

subject present in the IMC. These sections remain in the IMC for mechanical professionals ease of access to such information. The last sentence related to existing buildings undergoing repairs, alterations, etc. and the reference to the IEBC is needed to refer the code user to mechanical requirements that might be triggered as a result of work performed under the jurisdiction of the IEBC. An example would be IEBC Section 609.2 where in buildings undergoing "Alterations Level 2", a minimum amount of outdoor air and ventilation air is specified. The IEBC chapters have a cascading effect such that IEBC Section 609.2 is also applicable to buildings undergoing "Alterations Level 3" and "Change of Occupancy Classification".

3. 102.4 : The IEBC also addresses mechanical issues related to additions, alterations and repairs. The IEBC Drafting Committee after extensive discussions agreed on the goal that existing building provisions while providing for health and safety should also encourage the use and re-use of existing buildings. Accordingly Sections 401.2, 401.3, 409 (Repair), 501.2, 503.3 (Alteration level 1), 601.2, 609 (Alteration level 2), 701.2 (Alteration level 3), and 901.1 (Additions) address such issues.

4. 102.5 : This section is revised to make reference to the IEBC . The IEBC contains comprehensive provisions for change of occupancy.

5. 102.6 : This section is revised to make reference to IEBC. The IEBC contains comprehensive provisions for historic buildings.

6. 201.3 : The *International Existing Building Code* is added as many terms related to existing buildings such as those discussed under 102.4 are found in the IEBC.

7. Section 302.1 : Any change or modification to walls, floors, ceiling and other building elements as a result of mechanical work, will create a category of work under the provisions of the IEBC and therefore a reference to the IEBC is needed to alert the code user to the possibility of requirements that might be triggered under the IEBC.

Committee Action: **Disapproved**

Committee Reason: It is premature to refer to a code that is not finalized.

Assembly Action: **No Motion**

Individual Consideration Agenda

This item is on the agenda for individual consideration because a public comment was submitted.

Public Comment:

John Terry, State of New Jersey, representing the IEBC Drafting Committee, requests Approved as Modified by this comment.

Modify proposal as follows:

101.2 Scope. This code shall regulate the design, installation, maintenance, alteration and inspection of mechanical systems that are permanently installed and utilized to provide control of environmental conditions and related processes within buildings. This code shall also regulate those mechanical systems, system components, equipment and appliances specifically addressed in herein. The installation of fuel gas distribution piping and equipment, fuel gas-fired appliances and fuel gas-fired appliance venting systems shall be regulated by the International Fuel Gas Code. ~~Repairs, alterations, or additions to mechanical systems in existing buildings shall also comply with the *International Existing Building Code*.~~

102.4 Additions, alterations or repairs. Additions, alterations, renovations and repairs to mechanical systems shall comply with the provisions of the *International Existing Building Code* and this code, as applicable.

102.5 Change in occupancy. The provisions of the *International Existing Building Code* shall apply to all buildings undergoing a change of occupancy.

~~**102.6 Historic buildings.**~~ The provisions of the *International Existing Building Code* shall apply to historic buildings.

201.3 Terms defined in other codes. Where terms are not defined in this code and are defined in the International Building Code, ICC Electrical Code, International Fire Code, International Fuel Gas Code, International Plumbing Code or the *International Existing Building Code*, such terms shall have meanings ascribed to them as in those codes.

302.1 Structural safety. The building or structure shall not be weakened by the installation of mechanical systems. Where floors, walls, ceilings or any other portion of the building or structure are required to be altered or replaced in the process of installing ~~or repairing~~ any system, the building or structure shall be left in a safe structural condition in accordance with the *International Existing Building Code*.

**CHAPTER 15
REFERENCED STANDARDS**

ICC International Code Council
5203 Leesburg Pike, Suite 600
Falls Church, VA 22041

Standard reference number	Title
IEBC-2003	<i>International Existing Building Code</i>

Commenter's Reason: This code change was originally Disapproved. The proposed modification simply deletes the part of text in Section 101.2 which currently appears in section 102.4 addressing additions, alterations and repairs and its duplication in Section 101.2 is unnecessary. Section 102.6 Historic Buildings has been deleted as historic buildings are existing buildings and covered under the IEBC. The revisions shown in Section 302.1 incorporate submitted revisions on the floor of the committee hearings in Pittsburgh. This revision keeps the reference to the IBC and the administrative sections of the code make proper reference to the IEBC for repair.

The *International Mechanical Code* Development Committee disapproved the code change because "it is premature to refer to a code that is not finalized". Contrary to the reported reason for Disapproval, the IEBC is, in fact, complete and is undergoing maintenance of provisions in the 2002 Cycle, just like all the I-codes. In recognition of this fact, the IBC General Committee approved code change proposal G133, that replaces the current text of 2000 IBC chapter 34, Existing Structures, with a reference to the IEBC. The IEBC Drafting process was very similar to the process used to develop the IBC - a committee developed a draft(s) which was then exposed to the rigors of the ICC Code Development Process. The 2003 IEBC will be part of the 2003 family of International Codes. The ICC Board of Directors established the IEBC Drafting Committee and charged it with the responsibility of drafting a code to have comprehensive provisions for existing buildings. The *International Existing Building Code* (IEBC), 2003 Final Draft, was published in August of 2001.

The IEBC Drafting Committee respectfully requests the membership approval of this public comment (AM).

**M7-02
304.3 (IRC M1307.3)**

Proposed Change as Submitted:

Proponent: ICC Ad Hoc Committee for Hydrogen Gas

THIS PROPOSAL IS ON THE AGENDA OF THE IMC AND THE IRC MECHANICAL CODE DEVELOPMENT COMMITTEES. SEE THE TENTATIVE HEARING ORDERS FOR THESE COMMITTEES.

Revise as follows:

1. IMC 304.3 Location Elevation of ignition source.

Equipment and appliances having an ignition source and located in hazardous locations and public garages, private garages, repair garages, automotive service stations, and parking garages where flammable liquids or flammable gases heavier than air are present shall be elevated such that the source of ignition source is not less than 18 inches (457 mm) above the floor surface on which the equipment or appliance rests. Such equipment and appliances shall not be installed in Group H occupancies or control areas where open-use, handling or dispensing of combustible, flammable or explosive materials occurs. For the purpose of this section, rooms or spaces that are not part of the living space of a dwelling unit and that communicate directly with a private garage through openings shall be considered to be part of the private garage.

Add new text as follows:

304.4 Hydrogen Generating and Refueling Operations.

In rooms or spaces that contain hydrogen generating or refueling systems, equipment and appliances having an ignition source shall be located such that the ignition source is not less than 24 inches (457 mm) below the ceiling in hazardous locations and public garages, private garages, repair garages, automotive service stations and parking garages where gaseous hydrogen is present. Such equipment and appliances shall not be installed in Group H occupancies or control areas where open-use, handling or dispensing of combustible, flammable or explosive materials occurs. For the purpose of this section, rooms or spaces that are not part of the living space of a dwelling unit and that communicate directly with a private garage through openings shall be considered to be part of the private garage.

Exceptions:

1. Where rooms or spaces that contain hydrogen generating or refueling systems are ventilated

in accordance with Section 304.4.1

2. Where rooms or spaces that contain hydrogen generating or refueling systems are ventilated in accordance with Section 502.15 of the

International Mechanical Code and the following:

- 2.1. The ventilation system shall be designed to maintain the maximum concentration of flammable contaminants below 25 percent of the contaminant's lower flammability limit; or
- 2.2. Continuous ventilation shall be provided at a rate not less than 1 cubic foot per minute per square foot [(0.0051m³/s x m²)] of floor area of the room.
3. Where rooms or areas that contain hydrogen generating or refueling systems are ventilated in accordance with Section 304.4.2

304.4.1 Natural Ventilation. Rooms or spaces located underneath or adjacent to habitable space and intended for hydrogen generating or refueling operations shall be provided with mechanical ventilation as required by the exception to Section 304.4 or shall communicate with the outdoors in accordance with Sections 304.4.1.1 through 304.4.1.2. The minimum cross-sectional dimension of air openings shall be 3 in. (76 mm). Where ducts are used, they shall be of the same cross-sectional area as the free area of the openings to which they connect.

304.4.1.1 Two openings. Two permanent openings, one commencing within 12 inches (305 mm) of the ceiling of the garage, and one commencing within 12 inches (305 mm) of the floor of the garage, shall be provided. The openings shall communicate directly, or by ducts, with the outdoors. Each opening shall directly communicate with the outdoors horizontally, and have a minimum free area of ½ square foot per 1,000 cubic feet of garage volume.

304.4.1.2 Louvers and grilles. In calculating free area required by Section 304.4.1.1, the required size of openings shall be based on the net free area of each opening. If the free area through a design of louver or grille is known, it shall be used in calculating the size opening required to provide the free area specified. If the design and free area are not known, it shall be assumed that wood louvers will have 25 percent free area and metal louvers and grilles will have 75 percent free area. Louvers and grilles shall be fixed in the open position.

304.4.2 Specially engineered installations. As an alternative to the provisions of Section 304.4.1, the necessary supply of air for, ventilation and dilution of flammable gases shall be provided by an approved engineered system.

(Renumber remaining sections)

**SECTION 202
GENERAL DEFINITIONS**

HYDROGEN GENERATING APPLIANCE. A self-contained package or factory-matched packages of integrated systems for generating gaseous hydrogen. Hydrogen generating appliances utilize electrolysis, reformation, chemical, or other processes to generate hydrogen.

Revise as follows:

2. IRC 1307.3 Location Elevation of ignition source.

Appliances having an ignition source of ignition shall be elevated such that the ignition source is not less than 18 inches (457 mm) above the floor in garages where flammable liquids or flammable gases heavier than air are present. For the purpose of this section, rooms or spaces that are not part of the living space of a dwelling unit and that communicate directly with a private garage through openings shall be considered to be part of the garage.

Add new text as follows:

1307.4 Hydrogen Generating and Refueling Operations. In rooms or spaces that contain hydrogen generating or refueling systems, equipment and appliances having an ignition source shall be located such that the ignition source is not less than 24 inches (457 mm) below the ceiling in garages where gaseous hydrogen is present. For the purpose of this section, rooms or spaces that are not part of the living space of a dwelling unit and that communicate directly with a private garage through openings shall be considered to be part of the private garage.

Exceptions:

1. Where rooms or spaces that contain hydrogen generating or refueling systems are ventilated in accordance with Section 1307.4.1
2. Where rooms or areas that contain hydrogen generating or refueling systems are ventilated in accordance with Section 502.15 of the *International Mechanical Code* and one of the following:
 1. The ventilation system shall be designed to maintain the maximum concentration of flammable gas present below 25 percent of the lower flammability limit of the substance for the expected room temperature; or
 2. Continuous ventilation shall be provided at a rate not less than 1 cubic foot per minute per square foot [(0.0051m³/(s x m²))] of floor area of the room.
3. Where rooms or areas that contain hydrogen generating or refueling systems are ventilated in accordance with Section M1307.4.2

1307.4.1 Natural Ventilation. Rooms or spaces located underneath or adjacent to habitable space and intended for hydrogen generating or refueling operations shall be provided with mechanical ventilation as required by the exception to Section M1307.4 or shall communicate with the outdoors in accordance with Sections M1307.4.1.1 through M1307.4.1.2. The minimum dimension of air openings shall be not less than 3 in. (76 mm). Where ducts are used, they shall be of the same cross-sectional area as the free area of the openings to which they connect.

1307.4.1.1 Two openings. Two permanent openings, one commencing within 12 inches (305 mm) of the ceiling of the garage, and one commencing within 12 inches (305 mm) of the floor of the garage, shall be provided. The openings shall communicate directly, or by ducts, with the outdoors. Each opening shall directly communicate with the outdoors horizontally, and have a minimum free area of ½ square foot per 1,000 cubic feet of garage volume.

1307.4.1.2 Louvers and grilles. In calculating free area required by Section 1307.4.1.1, the required size of openings shall be based on the net free area of each opening. If the free area through a design of louver or grille is known, it shall be used in calculating the size opening required to provide the free area specified. If the design and free area are not known, it shall be assumed that wood louvers will have 25 percent free area and metal louvers and grilles will have 75 percent free area. Louvers and grilles shall be fixed in the open position.

1307.4.2 Specially engineered installations. As an alternative to the provisions of Sections M1307.4.1, the necessary supply of air for, ventilation and dilution of flammable gases shall be provided by an approved engineered system.

(Renumber remaining sections)

**CHAPTER 202
DEFINITIONS**

Hydrogen Generating Appliance. A self-contained package or factory-matched packages of integrated systems for generating gaseous hydrogen. Hydrogen generating appliances utilize electrolysis, reformation, chemical, or other processes to generate hydrogen.

Proponent's Reason: Introduction. Hydrogen energy safety is based on three primary elements: regulatory requirements, capability of safety technology and the systemic application of equipment and procedures to minimize risks. Groups involved in the industrial scale production of hydrogen (producers) currently implement many successful proprietary methodologies for safely generating and handling large amounts of hydrogen. Hydrogen users (e.g., NASA) depend on cryo-hydrogen as a fuel and have effectively proven the safety of large scale ground and vehicle systems which support the Space Shuttle Program.

The efforts of the International Code Council Ad Hoc Committee for Hydrogen Gas (AHC) intend to address how future building codes can safely cover hydrogen applications in fuel cell vehicles and hydrogen

gas motor-vehicle fuel dispensing and generation stations. The AHC consists of a balanced membership of user, producer and regulatory interests working together with a diverse group of technical and advisory interests to propose changes as necessary to the ICC International Codes. This, and other, related proposals is a summation of their work.

IRC Section 1307.4. Ventilation, whether natural or mechanical, cannot remove all risk from combustible gas leaking into a garage. Based on ongoing research into the dispersion characteristics of gaseous hydrogen, and conducted at the University of Miami, Coral Gables, 1/2 square foot of opening area per 1,000 cubic feet of garage volume greatly reduces risk, assuming upper and lower openings of approximately equal areas are used. In addition, relying entirely on natural (i.e., passive) ventilation, the ventilation exchange rate increases with increasing hydrogen concentration due to the buoyancy of hydrogen. This is in contrast to mechanical (i.e., active) ventilation, which remains at a constant rate despite any change in hydrogen concentration.

The following is a comparison of a ventilated garage with an unventilated garage, for three leakage rates. The leakage rates were 1.0, 4.0 and 13.0 SCFM. It should be stated clearly that the findings of the University of Miami are based on leakage at the refueling interface and not the vehicle fuel tank. The AHC feels this is a reasonable assumption given the very real potential for the future installation of remote home gaseous hydrogen refueling appliances.

The comparisons of hydrogen accumulation in the garage show the reduction in risk with garage ventilation. The comparisons were made after 20 minutes of leakage. If a garage has openings, the hydrogen accumulation has reached relative equilibrium after 20 minutes and does not continue to increase appreciably with time. If a garage is not ventilated the hydrogen will continue to accumulate with time and eventually produce a hazardous environment.

The two garages, in Figures C1 through C6, are identical with the exception that the first garage did not have an upper opening. Both garages have lower openings, which spanned the bottom of the garage door. The openings were sized at 1/2 ft²/1000 ft³ of garage volume. The leak was assumed to occur at the vehicle-filling interface, as this type of leakage is difficult to detect. The filling interface was located on the rear passenger side fender. The garage was 9 feet 2.5 inches high by 12 feet 2 inches wide by 21 feet long.

Figures C1 and C2 show the results of hydrogen leaking at 1 SCFM for 20 minutes. The garage without an upper opening is shown in figure C1. The red lines (dark lines) are a surface of constant 4.1% concentration. 4.1% concentration is the lean limit of combustion for hydrogen. It can be seen that a layer of burnable gases approximately 9 inches thick were trapped against the garage ceiling. The blue lines (grey lines) represent a surface of constant 0.82% hydrogen (20% of the lean limit of combustion). They exist down to a level approximately 28 inches below the ceiling. The result of using both lower and upper openings can be seen in figure C2. No appreciable burnable (4.1% hydrogen concentration) gases exist in the garage and the gases, which are richer than 20% of the lean limit of combustion, are only 21 inches thick. As the leak continues the upper garage will continue to fill with greater amounts of hydrogen while lower garage will stay at a relatively constant concentration.

As seen in figure C3 and C4, a 4.0 SCFM leak of hydrogen produces a burnable mixture in both garages. The layer of burnable gases in the lower garage (figure C4 with upper and lower openings) was about 11.0 inches thick, as opposed to 34 inches thick, and contained less than 1/10 the energy of the upper garage (figure C3). The severity of an accident would be substantially reduced by the lower energy content of the burnable gases in figure C4. The buoyancy of hydrogen created an 83 SCFM ventilation rate in the garage in figure C4.

As seen in figure C5, a 20-minute 13.0 SCFM leak of hydrogen almost completely filled the garage with a burnable mixture if no upper opening was provided. The ventilated garage (figure C6) contained a burnable layer approximately 22 inches thick. This was noticeably less than in the unventilated garage with a 4 SCFM leak (figure C4) and contained less than half the energy. The buoyancy of hydrogen created a 123

SCFM ventilation rate in the garage in figure C6.

The SAE Fuel Cell Vehicle (FCV) Standards Committee has been monitoring and contributing to the work of the AHC and is aware of the AHC's decision to require additional natural or mechanical ventilation ONLY in rooms or spaces intended for hydrogen generating or refueling operations. To be explicitly clear it is NOT the intent of the AHC to require additional natural or mechanical ventilation in areas solely dedicated to the parking/storage of hydrogen-fueled vehicles (i.e., where no hydrogen generating or refueling operation is present).

Therefore, to inform the U.S. Building Regulatory Community of measures the SAE Fuel Cell Vehicle (FCV) Standards Committee plans to take to ensure safety, the Safety Working Group of the SAE FCV Standards Committee is currently preparing two "recommended practices". The following recommendations have been incorporated into drafts of these standards to address hydrogen safety for the situation cited above:

1. Fuel systems will be designed and built to appropriate standards and leak tested to demonstrate integrity.
2. Performance-based requirements related to parking an FCV in a single-bay residential garage have been established. The standard requires validation testing in a garage with very low natural ventilation (of only 0.2 air exchanges per hour) to ensure that the vehicle is normally capable of being safely stored in a residential garage.
3. The vehicle manufacturer (VM) is required to perform a Failure Mode and Effects Analysis (FMEA) for the vehicle. If a single failure could lead to hazardous event, the vehicle manufacturer is required to either modify the system to preclude the failure mode, add failsafe or redundant design measures to prevent the failure, or improve the integrity of components and systems such that risks of these failures are acceptably minimal.
4. If the vehicle manufacturer (VM) is unable to meet any of the above requirements, then the VM shall caution the owner/operator of the vehicle of any operating or parking restrictions.

SAE trusts that the U.S. Building Regulatory Community will find these measures suitable for product introduction. As operating experience is accrued with these new types of vehicles, both SAE and the ICC may need to reassess the situation and provide additional measures for FCV safety as necessary.

Thus, in crafting the proposed language specific to ventilation, the AHC has reviewed the findings of the University of Miami and takes the position that existing provisions for mechanical ventilation of residential garages are not enforced. In concert with these findings and our confidence in the SAE Safety Working Group's investigations into failure mode analyses for hydrogen-fueled vehicle design, the AHC has recommended both natural and mechanical ventilation alternatives for private garages located underneath living space and intended for hydrogen generating or refueling operations. For the natural ventilation alternative, the proposed 1/2 ft.² of net free area per 1,000 cubic feet of garage floor area represents a minimum. This level of ventilation provides more than a 100 SCFM mechanical system would provide when the hydrogen leak is greater than 8 SCFM. Protection against higher leakage rates than those represented in the University of Miami study could be obtained by larger opening areas. In fact, the opening size and location criteria are not unlike those required to meet combustion air requirements.

In Summary. The AHC has developed these changes through the consultation of a diverse group of technical and advisory parties from various parties in the hydrogen community, inclusive of industry, professional associations, testing laboratories, agencies of government, academic and research institutions and believes it important to provide a template for thorough coverage in the International Codes of equipment, appliances and vehicles that will utilize hydrogen as a fuel such that regulators have a sound technical basis on which to verify installation and to uphold the standard of health and safety for the citizens of their jurisdictions.

Industry is ready to commercialize hydrogen energy systems. The AHC

urges your APPROVAL of this proposal "as submitted".

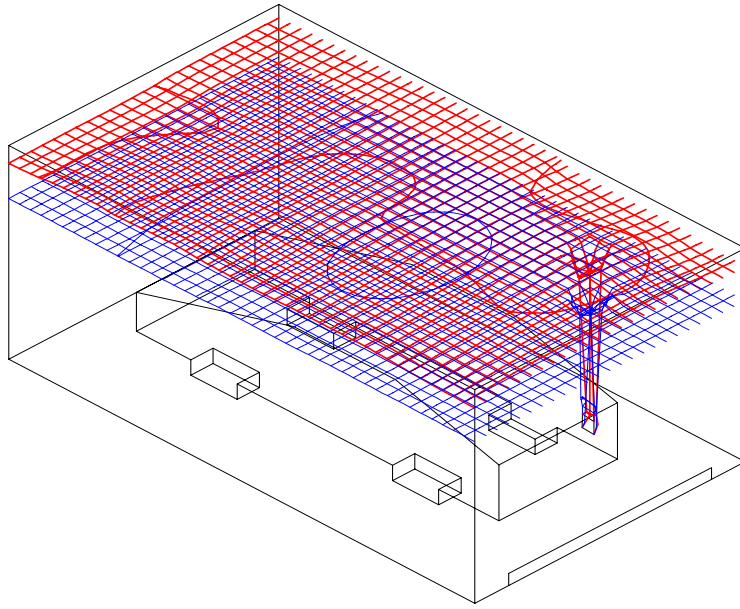


Figure C 1 - Unvented garage, 1 SCFM hydrogen leak for 20

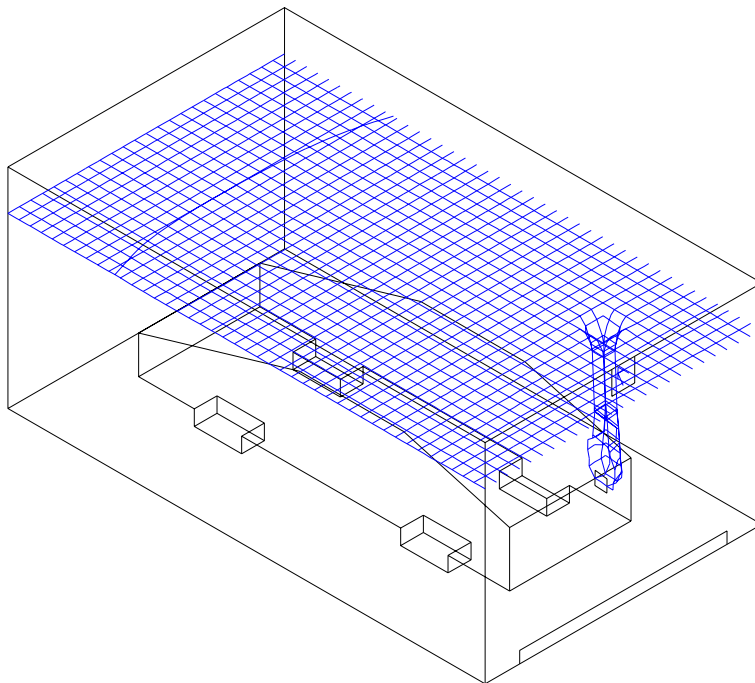


Figure C 2 - Vented garage, 1 SCFM hydrogen leak for 20

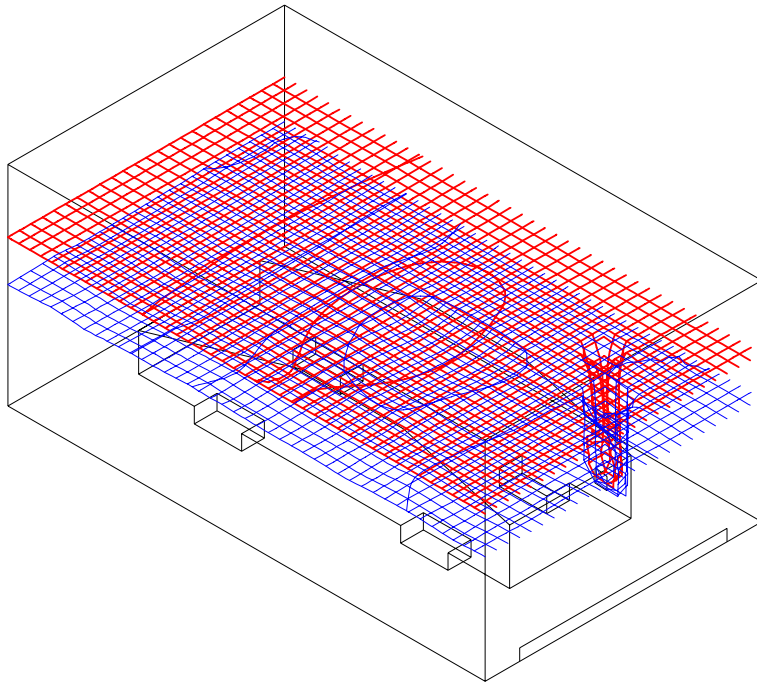


Figure C 3 - Unvented garage, 4 SCFM hydrogen leak for 20

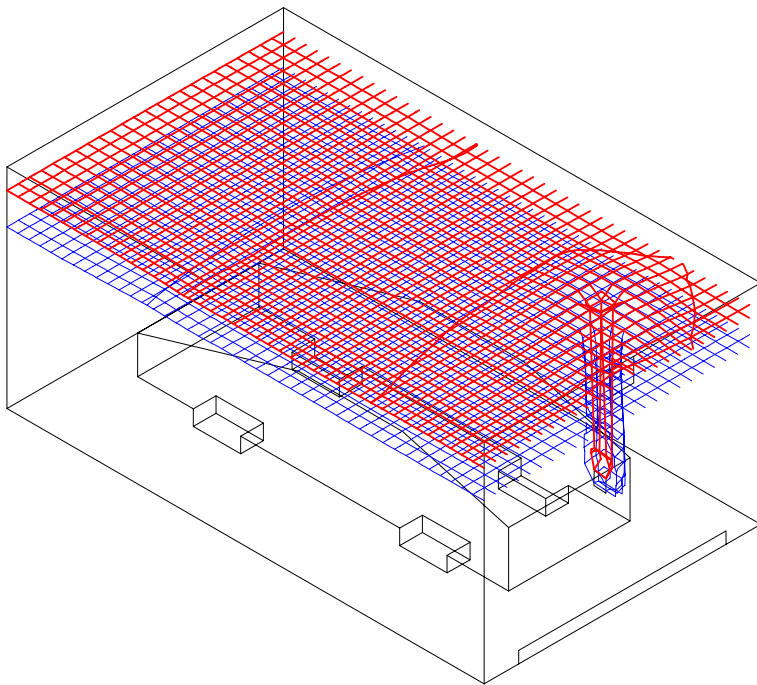


Figure C 4 - Vented garage, 4 SCFM hydrogen leak for 20

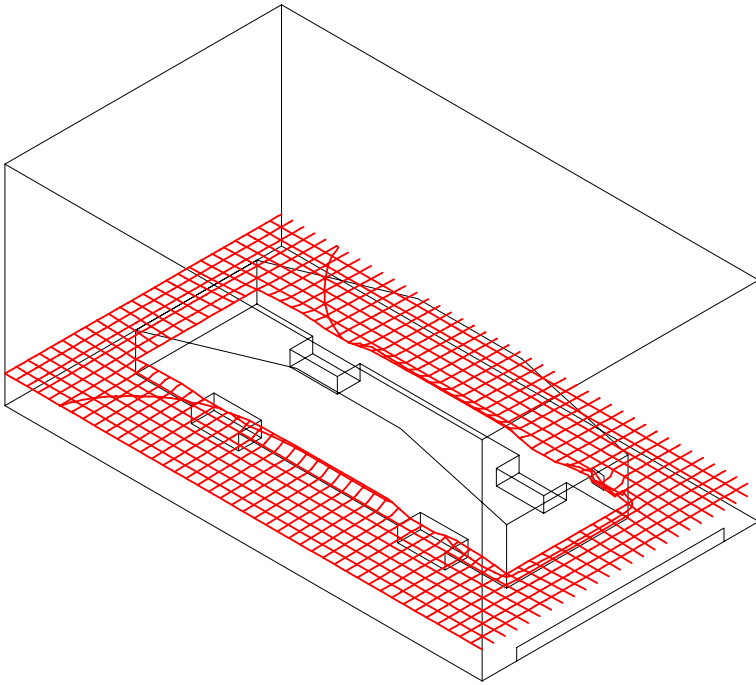


Figure C 5 - Unvented garage, 13 SCFM hydrogen leak for 20

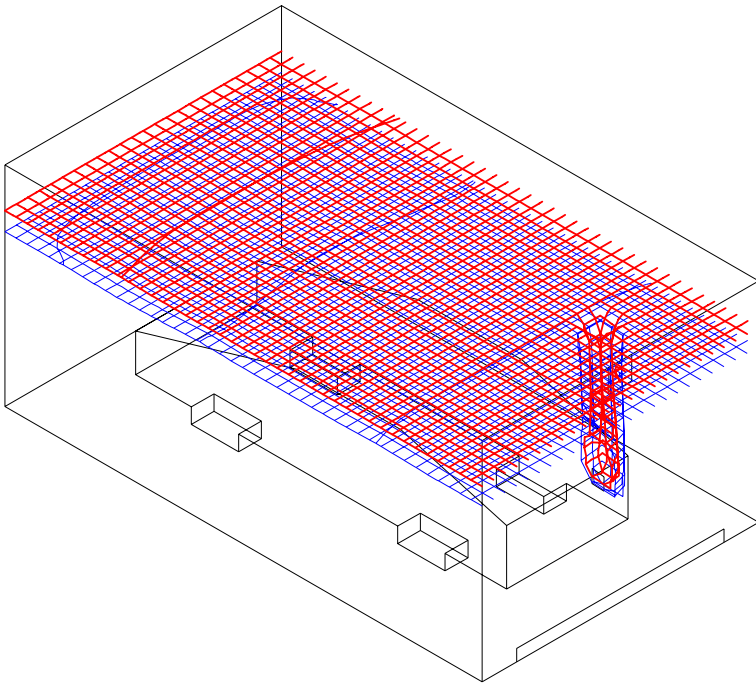


Figure C 6 - Vented garage, 13 SCFM hydrogen leak for 20

ITEM 1 (IMC)

Committee Action: Approved as Modified

Modify proposal as follows:

IMC 304.3 Location Elevation of ignition source. Equipment and appliances having an ignition source and located in hazardous locations and public garages, private garages, repair garages, automotive service stations, and parking garages ~~where flammable liquids or flammable gases heavier than air are present~~ shall be elevated such that the source of ignition source is not less than 18 inches (457 mm) above the floor surface on which the equipment or appliance rests. Such equipment and appliances shall not be installed in Group H occupancies or control areas where open-use, handling or dispensing of combustible, flammable or explosive materials occurs. For the purpose of this section, rooms or spaces that are not part of the living space of a dwelling unit and that communicate directly with a private garage through openings shall be considered to be part of the private garage.

Add new text as follows:

304.4 Hydrogen Generating and Refueling Operations. In rooms or spaces that contain hydrogen generating or refueling systems, equipment and appliances having an ignition source shall be located such that the ignition source is not less than 24 inches (457 mm) below the ceiling in hazardous locations and public garages, private garages, repair garages, automotive service stations and parking garages where gaseous hydrogen is present. Such equipment and appliances shall not be installed in Group H occupancies or control areas where open-use, handling or dispensing of combustible, flammable or explosive materials occurs. For the purpose of this section, rooms or spaces that are not part of the living space of a dwelling unit and that communicate directly with a private garage through openings shall be considered to be part of the private garage.

Exceptions:

1. Where rooms or spaces that contain hydrogen generating or refueling systems are ventilated in accordance with Section 304.4.1
2. Where rooms or spaces that contain hydrogen generating or refueling systems are ventilated in accordance with Section 502.15 ~~of the International Mechanical Code~~ and the following:
 - 2.1. The ventilation system shall be designed to maintain the maximum concentration of flammable contaminants below 25 percent of the contaminant's lower flammability limit; or
 - 2.2. Continuous ventilation shall be provided at a rate not less than 1 cubic foot per minute per square foot [(0.0051m3/(s x m²))] of floor area of the room.
3. Where rooms or areas that contain hydrogen generating or refueling systems are ventilated in accordance with Section 304.4.2

(No modification to remainder of code change)

Committee Reason: The IMC needs to be proactive and include this new technology in the code before it begins to be installed. As the technology improves and the price drops, these units will become widely accepted and the code official needs the guidance to insure they are properly installed. The modification deletes changes to Section 304.3 to return it to its original language and deletes the reference to the IMC in Section 304.4, Exception 2.

Assembly Action: No Motion

ITEM 2 (IRC)

Committee Action: Disapproved

Committee Reason: The committee did not want to add this technology to the IRC until further study and data are available.

Assembly Action: Approved as Modified

Modify proposal as follows:

2. IRC M1307.3 Location Elevation of ignition source. Appliances having a ~~ignition source~~ of ignition shall be elevated such that the ignition source is not less than 18 inches (457 mm) above the floor in garages ~~where flammable liquids or flammable gases heavier than air are present~~. For the purpose of this section, rooms or spaces that are not part of the living space of a dwelling unit and that communicate directly with a private garage through openings shall be considered to be part of the garage.

(No modification to remainder of code change)

Individual Consideration Agenda

This item is on the agenda for individual consideration because the public hearing actions resulted in a technical inconsistency between the International Residential Code and the associated ICC International Code, an assembly action was successful and a public comment was submitted.

Public Comment:

ICC Ad Hoc Committee for Hydrogen Gas, requests Approved as Modified by this comment.

Modify proposal as follows:

ITEM 1 (IMC)

No change to current Section 304.3 (current text of Section 304.3 remains unchanged)

304.4 Hydrogen Generating and Refueling Operations. ~~In rooms or areas that contain hydrogen generating or refueling systems, equipment and appliances having an ignition source shall be located such that the source of ignition is not less than 24 inches (457 mm) below the ceiling in hazardous locations and~~ Ventilation shall be required in accordance with Section 304.4.1, 304.4.2 or 304.4.3 in public garages, private garages, repair garages, automotive service stations and parking garages where gaseous hydrogen is present which contain hydrogen generating appliances or refueling systems. Such spaces shall be used for the storage of not more than three hydrogen-fueled passenger motor vehicles and have a floor area not exceeding 850 square feet. The maximum rated output capacity of hydrogen generating appliances shall not exceed 4 SCFM of hydrogen for each 250 square feet of floor area in such spaces. Such equipment and appliances shall not be installed in Group H occupancies unless the occupancy is specifically designed for hydrogen use, or in control areas where open-use, handling or dispensing of combustible, flammable or explosive materials occurs. For the purpose of this section, rooms or spaces that are not part of the living space of a dwelling unit and that communicate directly with a private garage through openings shall be considered to be part of the private garage.

Exceptions:

4. ~~Where rooms or areas that contain hydrogen generating or refueling systems are ventilated in accordance with Section 304.4.1~~

~~2. Where rooms or areas that contain hydrogen generating or refueling systems are ventilated in accordance with Section 502.15 and the following:~~

~~2.1. The ventilation system shall be designed to maintain the maximum concentration of flammable contaminants below 25 percent of the contaminant's lower flammability limit; or~~

~~2.2. Continuous ventilation shall be provided at a rate not less than 1 cubic foot per minute per square foot (1 ft³/min/ft²) [(0.0051m³/(s x m²))] of floor area of the room.~~

~~3. Where rooms or areas that contain hydrogen generating or refueling systems are ventilated in accordance with Section 304.4.2~~

304.4.1 Natural Ventilation. ~~Rooms or spaces located underneath or adjacent to habitable space and Indoor locations intended for hydrogen generating or refueling operations shall be provided with mechanical ventilation as required by exception to Section 304.4 or shall communicate with the outdoors in accordance with Sections 304.4.1.1 through 304.4.1.2. The minimum dimension of air openings shall be not less than 3 in. (76 mm). Where ducts are used, they shall be of the same cross-sectional area as the free area of the openings to which they connect. In such locations, equipment and appliances having an ignition source shall be located such that the source of ignition is not less than 12 inches (228 mm) below the ceiling.~~

304.4.1.1 Two openings. ~~Two permanent openings, one commencing located entirely within 12 inches (305 mm) of the ceiling of the garage, and one commencing located entirely within 12 inches (305 mm) of the floor of the garage, shall be provided in the same exterior wall. The openings shall communicate directly, or by ducts, with the outdoors. Each opening shall directly communicate with the outdoors horizontally, and have a minimum free area of ½ square foot per 1,000 cubic feet of garage volume.~~

304.4.1.2 Louvers and grilles. ~~In calculating free area required by Section 304.4.1, the required size of openings shall be based on the net free area of each opening. If the free area through a design of louver or grille is known, it shall be used in calculating the size opening required to provide the free area specified. If the design and free area are not known, it shall be assumed that wood louvers will have 25 percent free area and metal louvers and grilles will have 75 percent free area. Louvers and grilles shall be fixed in the open position.~~

304.4.2 Mechanical ventilation. ~~Indoor locations intended for hydrogen generating or refueling operations shall be ventilated in accordance with Section 502.15.~~

~~**304.4.2 304.4.3 Specially engineered installations.** As an alternative to the provisions of Sections 304.4.1 and 304.4.2 the necessary supply of air for, ventilation and dilution of flammable gases shall be provided by an approved engineered system.~~

SECTION 202 GENERAL DEFINITIONS

HYDROGEN GENERATING APPLIANCE. A self-contained package or factory-matched packages of integrated systems for generating gaseous hydrogen. Hydrogen generating appliances utilize electrolysis, reformation, chemical, or other processes to generate hydrogen.

ITEM 2 (IRC)

No change to current Section 1307.3 (current text of Section 1307.3 remains unchanged)

~~**1307.4 Hydrogen Generating and Refueling Operations .** In rooms or areas that contain hydrogen generating or refueling systems, equipment and appliances having an ignition source shall be located such that the source of ignition is not less than 24 inches~~

~~(457 mm) below the ceiling in garages where gaseous hydrogen is present. Ventilation shall be required in accordance with Section 1307.4.1, 1307.4.2 or 1307.4.3 in private garages which contain hydrogen generating appliances or refueling systems. Such spaces shall be used for the storage of not more than three hydrogen-fueled passenger motor vehicles and have a floor area not exceeding 850 square feet. The maximum rated output capacity of hydrogen generating appliances shall not exceed 4 SCFM of hydrogen for each 250 square feet of floor area in such spaces. For the purpose of this section, rooms or spaces that are not part of the living space of a dwelling unit and that communicate directly with a private garage through openings shall be considered to be part of the private garage.~~

~~Exceptions-~~

~~1. Where rooms or areas that contain hydrogen generating or refueling systems are ventilated in accordance with Section 1307.4.1:~~

~~2. Where rooms or areas that contain hydrogen generating or refueling systems are ventilated in accordance with Section 502.15 of the *International Mechanical Code* and the following:~~

~~2.1. The ventilation system shall be designed to maintain the maximum concentration of flammable gas present below 25 percent of the lower flammability limit of the substance for the expected room temperature; or~~

~~2.2. Continuous ventilation shall be provided at a rate not less than 1 cubic foot per minute per square foot (1 ft³/min/ft²) [(0.0051m³/(s x m²))] of floor area of the room.~~

~~3. Where rooms or areas that contain hydrogen generating or refueling systems are ventilated in accordance with Section 1307.4.2~~

~~**1307.4.1 Natural Ventilation.** Rooms or spaces located underneath or adjacent to habitable space and Indoor locations intended for hydrogen generating or refueling operations shall be provided with mechanical ventilation as required by exception to Section 1307.4 or shall communicate with the outdoors in accordance with Sections 1307.4.1.1 through 1307.4.1.2. The minimum dimension of air openings shall be not less than 3 in. (76 mm). Where ducts are used, they shall be of the same cross-sectional area as the free area of the openings to which they connect. In such locations, equipment and appliances having an ignition source shall be located such that the source of ignition is not less than 12 inches (228 mm) below the ceiling.~~

~~**1307.4.1.1 Two openings.** Two permanent openings, one commencing located entirely within 12 inches (305 mm) of the ceiling of the garage, and one commencing located entirely within 12 inches (305 mm) of the floor of the garage, shall be provided in the same exterior wall. The openings shall communicate directly, or by ducts, with the outdoors. Each opening shall directly communicate with the outdoors horizontally, and have a minimum free area of ½ square foot per 1,000 cubic feet of garage volume.~~

~~**1307.4.1.2 Louvers and grilles.** In calculating free area required by Section 1307.4.1, the required size of openings shall be based on the net free area of each opening. If the free area through a design of louver or grille is known, it shall be used in calculating the size opening required to provide the free area specified. If the design and free area are not known, it shall be assumed that wood louvers will have 25 percent free area and metal louvers and grilles will have 75 percent free area. Louvers and grilles shall be fixed in the open position.~~

~~**1307.4.2 Mechanical ventilation.** Indoor locations intended for hydrogen generating or refueling operations shall be ventilated in accordance with Section 502.15 of the *International Mechanical Code*.~~

~~**1307.4.2 1307.4.3 Specially engineered installations.** As an~~

alternative to the provisions of Sections 1307.4.1 and 1307.4.2 the necessary supply of air for, ventilation and dilution of flammable gases shall be provided by an approved engineered system.

**CHAPTER 202
DEFINITIONS**

HYDROGEN GENERATING APPLIANCE. A self-contained package or factory-matched packages of integrated systems for generating gaseous hydrogen. Hydrogen generating appliances utilize electrolysis, reformation, chemical, or other processes to generate hydrogen.

Commenter's Reason: The AHC has addressed and resolved the technical issues identified by the Code Development Committee directly as modified by this and other coordinated public comments to all hydrogen-related proposals (F176, M7, FG2, FG15, FG41 & FG48). The supporting Reason to FG2-02 provides a brief explanation of each solution.

The ICC AHC for Hydrogen Gas requests your Approval as Modified by this Public Comment (AMPC).

Analysis: The following combinations of actions would achieve technical consistency between the IPC and the IRC:

- Item 1 AS Item 2 AS
- or
- Item 1 AM Item 2 AMAA
- or
- Item 1 AMPC Item 2 AMPC
- or
- Item 1 D Item 2 D

**M8-02
304.3 (IRC R1307.3)**

Proposed Change as Submitted:

Proponent: Robert D. Lee, Town of Cave Creek, representing the Arizona Building Officials

THIS PROPOSAL IS ON THE AGENDA OF THE IMC AND THE IRC MECHANICAL CODE DEVELOPMENT COMMITTEES. SEE THE TENTATIVE HEARING ORDERS FOR THESE COMMITTEES.

Revise as follows:

1. IMC 304.3 Elevation of ignition source. Equipment and appliances having an ignition source and located in hazardous locations and public garages, private garages, repair garages, automotive service stations and parking garages shall be elevated such that the source of ignition is not less than 18 inches (457 mm) above the floor surface on which the equipment or appliance rests. Such equipment and appliances shall not be installed in Use Group H occupancies or control areas where open use, handling or dispensing of combustible, flammable or explosive materials occurs. For the purpose of this section, rooms or spaces that are not part of the living space of a dwelling unit and that communicate directly with a private garage through openings shall be considered to be part of the private garage.

Exception: Clothes dryers installed in private garages.

2. IRC M1307.3 Elevation of ignition source. Appliances having an ignition source shall be elevated such that the source of ignition is not less than 18 inches (457 mm) above the floor in garages. For the purpose of this section, rooms or spaces that are not part of the living space of a dwelling unit and that communicate with a private garage through openings shall be considered to be part of the garage.

Exception: Clothes dryers installed in private garages.

Proponent's Reason: In the definition of clothes dryers, it specifically calls a clothes dryer an appliance. ICBO has had a longstanding opinion that a clothes dryer was a portable appliance and therefore not subject to this requirement. Other types of portable appliances such as clothes washers, freezers and refrigerators are not regulated and clothes dryers present no greater hazard.

Analysis: If a clothes dryer is a portable appliance, it is not covered by this code since this code specifically excludes portable appliances. Since clothes dryers are addressed in Chapter 9, it is apparent that the IMC does not consider clothes dryers to be portable.

**ITEM 1 (IMC)
Committee Action:** **Disapproved**

Committee Reason: Clothes dryers are regulated by the IMC and must meet all requirements, including elevation of potential ignition sources.

Assembly Action: **No Motion**

**ITEM 2 (IRC)
Committee Action:** **Disapproved**

Committee Reason: Clothes dryers can produce sparks which can ignite fumes in the garage.

Assembly Action: **Approved as Submitted-
Motion Failed**

Individual Consideration Agenda

This item is on the agenda for individual consideration because a public comment was submitted.

Public Comment:

**David Fizzell, City of Prescott, AZ, requests
Approved as Submitted for Items 1 and 2.**

Commenter's Reason: A review of the statistics from NAHB, NFPA, and FEMA shows that there have been over 26 million houses constructed in the United States between 1978 and 2001. Approximately one third, 8.5 million, of these have been built in the western portion of the country under the ICBO codes. ICBO has had a long-standing policy that considered dryers to be portable equipment and as such they were not regulated by the code. Based upon this policy several jurisdictions did not require dryers in garages