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Life Safety - Means of Egress/Exits – NFPA 101

Properly designed exits provide a safe path of escape from a fire or other emergency environment. The means of egress (exits) should be arranged to permit all occupants to reach a safe place before they are endangered by fire, smoke, or heat. The goal is for everyone to leave the hazardous areas in the shortest time possible.

The National Fire Protection Association (NFPA) developed model codes for fire protection and life safety. These model codes were adopted by federal, state, and local organizations and are included in their various building codes. NFPA 101 is the code that addresses life safety. This code includes minimum life safety requirements and requirements for specific building occupancy. The “authority having jurisdiction” (AHJ) (fire marshal, etc.) can modify these requirements under certain circumstances. NFPA 101 is a performance code and uses an “equivalent protection” concept by permitting alternatives, such as credits in case of a fully sprinklered occupancy. The code makes a distinction between a new and an existing occupancy. In most cases, adequate consideration is given to life safety in new construction. Changes in occupancy, growth, or modernization of operations require a periodic life safety review.

This bulletin is intended only as a general overview of the basic requirements. Please refer to the most current edition of Life Safety Code NFPA 101 for specific details for each type of occupancy.

Definitions

Means of Egress: A continuous and unobstructed path of travel from any point in a building or structure to a public way that consists of the following three separate and distinct parts:

- **Exit access:** The travel path or area that leads from where a person is located to the entrance to an exit.
- **Exit:** That portion of a means of egress that is separated by construction or equipment from other areas of the building. Exit components include walls, floor, doors, or other means that provide the protected path necessary for the occupants to proceed with reasonable safety to the exterior of the building. An exit may comprise vertical or horizontal means of travel such as doorways, stairways, ramps, corridors, and passageways. Types of permissible exits are doors leading directly outside or through a protected passageway to the outside, smoke-proof towers, interior and outside stairs, ramps, and escalators in existing buildings. Elevators are not accepted as exits.
- **Exit discharge:** That portion of a means of egress between the end of the exit and a public way or other safe place.

Arrangement of means of egress

Location

At least two exits should be provided for all areas. These exits must be remotely located from each other and arranged and constructed to minimize the possibility that more than one may be blocked by any one fire or other emergency condition. For all new construction, the “diagonal” rule requires exits to be separated by at least half of the diagonal distance of the area served.

Number of means of egress

The minimum number of exits from any balcony, mezzanine, or other area must be two. The minimum number of exits must be increased as follows:

- Occupant load of more than 49 but fewer than 500
- Occupant load of more than 500 but fewer than 1,000
- Occupant load of more than 1,000
- Exceptions are granted for existing buildings as provided by the specific occupancy sections of various Building or Life Safety codes.

The minimum occupant load or number of people expected in a building at any time is determined by dividing the gross or net floor area of a specific portion of the building by a factor projected for each person. The factor projected for each person and the choice of gross or net floor area varies with the type of occupancy. Specific requirements also exist for fixed seating arrangements. These values are minimums and, if the occupancy level will be higher, then additional existing capacity must be provided. In addition, the exit capacity provided must meet the highest occupancy level expected and should not be designed to an average.

Access to an exit

The codes specify the travel distance allowed to reach an exit. This is an extremely important feature since a person could be exposed to fire or smoke conditions during the time it takes to reach an exit. A general rule is the maximum travel distance to at least one exit shall not exceed 150 feet in buildings not sprinklered or exceed 200 feet in buildings protected throughout by an approved supervised sprinkler system. Depending on the occupancy, additional limitations on dead-end corridors and common pathways are required in the travel distances to an exit.

Caution: Specific travel distance limitations and exceptions for individual NFPA 101 Occupancy Classifications

Impediments to egress

In no case shall access to an exit be through kitchens, storerooms, restrooms, workrooms, closets, bedrooms, or similar spaces, and exit access doors leading to exits must be designed and arranged to be clearly recognizable. Hangings or draperies should not be placed over exit doors or otherwise located so as to conceal or obscure any exits.

Discharge of an exit

Exits should discharge directly to the outside or equivalent safe area. NFPA highlights circumstances where alternatives such as areas of refuge and exiting through lobby areas can be used.

Means of egress components

Doors, stairs, ramps, and exit passageways are the most common means of egress components. The code also permits fire escape, ladder, alternating tread devices, and slide escapes in certain occupancies. Where safe exiting is not possible, the code also permits “area of refuge” in specific cases.

Egress capacity

Egress capacity for each means of egress component is based on clear width of the component and the type of occupancy. Egress capacity for an exit route is determined by figuring egress capacity for each egress component and determining the most restrictive component in the exit tour. In general, the egress capacity feet factor for stairs is 0.3 inches per person and for ramps and level components is 0.2 inches per person.

Egress width

In determining the egress width for a doorway for purposes of calculating capacity, only the clear width of the doorway when the door is in the full open position should be measured. Clear width is the unobstructed width of the door opening.

No door opening in the means of egress should be less than 32 inches clear width opening. This width will allow passage of wheelchairs. For rooms with less than 70 square feet, the width may be reduced to 28 inches provided that wheelchair use is not allowed in the room. For existing structures, the minimum width is 28 inches. The maximum door leaf width is 48 inches to facilitate use in an emergency.

Door swing and arrangement

A door in a means of egress should be side-hinged or pivoted-swinging. Doors must swing in the direction of exit travel when:

1. Serving a room or area with an occupant load of 50 or more.
2. Used in an exit enclosure or where serving a high hazard area. Again, there are exceptions depending upon the NFPA 101 occupancy classification.

During its swing, the door should leave at least one-half the required width of an aisle, corridor, or landing available for use. For existing buildings, the minimum available space while the door is swinging is 22 inches. The door should not project more than 7 inches into the required width of an aisle or landing when fully opened.

Locks

Doors must be arranged to be readily opened from the exit side whenever the building is occupied. Also, a latch or other fastening device on a door must be provided with a knob, panic bar, or other simple type of releasing device having an obvious method of operation under all lighting conditions.

Panic hardware and fire exit hardware consist of bars that must extend across not less than one-half the width of the door leaf, not less than 30 inches or more than 44 inches above the floor. An applied force not to exceed 15 pounds will cause the door latch to release. There are specific requirements for electronically controlled egress doors.

Only approved fire exit hardware should be used on fire doors.

Corridors

The minimum width of an exit access shall be 36 inches for new buildings and 28 inches for existing. These minimums may be increased by individual occupancy chapter requirements.

Limit displaying combustible wall hangings such as crafts and artwork in school on the corridor walls. The corridor should not be used to store materials and equipment that will restrict its use for safe exiting.

Stairs - dimensional criteria

Stairs must be of sufficient width so two persons can descend side by side to maintain a reasonable rate of evacuation. Minimum width clear of all obstructions must be 44 inches.

Stair treads must be wide enough to give good footing. NFPA 101 specifies a minimum 11-inch tread and a maximum 78-inch riser for new stairs. Stair treads must be uniformly slip resistant and must be free of projections or lips that could trip stair users. Landings are required every 12 feet of stair height. Stairs that continue beyond the level of exit discharge must be interrupted at the level of exit discharge by partitions or other effective means. The variance in tread and riser dimensions should not exceed 3/16 of an inch for adjacent treads or risers of 3/8 of an inch from the largest to smallest tread/riser.

Handrails should be provided with stairs and shall not be more than 37 inches nor less than 30 inches from the upper surface of the handrail to the surface of the tread, in line with the face of the riser at the forward edge of the tread. New handrails on open sides of stairs must have intermediate rails or an ornamental pattern through, which a sphere of 4-inches in diameter cannot pass.

Any means of egress that are more than 30 inches above the floor or grade below must be provided with guards to prevent falls over the open side. Guards must be no less than 42 inches high and new railings should prevent a 4-inch sphere from passing through.

Ramps

The code permits use of inclined ramps. A new ramp in a public occupancy must have a clear width of 44 inches and typically will have a 1-in-12 slope for a 6-inch or greater rise. Steeper but shorter ramps are permitted. Maximum single rise for a ramp is limited to 30 inches. The code also requires guards and handrails for ramps. Due to accessibility considerations for the physically challenged, the ramp should be designed with proper slope, width, and slip resistant surfaces.

Smoke-proof enclosures

A smoke-proof enclosure is a stair enclosure so designed that the movement into the smoke-proof enclosure of products of combustion produced by a fire occurring in any part of the building is limited. The occupancy chapters of NFPA 101 highlight when this arrangement is recommended. A smoke-proof enclosure using stair pressurization must be protected throughout by an approved automatic sprinkler system. Equipment and ductwork for stair pressurization must be enclosed in 2-hour construction and any openings needed for maintenance and operation be protected by self-closing 1.5 hour fire protection rated devices.

The activation of the pressurized stair enclosure system must be initiated by a smoke detector installed within 10 feet of the entrance to the smoke-proof enclosure. This system also must be activated by the water flow signal from an approved automatic sprinkler system.

The stair pressurization system must be provided with standby power. This is to be provided by an approved self-contained generator set to operate whenever there is a loss of power. This standby generator also can provide power to emergency lighting units in the stair shaft and vestibule.

Marking means of egress

All exits and access ways must be marked by an approved sign readily visible from any direction of exit access. Every sign must be so located and of such size, distinctive color, and design as to be readily visible and must provide contrast with decorations, interior finish, or other signs. Every sign must be suitably illuminated by a reliable light source. Externally and internally illuminated signs must be visible in both normal and emergency lighting mode.

Emergency lighting

In buildings where artificial lighting is provided for normal use and occupancy, exit lighting and the illumination of the means of egress is required to ensure occupants can quickly evacuate the building.

Emergency lighting (1-foot candle average; 0.01-foot candle minimum) must be provided for a period of 1.5 hours in the event of failure of normal lighting. The emergency lighting system must be arranged to provide the required illumination automatically in the event of any interruption (10 seconds) of normal lighting, such as any failure of public utility or other outside electrical power supply or opening of a circuit breaker or fuse. Either the emergency lighting system must be continuously in operation or capable of repeated automatic operation without manual intervention. All emergency lighting must be installed and tested in accordance with NFPA 111 (Full 1.5 hour test annually and 30-second test every 30 days.)

Summary

NFPA 101 is a Life Safety Code that addresses minimum life safety and safe exiting requirements for occupants in case of a fire and other emergencies. The code is a performance-oriented code written in specification language for easy adoption by jurisdictional authorities.

The code made a distinction between new construction and existing buildings. Contrary to the common misconception, the code does not have any “grandfathering” provisions for existing buildings. The code does not permit an existing building to fall below the requirements for an existing occupancy. Prompt improvements are required to bring it up to the requirements for an existing building for occupancy. For any addition, alternations, renovations, or changes in occupancy of the building, more restrictive new construction requirements will apply. The authority having jurisdiction (AHJ, i.e., fire marshal or your insurance company) may permit limited but reasonable time for code compliance based on the evaluation and a reasonable time for code compliance based in the degree of hazard, magnitude of expenditure, and disruption of service.

References

1. National Fire Protection Association NFPA 101 Life Safety Code, 2015 edition.
2. National Fire Protection Association NFPA Life Safety Code Handbook, 2015 edition.
3. National Fire Protection Association NFPA Fire Protection Handbook, 20th edition, 2008.