

OREGON
Interpretive Ruling No. 93-47
MASONRY HEATER
RADIANT HEAT SYSTEMS
(revised 05/01/00, editorial only)

REQUESTED BY: Robert Waldron, Designer/Builder

QUESTION: (1) Under what code section(s) are radiant heat systems (masonry heater) regulated? (2) Are they considered wood stoves? (3) Fireplaces?

APPLICABLE CODE SECTIONS: One and Two Family Dwelling Specialty Code (*Dwelling Code*), Sections 107, 108, 109, 303.5, Chapter 10 and 1307.5.

BACKGROUND: Robert Waldron has submitted the following background information: The Kachelofen (masonry heater), one of several types of radiant heaters, is a wood-fired, whole-house heating system. This specific technology is the only form of wood burning with the ability to burn wood at a high enough temperature (1800-2000 degrees) to allow complete and clean combustion, while simultaneously storing the heat in the body of the stove for long-term dissipation. The true description of the technology is termed "Thermal Mass Masonry Heating." For the most effective operation of this system, the following procedures should be observed.

Most types of firewood will work well in a masonry heater. Hardwoods offer a slightly better heating potential. One thing that must be stressed is the dryness of the wood. It is best if the wood has been seasoned for a period of three years; one year is minimum. Burning green wood will foul even the best stove. The firewood should be cut into pieces two to four inches in diameter. Uniform size is important so all pieces of wood burn at an even rate.

Unlike other forms of wood burning, the masonry heater does not restrict the air during the initial burn cycle. The firebox should be fully packed along with a few pieces of kindling for ignition. The masonry heater is designed to burn a "load" of wood and then go out. There is no need to keep "feeding" this stove system.

The firebox door is left open through the first phase of the burn. The masonry heater wants to burn fast and hot in order to reach peak efficiency. The wood burns through to what is a form of charcoal. When the flames die out and hot embers remain, the door is closed most of the way. This "charcoal" will burn for an hour or so and then go out. When the embers go out, the warm stove is shut down.

Only a small amount of white ash will remain in the bottom of the firebox. The masonry heater burns so hot in the first phase of the cycle, creosote and particulate normally associated with wood stove pollution, are ignited and realized as greater fuel potential. Thus, the clean burn and high efficiency.

Radiant heat from a masonry heater is quite different from other forms of heat. It delivers a very subtle and healthy heat to a living environment. The masonry heater is a crafted heating system. Each stove is unique and built to the specific application. Much like a musical instrument, the owner learns to "tune" the masonry heater to the desired level of personal comfort.

When a masonry heater has been properly designed and sized to the living environment, a single firing should be sufficient for many hours of comfortable, uniform heating. In the coldest of times a second firing may be necessary on the opposite end of the day. These procedures need to be followed to insure complete and clean combustion.

FINDINGS:

107.1 Right of appeal. See also ORS 455.690 and local ordinances.

and;

108.1 Alternate materials, methods and equipment. The provisions of this code are not intended to limit the appropriate use of materials, appliances, equipment or methods of design or construction not specifically prescribed by this code, provided the building official determines that the proposed alternate materials, appliances, equipment or methods of design or construction are at least equivalent of that prescribed in this code in suitability, quality, strength, effectiveness, fire resistance, durability, dimensional stability, safety and sanitation. Compliance with specific

performance-based provisions of the current editions of the Oregon specialty codes, in lieu of a prescriptive requirement of this code shall also be permitted as an alternate. See ORS 455.060.

108.2 Evidence submitted. The building official may require that evidence or proof be submitted to substantiate any claims that may be made regarding the proposed alternate.

108.3 Tests. Determination of equivalence shall be based on design or test methods or other such standards approved by the building official. The building official may accept as supporting data to assist in this determination duly authenticated reports from the Building Officials and Code Administrators International, Inc., Southern Building Code Congress International, Inc., International Conference of Building Officials, the National Evaluation Service Committee of the Council of American Building Officials, acceptance documents from the U.S. Department of Housing and Urban Development or from other approved authoritative sources for all materials or assemblies proposed for use which are not specifically provided for by this code. The costs of all tests, reports and investigations required under these provisions shall be paid by the applicant.

and;

109.1 Modifications. Whenever there are practical difficulties involved in carrying out the provisions of this code, the building official may grant modifications for individual cases. Prior to granting a modification the building official shall find that a special individual reason makes the strict letter of this code impractical and that the modification does not lessen any fire protection requirements or any degree of structural integrity. The details of any action granting modifications shall be recorded and entered in the files of the code enforcement agency.

and;

303.5 Required heating. Every dwelling unit shall be provided with heating facilities capable of maintaining a room temperature of 68°F (20°C) at a point 3 feet (914mm) above the floor at the design temperature in all habitable rooms.

and;

1001.7 Flue lining (material). Masonry chimneys shall be lined with fireclay flue liners not less than 5/8 inch (15.9mm) in thickness or with other approved liner of material that will resist, without cracking or softening, a temperature of 1,800(982°C).

Exception: Masonry chimneys may be constructed without flue liners when walls are at least 8 inches (203mm) in thickness of solid masonry.

1001.8 Flue lining (installation): Flue liners shall extend from a point not less than 8 inches (203mm) below the lowest inlet or, in the case of fireplaces, from the top of the smoke chamber, to a point above the enclosing walls. Fireclay flue liners shall be laid with tight mortar joints left smooth on the inside and installed to maintain a 1/2-inch-wide (12.7mm) air space separating the flue liners from the interior face of the chimney masonry walls. Flue lining shall be supported on all sides.

and;

1003.1 Fireplace support. Fireplace foundations and supporting walls shall be anchored, supported and reinforced as required in Sections 1003.1 through 1003.12, Table 1003.1, Figure 1003.1, and the applicable provisions of Chapters 3 and 4. Foundations for masonry fireplaces and their chimneys shall be constructed of concrete or solid masonry at least 12 inches (305mm) thick and extend at least 6 inches (153mm) beyond the face of the fireplace or supporting wall on all sides. Footings shall be founded on natural undisturbed earth or engineered fill below frost depth. In areas not subjected to freezing, footings shall be at least 12 inches (305mm) below finished grade.

1003.2 Seismic reinforcing. Masonry or concrete chimneys in Seismic Zone 3 and 4 shall be reinforced. Reinforcing shall conform to the requirements set forth in Table 1003.1. When the width of the chimney exceeds 40 inches (1016mm), two additional No. 4 vertical bars shall be provided for each additional flue incorporated in the chimney or for each additional 40 inches (1016mm) in width or fraction thereof.

1003.4 Fireplace walls. Masonry fireplaces shall be constructed of solid masonry units, stone, or reinforced concrete in accordance with Figure 1003.1. When a lining of firebrick at least 2 inches (51mm) in thickness is provided, the total thickness of back and sides, including the lining, shall not be less than 8 inches (203mm). When no lining is provided, the thickness of back and sides shall be not less than 10 inches (254mm).

1003.7 Hearth extensions material. Hearth extensions shall be of masonry or concrete at least 2 inches (51mm) thick and supported by noncombustible materials and reinforced to carry its own weight and all imposed loads. The hearth extension shall be readily distinguishable from the surrounding floor. Combustible forms and centers used during the construction of hearth extension shall be removed after the construction is complete.

Exception: When the bottom of the fire box opening is raised at least 8 inches (203mm) above the top of the hearth extension, a hearth extension of not less than 3/8-inch (9.5mm) thick brick, concrete, stone, tile or other approved noncombustible material may be used.

1003.8 Hearth extension. The hearth and the hearth extension shall extend a minimum of 36 inches (914mm) from the back of the firebox to the end of the hearth extension. Hearth extensions shall extend at least 16 inches (406mm) in front of, and at least 8 inches (203mm) beyond, each side of the fireplace opening. Where the fireplace opening is 6 square feet (0.557m²) or larger, the hearth extension shall extend at least 20 inches (508mm) in front of, and at least 12 inches (305mm) beyond, each side of the fireplace opening.

1003.9 Fireplace clearance. Wood or combustible framing shall not be placed within 2 inches (51mm) of outside face of masonry fireplace and not less than 6 inches (153mm) from inside surface of nearest flue lining. Wood framing and other combustible material shall not be placed within 2 inches (51mm) of the back surface of a masonry fireplace.

1003.10 Fireplace firestopping. See Section 602.7.

1003.11 Combustible materials. Woodwork or other combustible materials shall not be placed within 6 inches (153mm) of a fireplace opening. Combustible material within 12 inches (305mm) of the fireplace opening shall not project more than 1/8 inch (3.2mm) for each 1-inch (25mm) distance from such opening.

and;

1006.1 Exterior air. All solid fuel burning masonry fireplaces covered in this chapter shall be equipped with an exterior air supply to assure proper fuel combustion.

1006.2 Exterior air intake. The exterior air intake shall be capable of providing all combustion air from the exterior of the dwelling or from spaces within the dwelling ventilated with outside air, such as crawl or attic space. The exterior air intake shall not be located within the garage of the dwelling. The exterior air intake shall be covered with a corrosion-resistant screen of 1/4-inch (6.4mm) mesh.

1006.3 Passageway. The combustion air passageway shall be a minimum of 6 square inches (3870mm²) and not more than 55 square inches (0.035m²).

1006.4 Inlet. The exterior air inlet is permitted to be located in the sides of the firebox chamber, or within 24 inches (610mm) of the firebox opening on or near the floor. The inlet shall be closeable and designed to prevent burning material from dropping into concealed combustible spaces.

and;

1307.5 Used wood stoves. A wood stove as defined in ORS 468A.005(7) shall not be installed unless the stove was certified for sale as new on or after July 1, 1986, under rules adopted by the Oregon Department of Environmental Quality pursuant to ORS 468A.480(1).

Exception:

1. Antique wood stoves as defined by ORS 468A.510;

2. Wood stoves which appear on the Wood stove Exemption List published by the Oregon Department of Environmental Quality; and
3. Wood stoves which were purchased by the user as new prior to July 1, 1986, and which have not yet been installed or used.

Note: The following definitions are taken from the Oregon Department of Environmental Quality's OAR 340-262-0020 and are reproduced here for reference, but are not part of this code:

Antique wood stove means a wood stove built before 1940 that has ornate construction and a current market value substantially higher than a common wood stove manufactured in the same time period.

Pellet stove means a woodburning heating appliance which uses wood pellets as its primary source of fuel.

Used wood stove means any wood stove that has been sold, bargained, exchanged, given away or has had its ownership transferred from a retailer, manufacturer's dealer agent to a consumer.

Wood stove or wood heater means an enclosed woodburning appliance capable of and intended for space heating and domestic water heating that meets all of the following criteria:

- (1) An air-to-fuel ratio in the combustion chamber averaging less than 35-to-1 as determined by the test procedure prescribed in federal regulations 40 CFR part 60, subpart AAA, e60.534 performed at an accredited laboratory,
- (2) A usable firebox volume of less than 20 cubic feet,
- (3) A minimum burn rate less than 5 kg/hr as determined by the test procedures prescribed in federal regulations 40 CFR part 60, subpart AAA, e60.534 performed at an accredited laboratory, and
- (4) A maximum weight of 800 kg. In determining the weight of an appliance for these purposes, fixtures and devices that are normally sold separately, such as flue pipe, chimney, and masonry components that are not an integral part of the appliance or heat distributions ducting shall not be included. (**Emphasis added**)

This interpretation is authorized by ORS 455.060, Rulings on Acceptability of Materials, Designs or Methods of Construction and Attorney General's Opinion OP-5208 issued October 1, 1981, which advised the statute permits authoritative interpretations of existing code requirements.

DISCUSSION & CONCLUSION:

(Q1) Under what code section(s) are radiant heat systems (masonry heater) regulated?

(A1) The *Dwelling Code*, structural and mechanical, Chapters 10 and 13.

(Q2) Are they considered wood stoves?

(A2) According to the definition taken from the Oregon Department of Environmental Quality's (DEQ) OAR 340-262-0020, a masonry heater would not be classified as a wood stove or wood heater if it exceeded a weight limitation of 800 kg. (1764 lb.).

(Q3) Are they considered fireplaces?

(A3) A masonry heater would be most like a fireplace, but because of the many design variations and the deviation from standard fireplace construction, an approved alternate method of construction may be required from the building official.

The building official may require evidence or proof be submitted to substantiate any claims made regarding the use of a masonry heater as the sole source of heat for a residence. (303.5 Required heating)
Although a masonry heater closely resembles a fireplace, the building official may request some additional information to verify the proposed alternate materials, appliances, equipment or methods of design or construction, are at least equivalent of that prescribed in this code in suitability, quality, strength, effectiveness, fire resistance, durability, dimensional stability and safety.

(signed September 28, 1993)
John Talbott, Chairman
Structural Code Advisory Board

_____ Date

The recommendations and findings of the Structural Code Advisory Board are accepted and the conclusions are adopted.

(signed October 1, 1993)
Gary J. Wicks, Administrator
Building Codes Division

_____ Date