Technical Principles and Practices of Fire Prevention

Module Introduction

MODULE OBJECTIVES

The students will be able to:

- *Explain the relationship between this course and their career development as competent fire prevention inspectors.*
- *Identify methods and procedures for applying codes.*
- *Given various examples of potential hazards, describe the hazard and discuss methods for gaining compliance.*
- *Define, identify components, and describe the theory related to common problems/issues that cross all occupancies.*
- *Discuss the aspects of report writing that contribute to effective communication of their inspection findings, conclusions, and recommendations to others.*

STARTING THE JOURNEY

You are about to begin your journey into the world of fire inspection. You can take one of many roads, and each road will take you to a slightly different place. It helps to think of the code your jurisdiction uses as your road map. This map has been developed over time and like any other road map, it keeps changing as the environment changes. If you wish to become a proficient inspector, you need to become intimately familiar with your code. You will need to study it and use it. These are the only ways you will ever come close to mastering it.

This course follows one road to help you on this inspection journey. The course developers thought that organizing the course around nine standard occupancy types would be one way to journey. After this introductory module, which covers some generic and specific points that are common to many occupancies, the other modules each deal primarily with one type of occupancy. The discussion in these modules centers on the key inspection issues and concerns for that particular occupancy. This is a key point that the course will emphasize over and over, but some of these issues and concerns apply to other occupancies as well. They are not necessarily unique to one occupancy.

So, you have to learn to extrapolate what you are learning about one occupancy and be able to apply this to other occupancies if appropriate. This won't be all that simple at first. But after a while, the carryover will become more routine.

The more you journey following your road map, the more you will begin to see similarities and patterns. When that begins to happen, it means you are making great progress. Instead of just seeing trees, you are beginning to recognize the forest.

But at some point on your journey, you will get involved with one of the occupancies. This is what inspection is all about. How does an inspector get involved with an occupancy? There are various ways. Let's look at some common ones.

BECOMING INVOLVED WITH AN OCCUPANCY

We covered the first method for becoming involved with an occupancy in the first course, *Introduction to Fire Inspection Principles and Practices* (IFIPP). This method is the scheduled inspection. Another method is personal observation of unusual or changing conditions noted during routine and emergency activities in your district (a proactive approach). Others include changes noted during prefire planning (also covered in the

first course) and while conducting complaint inspections. We'll allot some time to complaints, because dealing with them is an important part of an inspector's job.

DEALING WITH COMPLAINTS

Complaints come to a fire department in a number of ways. They may come from citizens, politicians, or business owners; from referrals from other city departments; or from the observations of fire department personnel. No matter how they come in, you must handle complaints professionally.

Most jurisdictions have established procedures to handle complaints. They usually get routed to the fire prevention bureau (if a code-related complaint). Sometimes station personnel handle the more basic, less technical complaints. Bureau specialists handle the more technical, complex issues. Often complaints are processed like a normally scheduled inspection until all hazards have been corrected.

Reporting procedures may vary, but they generally follow the normal inspection process with similar reports, or a complaint inspection report. (You should find out how your jurisdiction handles complaints.)

Good customer service requires reporting back to the complainant. If your department uses a formal process, you need to follow up with a letter, memo, or other appropriate report back to the customer. Always answer the basic questions in your report: who, what, when, where, why, how. Don't give out the complainant's name while conducting the complaint investigation. This is not generally public information; however, more often than not, the person involved knows the complainant.

Keeping this information quiet can help to avoid the escalation of a problem or neighborhood quarrel. Sometimes one person uses complaints to get back at another. Stay out of the middle of these situations. Be professional. Handle all complaints as if they are legitimate, and work to have all hazards corrected.

Good complaint resolution requires good technical know-how and expert diplomacy.

DEALING WITH THE UNEXPECTED

One of the most common happenings in an inspector's life is going out to inspect an occupancy type only to discover that a significant change has

taken place there. Although you do expect to run into these situations, they always happen when they are least expected. Sometimes you make this discovery during prefire planning, and these changes can have a far-reaching impact on the code requirements for the new occupancy.

When this happens, it's time to do more research. First ask whether the building construction meets the standards for the new occupancy. For example, was a small restaurant turned into a welding shop? You can find information on this by checking the building plans on file in the building department.

If it appears that significant changes must be made to meet construction code requirements, it's referral time. It may be necessary to notify the building official, electrical inspector, zoning department, health department, or others.

When you run into these situations and you are in doubt, go to more experienced personnel for help. If you try to make a call when you are in doubt, you may make serious mistakes. Take your time and do it right the first time.

RELATIONSHIP OF FIRE CODE TO OTHER CODES

A typical community has many codes to protect the health and safety of local residents. More populous or more affluent communities generally have more codes with more stringent provisions. Rural or poor communities have very limited codes. In some cases, States and even Federal standards fill in or supersede local codes.

The two codes with the greatest impact on fire safety are the building code and the fire prevention code. A fire prevention code normally includes the following areas of regulation:

- maintenance of fire protection features:
  - systems,
  - fire separations, and
  - exitways;
- use and storage of flammable and hazardous materials;
- limits on hazardous process or activities;
- emergency planning;
- upgrading fire protection features in existing buildings;
- overcrowding and other unsafe conditions; and
- life safety and automatic fire suppression system requirements.

The building code is the second code with a great impact on fire safety. Building codes initially were prepared on the premise that all matters pertaining to the construction of a building, either in its original state or through renovation, should be covered by some standard of safety. This includes all permanent or built-in fire protection features such as firewalls and separations, fire-resistant materials, safe exit corridors and stair wells, etc.

A building code becomes part of the local law once the jurisdiction legally adopts it. This adoption process makes the code the basis of building requirements to promote public safety, health, and welfare.

As you learned in the IFIPP course, in addition to the building code and the fire protection code, there are other codes, such as the electrical code and the plumbing code. This course will deal primarily with the fire protection code, but occasionally will make reference to the others, notably the building code. As an inspector starting out on your journey, the fire protection code will be your main guide.

But codes don't just appear out of the blue. There is a process by which codes get adopted.

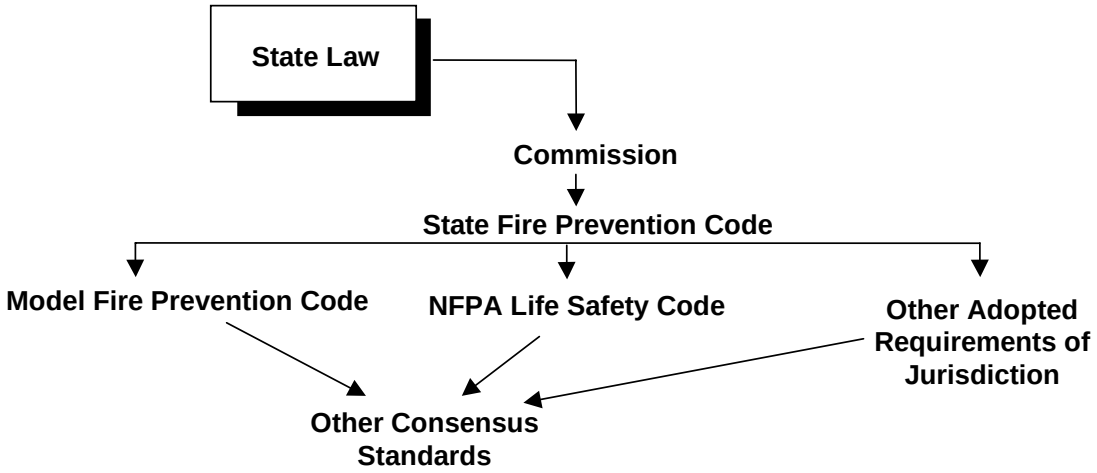
CODE ADOPTION PROCESS

It is extremely important that every fire and life safety inspector understand the community code adoption process. This process enables the inspector to perform an inspector's duties legally. This process may occur on one or several levels of authority: State, county, municipality, or agency. It may encompass several different methods or levels of authority. The inspector will need to research this point carefully to gain a full understanding of how one receives the authority to conduct inspections.

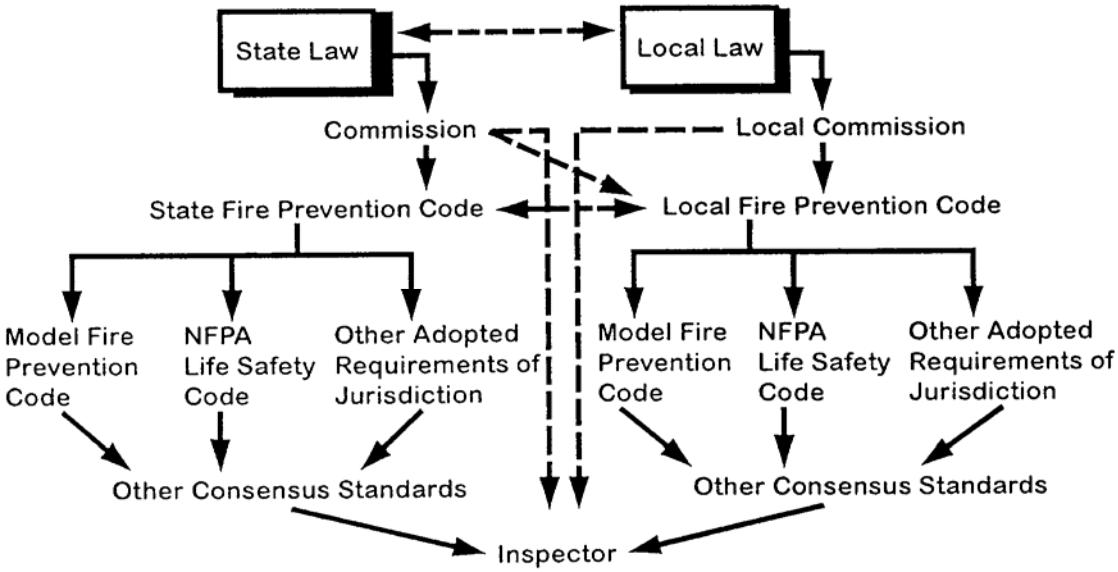
The simplest method is that a local municipality or lowest level of government has adopted one of the model fire prevention codes, and there is no level of government with a higher jurisdiction. This permits the inspector to review the adoption process (locally) and the local enabling legislation. The inspector will see that the authority is specified clearly within the model code; either it is given directly to the inspector, or to a higher authority that has delegated the authority to the inspector.

A more complicated system exists when the higher level of government has established a mechanism for the right to perform the duties of an inspector. An example of this is when the State government has passed legislation. This law establishes a commission to promulgate rules and

regulations pertaining to the prevention of fire and explosions. In the law, this commission also has the authority to establish the office of State Fire Marshal, which will exist and function to the degree permitted through the budgetary process. The State commission adopts a State fire prevention code through the regulatory process of the State. This State fire prevention code basically adopts one of the model fire prevention codes, with additions and deletions as noted. This State fire prevention code may also adopt the NFPA *Life Safety Code* from one of the consensus code-writing organizations. The model fire prevention code also refers to other identified codes and standards. Thus you have a long string of events to understand and to trace so that you understand exactly how you may enforce a particular point of a law.



Now add to this the consideration that a local or lower level of government may do the same, as long as it is not less strict then the higher level of government. This will complicate the process, in that some items may be left to the jurisdiction of the State, the State allows or delegates enforcement to the local entity, and the local entity has its own code to enforce. It becomes a very complicated process to understand exactly who may enforce which, when, and where. When this occurs, it is even more important that all those involved in the enforcement process understand clearly how they are empowered.



Codes are produced and published by editions, generally on three-to five-year cycles. You must research your local authority as far as you can, and gather as complete an understanding as possible of the process and thus of your authority.

ORGANIZATION OF CODES

Most model fire safety codes have a similar format. A scope section in the beginning indicates matters covered and matters excluded. New material is indicated by a black line in the left margin. National Fire Protection Association (NFPA) codes and standards use an asterisk to indicate explanatory material in an appendix. The word "shall" indicates a legal mandate. Codes generally have administrative information first.

The administrative section includes authority, permit requirements, and definitions. When model codes are adopted, the administrative information is frequently in the adopting ordinance. Local amendments normally are found in the adopting ordinance. The designation of the Authority Having Jurisdiction (AHJ) also is made in the ordinance. The AHJ may be the fire marshal, the fire chief, or some other person. That person may delegate the authority to a senior inspector. Conceivably the AHJ may be some type of board or committee, or this may refer to an appeals board of some type.

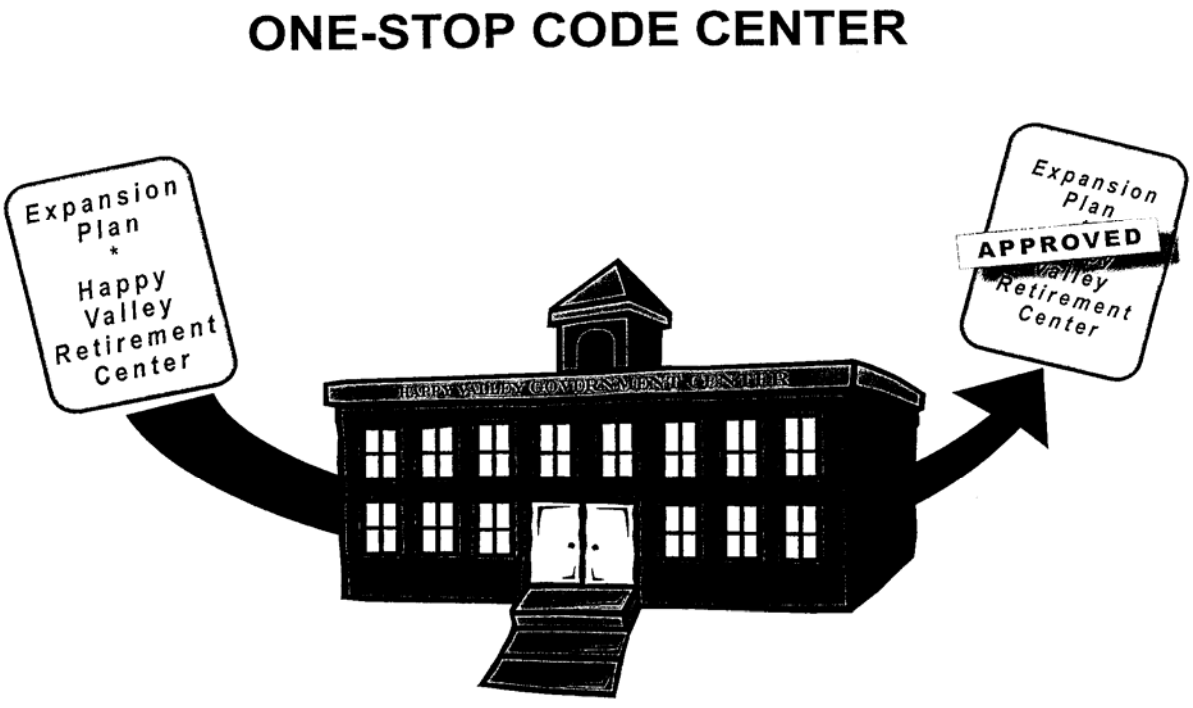
LIMITATION OF CODES

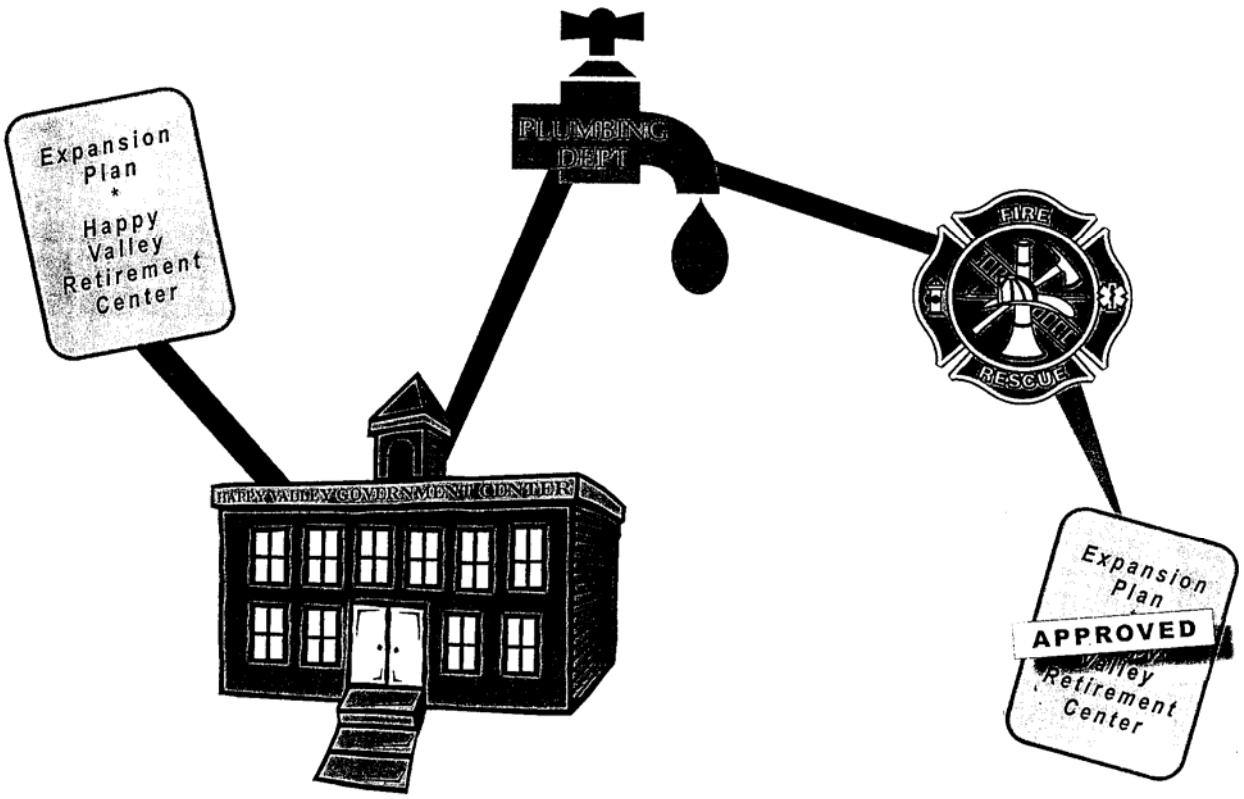
Most buildings or occupancies must comply with codes in effect at the time of construction or occupancy. Retroactive enforcement is permitted within limits. Justification for retroactive improvements may include major construction or a change in use. In some cases, laws or ordinances require compliance to more restrictive standards, e.g., life safety standards.

PLAN REVIEW PROCESS

Code development usually begins at the time land is subdivided or proposed for development. This process will help determine whether new construction meets codes. To be effective, the process should address all applicable codes. It may be simple in small communities. In a large community, it may be a complex multiagency process. The fire code review is one of the last steps in the process.

It's time to move from the processes that govern code adoption and review to a consideration of some common hazards found in all occupancies.

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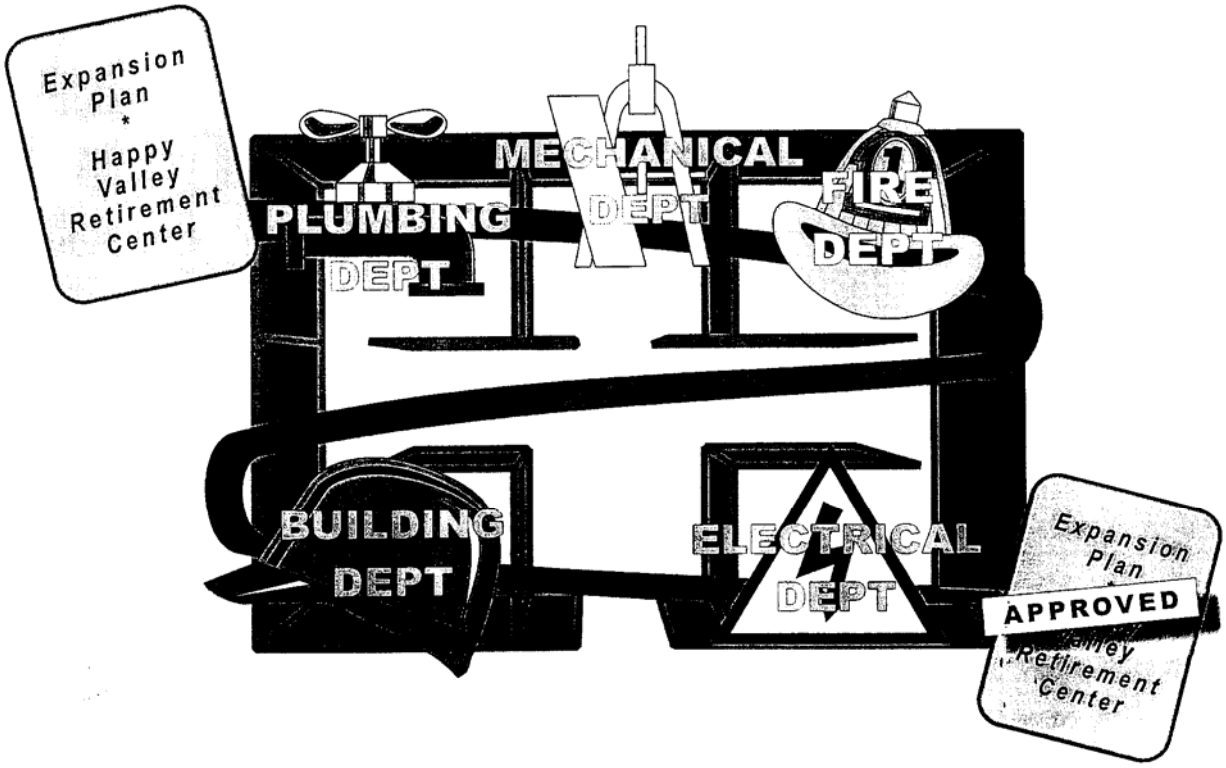
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COMMON OCCUPANCY HAZARDS

A fire hazard is a material, process, condition, or action that contributes to the start of a fire or that increases the severity of a fire. It may be an ignition source, some type of heat energy or fuel, or some type of combustible material. A hazard also could be an act or omission that may bring heat and fuel together. Common fire hazards exist in most occupancies. They include accumulation of rubbish, storage problems, and heating or electrical equipment. Special fire hazards are activities peculiar to certain occupancies. They include welding, flammable liquids storage, chemical production, and fireworks manufacturing.

Life safety hazards are materials, processes, conditions, or actions that delay or prevent evacuation, contribute to rapid fire and smoke spread, or decrease the effectiveness of installed systems. In some cases, the same deficiency, for example, the improper storage of flammable liquids, can be both a fire and a life safety hazard. An improper lock on an exit door is a life safety hazard and not a fire hazard. Other examples of life safety hazards are obstructed exits, inoperable smoke detectors, broken fire doors, and improper interior finishes. The first common hazard we will examine is the electrical hazard.

ELECTRICAL

Since fuel and oxygen normally are available, most of the effort to prevent fire aims to control the sources of heat. Heating, cooking, electrical systems, and open flames are common sources of heat energy; electrical energy is the most universally available. Sufficient electrical energy to cause a fire or injury is present in almost every room of almost every structure. You need only observe the coils in a toaster to see that a basic electrical circuit has more than enough power to cause fire or injury. Given the potential for damage and injury, the low rate of electrical incidents is a tribute to our code system, notably the electrical code.

Electrical Code

NFPA 70, *National Electrical Code* (NEC), is the most widely adopted and used code of any published by the NFPA. Within North America there is no other comprehensive standard available for the installation of electrical systems. This standard does not apply to the overhead and underground service provided by utility companies. The adopting regulation or ordinance must define the exact dividing point between utility responsibility and the application of the electrical code. It might be the meter socket, the main disconnect, or some other point.

The NEC is one of many consensus codes and standards developed by the NFPA. Because of its complexity, a group of committees prepared it. The primary goal of the NEC is to prevent fire and injury.

The NEC usually is one of the first safety codes adopted by small, growing municipalities. In rural areas that have no codes, most utility companies require that a licensed or certified inspector inspect all installations for compliance with the NEC before power can be supplied. There are private companies that provide this service.

In addition to the NEC, the standards of the National Electrical Equipment Manufacturers' Association (NEMA) are important to the safe and efficient use of electrical energy. For example, it is the NEMA standards that ensure that the plug on a lamp manufactured in Pennsylvania will work in a receptacle in a California condo. Without standards to define plugs, receptacles, lamp bases, fuses, and other components, there would be chaos.

Responsibility

Electrical inspectors generally do not inspect existing buildings routinely. Therefore, fire inspectors will discover most electrical problems. Unless the violations are simple items covered by the fire prevention code, qualified electrical inspectors should examine most electrical problems.

For the purpose of understanding and preventing fires of electrical origin, electrical fires fall into four categories.

- Worn-out, "tired," or damaged equipment. Over time, equipment or wires can wear out or deteriorate. This generally means that the insulation fails, or that corrosion or fatigue attacks the wires. The largest percentage of fires in this category results from motors. Failed wires, appliances, and fixtures also can fall into this category.

- Improper use. This category is for cases of incorrect use of tested and approved components, for example: using a number 18 lamp cord to supply a high-powered electrical heater. The three most common causes of incidents in this category are the improper uses of heating appliances, electric motors, and extension cords.

- Accidental occurrences. Fires that result from accidental misuse or oversight. Examples are clothing left in contact with a lamp, objects dropped into electrical equipment, or heating appliances left on unintentionally.

- Defective installation. This category includes fires caused by installations that are not acceptable under the NEC.

The heat of ignition in electrical fires can be either from arcing or from overheating. Personal injury results from contact with energized items or from burns from arcing. Arcing occurs when electrical current is interrupted at a switch or other point. The size and duration of the arc depend on the voltage and the material involved. The arc inside a switch is short and small. However, it is sufficient to ignite a proper mixture of air and natural gas. The arc from an electric welder can last for quite a long time.

Components

In order to understand the codes and to refer problems properly to an electrical inspector, it is helpful to know some of the language. Here are some commonly used terms:

Conductor. A conductor is a material, usually copper or aluminum, used to transmit or conduct the electrical energy from its point of generation to its point of use. Conductors are usually some type of wire, but the NEC rarely uses the term "wire." What the code refers to as a conductor, most people call a wire. However, a busbar or foil strip also could be a conductor. Conductors are either bare or covered, depending on whether or not electrical insulation envelops them.

Cable is an assembly of two or more conductors. Individual large conductors also are referred to as cable, because they consist of several strands of smaller conductors. When used in the code, a cable is usually an assembly of two or more conductors within an outer metallic or nonmetallic enclosure.

Flexible cords normally exist between a receptacle and a lamp, appliance, or tool. Cable used for permanent wiring in a building is too stiff for this purpose.

Overcurrent protection. Overcurrent is a flow of electricity that exceeds the rating of the equipment or the conductor. Overcurrent protection is a fuse or circuit breaker that interrupts an excess of current.

Fuse. An enclosure containing a line of metal that will melt and open a circuit at a predetermined level of overcurrent.

Circuit breaker. A device designed to open and close a circuit by manual action, and to open the circuit automatically on a predetermined overcurrent.

Thermal overload devices or thermal protectors (as applied to motors). A protective device for assembly as an integral part of a motor or motor compressor that protects the motor against dangerous overheating due to overload and failure to start.

Ground-fault-circuit interrupter (GFI). A device intended for the protection of personnel. It functions to de-energize a circuit or portion thereof within an established period of time when a current to ground exceeds some predetermined value that is less than that required to operate the overcurrent protective device of the supply circuit.

Circuit breakers operate to protect wiring and equipment from damage that results from overheating or fire at high current levels. The GFI operates to protect people from damage that results from current flow through the body to ground. GFIs operate at very low current levels. A GFI will not protect a person if the current is flowing through the body between two conductors in a circuit. Most electrocutions occur from incidents where the flow is to ground and not between conductors.

Ground. A conducting connection, whether intentional or accidental, between an electrical circuit or equipment and the earth, or to some conducting body that serves in place of the earth.

Grounded. This refers to something connected to earth or to some conducting body that serves in place of the earth.

Effectively grounded. This is something intentionally connected to earth through a ground connection or connections of sufficiently low impedance and having sufficient current-carrying capacity to prevent the buildup of voltages that may result in undue hazards to connected equipment or to persons.

Boxes protect wire ends, connections, and splices.

Raceway. An enclosed channel designed expressly for holding wires, cables, or busbars, including surface raceways and conduit. The raceway may be of metal or nonmetallic materials. Raceways may be of metal or insulating material, and the term includes rigid metal conduit, rigid nonmetallic conduit, intermediate metal conduit, liquid-tight flexible conduit, flexible metal tubing, flexible metal conduit, electrical nonmetallic tubing, electrical metallic tubing, underfloor raceways,

cellular concrete floor raceways, cellular metal floor raceways, surface raceways, and busways.

Wiring Methods

The NEC recognizes many wiring methods. Some are very specialized and are used only in very limited applications. Except for outdoor overhead wiring, most wiring methods use some type of insulated conductors, either in a raceway or assembled into some type of cable. Here too, there are some common technical terms.

Nonmetallic sheath cable. Commonly (incorrectly) called by the trade name ROMEX, this is one of the most common wiring methods. It is standard for residential construction and allowed in some other occupancies. Nonmetallic sheath cable is easy to work with and is relatively inexpensive.

Armored cable. Most people know the common armored cable as BX. Armored cable gets it name from the tough covering of spiral steel wrapped around the conductors.

Conduit. This is a metal or plastic tube that protects the conductors. Conduit is required in more critical installations.

Hazardous area. These are areas where flammable or other hazardous materials may be present and may cause a fire or explosion if exposed to electrical energy or heating. Hazardous areas require special wiring methods and fixtures to prevent ignition.

Common Faults

In addition to these major electrical problems, there are others we will not take time to discuss. However, it is worth listing them:

- deteriorated components;
- unsupported components;
- damaged or broken components;
- exposed live elements;
- flexible cords improperly used;
- boxes not covered;
- cords or cables not protected from damage;
- components overheated;
- improper installation; and
- incorrect wiring methods.

FIRE SEPARATIONS AND ASSEMBLY RATINGS

This topic is a very important one; it will apply to every occupancy. We will examine the key concepts of fire separations and assembly ratings.

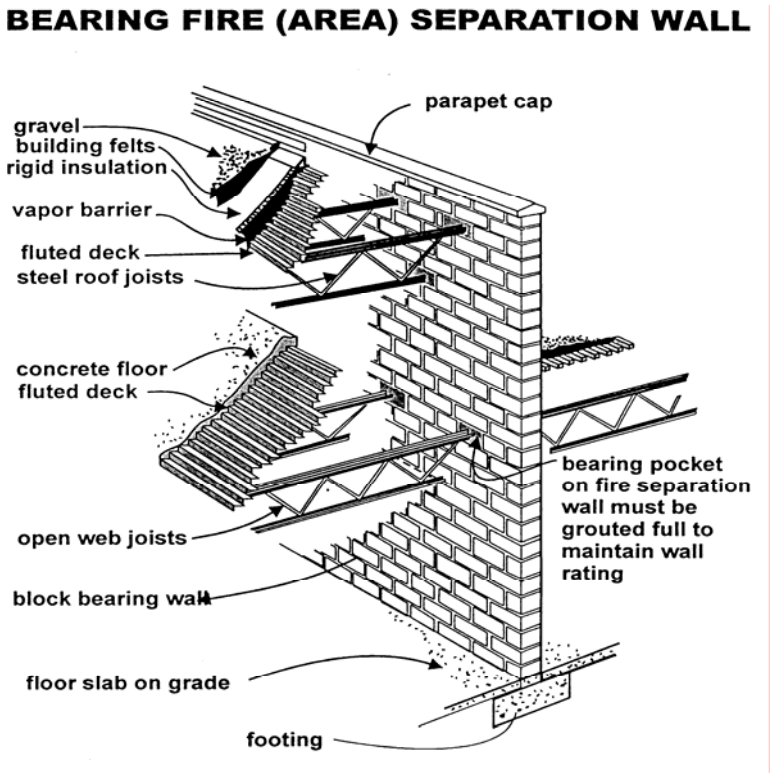
Theory of Compartmentation and Separation

Historically, one of the first methods used to prevent total loss of factories and warehouses was the firewall. These walls were strongly constructed of masonry, and designed to withstand the collapse of the building on one side of the wall without permitting the fire to pass. The wall had a parapet extending several feet above the roof. If the building had a combustible exterior wall, the firewall extended through the wall to prevent the fire burning around the wall. Firewalls were clearly identifiable from the exterior of the building.

In modern code requirements, the firewall has lost some of its unique appearance and ability to restrict the spread of fire. These walls in most cases will not survive the collapse of part of the building without serious damage. They will, however, inhibit the spread of fire through the structure and provide a place for the fire department to make a stand. Unfortunately, the location of the firewall may no longer be evident from the building exterior.

The early 20th-century factory may have had strong masonry firewalls between sections, but the area between the firewalls was one large fire compartment. Multistory buildings had openings between floors. Stairs and conveyors were not enclosed. Floors and interior walls were constructed primarily of wood. Mill construction featured heavy timber structural elements. These structures were considered slow burning, but one modern expert in building construction renamed them "long burning."

In 1904, a conflagration spread through downtown Baltimore, Maryland. Buildings that were believed to have a high degree of resistance to fire damage were destroyed. After the fire, it was determined essential to improve methods of assessing the fire resistance of construction materials. Several organizations began a process ultimately resulting in the test methods used today.



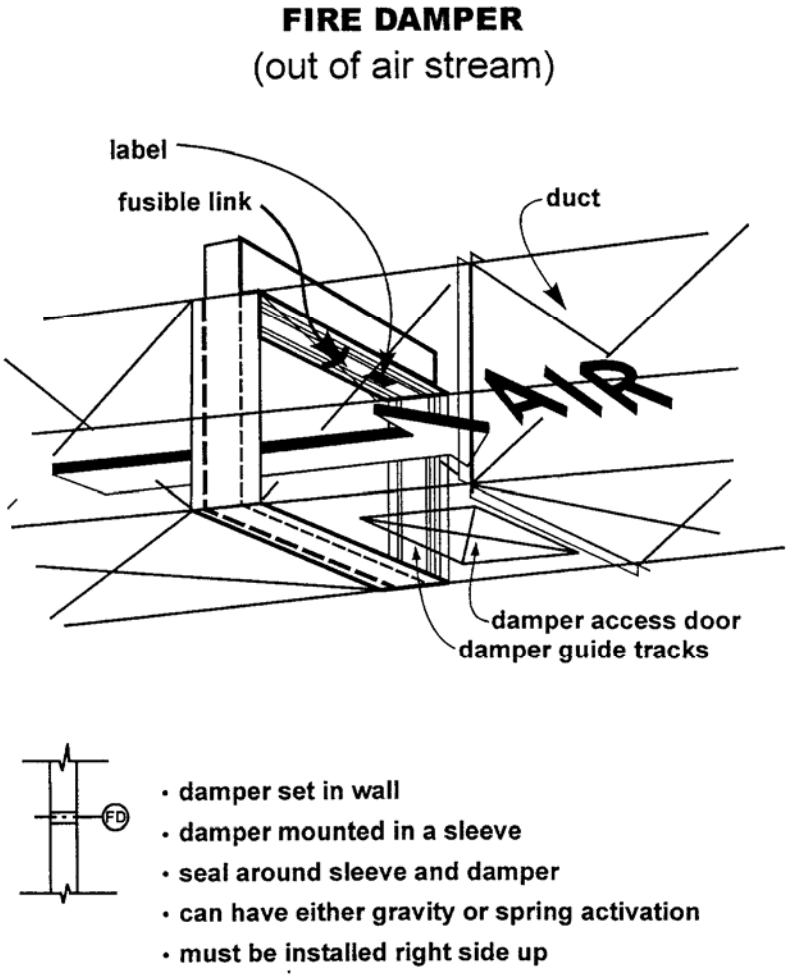
Construction

Modern fire-resistant construction methods use both inherently fire-resistive materials and assemblies that provide the necessary protection. The simplest of assemblies is a stud wall with regular gypsum board on each side. If increased protection is required, fire-resistive gypsum board is used and, if needed, additional layers of board are added. Dropped ceilings with tiles in a grid are more complex. With the exception of concrete, walls, floors, and ceilings are made of a combination of materials. Even concrete normally is reinforced with steel. Therefore, the term "assembly" is used frequently to indicate that the fire resistance results from all of the materials used in a particular application. This is particularly true of floor-ceiling combinations. All of the materials from the lower side of the ceiling to the top of the floor are part of the total fire-resistant assembly.

Structural materials are tested on the top or the side of a furnace. Wall assemblies are tested as one wall of the furnace. Floor-ceiling assemblies are tested on the top of the furnace. Nationally recognized and published standards dictate the exact method of conducting the tests. Standard temperature is applied over time.

The results are expressed in terms of time; for example, a one-hour assembly survived at least one hour in a test. Failure criteria are included in the standard, including structural collapse and transmission of heat or flame.

Fire separations are used to reduce the size of fires and to protect areas of different use or hazard level. Firewalls divide a structure into separate fire areas. Floor-ceiling assemblies create separate fire areas on different floors. Separation walls protect exitways from other portions of the building. Other walls separate hazardous areas from areas of general occupancy.



Separate Hazardous Areas From General Occupancy

Openings in fire separations need protection. Protection features include fire doors, fire dampers, and sealing all openings at points where cables, pipes, or other items pierce walls or floors. The space between exterior walls and floor in some construction types also requires sealing.

Fire dampers are installed to maintain the required integrity of a fire-resistance-rated assembly. Fire dampers must comply with the requirements of UL 555 and bear the label of the testing agency. They also must be installed in accordance with the manufacturer's installation instructions. Dampers must have access for maintenance.

The installation of fire doors must maintain the integrity of a fire-resistant wall assembly. Usually the requirements for the installation of fire doors are found in the building codes; requirements also are noted in fire prevention codes relating to fire safety issues. NFPA 80, *Standard for Fire Doors and Windows*, covers the installation and maintenance of fire door assemblies and windows.

The requirement for fire doors is determined by the minimum opening protection, located in the required assembly rating of the walls. These ratings generally are as follows:

- 4-hour and 3-hour walls = 3-hour-rated doors;
- 2-hour walls = 1-1/2-hour-rated-doors;
- 1-1/2 hour walls = 1-1/2-hour-rated doors;
- 1-hour walls for exit enclosure, shafts, fire partitions, and fire separation assemblies = 1 hour or 3/4 hour;
- 1-hour exit access corridor walls = 20-minute rating; and
- 1/2-hour exit access corridor walls = 20-minute rating.

Fire doors must be self-closing or automatic closing and installed as part of an approved assembly, which includes the door, frame, closer, and self-latching device. Fire doors protecting doorway openings to exit enclosures shall be labeled means of egress fire doors and have a maximum transmitted temperature endpoint of not more than 450°F (232°C) at the end of 30 minutes of standard fire test exposure. Fire door assemblies shall be labeled by an approved agency. Fire doors shall have a label showing the name of the manufacturer, its rating, and maximum temperature rating end point, where required, permanently affixed and applied at the factory where assembly is done.

Fire doors are permitted to have approved wire glass panels which generally are as follows:

- 3-hour rating = none permitted;
- 1-1/2-hour and 1-hour rating = 100 square inches maximum;
- 3/4-hour rating 1,296 square inches maximum; and
- 20-minute rating not limited.

Labeled door frames shall be installed and anchored into the wall in accordance with their listing. Door frames in drywall installations shall be of the wrap-around type.

Types of fire door installations:

- swinging doors;
- horizontal slide door;
- vertical slide door;
- rolling steel door; and
- special purpose, horizontal, sliding, and accordion or folding doors.

Actual fire-resistance rating required for fire separations is specified by building codes. The continued integrity of fire resistance is a requirement of the fire prevention code.

FIRE EXTINGUISHER DISTRIBUTION AND MAINTENANCE

Class A fires are ordinary combustibles, such as wood, cloth, paper, rubber, and some plastics. Method of extinguishment is cooling, smothering, insulating, or by inhibiting the combustion chain reaction. Class B fires are flammable or combustible liquids and gases. Method of extinguishment is smothering insulating, or by inhibiting the combustion chain reaction. Class C fires are energized electrical equipment. The best method of extinguishment is to kill the power; then the fire becomes a Class A or B fire. Principal methods of extinguishment are smothering and insulation. Class D fires are combustible metals such as magnesium, potassium, sodium, titanium, and zirconium, which require a special agent that does not react with the burning metal. Principal methods of extinguishment are inhibiting the combustion chain reaction or covering the burning metal. Class K fires involve cooking appliances that involve combustible vegetable or animal oils or fats.

Extinguisher ratings are based on the size of fire they can extinguish for Class A and B fires. Rating is for estimating only; actual effectiveness will depend on the skill of the extinguisher operator.

Distribution guidelines are based on the following criteria. Area is a consideration and is identified by the square footage allowed per type of extinguisher, size, and agent. Travel distance is a consideration and is identified as the maximum distance to an extinguisher, based upon the occupancy hazard and the size and agent of the extinguisher. Hazards present will dictate the class, size, and agent within a particular fire extinguisher. It also will identify the occupancy hazard, which will have an influence on the type of extinguisher.

Table 3-2.1 shows the required minimum rating, maximum floor and travel distance allowed for class A extinguishers. Table 3-3.1 shows the required minimum rating and travel distances allowed for class B extinguishers.

Table 3-2.1 (NFPA Standard 10)

	Light (Low) Hazard Occupancy	Ordinary (Moderate) Hazard Occupancy	Extra (High) Hazard Occupancy
Minimum rated single extinguisher	2-A	2-A	4-A
Maximum floor area per unit of A	3,000 sq. ft.	1,500 sq. ft.	1,000 sq. ft.
Maximum floor area for extinguisher	11,250 sq. ft.	11,250 sq. ft.	11,250 sq. ft.
Maximum travel distance to extinguisher	75 ft.	75 ft.	75 ft.

Source: Table 3-2.1, NFPA 10, *Standard for Portable Fire Extinguishers*. Quincy, MA: NFPA, 1998.

Table E-3.4 (NFPA)

Class A Rating Shown on Extinguisher	Light (Low) Hazard Occupancy	Ordinary (Moderate) Hazard Occupancy	Extra (High) Hazard Occupancy
1A	—	—	—
2A	6,000	3,000	—
3A	9,000	4,500	—
4A	11,250	6,000	4,000
6A	11,250	9,000	6,000
10A	11,250	11,250	10,000
20A	11,250	11,250	11,250
30A	11,250	11,250	11,250
40A	11,250	11,250	11,250

Note: 11,250 is considered a practical limit. Source: Table E-3-4, NFPA 10, *Standard for Portable Fire Extinguishers*. Quincy, MA: NFPA, 1990.

Table 3-3.1 (NFPA)

Type of Hazard	Basic Minimum Extinguisher Rating	Maximum Travel Distance to Extinguishers (ft)
Light (low)	5-B	30
	10-B	50
Ordinary (moderate)	10-B	30
	20-B	50
Extra (high)	40-B	50
	80-B	50

Source: Table 3-3.1, NFPA 10, *Standard for Portable Fire Extinguishers*, Quincy, MA: NFPA, 1998.

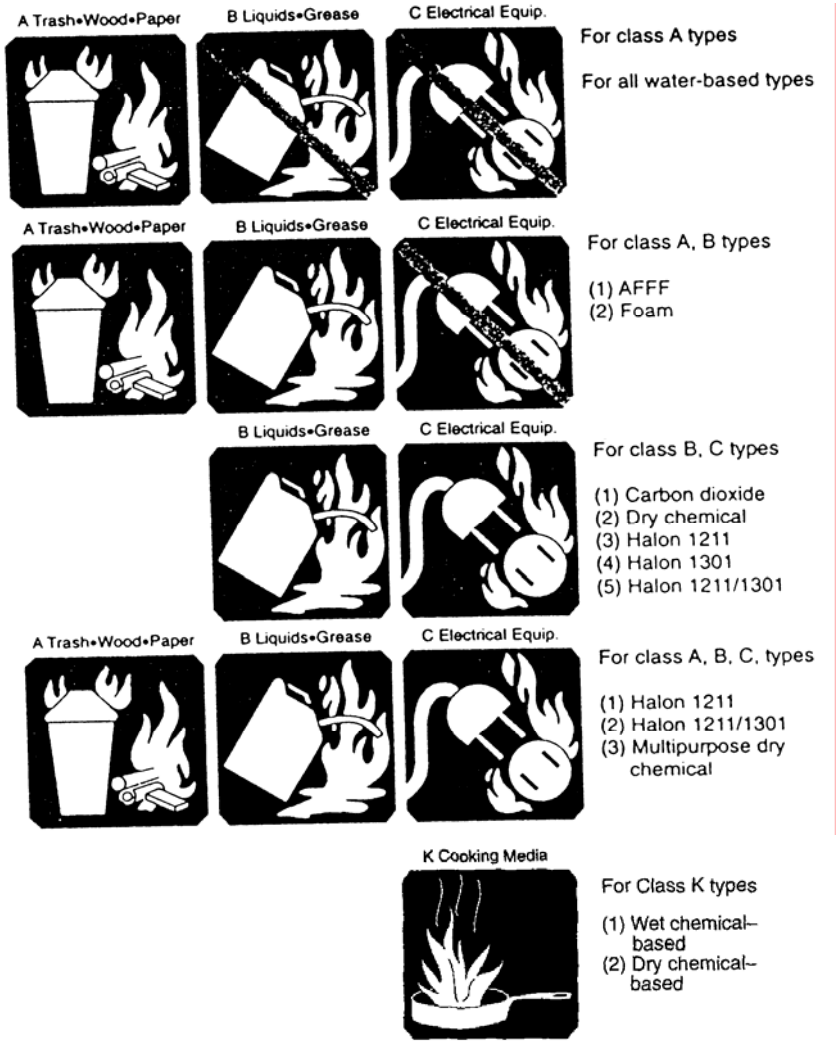
Class C extinguishers are needed for fire in energized electrical equipment; once the equipment is no longer energized, the fire becomes either a Class A or Class B. The agent is generally carbon dioxide, dry chemical, or Halon. Class D extinguishers are required for fires in combustible metals. The agent is chosen based on the type of metal to be protected or extinguished. The fire is extinguished by the agent "smothering" the fire. Class K extinguishers are provided for hazards where there is a potential for fires involving cooking oils and fats. The maximum travel distance shall not exceed 30 ft. from the hazard to the extinguisher.

INSPECTION AND MAINTENANCE OF EXTINGUISHERS

An inspection (quick check) would answer the following questions:

- What is the occupancy hazard classification?
- What type(s) of extinguishers should be present?

Recommended Marking System
Figure B-2-1 (NFPA Standard 10)



- What type(s) of extinguishers are present?
- Is it charged?
- Is it tagged, and has it been serviced annually?
- Is it located without any obstacles for easy access, and mounted properly?
- Are extinguishers located within the allowable travel distances?

Annual service is usually required and is the owner's responsibility. The inspector needs to confirm service via the tag on an extinguisher, as well as any records the occupancy owner may have. A hydrostatic test is

required in accordance with a required schedule. This test is required per the type of cylinder used, and is the owner's responsibility. The date of last tests will be stamped on the cylinder.

Stored pressure fire extinguishers that require a 12-year hydrostatic test shall be emptied every 6 years and inspected internally. Extinguishers that have passed the 6-year requirement shall have the information recorded on a metallic label affixed to the extinguisher shell. In addition, extinguishers that have undergone an internal examination or have been recharged shall have a "verification of service" collar located around the neck of the container.

INSPECTION COMMUNICATION AND DOCUMENTATION

All inspections need to be documented as directed by the AHJ. Both the inspected party (customer) and the inspection organization need a record of the event. The inspection organization needs the information to maintain work performance records and for possible future use in any type of legal proceedings. The inspecting organization may initiate legal proceedings to gain compliance with the code. On very rare occasions, proceedings are initiated against the organization because of something that happened or did not happen as a result of the inspection. In either case, accurate records will be essential.

If the inspector sees any code deficiencies, the owner or occupant should get a notice of necessary corrective action. The circumstances of the violation, along with the language of the code, usually indicate what party to notify. The notice must be complete and must indicate corrective action clearly.

Inspection documentation can take many forms. A report, a special form, a letter, or an internal memo are all acceptable, depending on the circumstances. The inspector could handwrite it, type it, or compose it on a computer. The inspector may call it a report, a notice of violation, an order to correct a violation, or use some other descriptive name. Regardless, the documentation must provide a clear and complete picture that someone who was not present at the inspection can understand. For the purpose of this module, we will call this an inspection report.

The AHJ normally provides guidelines for the information required in the inspection report. Basic information normally required includes the location of the inspection; the date of the inspection; the responsible party--owner or operator; a reason for the inspection; and observations.

When the report is a notice to correct violations of the code, all comments must relate to legal requirements in effect. It must state the specific location of the condition to be corrected. It must use verbs indicating action to be taken. Words like repair, replace, install, or remove are examples of correct language. The referenced section of the code or standard should be included. The reader needs to be able to recognize the condition, and to understand what actions to take to be in compliance.

Because reports may be involved in judicial proceedings at some point, inspectors must prepare them carefully.

Some jurisdictions permit inspectors to provide recommendations. If comments are written as opinions or recommendations, the report should note this clearly as such, and not imply they are legal requirements.

Some examples of poor comments:

- The doors in the stairway are not in compliance with the code.
- The fire door is broken.

Usually any comment that describes a condition rather than a solution is not helpful.

Some examples of good comments:

- Repair the emergency light to illuminate the means of egress, first-floor hall between 102 and 112.
- Adjust the fire door to self-close and latch, second-floor stairway 2.

These are specific, and say exactly what the occupant needs to do to comply.

When documenting noncompliance conditions, remember that these comments and directions for compliance are not based on conjecture or derived from opinions of right and wrong. Conditions must be based on legally adopted codes or standards. Also remember that the reader of the report must be able to recognize the condition, and what needs to be done to be in compliance.

Report writing is a topic that is extremely difficult to address adequately in a few short comments. Similar to learning a musical instrument, the only real answer is practice, practice, and practice! In addition to all this practicing, you need to read, read, and read. Combining both ultimately

will help you to develop the skills necessary to write a clear, concise, and effective report.

The inspector's responsibility is not only to identify fire and life safety hazards, but to communicate the findings of an inspection effectively to those who must take the necessary corrective actions. This includes the identification of a hazard, why it is a hazard (code reference), and simple, clear ways to eliminate or correct the hazard, all submitted in writing.

This may take various forms and styles, depending upon the established procedures within your jurisdiction. There is no one correct way; all can be effective, and this is the key. The format of the report may be anything from a standard check-off-type form to a full narrative letter. In between these can be combinations of the two, as well as a memorandum. Again, this is your jurisdiction's call.

Purpose

The purpose of writing a report is to communicate your inspection findings, conclusions, and recommendations to others. It is necessary to produce a document for use and reference at a later time, whether for a court appearance or a followup inspection. This report gives the inspector the opportunity to record all observations, findings, and recommendations accurately. It provides, for the property owner, occupant, or the one responsible for the corrective action, a clear "road map" for correcting the deficiencies. Simply stated, the report is a communication, historical document, and "road map" for the future.

Format and Style

Format and style are options of the jurisdiction. Each has advantages and disadvantages; all must be decided at the local level. Basic examples of these formats are letter; memorandum; a report form with narrative and without narrative; and combinations of any or all of the above.

The simplest format is the report form without narrative. It does not offer the opportunity to discuss corrective action, and it limits your recording ability to those items listed. It is quick and simple for the inspector. In the narrative area of a form you can discuss corrective action and recording beyond the listed items. Without the narrative, the form becomes a "speeding ticket," strict enforcement, missing the opportunity for education and consultation. A sample report form appears on the next page.

The memorandum format is less formal than a letter. It is simple and at times can appear cold, being too informal. Very clearly it allows for explanation of the deficiencies found, code references, and corrective actions.

The letter format is the most formal. It offers the greatest opportunity, but at the same time requires the greatest skill in writing, and will require more time.

Report Writing Tips

Writing is a process. It requires prewriting, writing, and postwriting. All of this requires time, patience, and dedication to the communication process.

Your prewriting will start with an accurate recording of observations noted during the inspection. Once you note these observations, take the time to think before beginning your code research and then research the code very carefully. After you have concluded your research, you will be ready to write.

As you begin the writing process, you need to identify and consider your audience, purpose, problem, or need for writing--the **goal** of the document. You must identify your audience: Who will read it?

How will they understand clearly what must be done? Finally, you will organize your material. The simplest method is to develop your report the same way you conducted the inspection: from top to bottom or from bottom to top.

The actual writing will require the most time. First, you should outline your notes, then develop a draft of your report with the understanding that this is not the final document. This will allow you the opportunity to be creative, writing quickly and freely, capturing your thoughts. Then read what you wrote and ask some basic questions:

- Is it simple and clear?
- Does it reflect your observations accurately?
- Have you offered suggestions for corrections?
- Is it as concise as possible?

During the revision phase you must assess what you wrote, continually addressing the previously mentioned questions. Revising and polishing your writing will take time to improve the content, style, and mechanics, but the reader will be much more receptive to a good report, making your time spent rewriting important.

Access to a computer with a word processing program will assist the entire writing process. It will allow for the development of the notes and observations into an outline, and the outline into a narrative. Corrections, deletions, and additions are much simpler. Word processing offers the opportunity for composition, editing, storing, and retrieving for further revision and editing.

The report must be based on legal requirements in effect. It must be as specific as possible.

Effective writing is clear and concise. The prose has logical flow and development, offering clear explanations of all points.

Well-constructed sentences are the foundation of writing. Characteristics of effective sentences include the following.

- They are short and clear.
- They eliminate unnecessary words.
- They use the active, rather than the passive, voice.
- They use concrete rather than abstract words.
- They exhibit consistent expression through parallel construction by the use of clear, logical expressions repeated as necessary.

The report must indicate action, such as repair, replace, install, and remove. Always reference the applicable standard or code section. No comments should be written as opinion.

SUMMARY

Your journey into fire inspection has started. Already you have learned a number of things about the topic. Becoming involved with an occupancy can happen in a number of ways, and we pointed out the main ones while emphasizing the complaint route. Then we discussed the relationship of the fire code to the other codes. Next we looked briefly at the code

adoption process. A discussion of the code limitations and the plans review process rounded out this section.

We then began looking at some of the generic issues associated with just about all occupancies. These are electrical hazards, fire separation and assembly ratings, and fire extinguisher requirements. We spent a good deal of time on the electrical hazard, looking at such aspects as the NEC, the inspector's responsibilities regarding electrical inspections, the components associated with inspection of electrical hazards, and various wiring methods. We then looked at the theory behind compartmentalization and separation, focusing on wall and door ratings. Next we examined the requirements associated with portable fire extinguishers.

The module ended with a discussion of the steps involved in preparing the inspection documentation and report and pointed out a simple process for producing the report.

Activity I.1

Code Identification

Purpose

To identify the codes that an inspector will need for use within a specific jurisdiction.

Directions

Using your codes and your knowledge, answer the following questions individually.

1. What are the current fire, building, and other codes adopted by your jurisdiction?

2. Do you know the adoption process?

3. Do you have copies of the adopting document?

4. Do you have or have your read, your adopting ordinance or legislation?

5. How does your jurisdiction address existing occupancies at the time of code adoption?

Activity I.2

Code Research

Purpose

To demonstrate the ability to research and identify applicable code requirements.

Directions

1. Using your code book and an easel pad, identify the code section that applies to each of the following code issues.

    a. Where is it stated that extension cords cannot be used as a substitute for fixed or permanent wiring?

    b. Where are requirements for obstruction of exits found?

    c. Where are requirements for posting of occupant load in public assemblies found?

    d. Where are the requirements for the storage of cylinders in welding and cutting operations found?

    e. What are the permit requirements for flammable liquids in residences, and where are the requirements found?

    f. Where are the requirements for the cleaning and maintenance of commercial cooking equipment found?

    g. Where are the requirements for the testing of existing alarm systems found?

    h. Where are the requirements for the testing of existing fire sprinkler systems found?

    i. Where are the requirements for the testing of existing smoke control/ exhaust systems found?

    j. Where are the requirements for permits and licensing for explosives found?

    k. Where are the requirements for the posting of emergency exit plans for hotels found?

l. Where are the explanations found for code markings with solid lines in margins?

2. Select a spokesperson to present your group's findings.

3. You have 40 minutes for this activity.

Activity I.3

Effective Communication: Sentence Writing

Purpose

To demonstrate the ability to write clear and concise statements, given a hazard and the code reference, such that the reader will know what the violation is and why, as well as what may be done to correct the situation.

Directions

1. Individually, refer to the list of code issues in Activity I.2. As assigned by the instructor, take the code issue and write a statement or statements that will communicate the following information:

   a. What the code issue is (hazard or violation) for the following:

      - Extension cords.
      - Obstruction of exits.
      - Posting of occupant load.
      - Storage of cylinders for welding and cutting.
      - Permit for flammable liquids in residence.
      - Cleaning and maintenance of commercial cooking.
      - Testing of fire alarm systems.
      - Testing of fire sprinkler systems.
      - Testing of smoke control/exhaust systems.
      - Permit and license for explosives.
      - Posting of emergency exit plans in hotels.

   b. Why the hazard is an issue (code reference).

   c. Where the hazard is located.

   d. How the hazard may be corrected.

2. Discuss within your group each of your individual statement(s). After discussion, choose a spokesperson and one statement to be presented to the class.

3. Each group will review and discuss one of its statements with the whole class.