FS47-24

IBC: 714.5, 714.5.1

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2024 International Building Code

714.5 Horizontal assemblies.
Penetrations of a *fire-resistance-rated* floor, floor/ceiling assembly or the ceiling membrane of a roof/ceiling assembly not required to be enclosed in a *shaft* by Section 712.1 shall be protected in accordance with Sections 714.5.1 through 714.5.4.

Revise as follows:

714.5.1 Through penetrations.
Through penetrations of *horizontal assemblies* shall comply with Section 714.5.1.1 or 714.5.1.2.

Exceptions:

1. Penetrations by steel, ferrous or copper conduits, pipes, tubes or vents or concrete or *masonry* items through a single fire-resistance-rated floor assembly where the *annular space* is protected with materials that prevent the passage of flame and hot gases sufficient to ignite cotton waste when subjected to ASTM E119 or UL 263 time-temperature fire conditions under a minimum positive pressure differential of 0.01 inch of water (2.49 Pa) at the location of the penetration for the time period equivalent to the *fire-resistance rating* of the construction penetrated. Penetrating items with a maximum 6-inch (152 mm) nominal diameter shall not be limited to the penetration of a single fire-resistance-rated floor assembly, provided that the aggregate area of the openings through the assembly does not exceed 144 square inches (92 900 mm^2) in any 100 square feet (9.3 m^2) of floor area.
2. Penetrations in a single concrete floor by steel, ferrous or copper conduits, pipes, tubes or vents with a maximum 6-inch (152 mm) nominal diameter, provided that the concrete, grout or *mortar* is installed the full thickness of the floor or the thickness required to maintain the *fire-resistance rating*. The penetrating items shall not be limited to the penetration of a single concrete floor, provided that the area of the opening through each floor does not exceed 144 square inches (92 900 mm^2).
3. Penetrations by *listed* electrical boxes of any material, provided that such boxes have been tested for use in fire-resistance-rated assemblies and installed in accordance with the instructions included in the listing.
4. ~~Penetrations of concrete floors or ramps within parking garages or *structures* constructed in accordance with Sections 406.5 and 406.6 where the areas above and below the penetrations are parking areas.~~Vehicle ramps within or adjacent to parking garages or structures constructed in accordance with Sections 406.5 and 406.6 that are not used for vehicle parking do not require penetrations to comply with Section 714.5.1.1, 714.5.1.2 or 714.5.1.3.

Reason: During the 2021 to 2024 code cycle, Proposal No. FS64-21 introduced a new Exception 4 to Section 714.5.1 which permits unprotected penetrations through floors and ramps of both enclosed and open parking garages where the areas above and below the penetrations are parking areas. We believe this new exception is does not represent good fire protection practices and as such are proposing modifications to the scope of the exception.

The modifications being proposed are intended to limit the application of the exception to vehicle ramps serving parking garage where the ramps are not directly above or below the parking areas. This limitation will minimize the chances of a fire from below involving parked vehicles.

Parking garages often have penetrants (roof drains, electrical conduit, cables, etc.) extending vertically throughout multiple levels of the parking garage. The need to protect penetrations above or below parking areas is critical in preventing ignition of parked vehicles.

The construction of modern vehicles has changed to include more plastics and other combustibles. While this benefits the vehicle weight and fuel economy, and lowers the vehicle price, it increases the fuel load and fire growth we see in parking garages. Modern vehicles present new hazards due to the incorporation of larger quantities of combustible materials (e.g. fuels, plastics, synthetic materials, etc.) into their designs. Another recent vehicle construction change is the use of plastic fuel tanks. Plastic fuel tanks can result in an earlier release of fuel in a fire. Fire tests at Southwest Research Institute showed fuel leakage as a result of fire exposure occurs after less than

five minutes of fire exposure. Fuel spill fires represent a likely means of vehicle-to-vehicle fire spread.1 As alternative fuel vehicles are popularized, concerns regarding their unique hazards, burn characteristics, and typical burn duration have been raised. Compared to older vehicles, modern vehicles burn differently. At the same time, modern parking garages have optimized space requirements for vehicle parking and storage. It is clear that the design assumption of only one or two fire burning has to be revisited. Cars are larger and have more fuel load than before, and the parking spaces have become smaller. This enhances the probability of fire spread between vehicles.

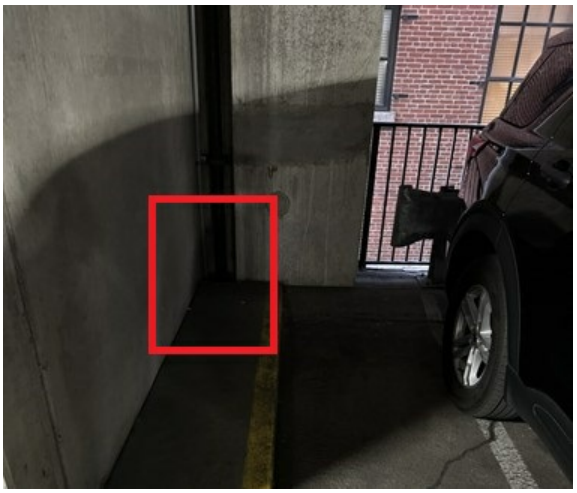
New electric vehicle battery and charging equipment technologies are also leading to much more rapid fire growth than previously contemplated in parking garage design. Fire accidents caused by the thermal runaway of lithium-ion battery have demonstrated that additional fire safety precautions are needed. It is particularly important to prevent these open and closed parking garage fires from occurring due to the challenges the fire services face in fighting parking garage fires.

There have been a number of recent cases and studies around the world that are demonstrating that fire safety in parking garages should be enhanced, not further reduced as done with Exception 4 of Section 714.5. In recent years, Europe has seen a series of large fires (Liverpool, UK (2017); Cork, Ireland (2018); Stavanger Airport in Sola, Norway (2020)1; Warsaw, Poland (2020)) that brought fires in parking garages into the focus of public discussions. In October, 2023, a major multi-storey parking garage fires occurred at the Luton Airport, London resulting in structural collapse.

A 2020 study on fires of electric vehicles concluded that in just 22 seconds, cell thermal runaway spreads flames throughout the battery compartment. A full-scale fire test was carried out on a battery system of seventeen 3P6S battery modules mounted with control systems in a car chassis. One battery module was overcharged until thermal runaway occurred. Within five seconds, thermal runaway spread to the four adjacent modules. Released gas was immediately ignited, with jet flame and smoke, and temperatures reached over 600 °C. These five modules then smouldered, and further modules ignited after around two minutes. The authors note that water fire suppression would be hindered by the battery pack casings.[1]

An NFPA Journal article published in 2019 indicated a typical garage fire today is much more likely to involve multiple vehicles than two decades ago, hinting that fires are in fact burning with more severity. In garage fires between 1995 and 1997, only 1 percent of fires involved more than five vehicles. By contrast, between 2010 and 2014, 8 percent of the garage fires involved more than five vehicles.[2]

The photos below show an example of a parking garage penetration. These photos were taken at the Marriott St Louis Grand Hotel multi-story parking garage. An approximate 12 in. by 12 in. opening was located approximately 4 ft from an adjacent parked car. By the 2024 IBC, this unprotected opening is permitted. Is the level of protection we should be permitting?



FCAC was established by the ICC Board of Directors in July 2011 to pursue opportunities to improve and enhance assigned International Codes or portions thereof. In 2023 and early 2024 the FCAC has held several virtual meetings and one in-person meeting open to any interested party. In addition, there were numerous virtual Working Group meetings for the current code development cycle, which included members of the committee as well as interested parties. Related documents and reports are posted on the **FCAC Website**

Cost Impact: Increase

Estimated Immediate Cost Impact:

The average cost of an installed firestop system for concrete floors is $35 - $50 per penetration.

Estimated Immediate Cost Impact Justification (methodology and variables):

The immediate cost impact estimate is based on industry and manufacturer input.This includes materials and labor costs for any type of penetrant through the floor assembly. The cost range includes, sealant based, intumescent, or mechanical devices. The total cost in any given parking garage will depend upon the number of penetrations.

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