

Chapter 3: General Regulations

General Comments

A fundamental principle of the code is its dependence on the listing and labeling method of approval for appliances and equipment. Section 301.3 prohibits the installation of unlisted appliances except where approved in accordance with Section 105.

Purpose

Chapter 3 contains requirements for the safe and proper installation of gas-fired equipment and appliances to help ensure protection of life and property.

SECTION 301 (IFGC) GENERAL

301.1 Scope. This chapter shall govern the approval and installation of all *equipment* and appliances that comprise parts of the installations regulated by this code in accordance with Section 101.2.

❖ This section states that this chapter governs the approval and installation of all gas-fired equipment and appliances that are regulated by the code. Section 101.2 establishes the scope of application of the code (see commentary, Section 101.2).

301.1.1 Other fuels. The requirements for combustion and dilution air for gas-fired appliances shall be governed by Section 304. The requirements for combustion and dilution air for appliances operating with fuels other than fuel gas shall be regulated by the *International Mechanical Code*.

❖ This code and the *International Mechanical Code*® (IMC®) each have a combustion air chapter that is specific to the fuels addressed in the respective code.

301.2 Energy utilization. Heating, ventilating and air-conditioning systems of all structures shall be designed and installed for efficient utilization of energy in accordance with the *International Energy Conservation Code*.

❖ This section states that all appliances and equipment must be designed and installed to use depletable energy sources efficiently. The *International Energy Conservation Code*® (IECC®) is the applicable document for regulating the efficiency and performance of appliances and heating, ventilating and air-conditioning (HVAC) systems. Special applications such as process heating or cooling should be designed for the maximum energy efficiency attainable.

301.3 Listed and labeled. Appliances regulated by this code shall be *listed* and *labeled* for the application in which they are used unless otherwise *approved* in accordance with Section 105. The approval of unlisted appliances in accordance with Section 105 shall be based on *approved* engineering evaluation.

❖ Gas-fired appliances must be listed and labeled by an approved agency to show that they comply with the

applicable national standards. The code requires listing and labeling for appliances, such as boilers, furnaces, space heaters, direct-fired heaters, cooking appliances, clothes dryers, rooftop HVAC units, etc. The code also requires listing for system components as specifically stated in the text addressing those components. The label is the primary, if not the only, assurance to the installer, the inspector and the end user that a representative sample of an appliance model has been tested and evaluated by an approved agency and has been determined to perform safely and efficiently when installed and operated in accordance with its listing.

Appliances must be listed and labeled for the application in which they are used, otherwise the installation would be a misapplication of the appliance. For example, if an appliance is listed for indoor use only and is installed outdoors, this installation is a misapplication of the appliance and serious malfunctions and/or conditions could result. An appliance might be marketed and installed for a particular purpose for which it was not tested and listed and this is what this section intends to prohibit. Verifying that an appliance has a testing agency label is only part of the code official's responsibility. He or she must also verify that the listing from the testing agency includes the application at hand. The bottom line is, the use of an appliance must match the use for which the appliance was tested.

The presence of a label is part of the information that the code official considers when approving appliances. The only exception to the labeling requirement occurs when the code official approves a specific appliance in accordance with the authority granted in Section 105.2.

Approval of unlabeled appliances must be based on documentation that demonstrates compliance with applicable standards or, where no product standards exist, that the appliance is appropriate for the intended use and will provide the same level of performance as would be provided by listed and labeled appliances. A fundamental principle of the code is the reliance on the listing and labeling process to ensure

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appliance performance; approvals granted in accordance with Section 105.2 must be well justified with supporting documentation. To the code official, the installer and the end-user, very little is known about the performance of an appliance that is not tested and built to an appliance standard.

301.4 Labeling. Labeling shall be in accordance with the procedures set forth in Sections 301.4.1 through 301.4.2.3.

❖ This section establishes the requirements for testing and labeling appliances by an approved agency. Included within this section are the requirements for testing the product and for approval of the testing agency, the testing equipment and the personnel who conduct the test. Also included is the information that must appear on a label.

301.4.1 Testing. An *approved* agency shall test a representative sample of the appliances being *labeled* to the relevant standard or standards. The *approved* agency shall maintain a record of all of the tests performed. The record shall provide sufficient detail to verify compliance with the test standard.

❖ When an approved agency labels an appliance, the agency is ensuring that a representative sample of the appliance has been tested in accordance with an appropriate standard and has been determined to perform acceptably when installed and operated in accordance with the appliance's listing.

The basis for a label is the requirement for testing a representative, perhaps identical, sample of the appliance to indicate conformance to a required standard. This is an important premise in the code because a code official will consider the presence of a label in the approval of an appliance. For this reason, the appliance must meet the requirements of the standard. Because the appliance tested is installed and operated in accordance with the manufacturer's instructions, these instructions must provide for proper installation and operation. This is important because the code requires that the labeled appliance be installed in accordance with the manufacturer's instructions, and operating instructions must be either attached to or shipped with each appliance.

There are numerous standards, not all of which are specifically referenced in the code, applicable to various appliances and equipment. For this reason, the approved agency determines the applicable standards to be used for testing and then, in turn, as the basis for labeling. Each standard contains safety requirements for a given appliance or piece of equipment and specifies tests that must be performed. The labeling agency is required to maintain sufficient documentation to demonstrate compliance with the test standard. The code official may require that copies of the test reports be submitted to determine the validity of the label.

Examples of standards that are used as a basis for testing and labeling include:

- ANSI Z21.47, *Gas-fired Central Furnaces*;
- ANSI Z83.8, *Gas Unit Heaters*; and

- UL 795, *Commercial—Industrial Gas Heating Equipment*.

301.4.2 Inspection and identification. The *approved* agency shall periodically perform an inspection, which shall be in-plant if necessary, of the appliances to be *labeled*. The inspection shall verify that the *labeled* appliances are representative of the appliances tested.

❖ The approved agency whose identification insignia appears on the label must perform periodic in-plant inspections. The primary objective of these inspections is to determine that the manufactured product is equivalent to the sample that was tested. Because the label is good only for the products that were tested, the in-plant inspections are intended to discover any design changes or production quality control problems. If any discrepancies are found, that the labeling agency would discontinue labeling of that particular product, and the manufacturer would be required to resolve the problem and, if necessary, have the redesigned product retested before the labeling process is resumed.

301.4.2.1 Independent. The agency to be *approved* shall be objective and competent. To confirm its objectivity, the agency shall disclose all possible conflicts of interest.

❖ As a part of the basis for a code official's approval of a particular labeling agency, the agency must demonstrate both its independence from the manufacturer of the product and its competence to perform the required tests. The judgment of objectivity is linked to the financial and fiduciary independence of the agency. The competence of the agency is judged by its experience, organization and the experience of its personnel. As a hypothetical example, the Acme Inspection Agency is performing testing for gas-fired furnaces for the Real Hot Furnace Company. After some investigation, both Acme and Real Hot are found to be the subsidiaries of the same parent company. The inspection agency and the manufacturer clearly have a relationship that presents the potential for conflict of interest, and the objectivity of the inspection agency is sufficiently questionable for the code official to justify not approving Acme as a testing and labeling agency for equipment produced by the Real Hot Furnace Company.

301.4.2.2 Equipment. An *approved* agency shall have adequate *equipment* to perform all required tests. The *equipment* shall be periodically calibrated.

❖ Referring to the example in the commentary for Section 301.4.2.1, if the Acme Inspection Agency had only the facilities to test and label fire doors, the agency would not be qualified to test and label a gas-fired furnace. Although this example is oversimplified, the point is that the inspection agency must have all of the necessary equipment to perform the testing required by the applicable standard.

In addition to having the proper equipment, the agency must maintain records of the maintenance and calibration of their equipment to demonstrate that

the equipment can be relied on to produce accurate, consistent and reproducible results. Testing apparatus, instruments and equipment must often be capable of measurements using very small units of measure within a specified tolerance. To produce accurate, dependable readings and reliable test results, testing apparatus, equipment and instruments must be routinely calibrated to a fixed reference. Having the proper testing equipment can be just as important as the competence of the testing personnel.

301.4.2.3 Personnel. An *approved* agency shall employ experienced personnel educated in conducting, supervising and evaluating tests.

- ❖ The competence of an inspection agency is based on the agency having the proper equipment to perform the test, as stated in Section 301.4.2.2, and also on the experience and abilities of its personnel. The best calibrated equipment can produce accurate results only when operated by experienced personnel who are trained to conduct, supervise and evaluate tests. For example, consider a newly formed agency that has employed individuals who do not have experience related to the testing to be conducted and have not been adequately trained. The capabilities and experience of supervisory personnel overseeing their work is also important.

301.5 Label information. A permanent factory-applied nameplate(s) shall be affixed to appliances on which shall appear in legible lettering, the manufacturer's name or trademark, the model number, serial number and, for *listed* appliances, the seal or mark of the testing agency. A label shall include the hourly rating in British thermal units per hour (Btu/h) (W); the type of fuel *approved* for use with the *appliance*; and the minimum *clearance* requirements.

- ❖ This section requires that the label be a metal plate, tag or other permanent label. In general, label materials other than metal tags or plates usually consist of material that is similar in appearance to a decal, and the label, its adhesive and the printed information must be durable and water resistant. Because of the important information given by a label, the label is intended to be permanent, not susceptible to damage and legible for the life of the appliance to which it is attached. The standards that appliances are tested to usually specify the required label performance criteria, the method of attachment and the required label information. The code requires that the label be affixed permanently and prominently on the appliance or equipment and specifies the information that must appear on the label. The manufacturer may be required by the relevant standard or may voluntarily provide additional information on the label. Commentary Figures 301.5(1) and 301.5(2) show typical appliance labels.

301.6 Plumbing connections. Potable water supply and building drainage system connections to appliances regulated

by this code shall be in accordance with the *International Plumbing Code*.

- ❖ Plumbing connections to appliances and equipment regulated by the code must be in accordance with the *International Plumbing Code*[®] (IPC[®]).

Section 624.2 of the code requires that combination domestic water heating and hydronic supply water heating units be listed and installed according to their listing and manufacturer's instructions.

Hydronic systems normally require a means of supplying fill and makeup water to replace any water lost to evaporation, leakage or intentional draining. Where direct connections are made to the potable water supply, the connections must be isolated from the potable water source. This requirement is intended to protect the potable water system from contamination by backflow when a direct connection is made to a hydronic system.

Hydronic systems are normally pressurized, contain nonpotable water and fluids and can contain conditioning chemicals or antifreeze solutions. Low-temperature hydronic fluids and cooling towers have also been associated with disease-causing organisms such as the Legionnaires' disease bacterium. The potable water system must be protected from potential contamination resulting from connection to hydronic systems, water-wash filter systems, cooling towers, solar systems, water-cooled heat exchangers, cooking appliances, ice makers, humidifiers, evaporative coolers, etc.

In addition, water heaters are part of the potable water distribution system and, therefore, must comply with both the code and the IPC. A water heater installation is complex in that it has a fuel or power supply; a chimney or vent connection, if fuel-fired; a combustion air supply, if fuel-fired; connections to the plumbing potable water distribution system and controls and devices to prevent a multitude of potential hazards from conditions such as excessively high temperatures, pressures and ignition failure.

It is not uncommon for jurisdictions to issue both plumbing and mechanical permits for water heater installations or to require that the installer be licensed in both the plumbing and mechanical trades when performing such installations (see commentary, Section 624). Water heaters are clearly under the purview of both plumbing and fuel gas codes. This section also refers to the IPC for the drainage associated with mechanical appliances and equipment, such as those addressed in Section 307.

301.7 Fuel types. Appliances shall be designed for use with the type of fuel gas that will be supplied to them.

- ❖ Appliances are usually designed by the manufacturer to operate on one specifically designated type of fuel. An element of information used for the approval of appliances is the label, which ensures that the appliance has been tested in accordance with a valid stan-



AMERICAN STANDARD INC.
THE TRANE COMPANY
TRENTON, N.J. 08619

MADE IN U.S.A.

FORCED AIR FURNACE CATEGORY I

ANS Z21.47 - 1990 CENTRAL FURN

FOR INDOOR INSTALLATION IN A BUILDING
CONSTRUCTED ON SITE.

NRTL

MODEL NO. TUD080R936A1	SERIAL NO. G36519785	EQUIPPED FOR NAT. GAS
INPUT 80,000 BTU/HR.	LIMIT SETTING 190 °F	MFRD. 09/92
TEMP. RISE °F FROM 30 TO 60	MAX. EXT. STATIC PRESS .50 INCHES WATER	MAX. DESIGN AIR TEMP. 100 °F
VOLTS/PHASE/HERTZ 115/1/60	TOTAL AMPS 8.5	SERVICE CODE 1

MANIFOLD PRESSURE (IN INCHES OF WATER)
NAT. 3.5 LP 10.5
SUPPLY PRESSURE (IN INCHES OF WATER)
MAX. NAT. 10.5, L P 13.0
MIN. NAT. 4.5 L P 11.0 FOR PURPOSE OF INPUT ADJUSTMENT.

FLAME ROLLOUT SWITCH - REPLACE
IF BLOWN WITH CATALOG NO.
WG09XQ33 (333 F CUTOFF TEMP.)
ONE TIME THERMAL FUSE.

LOW INPUT 52,000 BTU/HR

MINIMUM CLEARANCE COMBUSTIBLE MATERIALS:

FOR CLOSET		INSTALLATION AS FOLLOWS:	
SIDES	0 IN.	W/SINGLE WALL VENT	
FLUE	6 IN.	W/SINGLE WALL VENT	1 IN. W/TYP E B-1 VENT
FRONT	6 IN.	BACK	0 IN. TOP 1 IN.

UPFLOW UNITS FOR INSTALLATION COMBUSTIBLE FLOORING. 21D340159 P01

Figure 301.5(1)
TYPICAL LABEL FOR A CATEGORY I GAS-FIRED FURNACE
(Figure courtesy of the Trane Company, an American Standard Company)

ard and determined to perform acceptably when installed and operated in accordance with the appliance listing (see commentary, Section 301.5). The fuel used in the appliance test must be the type of fuel specified by the manufacturer.

301.7.1 Appliance fuel conversion. Appliances shall not be converted to utilize a different fuel gas except where complete instructions for such conversion are provided in the installation instructions, by the serving gas supplier or by the appliance manufacturer.

❖ A mismatch between an appliance and a fuel will create an extremely hazardous condition that can be avoided by examining the appliance label. When an appliance is converted to a different type of fuel, the original label that appears on the appliance is no longer valid. Because the original approval of the appliance is based in part on the label, the appliance is no longer approved for use. Fuel conversion kits will include a replacement label.

Many gas appliances are listed and labeled for more than one fuel, most commonly natural gas and liquefied petroleum (LP) (propane). Such appliances can be converted from one fuel to the other using a manufacturer's conversion kit and following instructions provided by the manufacturer. These conversions must be done only with the approval of the code official to make sure that the instructions are complied with and the safety of the original installation is maintained. Fuel conversions that are not performed correctly can adversely affect the performance of burners, the venting of combustion gases and the proper clearance to combustibles.

Once a conversion has been completed, a supplemental label must be installed to update the information contained on the original label, thereby alerting any service personnel to the modifications that have been made.

Fuel-fired appliances are designed to operate with a maximum and minimum heat energy input capacity.



Figure 301.5(2)
ROOFTOP HVAC UNIT LABEL

In accordance with the appliance manufacturer's instructions, this capacity might need to be field adjusted to suit the elevation because of the change in air density at different elevations. Alteration of heat energy input beyond the allowable limits can result in hazardous overfiring or underfiring. Either condition can cause operation problems that include overheating, vent failure, corrosion, poor draft and poor combustion. Input adjustments for different elevations are dictated by the appliance manufacturer and are not addressed in the code, other than by Section 305.1.

301.8 Vibration isolation. Where means for isolation of vibration of an *appliance* is installed, an *approved* means for support and restraint of that *appliance* shall be provided.

❖ Where vibration isolation connections are used in ducts and piping and where equipment is mounted with vibration dampers, support is required for the ducts, piping and equipment to maintain positioning and alignment and to prevent stress and strain on the vibration connectors and dampers.

301.9 Repair. Defective material or parts shall be replaced or repaired in such a manner so as to preserve the original approval or listing.

❖ Repair work must not alter the nature of appliances and equipment in a way that would invalidate the listing or conditions of approval. For example, replacement of safety control devices with different devices could alter the design and operation of an appliance from that intended by the manufacturer and the listing agency.

301.10 Wind resistance. Appliances and supports that are exposed to wind shall be designed and installed to resist the wind pressures determined in accordance with the *International Building Code*.

❖ Installations of equipment and appliances that are subject to wind forces must be designed to resist those forces. The wind pressures must be based on the wind provisions in the code. The wind pressure requirements are based on the exposure of the building and wind speeds for that region.

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[BS] 301.11 Flood hazard. For structures located in flood hazard areas, the appliance, equipment and system installations regulated by this code shall be located at or above the elevation required by Section 1612 of the *International Building Code* for utilities and attendant equipment.

Exception: The appliance, equipment and system installations regulated by this code are permitted to be located below the elevation required by Section 1612 of the *International Building Code* for utilities and attendant equipment provided that they are designed and installed to prevent water from entering or accumulating within the components and to resist hydrostatic and hydrodynamic loads and stresses, including the effects of buoyancy, during the occurrence of flooding to such elevation.

❖ In flood hazard areas, mechanical systems, equipment and appliances must be elevated above the elevation specified in the *International Building Code*[®] (IBC[®]). Exposure to water can damage most mechanical system components as well as cause serious appliance and equipment malfunctions. For example, the majority of appliance manufacturers require the replacement of safety controls or entire appliances that have been submerged in flood waters. See FEMA 348 for additional guidance.

The exception to this section provides criteria for placing specific equipment below the required elevation. To do so, the equipment must be designed to prevent the entry or accumulation of water. Standard equipment that typically is installed at-grade is not designed to withstand the entry of water and would not meet the requirements of this exception.

301.12 Seismic resistance. When earthquake loads are applicable in accordance with the *International Building Code*, the supports shall be designed and installed for the seismic forces in accordance with that code.

❖ This code requires building systems to be designed for specified seismic forces. This section references the detailed equipment and component seismic support requirements contained in the code to bring these requirements to the attention of the design professional and the permit applicant.

Equipment piping must be braced for earthquake loads as stated in the code. The failure of the supports for these components has been shown to be a threat to health and safety in geographical areas where moderate- to high-magnitude earthquakes occur. The code specifies the geographical locations where earthquake design is required for certain piping and equipment and the size of the components that must be braced.

301.13 Ducts. Ducts required for the installation of systems regulated by this code shall be designed and installed in accordance with the *International Mechanical Code*.

❖ Chapter 6 of the IMC governs duct systems used for the movement of environmental air, governing the construction, installation, alteration, maintenance and repair of these systems (see the definition of "Duct system" in Chapter 2).

301.14 Rodentproofing. Buildings or structures and the walls enclosing habitable or occupiable rooms and spaces in which persons live, sleep or work, or in which feed, food or foodstuffs are stored, prepared, processed, served or sold, shall be constructed to protect against rodents in accordance with the *International Building Code*.

❖ This section states the requirements to prevent rodent infestation of a building. Efforts must be made to protect the annular spaces around openings in exterior walls. The annular spaces can be sealed by any effective method, but the primary methods used are to fill the annular space with a sealant material or to place a metal collar around the penetrating pipe, duct, etc. The collar material must be durable for the weather exposure and strong enough to prevent the rodents from chewing through and entering the building.

Effort must also be made to cover ventilation and combustion air openings with wire mesh material to prevent the entry of rodents through the opening.

301.15 Prohibited location. The appliances, *equipment* and systems regulated by this code shall not be located in an elevator shaft.

❖ The code views an elevator shaft as an unnecessarily risky location for fuel-gas system components. There is a potential for leaks in fuel-gas system equipment and piping, which would release fuel gas into the shaft, creating a hazardous condition. Because the elevator is often relied on for fire-fighting access as well as egress for those with disabilities, the shaft must be maintained free from contaminants and potential hazards that could render the elevator inoperative or unsafe for the occupants. The location of fuel-gas-fired equipment in an elevator shaft could also create access problems for service of the gas-fired equipment and the elevator equipment.

SECTION 302 (IFGC) STRUCTURAL SAFETY

[BS] 302.1 Structural safety. The building shall not be weakened by the installation of any *gas piping*. In the process of installing or repairing any *gas piping*, the finished floors, walls, ceilings, tile work or any other part of the building or premises which is required to be changed or replaced shall be left in a safe structural condition in accordance with the requirements of the *International Building Code*.

❖ The installation of fuel gas systems must not adversely affect the structural integrity of the building components. The code dictates the structural safety requirements that must be applied to any structural portion of the building that is penetrated, altered or removed during the installation, replacement or repair of fuel gas systems.

[BS] 302.2 Penetrations of floor/ceiling assemblies and fire-resistance-rated assemblies. Penetrations of floor/ceiling assemblies and assemblies required to have a fire-resis-