Regulatory Framework

CHAPTER 2

CONTENTS

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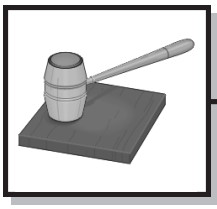


CAUTION:

Communities often adopt floodplain regulations that exceed the NFIP minimum requirements. More restrictive local codes and ordinances supersede the minimum requirements of the NFIP discussed in this manual. This section will examine only the minimum NFIP requirements governing construction in a Special Flood Hazard Area. Local building codes and construction criteria vary widely across the country. The reader must contact the local permit office to determine what floodplain management & building code requirements are in place.

2.0 Introduction

This chapter discusses the National Flood Insurance Program (NFIP) floodplain management requirements that apply within regulatory floodplains. A regulatory floodplain, established through the NFIP, is known as a Special Flood Hazard Area (SFHA). Communities have the primary responsibility for regulating development and construction in floodplains and do so through a range of techniques that can include land use plans and policies, zoning, subdivision, and sanitary ordinances, single purpose floodplain management ordinances, and building codes and standards.

Communities that participate in the NFIP must adopt and enforce floodplain management requirements that meet or exceed minimum criteria established by the Federal Emergency Management Agency (FEMA), which administers the program. Communities meet this requirement by either adopting a single purpose floodplain management ordinance or by incorporating NFIP floodplain management requirements into their other land use measures and building codes. Many States and communities have adopted floodplain management requirements that go beyond NFIP minimum criteria.

This chapter discusses the community floodplain management requirements and building code provisions that apply to development in floodplains, including building utility systems. Topics that are covered include:

- background of the NFIP;
- the community permitting process;
- NFIP floodplain management requirements;
- building codes; and
- health and sanitary regulations;

2.1 Background of the National Flood Insurance Program (NFIP)

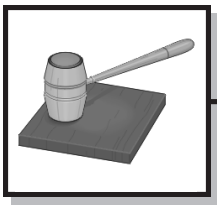
In 1968, the United States Congress passed and the President signed into law the National Flood Insurance Act, which created the NFIP. The NFIP is a

Federal Program enabling property owners to purchase insurance protection against losses from flooding. Participation in the NFIP is based on an agreement between local communities and the Federal Government which states that if a community will adopt and enforce a floodplain management ordinance to reduce future flood risks to new and substantially improved structures in Special Flood Hazard Areas (SFHAs), the Federal Government will make flood insurance available within the community as a financial protection against flood losses.

FEMA publishes maps designating SFHAs and the degree of risk in those areas. The SFHA in each community is identified on a Flood Hazard Boundary Map (FHBM) or Flood Insurance Rate Map (FIRM) prepared by FEMA. The limits of the SFHA are based on the area inundated during the Base Flood (a flood having a one percent chance of being equaled or exceeded in any given year; also referred to as a 100-year flood). Commonly accepted computer models that estimate both hydrologic and hydraulic conditions are used by FEMA to determine the Base Flood Elevation (BFE). Floodplain areas within the SFHA are either mapped as A zones or V zones.

V zones (Zones VE, VI-30, V), also known as Coastal High Hazard Areas, are mapped along the nation's coastlines. V zones, which include high velocity flows, breaking waves, and often debris, contain severe risks that present special challenges in ensuring that new development does not result in increased flood damages. NFIP regulations contain specific elevation and structural performance requirements for buildings constructed in V zones. Included are the requirements that natural features, which act to reduce flooding, such as frontal sand dunes and mangrove stands, are not altered.

All other areas within the SFHA are identified on FIRMs with one of the A zone designations (AE, AR, A1-30, AO, AH, or A). This includes riverine and lacustrine (lake) floodplains and coastal floodplains landward of V zones. A special risk area identified within A zones in riverine areas is the *floodway*. The floodway is an area identified on a FIRM or a Flood Boundary Floodway Map (FBFM) that represents the portion of the floodplain that carries the majority of the flood flow and often is associated with high velocity flows and debris impact. As with V zones, floodways often represent severe risks that present special challenges for local officials. Any new development in floodways must not obstruct flood waters or increase the BFE.



Flood insurance coverage is available to all owners and occupants of insurable property (a building and/or its contents) in a community participating in the NFIP. Almost every type of walled and roofed building that is principally above ground and not entirely over water may be insured if it is located in a participating community. To encourage participation in the NFIP by communities and the purchase of flood insurance by individuals, insurance premiums for buildings constructed prior to the issuance of a FIRM (referred to as pre-FIRM) are subsidized. Buildings constructed after the date of the FIRM (referred to as Post-FIRM) are rated based on their risk of flooding.

NOTE:

Unless superseded by more restrictive local requirements, the minimum NFIP requirements affect existing pre-FIRM buildings only when an existing building is substantially damaged or substantially improved.

Communities administer the floodplain management requirements of the NFIP. A "Community" is a governmental body with the statutory authority to enact and enforce zoning, building codes, subdivision, and other land use control measures. The authority of each unit of government varies by state. Eligible communities can include cities, villages, towns, townships, counties, parishes, states, and Indian tribes. When the community chooses to join the NFIP, it must adopt and enforce floodplain management requirements that meet or exceed the minimum requirements of the NFIP. The floodplain management requirements within the SFHA are designed to prevent new development from increasing the flood threat and to protect new and pre-FIRM buildings from anticipated flood events. A participating community in the NFIP must also require permits for all development in the SFHA and ensure that construction methods used will minimize future flood damages, including building support utility systems.

Many States and communities have adopted more restrictive requirements than those established by the NFIP based on their knowledge of local conditions and in the interest of increased safety. The most common of these are provided below:

- Adoption of floodplain management requirements that exceed the NFIP minimum standards by requiring new or substantially improved buildings to be elevated or floodproofed to one or more feet above the BFE. This more restrictive requirement is generally referred to as "freeboard" and provides an extra measure of flood protection above the design flood elevation to account for waves, debris impacts, hydraulic surge, or insufficient data.
- Counting improvements or repairs cumulatively over a specified period of time for determining if a building is being substantially improved or is substantially damaged so that it will be brought into compliance with local flood protection requirements.

- Adoption of land use requirements that prohibit specified buildings or uses in certain areas, such as the floodplain, conservation zones, and/or the floodway.
- Prohibiting the use of building materials and practices that have previously proven ineffective during flooding.

2.2 Community Floodplain Management Permitting Process

To participate in the NFIP, communities must regulate all development in the designated SFHA in accordance with the NFIP criteria and any applicable State and community floodplain management ordinances and/or laws. To do this, communities must require a floodplain development permit before any development proceeds in the designated SFHA of the community. "Development" means any man-made change to improved or unimproved real estate, including, but not limited to, buildings or other structures, mining, dredging, filling, grading, paving, excavation or drilling operations or storage of equipment or materials. Before the permit is issued, the community must ensure that the minimum NFIP requirements are met for development in the SFHA. This includes ensuring the building support utility systems are designed and installed in accordance with all applicable laws and ordinances. Often applicable laws and ordinances include building, fire, mechanical, and electrical codes, as well as floodplain management laws and/or ordinances.

Community floodplain management ordinances and/or laws are often incorporated into the community's building code, zoning or subdivision ordinance and/or law, or possibly as a separate ordinance or law. Where, within the community's laws and/or ordinances, floodplain management requirements reside will often indicate which community official is responsible for enforcing the community's floodplain management requirements. The responsible community official is often the Building Official, Zoning Administrator, Floodplain Management Official or Municipal Engineer.

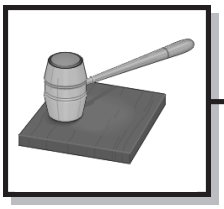
In addition, the community must review proposed development to assure that all necessary permits have been obtained from those governmental agencies from which Federal, State, or community laws or regulations require approval. It is the community's responsibility to ensure that all applicable Federal, State, or local permits are obtained before construction work begins on the selected mitigation measure.

NOTE:

Before committing a significant investment of time and money in developing a flood protection strategy for building utility systems, contact the local permit office for information on building code, floodplain management, health and safety, or other requirements that apply and on how to obtain necessary permits.

NOTE:

The lowest floor elevation for a substantially improved or new building must be located to or above the DFE in Zone A areas. In Zone V areas, the elevation of the bottom of the lowest structural member of the lowest floor must be above the DFE.



NOTE:

In V Zones, a registered professional engineer or architect must certify that the design is in accordance with, at a minimum, the V Zone requirements of the NFIP as specified in 44 CFR 60.6(e).

CAUTION:

Dry floodproofing is only permitted for non-residential structures located in A Zones.

NOTE:

More information on dry floodproofing non-residential buildings can be found in FEMA's NFIP Technical Bulletin #3, *Non-Residential Floodproofing - Requirements and Certification.*

For new construction and substantial improvement of buildings and other structures in a SFHA, the permit or accompanying documentation must indicate the elevation to which the building and the building support utility systems are to be elevated or otherwise appropriately protected from flood damage. The Design Flood Elevation (DFE) is a regulatory flood elevation adopted by a community that is the BFE, at a minimum, and may include freeboard, as adopted by the community.

Under the NFIP, the community is responsible for ensuring that the elevation and protection of building support utility systems of new and substantially improved buildings and other structures in a SFHA are built in accordance with permit requirements, approved plans and with all applicable laws and ordinances.

Additionally, the NFIP requires the community to obtain sufficient information such as the elevation of the lowest floor (including basement) and building support utilities of all new or substantially improved buildings located in A and V zones. This is done to ensure that new construction and substantial improvements meet the minimum requirements of the NFIP and the community's floodplain management requirements.

For non-residential buildings that are dry floodproofed, the community permit official must obtain and verify the elevation to which the building is floodproofed. In addition, a registered professional engineer or architect must certify that the design and methods of construction are in accordance with accepted standards of practice for meeting the following requirements: 1) the building is watertight with walls substantially impermeable to the passage of water; 2) the attendant utility and sanitary facilities are located above the BFE, enclosed within the building's watertight walls, or made watertight and capable of resisting damage during flood conditions; and 3) the structural components have the capability of resisting hydrostatic and hydrodynamic loads and effects of buoyancy. The community permit official must obtain and maintain a copy of the floodproofing certification.

Some communities require that a new or substantially improved building cannot be used or occupied without some type of use permit or "certificate of occupancy". The official will not normally issue a use or occupancy permit until the building passes a final inspection which includes meeting applicable floodplain management requirements.

2.3 NFIP Definitions

2.3.1 Flood Hazard Zones Shown on Flood Insurance Rate Maps (FIRMs)

The **Flood Insurance Rate Map** (FIRM) for each community identifies various zones of flooding. The six types of A Zones and the three types of V Zones described below compose the **Special Flood Hazard Area** (SFHA). The SFHA is the minimum area over which NFIP-participating communities must enforce their NFIP-compliant floodplain management requirements. The zones, shown on a FIRM, that compose the SFHA include:

A: Area of special flood hazard without water surface elevations determined.

A1-30, AE: Area of special flood hazard with water surface elevations determined.

AO: Area of special flood hazards having shallow water depths and/or unpredictable flow paths between (1) and (3) ft.

A99: Area of special flood hazard where enough progress has been made on a protective system, such as dikes, dams, and levees, to consider it complete for insurance rating purposes.

AH: Areas of special flood hazards having shallow water depths and/or unpredictable flow paths between (1) and (3) feet, and with water surface elevations determined.

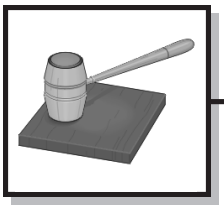
AR: Area of special flood hazard that results from the decertification of a previously accredited flood protection system that is determined to be in the process of being restored to provide a 100-year or greater level of flood protection.

V: Area of special flood hazard without water surface elevations determined, and with velocity, that is inundated by tidal floods (coastal high hazard area).

V1-30, VE: Area of special flood hazards, with water surface elevations determined and with velocity, that is inundated by tidal floods (coastal high hazard area).

VO: Area of special flood hazards having shallow water depths and/or unpredictable flow paths between (1) and (3) ft. and with velocity.

B, X: Area of moderate flood hazards.



C, X: Area of minimal hazards.

D: Area of undetermined but possible, flood hazards.

M: Area of special mudslide (i.e., mudflow) hazards.

N: Area of moderate mudslide (i.e., mudflow) hazards.

P: Area of undetermined, but possible, mudslide hazards.

E: Area of special flood-related erosion hazards.

2.3.2 NFIP Floodplain Management Definitions

In conjunction with the adoption of minimum NFIP floodplain management provisions, communities must adopt proper definitions associated with floodplain management requirements. The definitions needed to guide the designer in understanding floodplain management requirements are also found in Part 44 of the Code of Federal Regulations (CFR), Section 59.1. For a complete list of floodplain management terms used in this manual, refer to *Appendix B: Glossary of Terms.* Definitions of key floodplain management terms used in this manual are provided below:

Base Flood Elevation (BFE): The elevation of the flood having a one-percent chance of being equaled or exceeded in any given year. The BFE is determined by statistical analysis for each local area, and designated on the FIRM. The BFE is also known as the 100-year flood elevation.

Basement: Any area of the structure having its floor subgrade (below ground level) on all sides.

Design Flood Elevation (DFE): The regulatory flood elevation adopted by a community that is the BFE, at a minimum, and may include freeboard, as adopted by the community.

Enclosed Area Below the FPE: An unfinished flood-resistant enclosure, usable solely for parking, building access, or storage in an area other than a basement that is below the lowest floor.

Flood Protection Elevation (FPE): The elevation to which flood protection measures are designed. It is normally the sum of the expected flood

elevation (the BFE at a minimum) plus freeboard (also referred to as Design Flood Elevation or Flood Protection Level).

Freeboard: A factor of safety usually expressed in feet above a flood level for purposes of floodplain management. Freeboard tends to compensate for the many unknown factors that could contribute to flood heights greater than the height calculated for a selected size flood and floodway conditions, such as wave action, blocked bridge or culvert openings, and the hydrological effect of urbanization of the watershed.

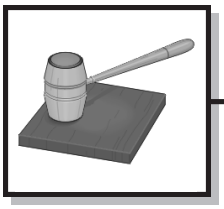
Lowest Floor: The lowest floor of the lowest enclosed area (including basement). An unfinished or flood-resistant enclosure usable solely for parking, building access, or storage in an area other than a basement is not considered a building's lowest floor, provided that such enclosure is not built so as to render the structure in violation of the applicable non-elevation design requirement of 44 CFR, section 60.3.

New Construction: For the purposes of determining insurance rates, structures for which the "start of construction" commenced on or after the effective date of an initial FIRM or after December 31, 1974, whichever is later, and includes any subsequent improvements to such structures. For floodplain management purposes, "new construction" means structures for which the "start of construction" commenced on or after the effective date of a floodplain management regulation adopted by a community and includes any subsequent improvements to such structures.

Special Flood Hazard Area (SFHA): Portion of the floodplain subject to inundation by the base flood, designated Zone A, AE, A1 - A30, AH, AO, AR, V, VE, V1 - V30, or VO, on a FIRM.

Structure: For floodplain management purposes, a walled and roofed building, including a gas or liquid storage tank, that is principally above ground, as well as a manufactured home.

Substantial Damage: Damage of any origin sustained by a structure whereby the cost of restoring the structure to its before-damaged condition would equal or exceed 50 percent of the value of the structure before the damage occurred.



Substantial Improvement: Any repair, rehabilitation, addition, or other improvement of a structure, the cost of which equals or exceeds 50 percent of the value of the structure before the "start of construction" of the improvement. This includes structures that have incurred "substantial damage," regardless of the actual repair work performed.

The term does not, however, include either:

1. any project to correct existing violations of state or local health, sanitary, or safety code specifications that have been previously identified by the local code enforcement official and that are the minimum necessary to assure safe living conditions, or

2. any alteration of an "historic structure," provided that the alteration will not preclude the structure's continued designation as an "historic structure."

2.4 NFIP Requirements for Existing Buildings

NFIP minimum floodplain management requirements generally apply to new buildings and to buildings that have been substantially improved or substantially damaged. A building is substantially improved if the cost of a repair, rehabilitation, addition or other improvement to the structure equals or exceeds 50 percent of its market value. A building is substantially damaged if the cost to repair the building to its before-damaged condition equals or exceeds 50 percent of its market value. The community permit official makes the determination of whether or not a building is substantially improved or substantially damaged and applies the provisions of the community's floodplain management regulations and building codes to the building.

Generally, a substantially improved or substantially damaged residential building must be elevated to or above the BFE. Substantially improved or substantially damaged non-residential buildings must either be elevated or dry floodproofed (made watertight) to that elevation. Building utilities must be provided the same protection that is provided for a new building.

Some communities have adopted more restrictive requirements for substantial improvement and substantial damage. For example some communities

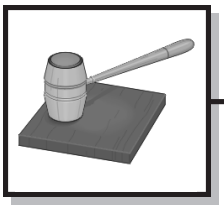
have a lower threshold than 50% for determining when a building is substantially improved or substantially damaged, or count all improvements and damages cumulatively over a specified time period or for the life of the building. Some states and communities require that all additions to buildings be elevated regardless of their size. Consult with your community permit official to determine if more restrictive requirements apply.

Existing buildings that are not substantially damaged or substantially improved are generally not required to meet floodplain management requirements contained in community floodplain management regulations or building codes. However, in most cases it is advisable to provide flood protection to building utility systems even if there is no requirement to do so. For further discussion, see Chapter 4, Existing Buildings.

A difficulty that communities have had in implementing substantial damage requirements after a flood has been that some building owners could not afford the cost of bringing their buildings into compliance with community floodplain management regulations. FEMA now provides assistance to these building owners through Increased Cost of Compliance (ICC) coverage contained in the Standard Flood Insurance Policy. Nearly all NFIP flood insurance policies on buildings now include ICC coverage. Exceptions are buildings located in communities enrolled in the NFIP Emergency Program, insured under Group Flood Insurance Policies or insured under a Condominium Unit Owner Policy.

Policyholders can now be reimbursed not only for the costs to repair actual physical damages from a flood, but also the additional costs, up to a maximum stated in the policy, to bring buildings into compliance with State and community floodplain management laws and ordinances. This coverage only applies to buildings suffering a flood loss that are declared substantially damaged or repetitively damaged by an authorized community official. Increased Cost of Compliance coverage would pay costs associated with bringing the structure including building utilities into compliance with applicable State and local floodplain management laws and ordinances.

Numerous FEMA publications provide information on retrofitting building support utility systems for existing buildings to bring them into compliance



with community floodplain management regulations or to provide additional flood protection in the absence of a regulatory requirement.

- FEMA FIA-TB-2 NFIP Technical Bulletin #2 *Flood-resistant Materials Requirements*
- FEMA FIA-TB-3 NFIP Technical Bulletin #3 *Non-residential Floodproofing Requirements and Certification*
- FEMA FIA-TB-4 NFIP Technical Bulletin #4 *Elevator Installation*
- FEMA 312 *Homeowners Guide to Retrofitting: Six Ways Of Protecting Your Home From Flood Damage*
- FEMA 259 *Engineering Principles and Practices for Retrofitting Flood Prone Residential Buildings*
- FEMA 102 *Floodproofing non-Residential Structures*

2.5 NFIP Building Performance Requirements

Communities often adopt floodplain regulations that exceed the NFIP minimum requirements. More restrictive local codes and ordinances supersede the minimum requirements of the NFIP discussed in this manual. This section will examine only the minimum NFIP requirements governing construction in a Special Flood Hazard Area. Local building codes and construction criteria may vary across the country.

The NFIP has established minimum design performance criteria that communities participating in the NFIP must adopt and enforce, at a minimum, for structures located in an SFHA. This manual provides specific techniques that comply with the minimum NFIP performance criteria as it relates to building utility systems.

According to Part 44 of the Code of Federal Regulations, Section 60.3:

If a proposed building site is in an SFHA, the building support utility systems for all new construction and substantial improvements shall:

i. be constructed with electrical, heating, ventilation, plumbing, and air conditioning equipment and other service facilities that are designed and/or located so as to prevent water from entering or accumulating within the components during conditions of flooding;

ii. require within flood-prone areas new and replacement water supply systems to be designed to minimize or eliminate infiltration of flood waters into the systems;

iii. require within flood-prone areas new sewage systems to be designed to minimize or eliminate infiltration of flood waters into the systems and discharges from the systems into flood waters; and

iv. onsite waste disposal systems to be located to avoid impairment to them or contamination from them during flooding.

If a proposed building site is in an SFHA, all new construction and substantial improvements shall:

i. be designed (or modified) and adequately anchored to prevent flotation, collapse, or lateral movement of the structure resulting from hydrodynamic and hydrostatic loads, including the effects of buoyancy,

ii. within A Zones, have the lowest floor to or above the BFE. Non-residential structures must meet the same requirements as residential structures, or be dry floodproofed so that the walls are substantially impermeable to the passage of floodwaters to or above the BFE.

iii. Within V Zones, be elevated on pile, post, pier, or column foundations that are free of obstruction and have the lowest horizontal structural member supporting the lowest floor to or above the BFE.

iv. be constructed with materials resistant to flood damage, and

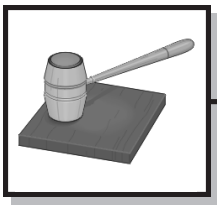
v. be constructed by methods and practices that minimize flood damages.

If a subdivision proposal or other proposed new development is in a flood-prone area, any such proposals shall be reviewed to assure that:

i. all such proposals are consistent with the need to minimize flood damage within the flood-prone area;

ii. all public utilities and facilities, such as sewer, gas, electrical, and water systems are located and constructed to minimize or eliminate flood damage; and

iii. adequate drainage is provided to reduce exposure to flood hazards.



FEMA provides guidance on compliance with the minimum requirements of the NFIP and has technical guidance manuals and information on effective flood protection design and construction. The U.S. Army Corps of Engineers (USACE) and the Natural Resources Conservation Service (NRCS) also have developed technical guidance manuals and information for public distribution on effective flood protective design and construction techniques. In addition, some states, regional authorities, and communities have developed guidance documents intended to address flooding problems found within their specific area. These publications, many of which are listed in Appendix A, Bibliography and Sources of Information, contain guidelines for the use of certain techniques and materials for design and construction that meet or exceed NFIP performance criteria. These publications also contain information on the generally accepted practices for flood-resistant design and construction.

2.6 Building Codes

Given the variation of building codes and standards in use throughout the United States, it is very important that the reader contact the community permit office to determine what floodplain management provisions are applicable.

FEMA has also undertaken a multi-year effort to incorporate the NFIP flood-damage-resistant design standards into the nation's model building codes and standards. FEMA's goal in this effort is to ensure that model building codes are in compliance with the minimum requirements of the NFIP. In recent years, this effort has focused on the International series of codes under development by the International Code Council.

States and communities often employ a broad range of regulatory approaches to manage floodplain development and construction. These regulatory approaches include building codes, ordinances, floodplain management ordinances, and other land use regulations such as a zoning ordinance, subdivision ordinance, and a stormwater management ordinance, often are employed separately or in combination. When a combination of regulatory approaches is utilized, there can be contradictory floodplain management requirements. Normally, when this occurs, the more restrictive provisions apply. But, in all cases, local regulatory officials shall determine what requirements apply.

2.6.1 Model Building Codes

When they decide to adopt building codes, most states and communities adopt all or portions of model building codes and standards. Model building codes have been developed over a period of years under the auspices of various nonprofit organizations. The most widely accepted model codes in the United States are shown below (refer to *Table 2.6.1* for more detailed data about the building codes):

National Code Series: developed by the Building Officials and Code Administrators International (BOCA), generally adopted by eastern and midwestern states;

Standard Code Series: developed by the Southern Building Code Congress International (SBCCI), generally adopted by southern states;

Uniform Code Series: developed by the International Council of Building Officials (ICBO), generally adopted by western states;

International Code Series: Under development by BOCA, ICBO and SBCCI; generally will be adopted nationally in lieu of existing model building codes.

One- and Two-Family Dwelling Code: developed by the Council of American Building Officials (CABO), used for residential structures in various parts of the country; and

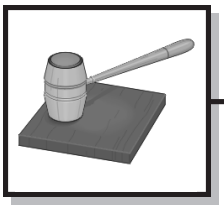
NFPA Life Safety Code: developed by the National Fire Protection Association (NFPA), used as a standard for fire protection in various parts of the country. This code is referenced in several other code series.

Manufactured Housing Regulations and Accompanying Standards: developed by the Department of Housing and Urban Development (HUD) and other related organizations.

Documents for each of the above code series follow standardized formats for content and references. Most model code groups also maintain product material evaluation reports, which contain specific testing information on a variety of building products.

NOTE:

In addition to the provisions in the codes, some professional organizations have published guidelines intended for use when designing buildings in floodplains. For example, the Structural Engineering Institute (SEI) of the American Society of Civil Engineers (ASCE) recently published a standard 24-98 titled *Flood Resistant Design and Construction*.



National Codes (BOCA):	• BOCA National Building Code • BOCA National Fire Prevention Code • BOCA National Mechanical Code • BOCA National Plumbing Code • BOCA Property Maintenance Code
Standard Codes (SBCCI):	• Standard Building Code • Standard for Floodplain Management • Standard Plumbing Code • Standard Existing Building Code • Standard Housing Code • Standard Fire Prevention Code
Uniform Codes (ICBO):	• Uniform Building Code • Uniform Mechanical Code • International Plumbing Code • Uniform Fire Code • Uniform Housing Code
NFPA Standards:	• NFPA 101—Life Safety Code • NFPA 70—National Electrical Code • NFPA 54 National Fuel Gas Code • NFPA 58 Standard for the Storage and Handling of Liquefied Petroleum Gases
CABO One- and Two- Family Dwelling Code:	• CABO One- and Two- Family Dwelling Code
Manufactured Housing Regulations and Standards:	• ANSI A225.1-87, Manufactured Home Installations • HUD Manufactured Home Construction and Safety Standards, Part 3280 with interpretative bulletins • Permanent Foundations Guide for Manufactured Housing, 4930.3 • Model Manufactured Home Installation Manual • NFPA 501A—987 Standard for Fire safety Criteria for Manufactured Home Installations, Sites, and Communities • ANSI A40, Safety Requirements for Plumbing - 93 Addition
International Code Council:	• International Building Code* • International Residential Code* • International Fire Code • International Fuel Gas Code • International Plumbing Code • International Private Sewage Disposal Code • International Mechanical Code *under development at the time this manual went to print

Table 2.6.1: Model code groups and associated model codes

The following is a discussion of the general contents of the International Code Series. These discussions include reference to the appropriate chapters and sections.

ICC Mission

On December 9, 1994, the International Code Council (ICC) was established as a nonprofit organization dedicated to developing a single set of comprehensive and coordinated national codes.

The ICC founders-BOCA, ICBO, and SBCCI - created the ICC in response to technical disparities among the three sets of model codes now in use in the U.S.

INTERNATIONAL RESIDENTIAL CODE (2000)

The International Residential Code (IRC) is tailored by the community when it is adopted to incorporate data related to various hazards, including snow load, wind, seismic, cold weather, and flooding. The community inserts in the table the date of entry into the NFIP and the date of the effective Flood Insurance Rate Map (FIRM) or other more restrictive regulatory flood hazard map the local jurisdiction has adopted.

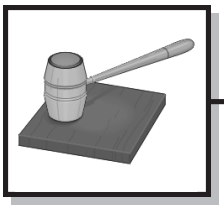
General flood resistant construction provisions are in Section 327, including establishment of the design flood elevation (DFE). Protection of mechanical and electrical systems is covered in Section 327.1.5, where elevation above the design flood elevation is specified. Electrical components are required to be elevated unless they conform to the requirements for wet locations. Ducts and duct installation are not allowed below the DFE.

Section 327.1.6 includes requirements for the protection of water supply and sanitary sewage systems. Both types are to be designed to minimize infiltration into the systems, and sewage systems must be designed to minimize discharges into floodwater. The plumbing provisions of the IRC are referenced along with Chapter 3 of the International Private Sewage Disposal Code.

The International Fuel Gas Code is cited in Chapter 24, requiring gas appliances to be elevated or protected to prevent flood water from entering or accumulating within them.

INTERNATIONAL BUILDING CODE (2000)

In Chapter 27, the IBC refers to the NFPA 70 for electrical components, equipment and systems. Both the International Mechanical Code and the International Fuel Gas Code are referenced as governing heating, air conditioning, refrigeration, mechanical installations, and for ventilation, and chimneys, fireplaces and barbecues. Chapter 29 covers plumbing systems and equipment, which are governed by the International Plumbing Code. Private sewage disposal is required to conform to the International Private Sewage Disposal Code.



When elevators and conveyor systems are included in the design of buildings in special flood hazard areas, the Chapter 30 of the IBC references ASCE 24 for specifications for installation in a Special Flood Hazard Area (SFHA) other flood hazard area as designated by a local jurisdiction.

INTERNATIONAL PLUMBING CODE (1997)

Section 309 specifically addresses systems and equipment in structures in flood hazard and high-hazard zones, requiring them to be capable of resisting hydrostatic and hydrodynamic loads and stresses, including the effects of buoyancy. Certain system elements specifically are required to be sealed or elevated, including water supply pumps, potable water well seals, and manhole covers.

INTERNATIONAL PRIVATE SEWAGE DISPOSAL CODE (1997)

Certain types of private sewage disposal systems involve placement of fill dirt. Chapter 3 of the IPSDC is comprehensive in that prior to approval of a disposal system, the code official is required to receive written evidence that construction in and filling of floodplain areas is acceptable. The IPSDC includes a number of restrictions on placement of private sewage disposal systems in floodways. And in flood fringe areas, installations must be on land that is contiguous to land outside the floodplain. When a proposal includes placement of fill for the building and a sewage disposal system, the filled areas must be connected. Mound systems are not allowed in the floodplain.

Chapter 8 addresses placement and replacement of holding tanks and in areas with existing development, and requires that they be floodproofed, adequately anchored to counter buoyant forces, and vents and service manholes are required to be at least 2 feet above the regional (regulatory) flood elevation established by the local jurisdiction. Septic tanks in the floodway are to be floodproofed.

INTERNATIONAL FUEL GAS CODE (1997)

Chapter 13 of the IFGC includes the general requirement that appliance installations are to be placed above the BFE or protected to prevent water from entering or accumulating within appliances, ducts or plenum spaces.

INTERNATIONAL MECHANICAL CODE
(1998)

The IMC, in Chapter 3, includes the general requirement that mechanical systems are to be placed above the BFE or protected to prevent water from entering or accumulating within appliances, ducts or plenum spaces. Plenum spaces and ducts are addressed in Chapter 6. They are required to be located above the BFE or protected to prevent water from entering. Alternatively, if located below the BFE, plenum spaces and ducts are required to be capable of resisting hydrostatic and hydrodynamic loads and stresses, including buoyancy.

INTERNATIONAL ELECTRICAL CODE
(1999)

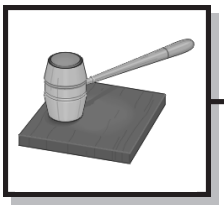
Chapter 12 refers to the *International One- and Two-Family Dwelling Code* or NFPA 70, as applicable. The NFPA does not include provisions specific to floodplain areas, although a number of specifications are set forth for wet locations.

INTERNATIONAL FIRE CODE
(Date not available)

FEMA is working closely with the model building code groups to ensure that NFIP requirements will be accessible, credible, and easier to use and enforce by the building community. This ongoing effort is aimed at placing as many of the NFIP floodplain management requirements as possible into the model building codes. For more information on the model building codes, contact the local building and permitting officials or refer to the model code organizations.

2.7 National Consensus Standards

There are a number of organizations that have been approved by the American National Standard Institute (ANSI) to produce and maintain national National Consensus Standards. FEMA has been working closely with the American Society of Civil Engineers (ASCE) to include flood-resistant design and construction provisions into two consensus standards. These ANSI-approved standards are:



ASCE 7: Minimum Design Loads for Buildings and other Structures. This standard includes information on how to determine flood loads and load combinations on buildings and other structures. ASCE-7 is incorporated into both the International Residential Code and the International Building Code.

ASCE 24: Flood Resistant Design and Construction. This standard includes information on how to design and construct buildings and others structures to be resistant to flood damage. ASCE 24 is incorporated by reference, into the International Building Code and is the basis for the flood resistant requirement contained in the International Residential Code.

2.8 Health and Sanitary Regulations

The installation of an on-site sewage disposal and water supply system often is regulated through a combination of building, land use, floodplain management, health or sanitary ordinances, laws, or regulations. These rules can be administered through a building, land use, floodplain management, health or environmental protection agency at the community, county, regional, or State level. In communities that administer building codes and floodplain management requirements, it is not unusual for health and sanitary regulations to be administered by a county, region, or State.

Many building, land use, floodplain management, or health and sanitary regulations bar or severely restrict the installation of on-site sewage disposal and water supply systems in flood-prone areas. Other building, land use, floodplain management, and health regulations provide highly detailed information on how to install on-site sewage disposal and water supply systems in flood-prone areas. For more information, contact the responsible building, land use, floodplain management, health or environmental protection agency in your community.

2.9 After the Flood - Guidelines for Building Officials

Several organizations have published information that can be helpful when repairing or replacing building support utility systems damaged as a result of flooding. The following provides information about particular problems that might be encountered.

Some flood damaged buildings may contain wires using fibrous insulation. If these wires are inundated by floodwaters, they must be replaced because

the fibers tend to deteriorate when exposed to water. If the insulation deteriorates, short-circuiting becomes a possibility and electrocution or fire may result. When replacing the wire, refer to the information in this chapter to assist in the selection of wire that can withstand inundation by flood. Even when water-resistant wire is used, ample time should be provided after inundation with floodwaters to allow the wires to dry fully before they are re-energized.

2.9.1 *Guidelines for Handling Water Damaged Electrical Equipment* ©, by the National Electrical Manufacturers Association (NEMA)

Guidelines for Handling Water Damaged Electrical Equipment

Use of this Publication

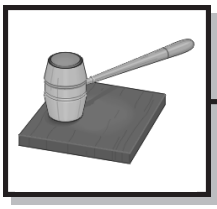
This publication provides guidelines on how to handle electrical equipment that has been exposed to water through flooding, fire fighting activities, hurricanes, etc. It is designed for use by suppliers, installers, inspectors and users of electrical products.

Electrical equipment exposed to water can be extremely dangerous if reenergized without proper reconditioning or replacement. Reductions in integrity of electrical insulation due to moisture, debris lodged in the equipment components and other factors, can damage electrical equipment by affecting the ability of the equipment to perform its intended function. Damage to electrical equipment can also result from flood waters contaminated with chemicals, sewage, oil and other debris which will affect the integrity and performance of the equipment.

Distributors of electrical equipment should not use any inventory that has been subjected to water damage. Damaged inventory should not be sold to resellers that will place the equipment back into the market. This can lead to damaged equipment still being used and creating a hazard to individuals or property.

To Contact the Manufacturer

Working knowledge of electrical systems and of the equipment in question is required to evaluate damage due to contact with water. The original manufac-



turer of the equipment should be contacted if any questions arise or specific recommendations are needed. In many cases, replacement will be necessary.

After consultation with the manufacturer, some larger types of electrical equipment may be reconditioned by properly trained personnel. The ability to recondition the equipment may vary with the nature of the electrical function, the degree of flooding, the age of the equipment, and the length of time the equipment was exposed to water.

Attempts to recondition equipment without consulting the manufacturer can result in additional hazards due to the use of improper cleaning agents which can further damage the equipment (see National Electrical Code Section 110-11 FPN No.2) or due to improper reconditioning techniques.

NEMA member companies are committed to safety. For specific contacts within these manufacturing firms, call or write:

National Electrical Manufacturers Association
1300 North 17th Street, Suite 1847
Rosslyn, Virginia 22209
Telephone: (703) 841-3268
Fax: (703) 841-3368
ATTN: Larry Miller
email: lar_miller@nema.org

NOTE:

Although panel boards can sometimes be cleaned and repaired, circuit breakers must normally be replaced in residential systems.

Electrical Distribution Equipment

Electrical distribution equipment usually involves switches and low-voltage protective components such as molded case circuit breakers and fuses, within assemblies such as enclosures, panelboards and switchboards. These assemblies can be connected to electrical distribution systems using various wiring methods.

The protective components are critical to the safe operation of distribution circuits. Their ability to protect these circuits is adversely affected by exposure to water and to the minerals and particles which may be present in the water. In molded case circuit breakers and switches, such exposure can affect the overall operation of the mechanism through corrosion, through the presence of foreign particles, and through removal of lubricants. The condition of the contacts can be affected and the dielectric insulation capabilities of internal materials can be reduced. Further, some molded case circuit breakers are equipped with electronic trip units and the functioning

of these trip units might be impaired. For fuses, the water may affect the filler material. A damaged filler material will degrade the insulation and interruption capabilities.

Distribution assemblies contain protective components together with the necessary support structures, buswork, wiring, electromechanical relays and meters. Exposure to water can cause corrosion and insulation damage to all of these areas. In the case of exposure of distribution assemblies to water, the manufacturer should be contacted before further action is taken.

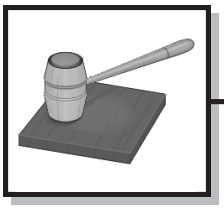
Items Which May Possibly Be Reconditioned by Trained Personnel in Consultation with Manufacturer.

- Enclosed switches - reference NEMA Standards Publication *KS 1-1996, Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum)*, para 5.1, 5.1.2
- Busway - reference NEMA Standards Publication *BU 1.1-1996, General Instructions for Handling, Installation, Operation, and Maintenance of Busway Rated 600 Volts or Less*, para 3.4.4, 9.2.4.2
- Panelboards - reference NEMA Standards Publication *PB 1.1-1991, General Instructions for Proper Installation, Operation, and Maintenance of Panelboards Rated 600 Volts or Less*, para. 8.3, 8.3.1.3, 8.3.1.4
- Switchboards - reference NEMA Standards Publication *PB 2.1-1991, General Instructions for Proper Handling, Installation, Operation and Maintenance of Deadfront Distribution Switchboards Rated 600 Volts or Less*, para. 9.3.1.3, 9.10

Motor Circuits

Motor circuits include motor control devices such as motor starters and contactors, together with overcurrent protection components such as overload relays, circuit breakers, and fuses often assembled into motor control panels and motor control centers as well as individual enclosures. Motor control centers contain both control and protective components together with support structures, buswork and wiring.

The protective components are critical to the safe operation of motor circuits and their ability to protect these circuits is adversely affected by exposure to water, and to the minerals and particles which may be present in the water.



For molded case circuit breakers, such exposure can affect the overall operation of the mechanism through corrosion, through the presence of foreign particles, and through removal of lubricants. The condition of the contacts can be affected and the dielectric insulation capabilities of internal materials can be reduced. Further, some molded case circuit breakers are equipped with electronic trip units, and the functioning of these trip units might be impaired. For fuses, the water may affect the filler material. A damaged filler material will degrade the insulation and interruption capabilities.

Corrosion, loss of lubrication and insulation quality can also be expected in contactors and starters. However, solid-state motor controllers and those electromechanical contactors or starters with integral electronic circuitry will be more severely affected by water.

Items Requiring Complete Replacement

- Electronically controlled and solid state contactors and starters
- Components containing semiconductors and transistors
- Overload relays
- Adjustable-speed drives
- Molded case circuit breakers and molded case switches - reference NEMA Standards Publication *AB 4-1996, Molded Case Circuit Breakers and Molded Case Switches*, para 2.2
- Fuses

Items Which May Possibly Be Reconditioned by Trained Personnel in Consultation with Manufacturer

- Manual and magnetic motor controllers
- Motor control centers

Power Equipment

Power equipment involves low voltage or medium voltage protective devices within an overall switchgear assembly. The assembly will also contain cabling, buswork with appropriate insulators, current transformers, electromechanical or solid state relays, and metering.

Reliable operation of the protective devices is vital to system safety; however, these devices can be adversely affected by water. In the case of low voltage and medium voltage circuit breakers and switches, the operation of the mechanism can be impaired by corrosion, by the presence of particles such as silt, and by the removal of lubricants. The dielectric properties of insulation materials and insulators will degrade and, for air circuit breakers, the condition of the contacts can be affected. Further, low voltage and medium voltage power circuit breakers usually incorporate electronic trip units; the functioning of these units will be impaired.

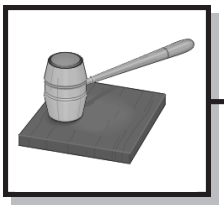
In the case of fuses, water may affect the filler material. A damaged filler material will degrade the insulation and interruption capabilities of fuses.

Power circuit breakers and medium voltage breakers are designed to be maintainable with the possibility, for example, of replacing contacts in air circuit breakers. It may, therefore, be possible to reuse such breakers provided the refurbishing is performed in close consultation with the manufacturer. This would include cleaning and drying techniques, lubrication advice, and thorough testing prior to the reapplication of power. However, the electronic trip units should be discarded and replaced, or at least returned to the manufacturer for inspection and possible furbishment.

In the case of fused equipment, the fusible units should be replaced, and the remainder of the apparatus would then be refurbished in close consultation with the manufacturer.

In all cases, great attention must be paid to the thorough cleaning, drying, and testing of insulators and insulation material.

The power equipment can be expected to contain additional electronic units such as solid state relays. These units can also be vital to the correct functioning of the protective device, and great care is needed in the cleaning and testing of such units. A first recommendation is to return the devices to the manufacturer. If this is not possible, the manufacturer should be consulted, for example, on the correct selection of cleaning agents which remove impurities without damaging the conformal coating. The manufacturer must also be contacted relative to the exact testing required of sophisticated electronic equipment containing, for example, microprocessors.



The overall power equipment assembly (switchgear) could be reconditioned provided careful steps were taken in the cleaning, drying and testing of the equipment prior to applying power. This would require input and advice from the manufacturer. An area of particular concern is the maintenance of the dielectric properties of insulators. In the field application of medium voltage equipment, for example, stand-off insulators are subjected to a wide variety of high voltage surges. Such insulators might need replacement.

Items Requiring Complete Replacement

- Fuses
- Electronic trip units of low and medium voltage power breakers

Items Which May Possibly Be Reconditioned by Trained Personnel in Consultation with Manufacturer

- Alternating current high-voltage circuit breakers - reference NEMA Standards Publication *SG 4-1990, Alternating-Current High Voltage Circuit Breaker*, para 6.12
- Low voltage power circuit breakers
- Protective relays and current transformers
- Low voltage switchgear
- Medium voltage switchgear

Transformers

Exposure of transformers to water can cause corrosion and insulation damage to the transformer core and winding. The ability of the transformer to perform its intended function in a safe manner can also be impaired by debris and chemicals which may be deposited inside the transformer during a flood. Water and contaminates also can damage transformer fluids.

Items Requiring Complete Replacement

- All dry-type transformers regardless of kVA ratings
- All dry type control circuit transformers

Items Which May Possibly Be Reconditioned by Trained Personnel in Consultation with Manufacturer

- Liquid-filled transformers (analysis of the insulating medium is required for evaluation of this equipment)
- Cast-resin transformers

Wire, Cable and Flexible Cords

When any wire or cable product is submerged in water, any metallic component (such as the conductor, metallic shield, or armor) is subject to corrosion that can damage the component itself and/or cause termination failures. If water remains in medium voltage cable, it could accelerate insulation deterioration, causing premature failure. Wire and cable that is listed for only dry locations may become a shock hazard, when energized, after being submerged in water.

The following recommended actions are based upon the concept that the water contains no unusually high concentrations of chemicals, oils, etc. If it is suspected that the water has unusual contaminants, such as may be found in some flood water, the manufacturer should be consulted before any decision is made to continue using any wire or cable products.

Items Requiring Complete Replacement

Any wire or cable that is listed for dry locations only, such as type NM-B cable, should be replaced if it has been submerged in water.

Any cable that contains fillers, such as polypropylene, paper, etc., should be replaced if the ends of the product have been submerged in water.

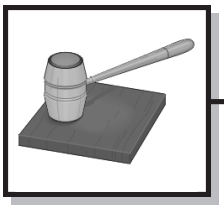
Items Which May Possibly Be Reconditioned by Trained Personnel in Consultation with Manufacturer

- Any wire or cable product that is suitable for wet locations and whose ends have not been submerged should be suitable for use or continued use. A qualified person, such as an electrical contractor or others familiar with wire and cable terminology, should make the determination of the product's suitability for wet locations.

  Any wire or cable product, not containing fillers, that is suitable for wet locations and whose ends have been submerged in water, may be con-

NOTE:

A Megger test can sometimes be used to determine whether or not wiring can be used after inundation by floodwaters.



sidered a candidate for "purging" (using an inert gas under pressure to remove water contained in the product) under engineering supervision. If this procedure is employed, the wire or cable should be tested prior to energization. As a minimum, an insulation resistance test with a megohmmeter should be conducted.

Wiring Devices, Ground Fault Circuit Interrupters (GFCI) and Surge Protectors

Sediments and contaminants contained in water may find their way into the internal components of installed electrical products and may remain there even after the products have been dried or washed by the user. These may adversely affect the performance of those products without being readily apparent to the user community. Also, electrical products, such as GFCIs and surge protective devices, contain electronic circuitry and other components which can be adversely affected by water resulting in the device becoming non-functional or a hazard to the user.

As a result, such products subjected to or believed to be subjected to water damage are not suitable for continued use and must be replaced with new undamaged products. Air drying and washing of water damaged products of this type should not be attempted.

Lighting Fixtures and Ballasts

Fluorescent, high-intensity discharge and incandescent lights are not intended for submersion in water except for those that are listed as submersible lighting fixtures. Flooded lighting fixtures and associated equipment may be damaged by corrosive materials, sediment, or other debris in the water. Corrosion of metallic parts and contamination of internal circuitry may prevent the equipment from operating properly. Lighting fixtures and associated equipment known to have been submerged should be replaced.

Motors

Motors which have been flooded by water may be subjected to damage by debris or pollutants. This may result in damage to insulation, switches, contacts of switches, capacitors and overload protectors, corrosion of metallic parts, and contamination of the lubricating means and should be evaluated by qualified personnel.

The manufacturer should be contacted for specific instructions on possible disassembly, cleaning and drying of the motor housing and internal components by trained personnel. Also, a method for drying is described in ANSI/IEEE 43-1974(R1992), para A2.1 B A2.1.2.

Electronic Products, Including Signaling, Protection, Communication Systems and Industrial Controls

Equipment used in signaling, protection and communication systems generally contain electronic components, and the exposure of such equipment to flooding by water can adversely affect the reliability of those systems. Contamination by pollutants or debris in flood waters may cause corrosion of components of the system, shorting of printed circuits, or alteration of circuit characteristics. Since some of these types of installations are classified as life safety systems, it is important that the reliability of those systems be maintained.

Where such systems are damaged by water, it is recommended that components of these systems be replaced or returned to the manufacturer for appropriate cleaning, recalibration, and testing. Manufacturers of these systems should be contacted for information on specific equipment.

Cable Tray

Carefully inspect the cable tray system to determine if its mechanical and/or electrical integrity has been breached. (WARNING-Do not use cable tray as a walkway.) Repair or replace any damaged portions per original installation requirements. Remove all debris from the cable tray. If any labels warning against the use of the cable tray as a walkway have been obliterated, obtain new labels from the manufacturer and apply as required.

National Electrical Manufacturers Association
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Rosslyn, Virginia 22209
Telephone: (703) 841-3268
Fax: (703) 841-3368
ATTN: Larry Miller
email: lar_miller@nema.org

2.9.2 Case Study: Sonoma County, California, *Flood 1997 - Electrical Requirements*

Following a major flood in 1997, Sonoma County, California, issued the following guidance on how to inspect and repair electrical systems to restore them in conformance with applicable building, floodplain management, and electrical code requirements.

FLOOD 1997 - ELECTRICAL REQUIREMENTS

- Repair and replacement for flood damaged electrical wiring and equipment.

  1) These requirements apply to any electrical equipment or wiring which was submerged in flood water for any length of time, and/or sustained any other water/storm damage. An electrical permit is required for all repairs/replacements of electrical wiring/equipment. Standard electrical fees will be charged.

- Before an electrical service panel may be re-energized, it must be cleaned and dried throughout, and all circuit breakers and/or other damaged components replaced: The busbars must show no evidence of corrosion/oxidation. Its connected load must be in an electrically safe condition.

- Here's a list of electrical wiring and equipment which must be replaced without exception:

  1) Electronically controlled and solid-state contactors and starters.

  2) Components containing semi-conductors and transistors.

  3) Overload relays.

  4) Adjustable-speed drives.

  5) Molded case circuit breakers, switches, and receptacle outlet devices.

  6) Fuses.

  7) Any cable or wire which has been submerged at either end and thus allowing water to enter its body. *The wire/cable would not need to be replaced if PRMD were presented with a report showing the results*

of a high voltage test (such as a "megger test") of the wiring indicating the insulation has not failed. This test must be performed by a licensed electrician.

- Manual and magnetic motor controlled centers may possibly be reconditioned by trained personnel.

FLOOD 97 - ELECTRICAL CHECKLIST

This form must be completed before re-energizing service panel/finalization of building permit.

MANDATORY ITEMS REQUIRING REPLACEMENT

I Service panels and panelboards (subpanels):

1) Molded case circuit breakers replaced:
☐yes ☐no If 'no', why?_____

2) Fuses replaced:
☐yes ☐no If 'no', why?_____

3) Busbars clean and dry and shown no evidence of oxidation/corrosion?
☐yes ☐no If 'no', why?_____

4) Grounding Electrode system in place including water and gas bonds.
☐yes ☐no If 'no', why?_____

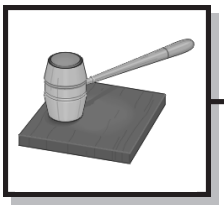
II House wiring system

5) Conductors of house wiring system tested (megometer)?
☐yes ☐no If 'no', why?_____

6) High voltage test results submitted on conductors if they're not being replaced (use attached PRMED form or facsimile)
☐yes ☐no If 'no', why?_____

7) Appliances replaced including electric water heaters?
☐yes ☐no If 'no', why?_____

8) Electronically controlled and solid-state contactors and starters replaced?
☐yes ☐no If 'no', why?_____



9) Components containing semi-conductors
☐yes ☐no If 'no', why?_____

10) Overload relays and Adjustable-speed drives replaced?
☐yes ☐no If 'no', why?_____

TEST RESULTS

Circuit #	Type of Circuit	Test Reading	Date of Test