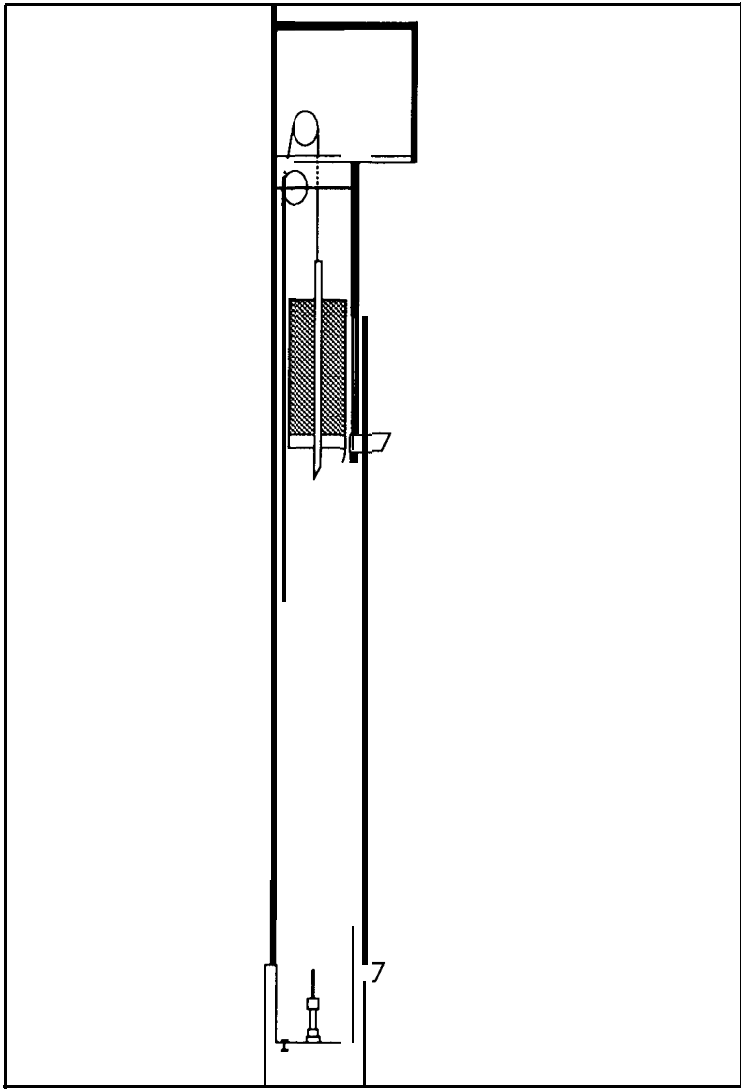


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**Elevator Installation**  
for Buildings Located in Special Flood Hazard Areas  
in accordance with the  
National Flood Insurance Program

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## **Key word/Subject Index:**

This index allows the user to quickly locate key words and subjects in this Technical Bulletin. The Technical Bulletin User's Guide (printed separately) provides references to key words and subjects throughout the Technical Bulletins. For definitions of selected terms, refer to the Glossary at the end of this bulletin.

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Any comments on the Technical Bulletins should be directed to:

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Washington, D.C. 20472

Technical Bulletin 4-93 replaces Technical Bulletin 88-4 (draft) "Protection of Elevator Equipment. "

Graphic design based on the Japanese print *The Great Wave Off Kanagawa*, by Katsushika Hokusai (1760-1849), Asiatic collection, Museum of Fine Arts, Boston.

## TECHNICAL BULLETIN 4-93

### Elevator Installation for Buildings Located In Special Flood Hazard Areas in accordance with the National Flood Insurance Program

#### Introduction

Under the National Flood Insurance Program (NFIP), flood insurance coverage is limited for elevator equipment. New or replacement equipment relevant to an elevator, installed on or after October 1, 1987, and located below the lowest floor of an elevated building or in a basement is not covered for flood damage.

This Technical Bulletin provides information on proper installation of elevators in flood hazard areas to reduce flood damage. Elevator types and their associated equipment are described, and practical methods of protecting them from flood damage are provided.

The guidelines within this bulletin meet existing NFIP regulations that pertain to elevators, as well as serve to encourage the use of loss prevention measures that would reduce both the level of damage that can occur and the amount of time and work needed to make repairs. If these guidelines are followed, restoration of elevator service to the undamaged portion of the building can be accomplished as soon as possible after floodwaters recede and power is restored.

#### NFIP Regulations

The NFIP regulations require that elevators and their associated equipment be protected from flood damage. Section 60.3(a)(3) states that the community shall:

***“Review all permit applications to determine whether proposed building sites will be reasonably safe from flooding. If a proposed building site is in a floodprone area, all new construction and substantial improvements shall... be constructed with materials resistant to flood damage, (iii) be constructed by methods and practices that minimize flood damages, and (iv) be constructed with electrical . . .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. ”***

As these regulations indicate, all appropriate measures must be taken to mitigate flood damage to elevators and associated equipment to the maximum extent possible. While some components, to function properly, must be located below the lowest floor of a building, i.e., below the base flood elevation (BFE), most elevator components that can be damaged by floodwater can be located above the BFE or be designed to minimize flood damage. Components that can be damaged by floodwaters may be located below the BFE only if it is not technically feasible to elevate them above the BFE.

It should be noted that Technical Bulletins provide guidance on the minimum requirements of the NFIP regulations. Community or State requirements that exceed those of the NFIP take precedence. Design professionals should contact the community to determine whether more restrictive local or State regulations apply to the building or site in question. All applicable standards of the State or local building code must also be met for any building in a flood hazard area.

## Types of Elevators

There are two types of elevators, hydraulic and traction. The hydraulic elevator consists of a cab attached to the top of a hydraulic jack similar to a jack used for a car lift in a service station. The hydraulic jack assembly normally extends below the lowest floor and is operated by a hydraulic pump and reservoir, both of which are usually located in a separate room adjacent to the elevator shaft, as shown in Figure 1. Hydraulic elevators are the type generally used in single-family residences.

The second type is the traction elevator. This is the system that is most commonly associated with elevators. The traction system consists of a cable that is connected to the top of the cab and is operated by an electric motor located in a penthouse above the elevator shaft, as shown in Figure 2.

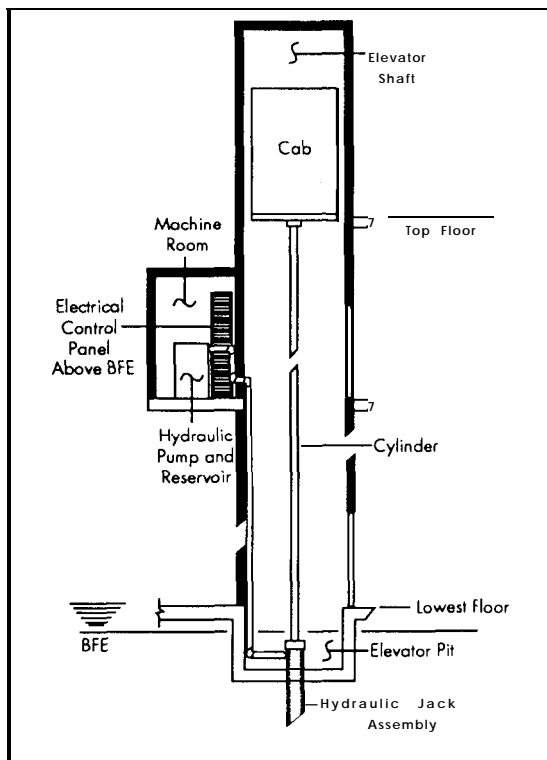


Figure 1. Hydraulic Elevator

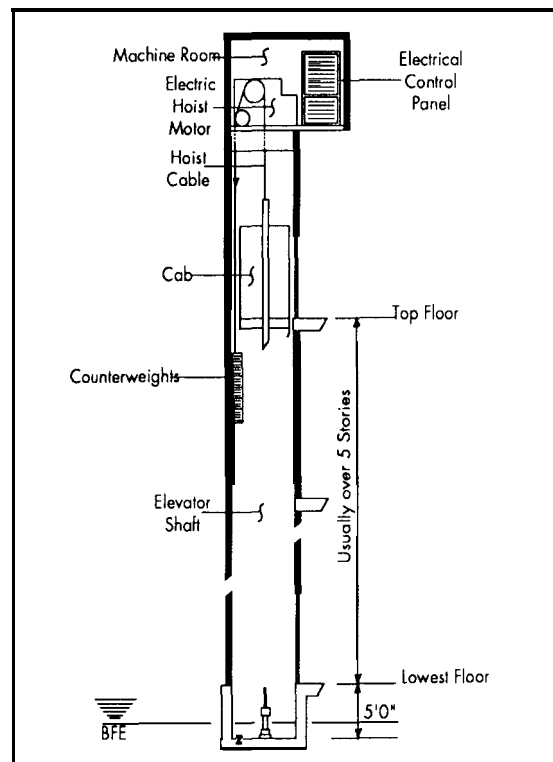


Figure 2. Traction Elevator

## Flood Damage Protection

For compliance with NFIP regulations, the design and construction of an elevator installation must include all possible steps for protecting the elevator equipment from flood damage.

### Hydraulic Elevators

The jack assembly for a hydraulic elevator (see Figure 1) will, by necessity, be located below the lowest floor and therefore generally below the BFE. The jack is located in a casing, and while it will resist damage from small amounts of water seepage, total inundation by floodwaters will usually result in contamination of the hydraulic oil and possible damage to the cylinders and seals of the jack. Salt water, because it is corrosive, can be particularly damaging. The hydraulic pump and reservoirs of the hydraulic elevator are also susceptible to water damage, but they can easily be located up to two floors above the jack and above the BFE as shown in Figure 1.

### Traction Elevators

For traction elevators (see Figure 2), the electric motor and most other equipment are normally located above the elevator shaft and would not be susceptible to flood damage. Some equipment, however, such as the counterweight roller guides, compensation cable and pulleys, and oil buffers, usually must be located at the bottom of the shaft. When such equipment cannot be located above the BFE, it must be constructed using flood-resistant materials where possible.

### Elevator Equipment

Some equipment common to all elevators will be damaged by floodwaters unless protected. The most obvious example is the elevator cab. Depending upon the size of the cab and the types of interior materials used, a cab may cost between \$5,000 and \$50,000. Flood damage, which can range from superficial to nearly a complete loss, can easily be avoided by keeping the cab above floodwaters. However, in most elevator control systems, the cab automatically descends to the lowest floor upon loss of electrical power. Installing a system of interlocking controls with one or more float switches in the elevator shaft to always keep the elevator cab from descending into floodwaters (see Figure 3) will result in a much safer system. A float switch system or an-

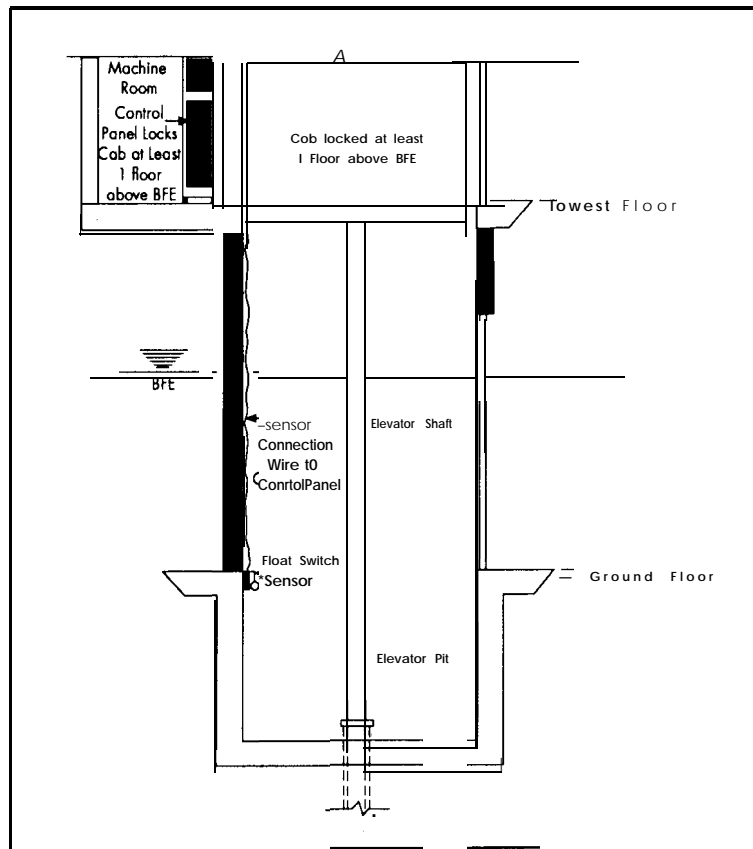


Figure 3. Float and Control Mechanism to Control Cab Descent

**other system that provides the same level of safety is necessary for all elevators where there is a potential for the elevator cab to descend below the BFE during a flood.**

Electrical equipment is often located below the BFE for both types of elevator systems. Some electrical equipment, such as electrical junction boxes and circuit and control panels, can be located above the BFE as shown in Figure 1. Other elevator components, such as doors and pit switches, must be located at or below the lowest floor. Where this becomes necessary, components may sometimes be replaced with more floodwater-resistant models. Some elevator equipment manufacturers offer water-resistant components; design professionals should contact suppliers to determine the availability of these components.

## **The NFIP**

The NFIP was created by Congress in 1968 to provide federally backed flood insurance coverage, because flood insurance was generally unavailable from private insurance companies. The NFIP is also intended to reduce future flood losses by identifying floodprone areas, and ensuring that new development is adequately protected from flood damage. The NFIP is based on an agreement between the federal government and participating communities that have been identified as floodprone. FEMA, through the Federal Insurance Administration (FIA), makes flood insurance available to the residents of a participating community provided that the community adopts and enforces adequate floodplain management regulations that meet the minimum NFIP requirements. The NFIP encourages communities to adopt floodplain management ordinances that exceed the minimum NFIP criteria. Included in the NFIP requirements, found under Title 44 of the U.S. Code of Federal Regulations, are minimum building design and construction standards for buildings located in Special Flood Hazard Areas. Through their floodplain management ordinances, communities adopt the NFIP design performance standards for new and substantially improved buildings located in floodprone areas identified on FIA's Flood Insurance Rate Maps.

## **Technical Bulletins**

This is one of a series of Technical Bulletins FEMA has produced to provide guidance concerning the building performance standards of the NFIP. These standards are contained in Title 44 of the U.S. Code of Federal Regulations at Section 60.3. The bulletins are intended for use primarily by State and local officials responsible for interpreting and enforcing NFIP regulations and by members of the development community, such as design professionals and builders. New bulletins, as well as updates of existing bulletins, are issued periodically, as necessary. The bulletins do not create regulations; rather they provide specific guidance for complying with the minimum requirements of existing NFIP regulations. Users of the Technical Bulletins who need additional guidance concerning NFIP regulatory requirements should contact the Natural Hazards Branch of the appropriate FEMA regional office. The "User's Guide to Technical Bulletins" lists the bulletins issued to date and provides a key word/subject index for the entire series.

## **Ordering Information**

Copies of the Technical Bulletins can be obtained from the appropriate FEMA regional office. Technical Bulletins can also be ordered from the FEMA publications warehouse. Use of FEMA Form 60-8 will result in a more timely delivery from the warehouse — the form can be obtained

from FEMA regional offices and your state's Office of Emergency Management. Send publication requests to FEMA Publications, P.O. Box 70274, Washington, D.C. 20024.

## **Further Information**

The following publications provide further information concerning elevator installation in buildings located in Special Flood Hazard Areas:

1. "Answers to Questions About Substantially Damaged Buildings," FEMA, May 1991, FEMA-213.
2. "Floodproofing Non-Residential Structures," FEMA, May 1986, FEMA-102.
3. "Flood Proofing Regulations," U.S. Army Corps of Engineers, March 1992, EP 1165-2-314.
4. "Floodproofing Test: Tests of Materials and Systems for Floodproofing Structures," U.S. Army Corps of Engineers, August 1988.

## **Glossary**

**Base flood** — The flood that has a 1-percent probability of being equaled or exceeded in any given year (also referred to as the 100-year flood).

**Base Flood Elevation (BFE)** — The height of the base flood, usually in feet, in relation to the National Geodetic Vertical Datum of 1929 or other datum as specified.

**Basement** — Any area of a building having its floor subgrade (below ground level) on all sides.

**Coastal High Hazard Area** — An area of special flood hazard extending from offshore to the inland limit of a primary frontal dune along an open coast and any other area subject to high-velocity wave action from storms or seismic sources.

**Federal Emergency Management Agency (FEMA)** — The independent federal agency that, in addition to carrying out other activities, oversees the administration of the National Flood Insurance Program.

**Federal Insurance Administration (FIA)** — The component of FEMA directly responsible for administering the National Flood Insurance Program.

**Flood Insurance Rate Map (FIRM)** — The insurance and floodplain management map issued by FEMA that identifies, on the basis of detailed or approximate analyses, areas of 100-year flood hazard in a community.

**Floodprone area** — Any land area susceptible to being inundated by floodwater from any source.

**Lowest floor** — The lowest floor of the lowest enclosed area of a building, including a basement. Any NFIP-compliant unfinished or flood-resistant enclosure useable solely for parking of vehicles, building access, or storage (in an area other than a basement) is not considered a building's lowest floor.

**Special Flood Hazard Area (SFHA)** — Area delineated on a Flood Insurance Rate Map as being subject to inundation by the base flood and designated as Zone A, AE, A 1 -A30, AR, AO, AH, V, VE, or V1-V30.

**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 market value of the structure before the damage occurred.

**Substantial improvement** — Any reconstruction, rehabilitation, addition, or other improvement of a structure, the cost of which equals or exceeds 50 percent of the market value of the structure before the “start of construction” of the improvement. This term includes structures that have incurred “substantial damage,” regardless of the actual repair work performed.