Inspecting Residential Attached Garages

by Aaron Miller, CMI®

Garages have been with us since before the automobile in the form of carriage houses (coach houses or remises). Being for the most part glorified barns detached from the residence, other than the danger of fire from the combination of stored hay and lanterns, these early structures were relatively safe. Unfortunately, this is not the case with today's garages, which are attached to almost 97% of homes.

Modern garages have (d)evolved to the point that a recent straw poll indicates a mere one quarter of homeowners are able to park a vehicle in theirs. About half say they can squeeze one car in, and the other quarter is somehow able to park multiple vehicles there. Most folks use their garage space to store personal items. Other uses run the gamut, from various hobby shops to rehearsal studios to budding dot-com headquarters.

Regardless of whether a garage is used to store fossil fuel-burning vehicles, it can be rife with hidden perils. Whether you are a minimalist adhering only to your mandated or

suggested standards of practice, or you are a code-certified stickler for the rules, if a fire starts in a garage, you do not want it to spread to the attached house. Additionally, if you start up your vehicle in the garage, you do not want carbon monoxide entering your home.

An unimaginably large number of potential hazards are present within garages attached to houses. Homeowners have a tendency to store an assortment of dangerous materials there. The likelihood exists for the presence of volatile chemicals and hazardous gases other than gasoline or diesel fuel. These include, but are not limited to, paint accessory chemicals, such as thinners, removers, etc., other cleaning solvents, propane cylinders for barbecue grills, swimming pool chemicals, and welding gases for welding enthusiasts and gearheads.

This is further exacerbated by the probability of carbon monoxide (CO) and other vapor accumulation within the garage. Fire separations are required between residences and attached garages and their attics, but are not well defined by the prevalent building codes. These are often not constructed correctly, do not perform as intended, and constitute health and fire safety hazards for homeowners. Curiously, there is no mention in the prevalent building codes regarding gases or vapors other than CO. Even when properly configured, given the lack of clarity and comprehensiveness of the pertinent building codes (such as the International Residential Code or IRC), safety is often not maximized.

Separation Codes

The IRC does not provide us with a definition for the term "fire separation," which is required in 302.6. Perhaps it is reasonable to assume that this is a reference to some sort of modified fire-resistance assembly, though it does not constitute a fire-resistance or fire-rated assembly, per se. Some would argue that it is not an assembly at all. However, there is a requirement for ½-inch gypsum board on the interior and garage side of the fire separation, as well as the requirement in 302.9 for a minimum flame-spread and smoke-developed index with regard to the gypsum board finish on both the fire separation wall and ceiling.

The lack of a proper, if not a comprehensive, glossary of terms has been a shortcoming of the IRC and IBC (International Building Code). Unfortunately, this often leaves the interpretation of code citations to contractors and code officials who are likely not qualified to deduce the meaning or intent of the code authors. As inspectors, it behooves us to petition the International Code Council (ICC) to provide all concerned with a more complete chapter of definitions in each of their code publications. Failing that, perhaps they could publish a stand-alone, all-inclusive glossary.

Other Than Gypsum Board Walls and Ceilings

There are several municipalities particularly in the Dallas-Fort Worth area where the building officials equate 7/16-inch OSB with ½-inch gypsum board for use in garage wall and ceiling separations. The two materials are clearly not equivalent when it comes to flame-spread ratings (FSR), where 1/2-inch gypsum board is rated at 10, and 7/16-inch OSB is rated at 150. Even if the builder installs the OSB over

the required gypsum board, this would not be code-compliant in that the OSB then constitutes a wall covering requiring an FSR of at least 50.

Ceiling and Wall Finishes

The code authors do define the term "fire resistance" as "that property of materials or their assemblies that prevents or retards the passage of heat, hot gases, or flames under conditions of use." When attempting to ascertain fire-resistance in a material, IRC 302.9 requires that all garage separation ceiling and wall finishes adhere to minimum flame-spread and smoke-developed index ratings. Two references for evaluating this are the *ASTM E84 Standard Test Method for Surface Burning Characteristics of Building Materials*, and the *UL 723 Standard for Test for Surface Burning Characteristics of Building Materials.*

Doors

One example of a problem area is the entry door between the garage and the residence. This door assembly is not specifically required to be fire-rated. One could make the argument that, given the wording in IRC 302.5.1, a fire-rated door or its equivalent is required.

> *R302.5.1 Opening protection. Openings from a private garage directly into a room used for sleeping purposes shall not be permitted. Other openings between the garage and residence shall be equipped with solid wood doors not less than 13/8 inches in thickness, solid or honeycomb-core steel doors not less than 13/8 inches thick, or 20-minute fire-rated doors, equipped with a self-closing device.*

No mention is made of the need for fire resistance of the door frame. There is also no mention of the need to gasket (weatherstrip) the door. Closure devices are obviously required. These can be spring hinges or hydraulic closures.

When the doors to attached garages are open or when atmospheric pressure changes, toxic airborne chemical vapors are able to pass from the garage into the home. Some homes experience considerable negative pressures inside as a result of poorly designed HVAC systems, or due to the chimney effect, which can result in fumes from the garage being drawn indoors through small openings in separation walls and ceilings, around poorly sealed doors, or from the shared attic space.

Many newer homes are air-sealed for energy efficiency. When properly done, this has the effect of aiding in the prevention of the intrusion of noxious fumes from attached garages. Older homes likely have little or no such protection. Inspectors should make a point to instruct homeowners and home buyers to make a concerted effort to seal the garage wall and ceiling separations, properly store flammable and toxic chemicals in fireproof enclosures, and provide adequate ventilation in their garages to remove unwanted fumes to the outdoors.

Ventilation is required by the International Mechanical Code's IMC 403.3. While this requirement has not been adopted by most municipalities as applicable to single-family residences, the inspector may wish to note it in his inspection report so that the client has options beyond the bare minimum provided by the IRC.

Plumbing Penetrations

The installation of PEX water supply piping manifolds is common in the fire separation walls of garages in many areas. This is also the case where the homes have fire-suppression sprinkler systems installed. These are usually just openings in the drywall framed with scrap trim material and covered with plywood or OSB doors. The builders often stuff insulation behind these manifolds and proclaim them to be code-compliant. However, this practice is actually a fire hazard. Therefore, it is prudent for inspectors to urge clients to protect these openings by either boxing out the panels with ½-inch gypsum board, or with 16-gauge self-closing metal access doors intended for use in fire rated walls. Again, if a door of any kind in a fire separation is not fire-resistant and closed, the fire separation is breached and therefore ineffective.

Attic Pull-Down Stair Units

One obvious example of a ceiling fire separation breach is the near an attic pull-down stair unit. One of these units is typically constructed of a softwood frame and faced with a panel of ¼-inch Philippine mahogany (often called lauan, luan or meranti, and having no relation to genuine mahogany). The flame-spread rating of this plywood (150) does not even begin to approach that of the required ½-inch gypsum board (10) for garage ceilings with attic space above, or the 5/8-inch Type X gypsum board (15) for ceilings with living space above. There are many different pull-down stair configurations available that mitigate this by using fire-retardant plywood or metal panels. Special attention must be paid to weatherstrip at the door on all four sides (including the hinge side). Whatever trim is used around the perimeter must have the approved flame-spread rating.

Electrical Penetrations

Other openings in the fire separation that require closer attention during inspections are the electrical panels and outlet boxes. The IRC makes no mention of these with regard to garage fire separation because they are not recognized as fire-resistant or fire-rated assemblies. That said, imagine an electrical outlet box that has a 1/8-inch gap between it and the surrounding gypsum board, along with openings where the electrical cables enter and exit the box. While the box itself may be UL-rated for installation in a fire-resistant or fire-rated assembly, the openings around and in the box itself form a passageway for fire, smoke, and vapor intrusion. Inspectors should strongly recommend that these openings be fire-blocked.

The IRC and National Electric Code (NEC) have no requirements for sealing or fire-blocking electrical panels or junction boxes in fire separation walls. Fire-resistant and fire-rated assemblies have many requirements regarding this. It is prudent to suggest these methods to clients living in or purchasing single-family homes.

Floors and Floor Coverings

Floors in garages also need consideration. Of course, they must be sloped in order to drain toward the garage door opening, and their surfaces must be "of approved non-combustible materials." The IRC does not specify the degree of slope in 309.4, but states only that, "The area of floor used for parking of automobiles or other vehicles shall be sloped to facilitate the movement of liquids to a drain or toward the main vehicle entry doorway." Most engineers specify a 1% slope, or 1/8-inch per foot.

The term "non-combustible" is defined in the IRC as "materials that pass the test procedure for defining non-combustibility of elementary materials set forth in ASTM E136." This ASTM test method is for the base material only—usually concrete, in the case of a garage floor—and does not cover any surface coverings or coatings. For materials that have a surface covering, the model building codes further define a non-combustible material as having a base material that meets the requirements of ASTM E136, and a surface covering less than 1/8-inch in thickness whose flame-spread index is not greater than 50. Most floor coverings in garages exceed the flame-spread rating of 50.

Mechanical Considerations

While most inspectors are aware of garage floor clearances where mechanical equipment or appliances are concerned, there is one thing that is often overlooked: protection of the appliances and equipment from vehicular damage with stanchions or bollards.

Tank water heaters and other appliances require protection from impact by automobiles, per IRC 1307.3.1. The addition of stanchions or bollards is required per 1307.3.1:

> *Protection from impact. Appliances located in a garage or carport shall be protected from impact by automobiles.*

If bollards or stanchions are not installed, then the unit must be raised 6 feet above the garage floor, per IRC G2408.3 (305.5):

> *Private garages. Appliances located in private garages shall be installed with a minimum clearance of 6 feet above the floor.*
>
> *Exception: The requirements of this section shall not apply where the appliances are protected from motor vehicle impact and installed in accordance with Section G2408.2.*

Appliances located in a private garage or carport must be protected from vehicle impact. This section is applicable to appliances located in an area where motor vehicles can be operated, and includes appliances under which a vehicle can pass, and those located anywhere in a vehicle's path where impact is possible. The 6-foot minimum height requirement is intended to provide adequate clearance above a typical automobile. With the popularity of conversion vans and recreational vehicles, which can be much higher than other automobiles, the 6-foot minimum installation height above the floor may not provide adequate clearance; additional height might be necessary. The garage door height can be used as a guide in determining the maximum vehicle height.

Model Homes are "Poster Children"

Probably the best place to find most or even all of the above issues is in a home builder's model home that is being sold once the houses in the subdivision are sold. Many builders utilize the attached garage in model homes as offices for their sales staff. These are outfitted as any other conditioned, habitable space. When one of these homes is

sold, it is the builder's responsibility to bring the attached garage area into code compliance, but this is rarely accomplished.

Code violations in re-converted model home garages may include, but are not limited to, electrical receptacles within 18 inches of the garage floor, air-conditioning duct diffuser and recessed lighting fixture penetrations of the garage ceiling, combustible floor coverings, etc.

Summary

To recap, there are many materials, systems and installations in attached garages that can represent real dangers to homeowners. Inspectors may want to consider moving beyond state-required or voluntary SOPs and minimal building codes to offer best-practice advice to their clients in order to ensure their safety.

About the Author

Following six years in the U.S. Army, Aaron D. Miller began work as a general contractor in the residential building and remodeling industry in 1975, until becoming a full-time home inspector in 1997. A member of InterNACHI and a Certified Master Inspector®, Aaron is also a TREC-Licensed Inspector and Professional Instructor, a Master TPREIA Inspector, and an ICC-Certified Residential Inspector in five areas. He is a native of Dallas and has lived in the Dallas suburb of Garland for the past 15 years. A full list of his extensive professional credentials can be found on his website at www.texasinspector.com (http://www.texasinspector.com/)

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