

UL 1261

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Electric Water Heaters for Pools and Tubs





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Standard for

Electric Water Heaters for Pools and Tubs

UL 1261, Fourth Edition

Accompanying this transmittal notice is a copy of the fourth edition of UL 1261.

THIS EDITION OF THE STANDARD IS NOW IN EFFECT.

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Standard for

Electric Water Heaters for Pools and Tubs

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FOREWORD

A. This Standard contains basic requirements for products covered by Underwriters Laboratories Inc. (UL) under its Follow-Up Service for this category within the limitations given below and in the Scope section of this Standard. These requirements are based upon sound engineering principles, research, records of tests and field experience, and an appreciation of the problems of manufacture, installation, and use derived from consultation with and information obtained from manufacturers, users, inspection authorities, and others having specialized experience. They are subject to revision as further experience and investigation may show is necessary or desirable.

B. The observance of the requirements of this Standard by a manufacturer is one of the conditions of the continued coverage of the manufacturer's product.

C. A product which complies with the text of this Standard will not necessarily be judged to comply with the Standard if, when examined and tested, it is found to have other features which impair the level of safety contemplated by these requirements.

D. A product employing materials or having forms of construction differing from those detailed in the requirements of this Standard may be examined and tested according to the intent of the requirements and, if found to be substantially equivalent, may be judged to comply with the Standard.

E. UL, in performing its functions in accordance with its objectives, does not assume or undertake to discharge any responsibility of the manufacturer or any other party. The opinions and findings of UL represent its professional judgment given with due consideration to the necessary limitations of practical operation and state of the art at the time the Standard is processed. UL shall not be responsible to anyone for the use of or reliance upon this Standard by anyone. UL shall not incur any obligation or liability for damages, including consequential damages, arising out of or in connection with the use, interpretation of, or reliance upon this Standard.

F. Many tests required by the Standards of UL are inherently hazardous and adequate safeguards for personnel and property shall be employed in conducting such tests.

INTRODUCTION

1 Scope

1.1 These requirements cover permanently installed electric water heaters, rated 600 volts or less, for heating the water supplied through plumbing to separately heated public or private pools or tubs, in which swimming, wading, bathing, or partial or total immersion of persons, may be involved. Equipment covered may or may not be intended for use with external water circulating equipment, and is intended for installation in accordance with the National Electrical Code, NFPA 70.

1.2 These requirements do not cover household storage tank water heaters or other equipment covered by individual requirements.

1.3 A product that contains features, characteristics, components, materials, or systems new or different from those covered by the requirements in this standard, and that involve a risk of fire, electric shock, or injury to persons shall be evaluated using the appropriate additional component and end-product requirements as determined necessary to maintain the acceptable level of safety as originally anticipated by the intent of this standard. A product whose features, characteristics, components, materials, or systems conflict with specific requirements or provisions of this standard cannot be judged to comply with this standard. Where considered appropriate, revision of requirements shall be proposed and adopted in conformance with the methods employed for development, revision, and implementation of this standard.

2 General

2.1 Components

2.1.1 Except as indicated in 2.1.2, a component of a product covered by this standard shall comply with the requirements for that component. See Appendix A for a list of standards covering components generally used in the products covered by this standard.

2.1.2 A component need not comply with a specific requirement that:

- a) Involves a feature or characteristic not needed in the application of the component in the product covered by this standard or
- b) Is superseded by a requirement in this standard.

2.1.3 A component shall be used in accordance with its recognized rating established for the intended conditions of use.

2.1.4 Specific components are recognized as being incomplete in construction features or restricted in performance capabilities. Such components are intended for use only under limited conditions, such as certain temperatures not exceeding specified limits, and shall be used only under those specific conditions for which they have been recognized.

2.2 Units of measurement

2.2.1 If a value for measurement is followed by a value in other units in parentheses, the second value may be only approximate. The first stated value is the requirement.

2.2.2 Unless indicated otherwise, all voltage and current values specified in this standard are root-mean-square (rms).

2.3 References

2.3.1 Any undated reference to a code or a standard appearing in the requirements of this standard shall be interpreted as referring to the latest edition of that code or standard.

3 Glossary

3.1 For the purpose of this standard, the following definitions apply:

3.2 HOT TUB — A tub intended for partial or total immersion of persons in heated water.

3.3 LIMITING CONTROL — A control intended to limit the operation of the heater to a water temperature of 70°C (158°F) under all conditions, including breakdown of any or all operating controls.

3.4 LOW-VOLTAGE CIRCUITS — A low-voltage circuit is one involving a potential of not more than 30 volts rms (42.4 volts peak) supplied by a primary battery, by a standard Class 2 transformer, or by a combination of a transformer and a fixed impedance that, as a unit, complies with all of the performance requirements for a Class 2 transformer. A circuit derived from a source of supply at line voltage by connecting resistance in series with the supply as a means of limiting the voltage and current is not considered to be a low-voltage circuit.

3.5 OPERATING CONTROL — A control, other than a limiting control or interlock, to start or regulate a heater according to load demand or water temperature and to stop or regulate output on satisfaction of demand or attainment of a specified temperature. Such control may be either electrical or mechanical, and may actuate auxiliary devices or equipment to perform the functions specified.

CONSTRUCTION

4 Frame and Enclosure

4.1 General

4.1.1 The frame and enclosure of a heater shall have the strength and rigidity required to resist the abuses likely to be encountered during normal service, thus precluding total or partial collapse of the enclosure with the attendant reduction of spacings, loosening or displacement of parts, and other defects that alone or in combination could constitute an increase in the risk of fire, electric shock, or injury to persons.

4.1.2 Among the factors to be determined when an enclosure is evaluated for acceptability are its:

- a) Physical strength;
- b) Resistance to impact;
- c) Moisture-absorptive properties;
- d) Combustibility;
- e) Resistance to corrosion; and

- f) Resistance to distortion at temperatures likely to be encountered under normal or abnormal conditions of use.

For a nonmetallic enclosure, these factors are to be determined with due regard for deterioration due to aging or other foreseeable environmental exposures.

4.1.3 Besides the factors listed in 4.1.2, an enclosure of sheet metal shall be evaluated with regard to its size, shape, the thickness of the metal, and its intended application.

4.2 Protection of combustible materials outside the enclosure

4.2.1 The enclosure shall reduce the risk of molten metal, burning insulation, flaming particles, or the like from falling on combustible materials, including the surface upon which the heater is supported.

4.2.2 The requirement in 4.2.1 necessitates use of a barrier of combustion resistant material under wiring, unless it is of the flame retardant type. Neoprene-, asbestos-, or thermoplastic-insulated wires are considered to be of this type.

4.2.3 A switch, transformer, relay, solenoid, or the like shall be individually enclosed unless it can be shown that breakdown of the component would not result in a risk of fire, or unless there are no openings in the bottom of the overall heater enclosure. An un baffled opening in the bottom of such a heater enclosure is not acceptable if it is located directly below field- or factory-made splices or overcurrent-protective devices.

Exception: Terminals of a switch, transformer, relay, solenoid, or the like need not be completely enclosed.

4.3 Ventilating openings

4.3.1 An opening in the enclosure for ventilation, other than in the bottom of a heater, and an opening associated with the dissipation of heated air from the element, shall be provided with one or more baffles that will reduce the risk of emission of flame, molten metal, burning insulation, or the like from the heater.

Exception: In a compartment other than one that houses an overload or overcurrent protective device, the baffles may be omitted if:

- a) *No ventilating opening in a vertical wall other than one associated with the dissipation of heat from the elements during normal operation of the heater is more than 3/8 inch (9.5 mm) in width or*
- b) *The heater is constructed so that baffles are not required, as shown by investigation.*

4.3.2 When an opening is provided in the enclosure of a heater or in an externally mounted component intended for permanent connection to the power supply, it shall be located so that it will not vent into concealed spaces of a building structure, such as into hollow spaces in the walls or the like, when the equipment is installed as intended.

Exception: The requirement in this paragraph does not apply to an opening for a mounting screw or nail or for a manufacturing operation such as a paint drainage hole, if such an opening has a dimension not greater than 17/64 inch (6.7 mm), or an area of more than 0.055 square inches (35.5 mm²).

4.4 Thickness of enclosure materials

4.4.1 Cast- and sheet-metal portions of an enclosure shall not be thinner than indicated in Table 4.1 unless the enclosure is determined to be acceptable when evaluated under considerations such as those specified in 4.1.2 and 4.1.3.

Table 4.1
Minimum thickness of enclosure metal

Metal	At small, flat, unreinforced surfaces and at surfaces that are reinforced by curving, ribbing, etc. (or are otherwise of a shape and/or size) to provide physical strength,		At relatively large unreinforced flat surfaces,	
	Inches	(mm)	Inches	(mm)
Die-cast	3/64	1.2	5/64	2.0
Cast malleable iron	1/16	1.6	3/32	2.4
Other cast metal	3/32	2.4	1/8	3.2
Uncoated sheet steel	0.026 ^a	0.66 ^a	—	—
Galvanized sheet steel	0.029 ^a	0.74 ^a	—	—
Nonferrous sheet metal	0.036 ^a	0.91 ^a	—	—

^a Thinner sheet metal may be used if determined to be acceptable when the enclosure is evaluated under considerations such as those specified in 4.1.2 and 4.1.3.

4.4.2 Sheet metal to which a wiring system is to be connected in the field shall have an average thickness not less than:

- a) 0.032 inch (0.81 mm) if uncoated steel;
- b) 0.034 inch (0.86 mm) if galvanized steel; and
- c) 0.045 inch (1.14 mm) if nonferrous.

4.4.3 An enclosure shall have a thickness not less than the following at points where the face of an attachment plug receptacle projects through it:

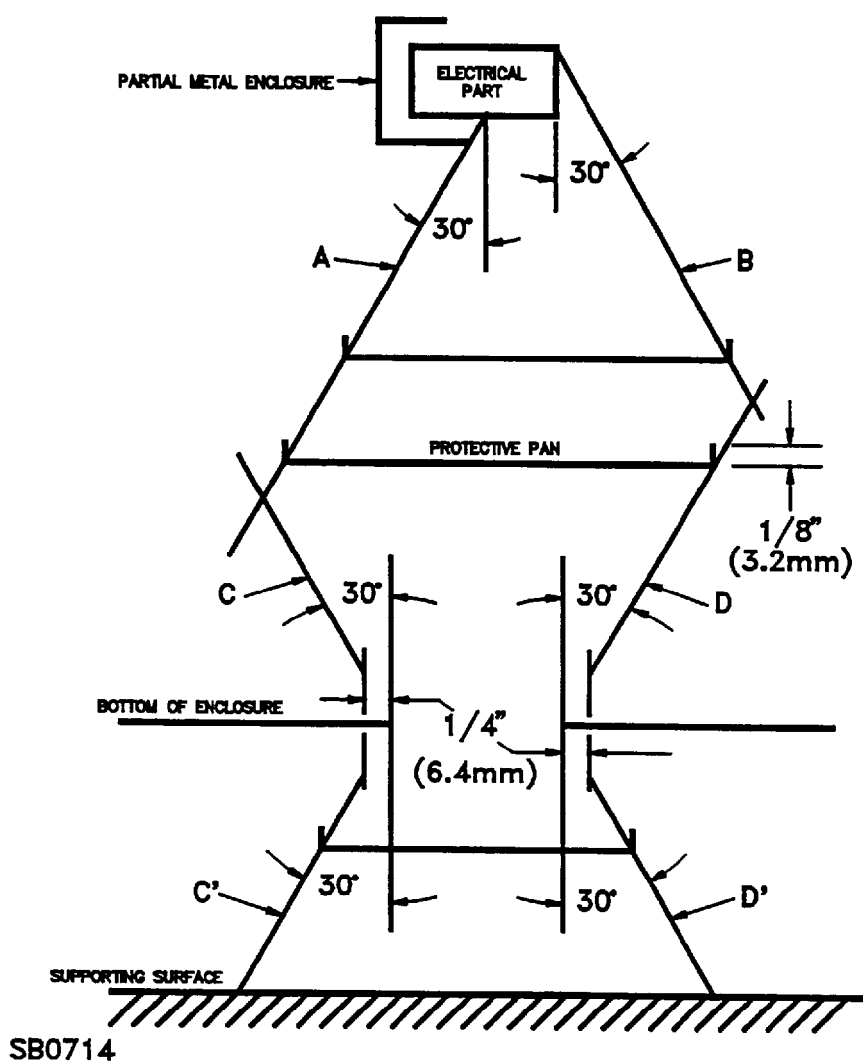
- a) 0.032 inch (0.81 mm) if the enclosure is of ferrous material;
- b) 0.045 inch (1.14 mm) if the enclosure is of nonferrous material; and
- c) 0.10 inch (2.5 mm) if the enclosure is of insulating material. The insulating material shall be combustion resistant.

Exception: An enclosure of insulating material may be of lesser thickness if it is formed or reinforced so that it will provide equivalent physical strength.

4.5 Openings

4.5.1 An opening in the bottom of an appliance shall not be located below an electrical part unless a solid, noncombustible pan complying with Figure 4.1 is interposed between the electrical part and supporting surface. The pan is to have a rim, lip, or other raised edge that is in a horizontal plane and extends all the way around the pan. The bottom of the pan need not be flat or any regular shape and the transition from the bottom to the rim, lip, or the like may have any convenient shape, but at every point directly below the electrical part, the floor of the pan is to be 1/8 inch (3.2 mm) or more below the plane of the rim, lip, or the like.

Figure 4.1
Minimum extent of baffle for opening in bottom of enclosure



A, B, C, and D are projections that define a volume between an electrical part and an opening; C' and D' are projections that define a volume between an opening and the supporting surface. A protective pan in any horizontal plane between the part and the opening in the supporting surface must be larger than the area defined by projections A, B, C, and D, or projections C' and D', respectively. Three examples of protective pans are illustrated in the figure, two are above the opening and one is below it.

4.5.2 The structure of the part or of the appliance may provide the equivalent of the pan described in 4.5.1 if it complies with Figure 4.1. The raised edge may be incorporated in the opening.

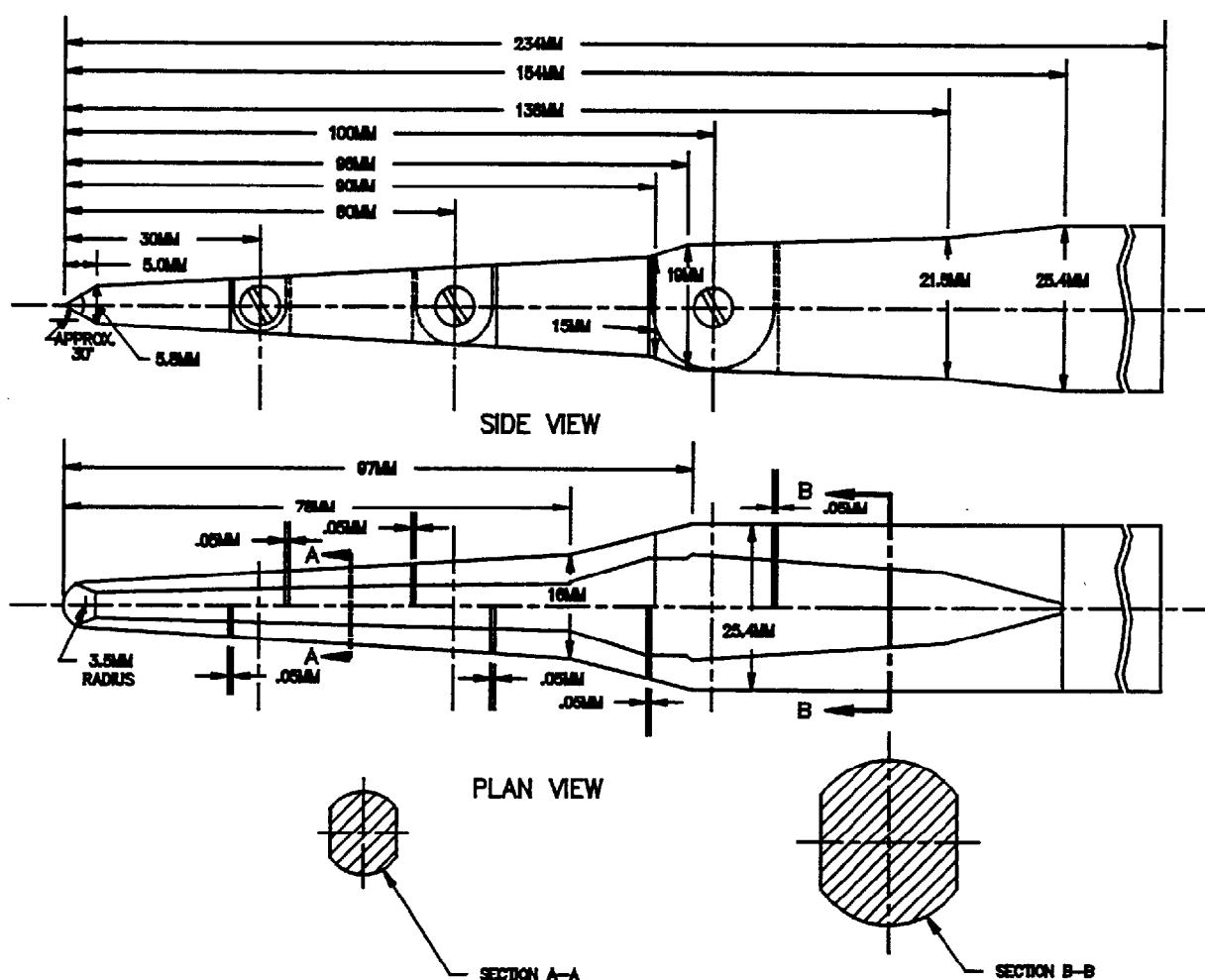
4.6 Accessibility of uninsulated live parts

4.6.1 To reduce the likelihood of unintentional contact that may involve a risk of electric shock from an uninsulated live part or injury to a person, an opening in an enclosure shall comply with (a) or (b).

a) For an opening that has a minor dimension (see 4.6.4) less than 1 inch (25.4 mm), such a part or wire shall not be contacted by the probe illustrated in Figure 4.2. If the minor dimension is less than 3/4 inch (19.1 mm) the articulate probe without the web stop may be used.

b) For an opening that has a minor dimension of 1 inch or more, such a part or wire shall be spaced from the opening as specified in Table 4.2.

Figure 4.2
Articulate probe with web stop



PA100

Table 4.2
Minimum distance from an opening to a part that
may involve a risk of electric shock or injury to persons

Minor dimension of opening ^a ,		Minimum distance from opening to part,	
Inches ^b	(mm) ^b	Inches ^b	(mm) ^b
1	25.4	6-1/2	165
1-1/4	31.8	7-1/2	190
1-1/2	38.1	12-1/2	318
1-7/8	47.6	15-1/2	394
2-1/8	54.0	17-1/2	444
c		30	762

^a See 4.6.4.

^b Between 1 inch and 2-1/8 inches, interpolation is to be used to determine a value between values specified in the table.

^c More than 2-1/8 inches, but not more than 6 inches (152 mm).

4.6.2 The probe specified in 4.6.1 and illustrated in Figure 4.2 shall be applied to any depth that the opening will permit; and shall be rotated or angled before, during, and after insertion through the opening to any position that is required to examine the enclosure. The probe illustrated in Figure 4.2 shall be applied in any possible configuration; and, if required, the configuration shall be changed after insertion through the opening.

4.6.3 The probe specified in 4.6.1 and 4.6.2 shall be used as a measuring instrument to judge the accessibility provided by an opening, and not as an instrument to judge the strength of a material; the probe shall be applied with the minimum force required to determine accessibility.

4.6.4 With reference to the requirements in 4.6.1, the minor dimension of an opening is the diameter of the largest cylindrical probe having a hemispherical tip that can be inserted through the opening.

4.6.5 During the examination of equipment in connection with the requirements in this section, a part of the outer enclosure that may be removed without the use of a tool by the user of the heater (to permit the attachment of accessories, to allow access to means for making operating adjustments, or for other reasons) is to be removed. Such a part shall not be assumed to provide protection against electric shock or personal injury.

4.6.6 A door or cover of an enclosure shall be provided with a means for holding it securely in place in the closed position.

4.6.7 The door or cover of an enclosure shall be hinged if it gives access to any fuse, circuit breaker, or manually-resettable limiting control in other than a low voltage circuit, and if any uninsulated live part is exposed during the normal replacement of the fuse. Such a door or cover shall also be provided with an automatic latch or the equivalent and, if any live part other than the screw shell of a plug fuseholder is exposed inside the enclosure, a captive screw (or similar means requiring the use of a tool to open) shall be provided to secure the door or cover in place, and the cover shall be legibly and permanently marked in accordance with 38.1.6.

4.6.8 A protective device shall be wholly inaccessible from outside the heater without opening a door or cover; however, the operating handle of a circuit breaker, the operating button of a manually-resettable limiting control, or a similar part may project outside the enclosure.

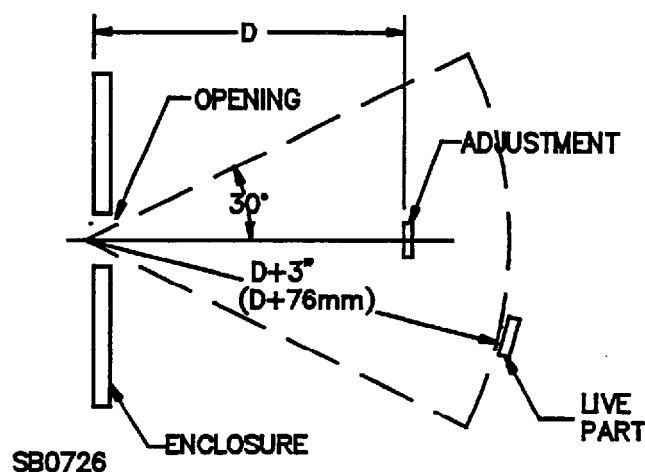
4.6.9 A door or cover giving access to any overload protective device in other than a low voltage circuit shall be tight-fitting and shall overlap the surface of the enclosure around the opening.

4.6.10 A spring latch, a magnetic latch, a dimple, or any other mechanical arrangement that will hold the door in place and would require some effort on the user's part to open is determined to be an acceptable means for holding the door in place as required in 4.6.6.

4.6.11 A component that is likely to need inspection, replacement, cleaning, or other servicing shall be as accessible as is practicable, and shall be readily accessible without the use of special tools if it is intended to be manually-operated or adjusted, or if it will require periodic servicing.

4.6.12 If an opening is provided to gain access to a control that is intended to be reset, adjusted, or otherwise manipulated by the user or service personnel, it shall not be possible to contact a live uninsulated or enamel insulated part with a 1/16 inch (1.6 mm) diameter rod applied as described in 4.6.13 and as illustrated in Figure 4.3.

Figure 4.3
Accessibility of live part through adjustment opening



4.6.13 With reference to the requirement in 4.6.12, the rod is to be inserted through the opening to its maximum depth and positioned in all possible directions without producing an angle of more than 30 degrees between the rod and a line connecting the center of the opening with the center of the face of the adjusting mechanism. The length of the rod beyond the opening is not to exceed the distance between the opening and the face of the adjusting mechanism by more than 3 inches (76 mm).

5 Metal in Contact With Water

5.1 A metal tank and associated metal pipe fittings that are in contact with pool water shall be of:

- a) Copper, copper alloy, or stainless steel, any of which is at least 0.036 inch (0.91 mm) thick. If a copper alloy has a zinc content, such content shall not exceed 15 percent;

- b) Cast iron at least 1/4 inch (6.4 mm) thick;
- c) Steel at least 0.067 inch (1.7 mm) thick if the surface of the steel in contact with water is galvanized or glass lined. The zinc coating shall be a minimum of 0.0017 inches (0.043 mm) thick as determined by the method specified in 32.1, and the minimum average thickness of the glass lining shall be 0.005 inches (0.13 mm). The minimum average thickness of the glass lining is to be calculated from six thickness measurements, all taken at different locations. Each measurement is to be made by first measuring the thickness of the metal with the glass lining, then subtracting the measured thickness of the metal after breaking off the glass; or
- d) Aluminum or aluminum alloy at least 0.093 inch (2.36 mm) thick if the surface in contact with water is glass lined. The minimum average thickness of the glass lining shall be 0.005 inches (0.13 mm) as measured by the method described in (c).

As an alternative to the specifications in 5.1(a) – (d), a tank that bears the symbol of the Boiler and Pressure Vessel Code, ANSI/ASME BPVC, consisting of the Code H, S, M, U, UM, or HLW in a clover leaf may be used.

5.2 Any pipe or fitting of iron or steel in contact with water shall be protected against corrosion by galvanizing or plating. Zinc coating used for corrosion protection shall be a minimum 0.0017 inches (0.043 mm) thick as determined by the method specified in 32.1.

6 Field Wiring Connections

6.1 General

6.1.1 A heater shall have provision for connection of a wiring system.

6.1.2 If the heater includes a length of flexible conduit for the heater supply leads, the flexible conduit shall be steel and an outlet box, control box, or similar enclosure intended for connection to the supply wiring system shall be provided on the end of the flexible conduit. Unless the conduit is terminated in an outlet box or other enclosure not larger than 2 by 4 by 4 inches (51 by 102 by 102 mm) for splice connections, locknuts on the fittings are not considered to be an acceptable means of preventing the loosening of the conduit fittings. An equipment grounding conductor sized in accordance with 9.3 shall be included unless:

- a) The conduit is not longer than 6 feet (1.8 m);
- b) No circuit conductor protected by an overcurrent protective device rated at more than 20 amperes is included; and
- c) The conduit is not larger than 3/4-inch trade size unless the fittings are identified as providing grounding.

6.1.3 A knockout for connection of a field wiring system to a field wiring compartment shall accommodate conduit of the trade size shown in Table 6.1.

Table 6.1
Trade size of conduit in inches

Wire size, AWG (mm ²)		Number of wires				
		2	3	4	5	6
14	2.1	1/2	1/2	1/2	1/2	1/2
12	3.3	1/2	1/2	1/2	3/4	3/4
10	5.3	1/2	1/2	1/2	3/4	3/4
8	8.4	3/4	3/4	3/4	1	1
6	13.3	3/4	1	1	1-1/4	1-1/4
4	21.2	1	1	1-1/4	1-1/4	1-1/2
3	26.7	1	1-1/4	1-1/4	1-1/2	1-1/2
2	33.6	1	1-1/4	1-1/4	1-1/2	2
1	42.4	1-1/4	1-1/4	1-1/2	2	2
1/0	53.5	1-1/4	1-1/2	2	2	2-1/2

NOTE — This table is based on the assumption that all conductors will be of the same size and there will be not more than six conductors in the conduit. If more than six conductors will be involved or if all of them are not of the same size, the internal cross-sectional area of the smallest conduit that may be used is determined by multiplying by 2.5 the total cross-sectional area of the wires, based on the cross-sectional area of Type THW wire.

6.1.4 A wiring space or other compartment in a heater intended to be wired in the field that will enclose wires shall be free of any sharp edges, burrs, fins, moving parts, or the like that can damage the conductor insulation.

6.1.5 An opening in an enclosure for the entrance of a conductor shall be provided with a bushing of insulating material. The bushing shall be mounted in place in the opening or may be provided with the enclosure so that it may be mounted when the equipment is installed.

6.1.6 A bushing of rubber or rubber-like material provided in accordance with 6.1.5 shall not be less than 1/8 inch (3.2 mm) thick. A hole in which such a bushing is mounted shall be free of sharp edges, burrs, projections, or the like, that might damage the bushing.

Exception: When the metal around a bushing hole is eyeletted or otherwise treated to provide smooth edges, the bushing shall not be less than 3/64 inch (1.2 mm) thick.

6.2 Leads and terminals

6.2.1 A lead intended to be connected to the source of supply shall be rated for minimum 60°C (140°F) if the heater is rated at 80 amperes or less, and minimum 75°C (167°F) if the heater is rated more than 80 amperes, even if such wiring material temperature rating would not be required for reasons of temperature alone.