to deal with problems related to the subject matter, work, or project.

1.4.40 Related Activities. Any and all functions that fire department members can be called upon to perform in the execution of their duties.

1.4.41 Risk. A measure of the probability and severity of adverse effects. These adverse effects result from an exposure to a hazard.

1.4.42 Risk Management. Identification and analysis of exposure to hazards, selection of appropriate risk management techniques to handle exposures, implementation of chosen techniques, and monitoring of results, with respect to the health and safety of members.

1.4.43 SCBA. See definition 1.4.44, Self-Contained Breathing Apparatus.

1.4.44 Self-Contained Breathing Apparatus (SCBA). A respirator, worn by the user, that supplies a respirable atmosphere that is either carried on or generated by the apparatus and is independent of the ambient environment.

1.4.45 Shall. Indicates a mandatory requirement.

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

1.4.47 Standard. A document, the main text of which contains only mandatory provisions using the word "shall" to indicate requirements and which is in a form generally suitable for mandatory reference by another standard or code or for adoption into law. Nonmandatory provisions shall be located in an appendix, footnote, or fine-print note and are not to be considered a part of the requirements of a standard.

1.4.48 Standard Operating Procedure. An organizational directive that establishes a course of action.

Chapter 2 Organization

2.1 Program Overview.

2.1.1 The fire chief shall have the ultimate responsibility for the fire department's health-related fitness program as required by NFPA 1500, *Standard on Fire Department Occupational Safety and Health Program*.

2.1.2* The fire department shall establish and provide a health-related fitness program that enables members to develop and maintain a level of health and fitness to safely perform their assigned functions.

2.2 Program Components. The health-related fitness program shall include the following components:

- (1) The assignment of a qualified health and fitness coordinator
- (2) A periodic fitness assessment for all members
- (3) An exercise training program that is available to all members
- (4) Education and counseling regarding health promotion for all members
- (5) A process for collecting and maintaining HRFP data

2.3 Roles and Responsibilities.

2.3.1 Each member of the fire department shall cooperate, participate, and comply with the provisions of the health-related fitness program.

2.3.2 The fire department shall require the structured participation of all members in the health-related fitness program.

2.4 Logistics.

2.4.1* The fire department shall be responsible for providing the opportunity and means for implementation of the HRFP.

2.4.2* The fire department shall provide the opportunity and means for regular exercise training.

2.4.2.1* Fire departments with assigned work shifts shall allow members to participate during scheduled work times.

2.4.2.2 Fire departments without assigned work shifts shall provide members with the opportunity to participate at times that do not conflict with other commitments.

2.5 Program Referrals.

2.5.1 The fire department shall be responsible for providing educational resources and professional referrals as needed. The department shall be financially responsible for fees associated with referrals only to the extent departmental policy, procedures, standard guidelines, or statutory obligations dictate.

2.5.2 The fire department shall be allowed to refer members to its primary health care providers for injuries and illnesses not related to employment.

Chapter 3 Health and Fitness Coordinator

3.1* Assignment.

3.1.1 The fire department, under the direction of the fire chief, shall appoint a health and fitness coordinator (HFC) as specified by NFPA 1500, *Standard on Fire Department Occupational Safety and Health Program*.

3.1.2* The health and fitness coordinator shall be a member of the fire department or an outside agent as designated by the fire department.

3.1.3 The health and fitness coordinator shall report to the fire chief or the fire chief's designated representative.

3.1.4 The health and fitness coordinator shall be the administrator of all components of the health-related fitness program.

3.1.5* The health and fitness coordinator shall act as a direct liaison between the fire department physician and the fire department in accordance with NFPA 1500, *Standard on Fire Department Occupational Safety and Health Program*.

3.1.6* The health and fitness coordinator shall act as a direct liaison to the fire department's health and safety officer.

3.2 Qualifications for Health and Fitness Coordinator.

3.2.1* The health and fitness coordinator shall have access to appropriate educational materials and/or formal certification from a professional organization, relevant educational experience, appropriate academic degrees, completion of course work relevant to the program components, or attendance at workshops related to health and fitness.

3.2.2 The health and fitness coordinator shall maintain the continuing education requirements as listed in 3.2.1 or as described in the fire department's job description.

Chapter 4 Fitness Assessment

4.1 General.

4.1.1 All members shall participate in a periodic fitness assessment under supervision of the department HFC and shall provide the HFC with data on which to base individual exercise prescription.

4.1.2 The fitness assessment shall be conducted at least annually.

4.2 Fitness Assessment.

4.2.1 All members shall be cleared for participation in the fitness assessment by the fire department physician.

4.2.2* If a member has an acute medical problem or a newly acquired chronic medical condition, the fitness assessment shall be postponed until that person has recovered from this condition and presents to the fire department for review.

4.3 Pre-Assessment Questionnaire. The HFC shall administer to all members a pre-assessment questionnaire that seeks to identify contraindications for participation in the fitness assessment and department exercise training program.

4.4* Fitness Assessment Components. The annual fitness assessments shall consist of the following components:

- (1) Aerobic capacity
- (2) Body composition
- (3) Muscular strength
- (4) Muscular endurance
- (5) Flexibility

Chapter 5 Exercise and Fitness Training Program

5.1 Program Components. The fire department's exercise and fitness training program, administered by the department HFC, shall consist of the following components:

- (1) An educational program that describes the components and benefits of exercise, fitness, fitness training, and weight management
- (2) An individualized exercise prescription based on the results of the fitness assessment
- (3) Warm-up and cool-down exercise guidelines
- (4) Aerobic exercise program
- (5) Muscular (strength, endurance) exercise program
- (6) Flexibility exercise program
- (7) Healthy back exercise program
- (8) Safety and injury prevention program

(See Appendix B, *Sample Fitness Plan*, for further information about each component of the fire department's exercise and fitness training program, to assist the HFC in setting up and administering such a program.)

5.2 Program Participation.

5.2.1 The fire department physician shall clear all members for participation in the exercise and fitness training program.

5.2.2* If a member has an acute medical problem or a newly acquired chronic medical condition, the exercise fitness training program shall be postponed until that person has recovered from this condition and reports to the fire department for review.

5.2.3 It shall be an ongoing objective of the fire department to assist members affected by occupational injuries or illnesses in their rehabilitation and to facilitate their return to limited duty or to full active duty where possible.

5.2.4 After returning to full duty from a debilitating injury, illness, or any other extended leave, a member shall have an exercise and fitness training program designed by the HFC, under direction of the department physician or other attending health care professional, in order to facilitate restoration to optimal fitness level.

Chapter 6 Health Promotion Education

6.1* General Requirements. The fire department shall provide health promotion education as an integral part of the health-related fitness program.

6.1.1* The fire department shall provide for the education of members regarding general health maintenance, fitness, and the prevention of occupational injuries and illnesses, accidents, or fatalities as required by NFPA 1500, *Standard on Fire Department Occupational Safety and Health Program*; NFPA 1581, *Standard on Fire Department Infection Control Program*; and NFPA 1582, *Standard on Medical Requirements for Fire Fighters and Information for Fire Department Physicians*.

6.1.2* The fire department, under the direction of the fire department physician, shall provide education regarding all of the topics in 6.1.1, and materials on these matters shall be made available to all members on an ongoing basis, with resource materials updated periodically to ensure current information.

6.1.3 The fire department shall provide education and guidance regarding access to the department's member assistance program (MAP) as required by NFPA 1500, *Standard on Fire Department Occupational Safety and Health Program*.

6.1.4 The fire department shall encourage all members to obtain ongoing health care from their primary care providers.

Chapter 7 Data Collection

7.1* General.

7.1.1 The fire department shall ensure that a confidential, permanent health-related fitness program file is established and maintained for each member.

7.1.2* The fire department shall ensure that confidential, permanent files containing data from the health-related fitness program are established and maintained.

7.2 Statistical Summary.

7.2.1 Group statistical data shall be permitted to be used for administrative purposes as long as it is coded so as not to reveal any employee's personal information.

7.2.2 The fire department shall maintain statistical data on gender and age.

7.3 Data Collected.

7.3.1* The individual HRFP file shall record the following:

- (1) Demographic information
- (2) The pre-assessment questionnaire
- (3) The fitness assessment
- (4) Program participation data

7.3.2 Data accumulated under this standard shall be used only to enhance the well-being of members and to assist in various studies of occupational fitness and health.

Chapter 8 Referenced Publications

8.1 The following documents or portions thereof are referenced within this standard as mandatory requirements and shall be considered part of the requirements of this standard. The edition indicated for each referenced mandatory document is the current edition as of the date of the NFPA issuance of this standard. Some of these mandatory documents might also be referenced in this standard for specific informational purposes and, therefore, are also listed in Appendix C.

8.1.1 NFPA Publications. National Fire Protection Association, 1 Batterymarch Park, P.O. Box 9101, Quincy, MA 02269-9101.

NFPA 600, *Standard on Industrial Fire Brigades*, 2000 edition.

NFPA 1500, *Standard on Fire Department Occupational Safety and Health Program*, 1997 edition.

NFPA 1581, *Standard on Fire Department Infection Control Program*, 2000 edition.

NFPA 1582, *Standard on Medical Requirements for Fire Fighters and Information for Fire Department Physicians*, 2000 edition.

Appendix A Explanatory Material

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

A.1.2.1 Although this standard is intended primarily for members of emergency operations, fire departments are encouraged to apply the components of the HRFP to all employees.

A.1.4.1 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.1.4.2 Authority Having Jurisdiction. The phrase "authority having jurisdiction" 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 authority having jurisdiction 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 authority having jurisdiction. In many circumstances, the property owner or his or her designated agent assumes the role of the authority having jurisdiction; at government installations, the commanding officer or departmental official may be the authority having jurisdiction.

A.1.4.13 Fire Department. The term *fire department* includes any public, governmental, private, industrial, or military organization engaging in this type of activity.

A.1.4.14 Fire Department Facility. The term *fire department facility* does not include locations where a fire department can be summoned to perform emergency operations or other duties, unless such premises are normally under the control of the fire department.

A.1.4.17 Fire Suppression. Fire suppression includes all activities performed at the scene of a fire incident or training exercise that expose fire department members to the dangers of heat, flame, smoke, and other products of combustion, explosion, or structural collapse.

A.1.4.18 Hazard. Hazards include the characteristics of facilities, equipment systems, property, hardware, or other objects and the actions and inactions of people who create such hazards.

A.1.4.20 Health and Safety Officer. This individual can be the incident safety officer, or that can also be a separate function.

A.1.4.23 Health-Related Fitness Program (HRFP). The HRFP includes fitness assessment, exercise training, and health promotion activities.

A.1.4.28 Member. A fire department member can be a full-time or part-time employee or a paid or unpaid volunteer, can occupy any position or rank within the fire department, and can engage in emergency operations.

A.1.4.30 Member Organization. This definition includes any organization authorized to represent the interests of its members in dealing with the fire department management.

A.1.4.31 Morbidity. Morbidity refers to the number of sick persons or cases of disease in relationship to a specific population.

A.2.1.2 The fire department needs to recognize that its members are its most valuable resource. The occupational safety and health program has provided direction on performing assigned functions in a safe manner. The health-related fitness program provides another process, one that allows members to enhance and maintain their optimum level of health and fitness throughout their tenure with the fire department. Education, one provision of HRFP, allows a means for improving health and fitness throughout the organization. The organization needs to provide the recognition and support to ensure the promotion and success of this process. Health and fitness needs to become a value within the organization, just as safety is a value.

Data suggest a correlation between the following:

- (1) A proactive approach to health and fitness and a decrease in debilitating occupational injuries
- (2) A reduction in workers' compensation claims and a decrease in acute and chronic health problems of fire fighters

Combining the health-related fitness program with a proactive occupational safety and health program provides a fire department with the level of quality needed for its members.

The purpose of the health-related fitness program is consistent with the medical requirements and occupational safety and health standards: to improve the health fitness and overall well-being of fire-fighting personnel. Compliance with the standards of NFPA 1500, *Standard on Fire Department Occupational Safety and Health Program*, has demonstrated that, even in the fire service, benefits will ultimately be manifested in cost savings, decreased sick times, and reduced worker's compensation and disability expenses.

A commitment of time and financial resources is necessary to fulfill requirements of this standard. The fire department should afford individual fire fighters the means, the facility, and the time, as part of their work-time function, to pursue the health-related goals. The initial investment of the fire service on behalf of its most valuable resource, the fire fighter, will pay significant dividends in the future.

A.2.4.1 For fire departments with assigned work shifts, implementing an HRFP could require allowing members to participate during scheduled work hours. Fire departments that do not assign work shifts should provide members with the opportunity to participate at times that do not conflict with other commitments, such as work, family, and other fire department obligations.

A.2.4.2 The fire department should provide an adequate facility for overall fitness, including flexibility, aerobic fitness, and muscular strength, where exercise equipment is centrally located. Such a facility can be developed from the following three sources:

(a) *Contracted Use of Public Gym and/or Exercise Equipment.* Exercise equipment can be placed directly in each station. The following equipment is recommended:

- (1) Treadmill, stairclimbing machine, stationary bike, or other aerobic training-type equipment
- (2) Multi-use, multi-elevation track
- (3) Leg extension
- (4) Leg curl
- (5) High cable pull
- (6) Low cable pull
- (7) Flat bench
- (8) Adjustable bench
- (9) Seated bench
- (10) Olympic straight bar
- (11) Plates of varied weights
- (12) Dumbbells of varied weights

(b) *Purchased or Donated Exercise Equipment.* The equipment listed in A.2.4.2(a) 1-12 is recommended and can be obtained from the following resources:

- (1) Made in local apprenticeship programs (e.g., welders or pipefitters)
- (2) Made at and donated by correctional or educational institutions
- (3) Donated by gyms or rehabilitation facilities
- (4) Purchased on a shared cost agreement with the governing city, based on a reduced industrial insurance cost for a fitness program

(c) *Contracted Use of a Gym in a High School, University, or Other Educational Institution or Private or Governmental Agency (e.g., Military Base).* The fire department should maintain

equipment owned or leased by the fire department and/or fitness memberships for personnel if an outside facility is used as the designated department fitness facility.

A.2.4.2.1 The fire department can allocate time on duty for physical fitness training. Scheduling of this time can vary due to emergency calls, training, and other activities.

A.3.1 There are no promulgated educational standards for health and fitness personnel in the United States. While it would be an unrealistic and unattainable goal to require that all HFCs have a baccalaureate or graduate degree in a related discipline, it is important to note the level of formal training such a degree connotes.

A.3.1.2 The fire department can choose to acquire the services of an outside agent to serve as the HFC. This HFC should meet or exceed the training and educational background listed in A.3.2.1. The fire department should ensure that such an outside agent is familiar with the unique physical stresses present on the fireground.

Appropriate outside agents can be found at local colleges or universities in the exercise science, kinesiology, physical fitness, or fire technology departments. The private sector can also provide qualified personnel to serve as HFCs. Such sources include hospital-based fitness programs, medical facilities, or private companies that provide fitness assessment and wellness programs.

A.3.1.5 The data generated through the HRFPP can show a correlation between fire fighter fitness and occupational safety and health. Non-identifying data should be shared to facilitate this. The health and fitness coordinator should confer with the health and safety officer regarding health-related fitness policies and procedures, fitness safety, accident and injury prevention, health promotion, and injury rehabilitation.

A.3.1.6 A liaison between the HFC and the department's health and safety officer will ensure that data collection and other requirements of the occupational safety and health program are maintained.

A.3.2.1 A number of professional organizations, including those listed in Table A.3.2.1, provide training and educational experiences as well as certification programs for interested persons. It is in the best interests of fire departments to avail themselves of these professional services, as time and resources allow.

Table A.3.2.1 Training

Organization	Training Program
American College of Sports Medicine	Health Fitness Instructor (HFI)
American Council on Exercise (ACE)	Personal Trainer
National Strength and Conditioning Association (NSCA)	Certified Strength and Conditioning Specialist (CSCS) or Certified Personal Trainer (CPT)
National Academy of Sports Medicine (NASM)	Personal Trainer

The HFC should have a background in the following areas:

(a) Functional Anatomy and Biomechanics

- (1) The basic anatomy of the cardiovascular and respiratory systems
- (2) The following muscles and their actions:
 - a. Trapezius
 - b. Pectoralis major
 - c. Latissimus dorsi
 - d. Biceps
 - e. Triceps
 - f. Abdominal
 - g. Erector spinae
 - h. Gluteus maximus
 - i. Quadriceps
 - j. Hamstrings
 - k. Gastrocnemius
- (3) The causes of low back pain and exercises that prevent or alleviate the problem
- (4) Location of the common anatomical sites for the following measurements:
 - a. Measurement of skinfold thickness and girths for estimating body composition
 - b. Palpation of peripheral pulses
 - c. Cuff and stethoscope positioning for blood pressure measurement

(b) Exercise Physiology

- (1) Aerobic and anaerobic metabolism and the sources of energy used in the performance of various physical activities, including those on the fireground
- (2) The following components of fitness:
 - a. Cardiorespiratory fitness
 - b. Muscular strength and endurance
 - c. Flexibility
 - d. Body composition
- (3) The normal cardiorespiratory responses to static and dynamic and how these responses change with regular exercise training
- (4) The physiological adaptations associated with strength training in men and women
- (5) The physiological principles related to warm-up and cool-down
- (6) The effects of temperature, humidity, altitude, and the use of respiratory protection on the physiological responses to exercise
- (7) The common theories of muscle fatigue and delayed onset muscle soreness
- (8) How the principle of specificity relates to the components of fitness and how this principle affects fitness programs for fire fighters
- (9) The concept of detraining or reversibility of conditioning and its implications in fitness programs for fire fighters

(c) Human Development and Aging

- (1) The changes that occur from young to older adulthood for the following areas:
 - a. Skeletal muscle
 - b. Bone structure
 - c. Reaction and movement time
 - d. Coordination
 - e. Tolerance to hot and cold environments
 - f. Maximal oxygen consumption

- g. Strength
- h. Flexibility
- i. Body composition
- j. Cardiorespiratory function
- (2) Common orthopedic and cardiovascular considerations for older fire fighters and indicated modifications in exercise prescription
- (d) Pathophysiology/Risk Factors
 - (1) Risk factors for coronary artery disease and the designation of those that can be favorably modified by regular and appropriate physical activity habits
 - (2) Resting blood pressure levels that are associated with hypertension
 - (3) The plasma cholesterol levels for various ages as recommended by the National Cholesterol Education Program
 - (4) Risk factors for or conditions that could require consultation with medical or allied health professionals prior to participation in physical activity or prior to a major increase in physical activity intensities and habits
 - (5) The effects of the following substances on exercise responses:
 - a. Antihistamines
 - b. Tranquilizers
 - c. Alcohol
 - d. Diet pills
 - e. Cold tablets
 - f. Caffeine
 - g. Anabolic steroids
 - h. Creatine
 - i. Nicotine
- (e) Human Behavior/Psychology
 - (1) Implementation of specific techniques to deal with non-compliant participants
 - (2) The psychological principles that are critical to healthful changes, such as the following:
 - a. Behavior modification
 - b. Reinforcement
 - c. Goal-setting
 - d. Social support
 - e. Peer pressure
 - (3) Implementation of specific behavioral change strategies that are appropriate for weight loss and modification of body composition
- (f) Health Appraisal and Fitness Testing
 - (1) The use and limitations of informed consent forms and medical clearances prior to exercise participation
 - (2) The categories of participants who should receive medical clearance prior to administration of an exercise test or participation in an exercise program
 - (3) Identification of relative and absolute contraindications to exercise testing or participation
 - (4) Skill to conduct group field tests of cardiorespiratory fitness, muscular strength and endurance, and flexibility
 - (5) Skill to conduct field tests of cardiorespiratory fitness, muscular strength and endurance, and flexibility
 - (6) Skill in the various techniques of assessing body composition and communication of the advantages, disadvantages, and limitations of each technique
 - (7) Skill necessary to accurately measure pulse rate, blood pressure, and perceived exertion at rest and during exercise
- (8) Instruction of participants in the use of exercise equipment
- (9) Calibration of a cycle ergometer and a motor-driven treadmill
- (g) Emergency Procedures and Exercise Safety
 - (1) Appropriate criteria for discontinuing a fitness evaluation as well as recognition of the signs and symptoms indicating that participants (including special populations) need to defer, delay, or terminate the exercise session
 - (2) Safety plans, emergency procedures, and first aid techniques needed during fitness evaluations, exercise testing, and exercise training
 - (3) Basic precautions in a weight room area that ensure participant safety, such as the following:
 - a. Spotting
 - b. Buddy system
 - c. Control speed of movement
 - d. Returning weights to rack
 - e. Safe passageways
 - f. Checking loose parts on equipment
- (h) Exercise Programming
 - (1) Appropriate modification of exercise programs where the following conditions are involved:
 - a. Older adults
 - b. Acute illness
 - c. Controlled conditions such as exercise-induced asthma
 - d. Allergies
 - e. Hypertension
 - f. Pregnancy and postnatal conditions
 - g. Obesity
 - h. Low back pain
 - (2) The following weight training methods used in resistance programming:
 - a. Progressive resistance exercise
 - b. Super sets
 - c. Pyramiding
 - d. Split routines
 - e. Plyometrics
 - f. Isokinetic, isotonic, isometric, and partner resistance exercises
 - (3) Skill in using various types of isometric, isotonic, and isokinetic equipment
 - (4) Advantages and disadvantages of various aerobic exercise equipment such as stairclimbers, rowing machines, treadmills, and bicycles
 - (5) Designing exercise programs to improve or maintain cardiorespiratory endurance
 - (6) Modifying type, duration, frequency, and progression level of supervision and monitoring techniques in exercise programs for persons with the following conditions:
 - a. Heart disease
 - b. Diabetes mellitus
 - c. Obesity
 - d. Hypertension
 - e. Musculoskeletal problems
 - f. Pregnancy and postnatal conditions
 - g. Exercise-induced asthma
 - (7) Maintenance of adequate records and compilation of data and reports as appropriate

(i) Nutrition and Weight Management

- (1) Definitions of obesity, percent fat, lean body mass, anorexia nervosa, bulimia
- (2) The relationship between body composition and health
- (3) The effects of diet plus exercise and of diet alone and exercise alone as methods for modifying body composition
- (4) Misconceptions about spot reductions and rapid weight loss programs and the concept of energy balance as it relates to weight control
- (5) The ramifications of the use of vitamins, salt tablets, diet pills, protein powder, and other nutritional supplements
- (6) The importance of and procedures for maintaining normal hydration and appropriate beverages for fluid replacement during and after exercise
- (7) The importance of calcium and iron in women's health
- (8) Appropriate weekly weight loss goals
- (9) Recommendation of appropriate diets in terms of distribution of calories from fat, carbohydrate, and protein
- (10) Guidelines for caloric intake for an individual desiring to lose or gain weight
- (11) Nutritional factors related to the female athlete triad syndrome (i.e., eating disorders, menstrual cycle abnormalities, and osteoporosis)

(j) Program Administration/Management

- (1) The fitness coordinator's role in administration and program management
- (2) Administration of fitness-related programs within established budgetary guidelines
- (3) Development and administration of educational programs (e.g., lectures and workshops) and educational materials (e.g., participant handouts)
- (4) Development, evaluation, and revision of policies and procedures for programming and elements of a program evaluation report
- (5) Sources of outside consultation, including the following:
 - a. Establishing contact with outside contractors, fire department physicians, and equipment suppliers
 - b. Contracting for services
 - c. Implementing follow-up procedures
- (6) Interpretation of applied research in the areas of testing, exercise, and educational programs in order to maintain a comprehensive and current fitness program
- (7) Establishing a database, including type of data to be collected, data management, and analysis
- (8) Skill in communication and public speaking

A.4.2.2 This requirement is consistent with NFPA 1582, *Standard on Medical Requirements for Fire Fighters and Information for Fire Department Physicians*, regarding postponement of medical evaluation for acute medical problems.

A.4.4 *Sample Assessment Protocols for the Health-Related Components of Fitness.* The following examples of assessment protocols for health-related components of fitness vary in terms of ease of administration, safety, cost, and predictive value:

- (1) Aerobic capacity
 - a. 1-mile walk
 - b. 1.5-mile run/walk
 - c. 12-minute run
 - d. Step test (various)
 - e. Stairclimbing machine
 - f. Cycle ergometer (various)
 - g. Treadmill (various)
- (2) Percentage of body fat
 - a. Skinfold (various)
 - b. Circumference (various)
 - c. Bioimpedance (BIA)
 - d. Hydrostatic weighing
 - e. Body mass index (optional)
 - f. Waist-to-hip ratio (optional)
- (3) Muscular strength
 - a. Handgrip dynameter
 - b. Static bicep curl with dynameter
 - c. Static leg press with dynameter
 - d. Bench press (1 rep maximum or percent of body weight)
 - e. Leg press (1 rep maximum or percent of body weight)
- (4) Muscular endurance
 - a. Push-ups
 - b. Modified push-ups
 - c. Pull-ups
 - d. Bent knee sit-ups
 - e. Crunches given time
 - f. Crunches to cadence
- (5) Flexibility
 - a. Sit and reach
 - b. Modified sit and reach
 - c. Trunk extension
 - d. Shoulder elevation

A.5.2.2 This requirement is consistent with NFPA 1582, *Standard on Medical Requirements for Fire Fighters and Information for Fire Department Physicians*, regarding postponement of medical evaluation for acute medical problems.

A.6.1 Health education is now the driving force of health promotion and disease prevention. In the fall of 1993, The Centers for Disease Control (CDC) formally added "Prevention" to its name. At that time the CDC director announced that prevention's time had come in America. Coincident with this, third-party payors had begun to recognize the value of preventive education and began to reimburse for preventive services and risk reduction counseling. Organizations that establish health care guidelines in this country, such as the U.S. Prevention Services Task Force and American Association of Family Practitioners, unanimously agree that most clinical evaluation time for the average nonpregnant adult should be spent on counseling. It is in that spirit that this technical committee is promoting health education as a major part of the health-related fitness program.

A.6.1.1 It is understood that the degrees of resources vary greatly between fire departments. Despite such differences, it is expected that even in the most austere circumstances, adequate low-cost opportunities will be universally available to satisfy this standard.

The fire department is encouraged to use an opportunistic team approach in the dissemination of informational materials, fostering, for example, collaboration between the fire department physician, the health and safety officer, and the HFC. Information obtained from the physician could be complemented by that supplied by guest speakers at fire department meetings. The balance of information could be available in the form of pamphlet materials kept in an accessible display case at the firehouse. Most materials are available free of charge through public medical organizations and public health agencies, or they can be found on the Internet and downloaded free of charge.

A.6.1.2 Education materials can be in literary or media form and administered in a formal or informal manner on the following topic areas:

- (1) Self-examinations, including the breast self-exam, mammography, and clinical exam
- (2) Prostate and PSA, PAP smears, annual gynecological exams, and risks to pregnancy
- (3) Smoking cessation programs
- (4) Cancer risks, including skin (the most common form of cancer); colon cancer, with recommendations for colonoscopies where appropriate; prostate cancer and the use of the PSA test; testicular cancer and instruction on the self-exam; and breast and lung cancer
- (5) Diet and nutrition education, including cholesterol, weight management, diabetes, effects of obesity, and balanced diet recommendations
- (6) Immunization disease education, including current recommendations for a given age group, as well as general recommendations for the prevention of influenza, hepatitis, tetanus, pneumonia, hepatitis A, tuberculosis, varicella (chicken pox), measles, and rubella
- (7) Infectious disease education, including current recommendations for a given age group, as well as general recommendations for the prevention, diagnosis, and treatment of sexually transmitted diseases (especially HIV, hepatitis, herpes, and chlamydia), potential exposures to tuberculosis, and all those given in A.6.1.2(1)–(7).

A.7.1 The primary purpose for maintaining a health-related fitness program (HRFP) file for each participant is to document health-related fitness information for exercise prescription and periodic comparison to previous results. Comparison of new data to previous results will show an individual's progress in attaining a higher level of fitness. Consequently, from analysis and comparison of data, an individual's exercise prescription can be modified. In addition to measuring a participant's progress and providing information for modification of an individual's fitness program, analysis of the organization's set of files, or database, will provide information about organizational progress in developing health-related fitness and the need for program modification. Along with providing valuable information about the success of the HRFP, maintenance of the database and its subsequent analysis will provide statistics for program justification.

A.7.1.2 This information should be managed in a manner modeled after the confidentiality of doctor–patient relationships. Electronic data processing is often employed to facilitate management of such a database.

A.7.3.1 It is recommended that the HRFP file contain demographic information such as age, gender, ethnicity, years of service, and job assignment, as well as exercise frequency information. To ensure consistency and continuity of the process, data should be collected on a standard form such as that shown in Figure A.7.3.1.

FIGURE A.7.3.1 Sample HRFP form showing demographic and assessment information.

Personal and Demographic Information	
Date of submission (<i>mm/dd/yy</i>): _____ Age: _____ Gender: <input type="checkbox"/> Male <input type="checkbox"/> Female	
Fire department confidential identification code: _____	
Fire-fighter confidential identification code number: _____	
Ethnicity: <input type="checkbox"/> African American <input type="checkbox"/> Asian <input type="checkbox"/> Hispanic <input type="checkbox"/> Native American <input type="checkbox"/> Filipino <input type="checkbox"/> Caucasian <input type="checkbox"/> Other	
Job assignment: <input type="checkbox"/> Structural fire fighting <input type="checkbox"/> Administrative officer <input type="checkbox"/> Field officer	
No. of years in service: _____	
Smoking/Tobacco usage (<i>packs per day</i>): <input type="checkbox"/> <1 pack <input type="checkbox"/> 1 pack <input type="checkbox"/> 2 packs <input type="checkbox"/> 3 or more packs <input type="checkbox"/> None	
Height (<i>in whole inches</i>): _____	
Weight (<i>in whole pounds</i>): _____	
Fitness Assessment	
Mode of Testing	Results
<i>Aerobic Capacity</i>	
<input type="checkbox"/> 1.5 mile walk/run (field test)	
<input type="checkbox"/> Other	Completed in _____ min _____ sec
<input type="checkbox"/> Step test	
Test duration _____	
Step height _____	VO ₂ max _____
<input type="checkbox"/> Other	
<input type="checkbox"/> Submaximal treadmill test	
<input type="checkbox"/> Other	Heart rate _____ Blood pressure _____
<input type="checkbox"/> Submaximal cycle ergometer test	
<input type="checkbox"/> Other	Heart rate _____ Blood pressure _____
Pre-exercise heart rate _____	Post-exercise heart rate _____
Pre-exercise blood pressure _____	Post-exercise blood pressure _____
<i>Flexibility</i>	
<input type="checkbox"/> Trunk flexion (sit and reach test)	
<input type="checkbox"/> Other	Most distal point reached _____
<i>Muscular Strength</i>	
<input type="checkbox"/> Grip strength test	
(One repetition maximum)	Right hand _____ kg
<input type="checkbox"/> Other	Left hand _____ kg

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FIGURE A.7.3.1 (Continued).

Mode of Testing	Results
Muscular Endurance	
<input type="checkbox"/> Push-up test [60 sec (max)]	Maximal number of push-ups performed
<input type="checkbox"/> Other	consecutively without resting _____
<input type="checkbox"/> Sit-up test [60 sec (max)]	Maximal number of sit-ups performed
<input type="checkbox"/> Other	within 1 minute _____
Body Composition Testing	
Skinfold assessment	Site #1 Site #2 Site #3 percent of body fat _____
Body mass index	Member's weight divided by height ² = <input type="checkbox"/> 20–24.9 kg/m ² <input type="checkbox"/> 25–29.9 kg/m ² <input type="checkbox"/> 30–34.9 kg/m ² <input type="checkbox"/> over 35 kg/m ²
Waist-to-hip ratio	Waist circumference _____ Hip circumference _____ Waist-to-hip ratio = _____
Hydrostatic weighing	Body density _____
Bioimpedance (BIA)	Body density _____

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Appendix B Sample Fitness Plan

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

B.1 Components and Benefits of Fitness. The health-related components of fitness focus on the importance of maintaining and increasing an individual's fitness levels, creating positive lifestyle changes, and enhancing job performance. The motor-related components of fitness improve an individual's athletic endeavors or area(s) of motor performance. Health-related and motor-related components of fitness include the following:

- (1) Health-related components of fitness
 - a. Aerobic capacity
 - b. Muscular strength
 - c. Muscular endurance
 - d. Flexibility
 - e. Body composition
- (2) Motor-related components of fitness
 - a. Coordination
 - b. Agility

- c. Power
- d. Balance
- e. Speed
- f. Accuracy

B.2 Individualized Exercise Prescription Based on the Fitness Assessment. The components of a basic exercise prescription should include the following:

- (1) *Mode*: type of exercise
- (2) *Intensity*: difficulty of the exercise
- (3) *Duration*: length of exercise session
- (4) *Frequency*: number of sessions per day or week
- (5) *Progression*: gradual increases in workload to promote a training adaptation

The individualized exercise prescription should take into consideration the following concepts:

(a) *Overload*. To create a training effect, the exercise performed must exceed the load the individual normally experiences. Excessive overload can lead to training injuries; therefore, it is best to underestimate workload and err on the side of safety.

(b) *Progression*. As adaptations to the load take place, the load must be progressively increased in order to continue adaptations and improvements. Programs should progress gradually to avoid overtraining and injuries.

(c) *Specificity*. Overload training leads to adaptations in the muscles and stresses physiological systems. The adaptations are specific to the manner in which the person trains. This principle of training will be very important for individuals who need to target a specific aspect of fitness.

(d) *Targeting the Improvement of Health and Fitness*. Programs designed to improve health will not necessarily improve fitness. However, any properly designed exercise training program designed to improve fitness will also have a positive impact on overall health. The *1996 Surgeon General's Report on Physical Activity and Health* states that physical activity need not be strenuous to improve health, although greater health and fitness benefits can be achieved by increasing the amount of physical activity. Since a high level of physical fitness is essential for safely performing fire-fighting duties, a fitness program designed for public safety personnel should promote health and a higher level of physical fitness. The workout regimen should include exercises to improve aerobic capacity and muscular fitness components (i.e., strength, endurance, flexibility).

B.3 Warm-Up and Cool-Down Exercise.

B.3.1 Pre-Exercise (Warm-Up). Each workout session should include at least a 5- to 10-minute warm-up period. The purpose of the warm-up is to increase body temperature while improving the flow of blood and oxygen to the muscles. A warm-up prepares the body for the more strenuous exercise to follow, decreases risk of injury, and improves performance.

B.3.2 Post-Exercise (Cool-Down). A 10- to 15-minute cool-down period should follow each workout. This period includes a gradual tapering of exercise intensity followed by stretching. The purpose of the cool-down is to assist in the return of blood to the heart, thereby reducing cardiac stress. Tapering should be followed by stretching of the affected muscles to promote flexibility and reduce muscle soreness.

B.4 Aerobic Fitness.

B.4.1 Significance. Aerobic exercise has many benefits, including increased aerobic capacity, muscular endurance, improved bone density, and improved body composition. The *1996 Surgeon General's Report on Physical Activity and Health* found that inactivity is hazardous to health. Aerobic exercise generally reduces coronary risk factors, muscle fatigue, injuries, and morbidity. Repeatedly, research has shown the need for fire fighters to have high levels of aerobic fitness in order to perform their job.

B.4.2 Definitions.

B.4.2.1 Aerobic Fitness. Enhancement of the body's ability to take in, transport, and utilize oxygen; improved stamina or ability to carry out muscular activity for a prolonged period of time. Aerobic fitness, also referred to as cardiovascular fitness and cardiorespiratory endurance, is generally measured by the maximal oxygen consumption test ($\text{VO}_2 \text{ max}$).

B.4.2.2 American College of Sports Medicine (ACSM). A national organization of exercise physiologists and health practitioners who review the body of studies on exercise physiology and present exercise testing guidelines as well as exercise prescription recommendations and position statements.

B.4.2.3 Interval Training. A method of training in which periods of high-intensity effort (work interval) are alternated with periods of lower training intensity or rest (rest interval). These intervals are performed repeatedly for a given number of repetitions. For example, a 1-minute jog (work interval) followed by a 1-minute walk (rest interval), performed a total of 10 times (10 repetitions).

B.4.2.4 Karvonens Formula. A formula used to predict the heart rates that represent approximately 50 to 85 percent of $\text{VO}_2 \text{ max}$. This rate is considered an appropriate range to promote aerobic fitness improvements.

B.4.2.5 Maximal Oxygen Consumption Level ($\text{VO}_2 \text{ max}$). The maximal amount of oxygen that can be consumed and utilized per minute. It is also measured in milliliters per kilogram of body weight per minute. This measurement is considered the best indicator of aerobic fitness.

B.4.3 Aerobic Exercise Prescription.

B.4.3.1 Mode. Activities that utilize large muscle groups in a rhythmical continuous manner (e.g., walking, running, swimming, cycling, rowing, stairclimbing, skating, dancing, cross-country skiing, rope skipping) are all endurance-based activities. Training can also be carried out in an interval-style fashion. Employing a variety of training modes will reduce the chance of workout boredom and overuse injuries.

Considerations in determination of exercise mode should include the following:

- (1) Individual preferences
- (2) Availability of proper equipment or facilities
- (3) Risk of injury versus benefit of activity
- (4) Specificity to occupational demands

Since fire fighters need to support their own body weight and the additional load of protective clothing and breathing apparatus, the most job-specific activities will be those that are weight-bearing, such as walking or stair stepping, in contrast to nonweight-bearing activities such as cycling.

B.4.3.2 Intensity. How hard an individual exercises can be determined by monitoring exercise heart rate, perceived exertion, or caloric expenditure. The ACSM recommends exercising at a heart rate between 70 to 90 percent of maximal heart rate or 50 to 85 percent of $\text{VO}_2 \text{ max}$, or heart rate reserve. Karvonens formula, which follows, can be used to calculate the heart rate range that represents approximately 50 to 85 percent of one's $\text{VO}_2 \text{ max}$. An alternative to this approach calculates a straight percentage (70 to 90 percent) of maximal heart rate. If the maximal heart rate is unknown, it can be predicted by subtracting age from the constant 220.

A second calculation method uses the perception of exertion to determine proper intensity of exercise; exercise should feel somewhat hard to hard.

A third method for determining exercise intensity calculates the number of calories burned per minute for a given exercise or for a total exercise period. Generally speaking, activities that burn less than 10 calories per minute would represent a low-to-moderate intensity, and activities that burn more than 10 calories per minute would be considered higher intensity.

B.4.4 Karvonens Formula. To predict maximal heart rate (HR_{max}), use the following formula:

$$220 - \text{age} = HR_{\text{max}}$$

To determine target heart rate range, use the 1-minute standing resting heart rate (HR_{rest}), as follows:

$$T_{HR} = (HR_{max} - HR_{rest}) \times 0.50 + (0.85 + HR_{rest})$$

When determining the proper intensity of exercise, the following must be considered:

- (1) Level of fitness
- (2) Medications that affect heart rate
- (3) Environmental conditions
- (4) Risk of cardiovascular or orthopedic injury
- (5) Individual objectives and preferences
- (6) Job specificity

Studies evaluating fire fighters' heart rate response to fireground activities find that heart rates range from 80 to 90 percent of maximal heart rate or 70 to 80 percent of VO_2 max. Therefore, a fire fighter should consider progressing to a program that includes some high-intensity efforts.

B.4.5 Duration. The duration of the workout can be determined by time, distance, or calories expended. Exercise duration is integrally related to exercise intensity, and together they determine the total number of calories burned in an exercise session. Total caloric expenditure can also be used to help determine exercise intensity and duration.

The ACSM recommends 20 to 60 minutes of continuous activity, excluding the warm-up and cool-down period. Unfit individuals can benefit from multiple sessions of less than 10 minutes until they are able to withstand training of a longer duration.

B.4.6 Frequency. Exercise frequency is related to the intensity and duration of the exercise program as well as to individual time constraints and goals. Persons with very low fitness levels will benefit from multiple workouts per day, because they have to exercise at a low intensity and short duration due to lack of fitness. Two to three short workouts per day could be most appropriate. The ACSM recommends a minimum of three aerobic workouts per week to improve fitness and two sessions per week to maintain current fitness levels. Workouts should be performed on nonconsecutive days in order to allow adequate recovery between sessions. Weight training exercises can be performed on the days following the aerobic workout.

B.4.7 Weekly Caloric Expenditure. One goal of an exercise program can be a reduction in body fat. The total weekly caloric expenditure, which is determined by exercise intensity, duration, frequency, and mode, can also be used as a tool to determine the exercise prescription. The ACSM recommends a minimal caloric expenditure of 300 calories per exercise session performed three times a week or 200 calories per session performed four times a week. The *1996 Surgeon General's Report* recommends an accumulated exercise expenditure of 1000 calories per week to improve health. A more optimal level to improve performance is an expenditure of 2000 calories a week.

B.4.8 Rate of Progression. According to the ACSM, the following considerations should be made when determining the proper rate of progression for an individual:

- (1) Medical, health, and coronary risk status
- (2) Functional capacity
- (3) Musculoskeletal conditions

- (4) Age
- (5) Individual goals and preferences
- (6) Specificity to occupational demands

Progressions can come in the form of increases in intensity, duration, and frequency, or a change in mode of exercise (e.g., running instead of cycling). Progressions should be gradual to avoid training injuries.

B.5 Muscle Fitness.

B.5.1 Significance. Components of muscle fitness include muscular strength, endurance, and flexibility. The demands of fire fighting require an above-average level of muscular strength and endurance. Increases in bone, muscle, and connective tissue strength and density decrease the risk of soft tissue injuries. Fire fighters have to be able to pull, drag, and carry heavy loads. Improved muscular fitness will improve job performance and decrease the likelihood of injuries.

B.5.2 Definitions.

B.5.2.1 Maximal Voluntary Contraction (MVC). Maximal amount of weight that can be lifted in a single voluntary muscular contraction.

B.5.2.2 Muscular Endurance. The ability of the muscle to perform repeated contraction for a prolonged period of time; the ability of the muscle to persist.

B.5.2.3 Muscular Strength. The maximal amount of force a muscle or group of muscles can exert in a single contraction; the ability to apply force.

B.5.2.4 National Strength and Conditioning Association (NSCA). A national association of exercise physiologist and health professionals who review the body of information generated on muscle fitness training and provide recommendations and position statements for exercise testing protocols and training programs.

B.5.2.5 Repetition Maximal (RM). The maximal number of repetitions that can be completed with a given weight. For example, if 150 pounds is a 10-RM load on the bench press, a person could lift 150 pounds at least 10 times but no more than 10 times, using proper lifting form.

B.5.2.6 Repetition (Rep). The lifting and then lowering of a weight.

B.5.2.7 Rest Interval. The period of rest that could include stretching or light activity between sets and different exercises. (See definition B.4.2.3, *Interval Training*.)

B.5.2.8 Set. A series of repetitions completed without rest.

B.5.3 Muscular Fitness Exercise Prescription.

B.5.3.1 Mode. Free weights, machine weights, circuit training, and calisthenics using body weight or tools and equipment from the fireground (e.g., hose, ladder, bundles), or anything that provides a resistance that the muscles have to overcome can be used to improve muscle fitness. The exercise modalities given here will be separated into the following four groups:

(a) *Free Weights.* Use of free weights (e.g., dumbbells and bar bells) requires a balance between the individual and the weight during lifting, which results in a greater use of muscles and the development of better coordination during forceful exertions. Balancing the individual and the weight improves strength transfer to real-life movements, whether for recreational, sport, or work activities. Free weights generally are less