

New Zealand Standard

Storage Water Heaters

Part 1 – General Requirements

NZS 4606.1:1989

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COMMITTEE REPRESENTATION

This Standard was prepared under the supervision of the Energy and Resources Advisory Committee (50/E) and the Building and Civil Engineering Divisional Committee (30/-) for the Standards Council established under the Standards Act 1988.

The Valve Vented Water Heaters Committee (46/4) was responsible for the preparation of the Standard and comprised representatives of the following organizations:

Electrical Development Association
Ministry of Energy
New Zealand Local Government Association
New Zealand Manufacturing Engineers Federation
New Zealand Society of Master Plumbers
Works and Development Services Corporation (NZ) Ltd

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RELATED DOCUMENTS

Reference is made in this Standard to the following:

NEW ZEALAND STANDARDS

NZS 3501:1976	Copper tubes for water, gas and sanitation
NZS 4602:1988	Low pressure copper thermal storage electric water heaters
NZS 4603:1985	Code of practice for the installation of low pressure thermal storage electric water heaters with copper cylinders
NZS 4607:1990	Installation of thermal storage electric water heaters: Valve vented systems
NZS 6200:1988	Specification for general requirements for electrical apparatus and material

AUSTRALIAN STANDARDS

AS 2345:1980	An accelerated laboratory test method for assessment of the susceptibility of brass to dezincification
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BRITISH STANDARDS

BS 21:1985*	Pipe threads for tubes and fittings where pressure-tight joints are made on the threads
BS 2779:1986*	Pipe threads for tubes and fittings where pressure-tight joints are not made on the threads
BS 2870:1980*	Rolled copper and copper alloys: sheet, strip and foil
BS 5490:1977*	Classification of degrees of protection provided by enclosures

NEW ZEALAND LEGISLATION

Drainage and Plumbing Regulations 1978
Electric Wiring Regulations 1976
Gas Industry Regulations 1984

OTHER PUBLICATIONS

Board of Health. Drinking-water standards for New Zealand.

*Endorsed as suitable for use in New Zealand.

The users of this Standard should ensure that their copies of the above-mentioned New Zealand Standards or of overseas Standards endorsed as suitable for use in New Zealand are the latest revisions or include the latest amendments. Such amendments are listed in the annual SANZ Catalogue which is supplemented by lists contained in the monthly magazine Standards issued free of charge to committee and subscribing members of SANZ.

NZS 4606:Part 1:1989

FOREWORD

This Standard has been based upon the Australian Standard AS 1056 *Storage water heaters* issued in three parts in 1985.

Parts 2 and 3 of AS 1056, which deal respectively with the specific requirements for water heaters for single and composite shells, were found to be acceptable for use in New Zealand with only minor changes and in consequence these parts have each been adopted for use in conjunction with a New Zealand amendment.

Part 1 of AS 1056, which deals with general requirements for water heaters was however found to require more modification than could be readily accommodated with a separate amendment and this Part is therefore produced as a New Zealand Standard.

Part 1 of NZS 4606 differs from Part 1 of AS 1056 in that provision is made for the use of screwed heating elements, thermostats are required to be user-adjustable, the thermal insulation requirements and standing heat loss test have been aligned with those currently applying in New Zealand. Care has also been taken to avoid as far as practicable any overlap with NZS 4602:1988 *Low pressure copper thermal storage water heaters*.

NEW ZEALAND STANDARD

STORAGE WATER HEATERS

Part 1 GENERAL REQUIREMENTS

1 SCOPE AND GENERAL

1.1 Scope This Standard

- (a) Specifies requirements for electrically heated thermal storage water heaters having capacities within the range 6.5 L to 630 L but excluding low pressure water heaters with copper cylinders within the scope of NZS 4602.
- (b) Covers gas-fired water heaters by cross-reference to Codes AG 102 and AG 109 published by the Australian Gas Association and the Australian Liquefied Petroleum Gas Association.
- (c) Does not apply to heat-exchange water heaters or to fixed water boilers.

NOTE-

- (1) Water heaters having deliveries in excess of 630 L generally have special requirements. Intending purchasers of such water heaters are advised to include in their specification such requirements of this Standard as are relevant to their needs.
- (2) For the installation of household type hot water systems, see NZS 4603 and NZS 4607.
- (3) Where supplementary heating, e.g. from a solar collector or a slow combustion stove, is used, additional requirements may be necessary.

1.2 Application

Electric water heaters shall comply with the relevant requirements of this Standard and with the requirements if the following Standards, as applicable:

- (a) Water heaters with single shells
NZS 4606:Part 2
- (b) Water heaters with composite shells
NZS 4606:Part 3

1.3 Definitions

1.3.1 For the purpose of this Standard, the following

definitions shall apply:

APPROVED. Approved by Engineer.

ENGINEER. The local authority's Engineer appointed under the Local Government Act.

HEATING ELEMENT. The electrical conducting medium which is heated by an electric current together with its insulation and supports and immediate closure, if any, plus any gasket.

MAINS PRESSURE WATER HEATER. A water heater designed to work at pressures exceeding 12 mH₂O (120 kPa).

LOW PRESSURE WATER HEATER. A water heater designed to work under a pressure not exceeding 12 mH₂O (120 kPa) and complying with NZS 4602.

MAXIMUM WORKING PRESSURE. The maximum working pressure to which a water heater may be subjected as measured at the lowest point of the water heater.

THERMAL STORAGE ELECTRIC WATER HEATER. An electric water heater in which the heated water is stored or may remain in a vessel. It includes the vessel, insulation, and outer casing, but does not include the hot water reticulation, control valves, cold water supply piping, thermostat, or heating elements. **WATER HEATER** shall have the same connotation.

VALVE VENTED WATER HEATER. A water heater in which the venting to atmosphere is controlled by a valve. The valve may be on the inlet side, in which case it is called an expansion control valve, or on the outlet side in which case it is referred to as a pressure relief valve.

OPEN VENTED WATER HEATER. A water heater in which provision is made for a vent permanently open to the atmosphere.

DISPLACEMENT WATER HEATER. A water heater in which water is fed into the container at or near the bottom, displacing the hot water as it is drawn off from or near the top.

HEADER TANK WATER HEATER. A displacement water heater which is supplied with water from a separately mounted feed tank in which the level of the water is automatically maintained.

CISTERN WATER HEATER. A displacement water heater with no free water surface and in which the inlet water is supplied from an attached feed tank.

FREE-OUTLET WATER HEATER. A displacement water heater with an open outlet from which hot water is discharged by displacement, the flow of water being controlled by means of valve or tap in the inlet water feed pipe.

FALLING-LEVEL WATER HEATER. A non-displacement water heater with a free water surface in which hot water is drawn off at or near the bottom, the level of the water falling as the hot water is drawn off.

MAXIMUM WATER-SUPPLY PRESSURE. The maximum pressure of the water supply to which a water heater (including reduction valve, if fitted) may be connected.

MAXIMUM HEAD. The maximum working pressure to which a water heater may be subjected as measured at the lowest point of the water heater.

CONTAINER. The vessel, including fittings, in which the heated water is stored.

SHELL. The container excluding all detachable fittings.

CASING. The jacket enclosing the container and its thermal insulation.

CORSET. The brace, stays, or restraints used to support the container, or the fittings of the container.

BONDED COATING. A coating formulated to be resistant to continuous exposure to hot water may be either:

Class X coating intended for applications where the water temperature does not exceed 70 °C; or

Class Y coating, a coating of lower solubility than Class X, intended to provide greater resistance to dissolution by water at temperatures up to 70 °C or for use at temperatures in excess of 70 °C.

1.3.2

For the purposes of this Standard, the word "shall" refers to practices which are mandatory for compliance with this Standard. The word "should" refers to practices which are advised or recommended.

1.4

Compliance with legislation

1.4.1

Attention is drawn to the need to comply with the

relevant requirements of the Electrical Wiring Regulations, Drainage and Plumbing Regulations, Gas Industry Regulations and local authority bylaws.

1.5

Facilities for maintenance

1.5.1

The design of a water heater shall be such as will facilitate maintenance.

1.5.2

Similar parts of water heaters of the same make, model, and size shall be interchangeable and, as far as practicable, shall be manufactured and located so as to be capable of easy replacement without the necessity for individual fitting or adjustment.

1.5.3

Provision shall be made for heating units, thermostats, and over-temperature protective devices to have adequate clearance from their housing so that they can be withdrawn easily when the water heater is fixed in accordance with NZS 4607 and the manufacturer's installation instructions. No heating unit shall interfere with any other heating unit during removal or replacement. Thermostats and over-temperature protective devices shall be capable of being removed without the water being drained.

1.6

Cleanliness in manufacture

1.6.1

None of the materials, including residual lubricants, solvents and fluxes, used in the fabrication of water heaters shall impart to the water traces of compounds in excess of those recommended by the Board of Health Drinking-Water Standards for New Zealand.

2

CONSTRUCTION

2.1

Fixing of heating elements to shell

2.1.1

Shells of electric water heaters shall provide facilities for fixing heating elements as follows:

- (a) Where provision is made for screwed heating elements the thread shall comply with the requirements of fig 2.1
- (b) For bolt-on type tubular-sheathed immersion heating elements an aperture and a sealing face shall be provided either in the form of a raised annular section (see fig. 2.2) or flush with the outer face of the aperture (see fig. 2.3). Means shall be provided to fix the heating element flange (see fig. 2.4) to the shell.

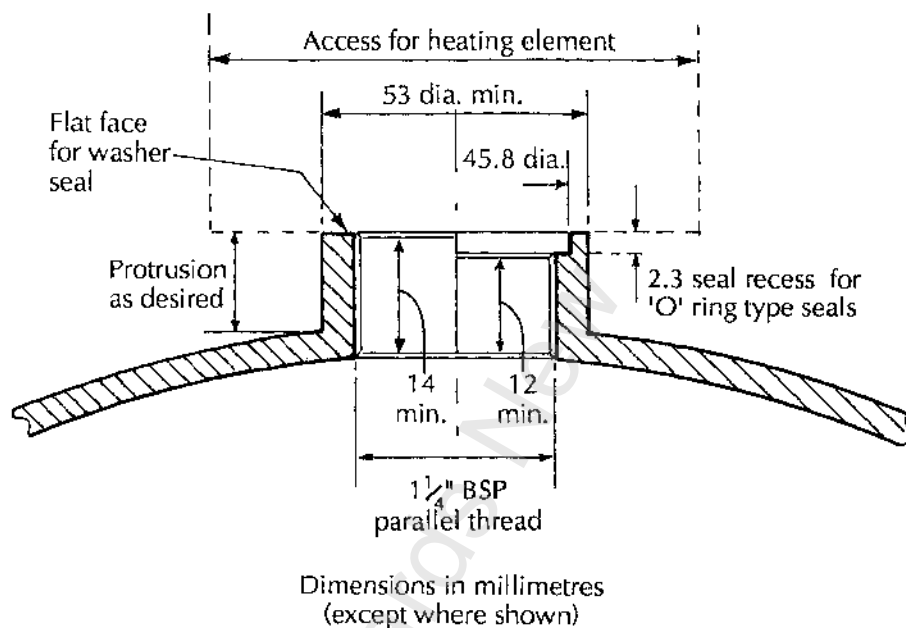


Fig. 2.1
DIMENSIONAL REQUIREMENTS FOR ATTACHMENT OF SCREWED HEATING ELEMENTS

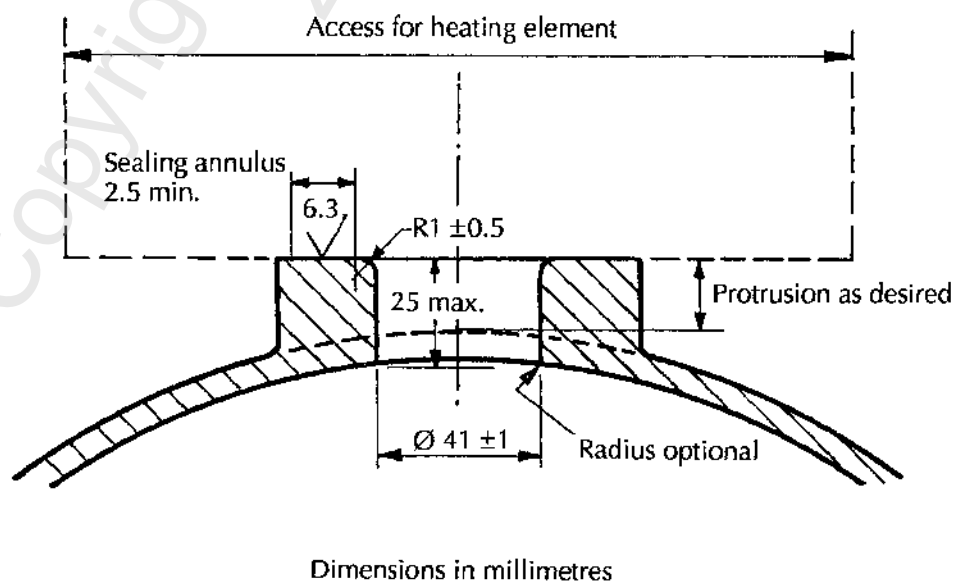


Fig. 2.2
APERTURE FOR TUBULAR-SHEATHED HEATING ELEMENT (WITH PROTRUDING FITTING)

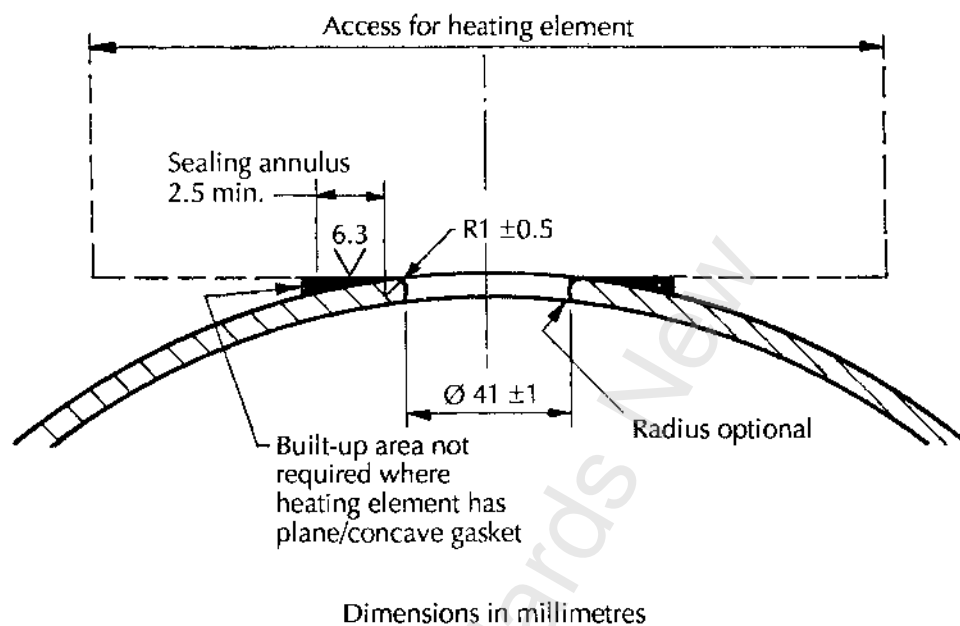


Fig. 2.3
APERTURE FOR TUBULAR-SHEATHED HEATING ELEMENT (WITHOUT PROTRUSION)

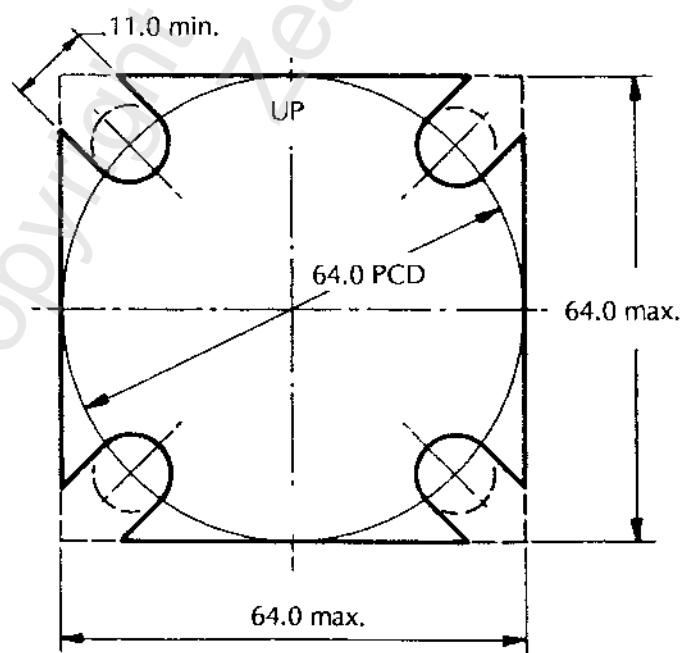


Fig. 2.4
HEATING ELEMENT FLANGE

2.1.2

A space shall be provided to facilitate insertion and removal of the heating element. Only detachable thermostat assemblies and wiring may encroach within this space.

2.2

Sacrificial anodes

2.2.1

Shells lined with vitreous enamel

At least one sacrificial anode shall be provided in composite shells lined with vitreous enamel. The anode(s) shall be cored magnesium or other suitable material having a total mass of not less than 270 g per square metre of container area. The anode(s), which shall be capable of being replaced, shall be in electrical contact with the container, and shall extend to within 100 mm of the nearest point of each end.

NOTE-

(1) In some cases it may be necessary to use a greater mass of anode than that specified above.

(2) Attention is drawn to the need to use either a high-potential or a low-potential anode, depending on the conductivity of the water in the area where the water heater is to be used. For high conductivity waters, an aluminium alloy anode formulated for use in water heaters may be suitable.

2.2.2

Shells lined with bonded plastics

A sacrificial anode shall not be provided in composite shells lined with bonded plastics.

2.3

Fittings in contact with water

2.3.1

Fittings in contact with water shall be galvanically compatible with the shell surface in contact with water, i.e. for a single shell, the shell material, or for a composite shell, the protective lining.

2.3.2

Fittings on vitreous enamel lined shells (see NZS 4606:Part 3, section 5) shall be lined with vitreous enamel or other suitable non-metallic materials in areas exposed to freely circulating water.

2.3.3

Fittings made from copper alloys and in contact with water shall be resistant to dezincification to the extent that the average depth of dezincification, determined in accordance with the method described in AS 2345, shall not exceed the following:

- (a) For extruded bar -
 - (i) longitudinally 300 µm; and
 - (ii) transversely 100 µm

- (b) For forgings and castings 100 µm.

NOTE - Stringers which do not exceed 400 µm at any one point are acceptable.

2.4

Thermal insulation

2.4.1

Thermal insulation shall be incorporated in the water heater in accordance with the following requirements:

- (a) The insulation material shall be such that it will not deteriorate in service or become depressed and leave uninsulated voids during transportation and installation or cause corrosion of any part of the water heater with which it is in contact.
- (b) The insulation shall be placed and contained so that its efficiency is maintained, contact with wiring terminations or temperature controls is prevented, and attack by vermin is deterred.
- (c) Each type water heater shall be subjected to a type test in accordance with Appendix A and shall achieve a 24 h standing heat loss not greater than the appropriate value specified in table 1. For water heaters of other sizes the maximum permitted 24 h heat loss shall be determined according to the following formulae and rounded to the nearest 0.1 kWh above:

Capacity (L)	Heat loss (kWh)
≤90	0.0084 L + 0.40
≥90	0.0048 L + 0.72

Table 1
STANDING HEAT LOSS

Cylinder capacity	Maximum 24 h loss
L	kWh
6.5	0.5
13	0.5
22	0.6
45	0.8
90	1.2
135	1.4
180	1.6
225	1.8
270	2.0
360	2.5
450	2.9
540	3.4
630	3.8

2.5

Corset

The corset shall be fabricated of material having corrosion-resistant properties, under the conditions of use, not inferior to those of the casing. Those sections of the corset coming into contact with the shell shall comply with the requirements of 2.3.

2.6

Casing

The casing shall have mechanical and corrosion-resistance properties suitable for the conditions of use, and in any event not inferior to those of unsupported 0.4 mm zinc-coated steel sheet.

2.7

Hydrostatic overpressure resistance

2.7.1

When tested in accordance with the following type and routine tests the container of a water heater shall show no evidence of leakage. For a container with a metallic insert (see NZS 4606:Part 3, section 4), the sealable openings shall be left open to facilitate the detection of leakage.

2.7.2

Test conditions

The container shall be subjected to its normal working pressure before testing. Air shall be removed from the container and the tests carried out at room temperature.

2.7.3

Type test

The container shall be subjected to a pressure of 1.5 times its maximum working pressure or 2000 kPa, whichever is the smaller, for a period of 30 minutes during which time there shall be no sign of leakage or undue distortion of the container. The applied pressure shall then be increased to 2 times the maximum working pressure and then immediately released. There shall be no leakage during this procedure. For the purpose of these tests the maximum working pressure shall be taken as equal to the relief valve pressure setting.

2.8

Pressure fatigue resistance

2.8.1

When tested in accordance with the following procedure, a container that has not been subjected to hydrostatic overpressure testing (see 2.7) shall neither leak nor exhibit distortion that would affect operation of the water heater:

- Support the container in the normal manner in its casing or in an agreed equivalent manner.
- Make provision for the detection of water leakage.

- Fill the container with water at the following temperature:
 - For a container of silicon bronze (see NZS 4606:Part 2 section 5) $80 \pm 3^\circ\text{C}$.
 - For other containers ambient temperature.

- For a container with a metallic insert (see NZS 4606:Part 3, section 4), pressurize to 90 % of the maximum working pressure and close the sealable openings.

- Eliminate all air pockets and alternately pressurize the container between 15 % and $100 \pm 5\%$ of the maximum working pressure of the container.

- Apply 250 000 pressure pulsations at between 25 and 60 pulsations per minute. For a container with a metallic insert, open the sealable openings at the end of each intermediate 100 000 cycles while maintaining a pressure of at least 90 % of the maximum working pressure and watching for leakage. Close the sealable openings before reducing the pressure.

2.9

External torque resistance

2.9.1

When the container is tested in accordance with the following procedure, neither the container nor its water fittings shall exhibit any distortion that would affect operation of the water heater:

- For containers for operation at a head exceeding 2 mH₂O (19.6 kPa), select a container that has been subjected to the hydrostatic overpressure test (see 2.7). (For lower pressure models, any container may be selected for testing.)
- Being careful to avoid crushing any fitting, apply a torque of 34 N.m to the end of each water fitting.

For a non-metallic single-shell container (see NZS 4606:Part 2, section 4), there shall be no movement between the container and any non-detachable fitting when the water connections are undone after application of the specified torque.

2.10

Capacity

2.10.1

The capacity of a water heater shall be stated in litres and, when tested by filling with cold water, shall be within $+5 -0\%$ of the capacity marked on the casing in accordance with item (c) of 6.1.1.

3 ELECTRICAL REQUIREMENTS

3.1 Heating elements

3.1.1

General

All tubular-sheathed immersion heating elements shall comply with the requirements of NZS 918 or an approved equivalent.

3.1.2

Gasket

A gasket shall be provided with each heating element so that the container with heating unit will comply with the relevant hydrostatic and pressure fatigue tests (see 2.7 and 2.8). The gasket shall be capable of withstanding the effects of oxygenated water at a temperature of 85 °C irrespective of the thermostat setting.

3.1.3

Material of sheath

The material of the sheath shall comply with the following requirements:

- (a) For a water heater with a metallic single shell (see NZS 4606:Part 2, sections 5 and 6) the sheath shall be galvanically compatible with the shell.
- (b) For a water heater with a metallic insert (see NZS 4606:Part 3, section 4) the sheath shall be galvanically compatible with the insert.

A tin-coated copper sheath may be in direct contact with its flange.

3.1.4

Power density

The power density of a heating unit sheathed with copper alloy shall not exceed 130 kW per square metre of heated surface of the sheath. Adjacent sections of the sheath shall be prevented from coming into close proximity under normal conditions of service.

3.1.5

Heating element support

Where a heating element could damage the container during transportation, the heating element shall be supported.

3.1.6

Location of heating element in falling-level water heaters

In falling-level water heaters the heating element shall be located so that it remains covered by water under all conditions of use, including any temporary failure of the water supply.

3.1.7

Location of boosting elements

Boosting elements in displacement water heaters shall be located so as to heat at least 15 % of the capacity of the heater or 45 L whichever is the greater, and shall be lower than the level of the sensor of any temperature relief valve or thermal cutout.

3.2

Thermostats and over-temperature protective devices

3.2.1

General

Thermostats, including those incorporated in multiple function devices, shall comply with NZS 6214.

3.2.2

Immersed-probe thermostats

The pockets of immersed-probe thermostats shall be located so as to remain covered by water under all conditions of use, including any temporary failure of the water supply.

3.2.3

Surface-contact thermostats

Surface-contact thermostats shall be located so as to control the water temperature effectively under all conditions of use, including any temporary failure of the water supply. Following 20 cycles of removal and replacement of a thermostat, the means of attachment shall maintain effective contact between the thermostat and the container.

3.2.4

Over-temperature protective device

Any over-temperature protective device (thermal cutout) shall comply with NZS 6214. The method of attachment of a surface-contact type device shall comply with the requirements of 3.2.3.

3.2.5

Provision for the mounting of thermostats and thermal cutouts shall not be made on the cover of the electrical terminal chamber.

NOTE - Resettable thermal cutouts should be positioned to permit resetting as part of servicing but so as to preclude as far as practicable their misuse, e.g. as a secondary control mechanism in the event of thermostat failure.

3.3

Electrical safety

3.3.1

Electrical components and wiring shall be protected in accordance with Classification IP34, or better, of BS 5490.

3.3.2

The relevant provisions of NZS 6200 shall be complied with.

4

CISTERN WATER HEATER FEED TANKS AND WATER FITTINGS

4.1

Feed tank

4.1.1

General

The feed tank and its associated float-control valve, supported on the water heater in the normal manner and connected to the cold water supply, shall be capable of withstanding the water in the feed tank being maintained at boiling point for 48 h in such a manner that any consequent distortion or apparent damage will not affect the operation of the tank.

4.1.2

Materials

4.1.2.1

All metallic parts in contact with water shall be galvanically compatible with the container and shall be made of materials having corrosion-resistance properties which, under the conditions of use, are not inferior to those of the materials specified in NZS 4606:Part 2. Parts made of copper alloy shall be resistant to dezincification to the extent specified in 2.3.

4.1.2.2

Under the conditions of use, materials in contact with water shall not be injurious to health.

4.1.2.3

The feed tank shall be constructed of copper complying with BS 2870 and having a thickness of not less than 0.5 mm, or of other materials approved for the purpose by the appropriate regulatory authority.

4.1.3

Design and construction

The design and construction of the feed tank shall comply with the requirements of the appropriate Regulatory Authority.

A metal feed tank shall comply with the following requirements:

- (a) The tank shall be reinforced along the upper edges
- (b) The tank shall be welded, brazed or soft-soldered at all joints
- (c) Soft-soldered joints shall not depend on the solder for mechanical strength

- (d) Joints shall be of a type suitable for the water conditions for which the tank is intended.

4.1.4

Capacity

The capacity of the tank shall be not less than one-third the capacity of the water heater.

4.1.5

Water level

The normal working water level shall be clearly and indelibly marked on the inside of the feed tank.

4.1.6

Overflow

The feed tank shall be provided with an overflow such that when the float-control valve is fully opened, with all service outlets closed, and the water pressure is maintained at 700 kPa, the following requirements are met:

- (a) The vertical clearance between the level of the discharging water and the bottom of the water inlet shall be not less than 20 mm.
- (b) There shall be no spillage from the feed tank.

The overflow shall be located so that there is no discharge when the full container is heated from cold through 70 °C with all service outlets closed. This requirement shall be deemed to have been complied with if the feed tank will accommodate without overflow an increase in volume of 3 % of the capacity of the heater above the marked water level.

4.1.7

Cover

The cold water feed tank shall be fitted with a close-fitting removable cover mechanically attached and formed so that condensate drains back into the tank.

4.2

Water fittings

4.2.1

Internal diameter

Water fittings shall have an internal diameter of not less than 15 mm.

NOTE - For displacement water heaters, other than the push-through type, the internal diameter of the inlet fitting of the container shall be not less than that of the outlet fitting.

4.2.2

Materials

The materials of water fittings shall comply with the requirements of 2.3.

4.2.3

Plumbing connections to water heater

All connection threads shall comply with BS 21 except that male threads capable of accepting copper tubes to NZS 3501 shall comply with BS 2779. The connections shall permit the water heater to be demountable.

4.3

Drainage facility

4.3.1

Provision shall be made for draining the container to a level below the heating element and thermostat for maintenance purposes, either as part of the water heater or as specified in NZS 4607.

5

DETERMINATION OF COMPLIANCE

5.1

Type tests

5.1.1

Compliance with this Standard shall be determined by means of type tests as specified in column 3 of table 2.

NOTE - For valve vented water heaters two units are required for type testing because of the restriction in 2.8.1.

5.2

Routine tests

5.2.1

A recommended schedule for routine testing is given in column 4 of table 2. Testing in accordance with 2.7 and 2.8 should be undertaken regularly and not less than once a year.

Table 2
COMPLIANCE TEST SCHEDULE

1	2	3	4
<i>Characteristic</i>	<i>Clause</i>	<i>Type test</i>	<i>Routine test</i>
Compliance with legislation	1.4	X	-
Facilities for maintenance	1.5	X	-
Cleanliness in manufacture	1.6	X	X
Fixing of heating elements	2.1	X	-
Sacrificial anodes	2.2	X	-
Fittings in contact with water	2.3	X	-
Thermal insulation	2.4	X	-
Corset	2.5	X	-
Casing	2.6	X	-
Hydrostatic overpressure resistance	2.7	X	See 5.2.1
Pressure fatigue resistance	2.8	X	See 5.2.1
External torque resistance	2.9	X	-
Capacity	2.10	X	-
Heating element and support	3.1	X	-
Thermostat(s) and over-temperature protective devices	3.2	X	-
Electrical safety	3.3	X	-
Feed tank	4.1	-	-
Water fittings			
- internal diameter	4.2.1	X	-
- materials	4.2.2	X	-
- connections	4.2.3	X	-
Drainage facility	4.3	-	-
Marking	6.1	X	X
Installation instructions	6.2	X	X

6

MARKING AND INSTRUCTIONS

6.1

Marking

6.1.1

The casing of every water heater shall be legibly marked, in letters of not less than 6 mm in height, with the following particulars grouped together in a prominent position:

- (a) Name of manufacturer and model number, type or name (to distinguish it from other models of the same manufacturer)
- (b) Year of manufacture
- (c) Capacity in litres
- (d) Permissible maximum working pressure
- (e) The number of this New Zealand Standard, i.e. NZS 4606
- (f) Description of the container e.g. stainless steel, or Class X vitreous enamel on steel
- (g) Maximum thermostat setting in degrees Celsius.

6.1.2

Where an internal pipe is used for the hot water draw off it shall be marked "hot water outlet only".

6.2

Instructions for installation and maintenance

The following instructions for installation and maintenance shall be supplied with each water heater:

- (a) A diagram and clear instructions giving details of the methods of connection and installation including the following:
 - (i) A statement to the effect that the water heater shall be installed in accordance

with the requirements of NZS 4603 or NZS 4607 and the requirements of the appropriate Local Authority.

- (ii) An outline of the practices which should be followed to provide for the draining of the container, the expansion of water during heating, and the relief of partial vacuum.
- (iii) A statement of the necessity for providing a properly drained safe-tray under heaters or feed tanks located where the overflow may cause damage.
- (iv) A statement (where applicable) that the water heater has a container of non-metallic material and that the method of fixing the fittings to the casing must not be interfered with, nor should excessive strain be applied to these fittings when the external connections are made.
- (b) The procedure to be followed to place the water heater in service and to ensure that it is adequately filled with water
- (c) Details of proper exercising of the temperature/pressure relief valve, if any
- (d) Details of anode replacement, if applicable
- (e) If the water heater is fitted with an anode, a warning statement along the following lines:

"If the hot water system is not used for two weeks or more, a quantity of hydrogen gas which is highly flammable may accumulate in the water heater. To dissipate this gas safely, it is recommended that a hot tap be turned on for several minutes at a sink, basin, or bath, but not at a dishwasher, clothes washer, or other appliance. During this procedure there must be no smoking, open flame, or any electrical appliance operating nearby. If hydrogen is discharged through the tap, it will probably make an unusual sound as with air escaping."

APPENDIX A METHOD OF TEST FOR DETERMINING STANDING HEAT LOSS

A1

The following conditions shall apply during the test:

- (a) The water heater shall be filled with water
- (b) Ambient temperature in the test room shall be maintained at any convenient nominal temperature between 21 °C and 32 °C. A fan or other means shall be employed to gently circulate the air to avoid stratification and dead pockets of air in the test area. The air from such fan should not play directly onto the water heater
- (c) The ambient air temperature during the test shall not vary by more than ± 3.0 °C measured using a temperature sensor with a thermal mass equivalent to 10 g - 20 g of water. The sensor shall be mounted 1.0 m - 1.5 m above the lowest part of water heater and 1.5 m \pm 100 mm from its surface. When a fan is used to circulate air, the temperature sensor should be on the suction side of the fan and within 1.5 m of the nearest part of the fan
- (d) The nominal mean temperature of the water in the heater shall be maintained at 55.6 °C above nominal ambient air temperature. With an on-off type thermostat the water temperature shall not vary from the mean temperature by more than the following:

Heater capacity	Temperature variation
Up to 100 L	± 4 °C
Above 100 L	± 2.4 °C

For other types of control, such as a simmerstat, the water temperature shall not vary by more than ± 1.4 °C from the mean temperatures.

Suggested heater element powers are:

Heater capacity	Power
Up to 100 L	60 W
Above 100 L	300 W

- (e) The temperature of the water in the heater shall be measured by sensors located two-thirds of the distance between the top of the heating element and the inside of the top of the heater. The sensors shall be within 50 mm of the centroid of the plan cross section of the heater at the given height. The tolerance on height shall be ± 10 mm. Not fewer than two sensors shall be used. A continuous record of temperature should be kept with a chart recorder and the mean water temperature calculated

- (f) A kilowatt-hour meter shall be connected in the element supply
- (g) All pipe fittings except the hot water outlet shall be plugged and insulated with 25 mm thick fibreglass blanket. The hot water outlet shall be left open until the heater reaches operating temperature prior to the start of power measurement and overflow has ceased. The outlet shall then be plugged with a cork or similar plug capable of being readily dislodged by water pressure, and insulated with 25 mm fibreglass blanket
- (h) Heaters shall stand on a base of 20 mm nominal thickness particle board with at least 400 mm clearance above floor level. Air shall be able to circulate freely under the base. Holes 50 mm diameter shall be cut in the particle board in the way of fittings protruding from the bottom of the heater.
- (j) The overall error of the time temperature measuring and recording systems, kilowatt-hour meter and rounding shall not be greater than the following:

Heater capacity	Maximum error
Up to 200 L	± 2 %
Above 200 L	± 3 %

A2

The first reading of the kilowatt-hour meter shall be taken at a cutout of the thermostat not less than 24 h after the water first reaches its highest temperature. Readings shall then be taken at intervals of about 24 h, at the times when the thermostat cuts out. The standing loss for a period of about 24 h is thus found, and the loss for 24 h shall be calculated by proportion.

No fewer than 4 such values shall be obtained, and the average of these determined.

The heat content corresponding to any temperature drift shall be determined using the following formula and be added to (or deducted from) the observed total energy consumption:

$$\text{Heat content (kWh)} = 1.2 \times 10^{-3} \times \text{temperature drift (°C)} \times \text{heater capacity (L)}$$

Where the difference between mean water and mean air temperatures is not 55.6 °C the correct standing loss value shall be calculated by proportion.

A3

When testing the quick-recovery type of water heater it may be necessary to modify the method of

NZS 4606:Part 1:1989

measuring the temperature of the water above the element in the vessel. Such a modification shall be as follows:

- (a) The water shall be heated as for the heat loss test and allowed to reach a steady temperature as determined by a sensor placed somewhere in the top third of the water above the level of the element. The value of the steady temperature so reached shall be between 66 °C and 88 °C
- (b) Not less than 24 h after the water has reached such a steady temperature, a temperature

gradient test shall be taken of the water at points along a conveniently positioned vertical line in the vessel

- (c) From these test figures a position on this line is then found at which the temperature is the average of the temperatures between the level of the element and the top of the vessel
- (d) The heat loss test is then carried out with the 55.6 °C temperature difference maintained between this "average temperature point" and ambient temperature.



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Manufacturers may obtain particulars of the conditions of licensing from the Director, Standards Association of New Zealand, Private Bag, Wellington.

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Declared on 24 November 1989 by the Standards Council to be a standard specification pursuant to the provisions of section 10 of the Standards Act 1988.

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NEW ZEALAND STANDARD

NZS 4606:Part 1:1989

STORAGE WATER HEATERS

Part 1 GENERAL REQUIREMENTS

AMENDMENT No. 1

February 1991

SCOPE

The amendment permits low pressure water heaters with copper vessels to be manufactured to NZS 4606 as well as to NZS 4602 by the removal of the current exclusion.

To ensure receiving advice of the next amendment to NZS 4606:Part 1:1989 please complete and return the amendment request form.

APPROVAL

Amendment No. 1 was approved on 15 February 1991 by the Standards Council to be an amendment to NZS 4606:Part 1:1989 pursuant to the provisions of section 10 of the Standards Act 1988.

(Amendment No. 1, February 1991)

Section 1 SCOPE AND GENERAL

1.1

Scope

In item (a) **delete** "but excluding low pressure water heaters with copper cylinders within the scope of NZS 4602" and **substitute** "Water heaters with copper vessels may also be made to NZS 4602".

(Amendment No. 1, February 1991)

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NEW ZEALAND STANDARD

NZS 4606:Part 1:1989

STORAGE WATER HEATERS

Pr Gratis

Part 1
GENERAL REQUIREMENTS

AMENDMENT No. 2

October 1991

SCOPE

This amendment revises the degree of protection for the electrical components and wiring and sets different levels depending upon whether the water heater is intended for use indoors or outdoors. A minor error is also corrected.

APPROVAL

Amendment No. 2 was approved on 8 October 1991 by the Standards Council to be an amendment pursuant to the provisions of section 10 of the Standards Act 1988.

(Amendment No. 2, October 1991)

RELATED DOCUMENTS

Delete:

"BS 5490:1977* Classification of degrees of protection provided by enclosures"

and substitute:

"AS 1939:1990 Degrees of protection provided by enclosures for electrical equipment (IP Code)".

(Amendment No. 2, October 1991)

3.3

Electrical safety

Delete clause 3.3.1 and substitute:

"3.3.1

Electrical components and wiring shall be protected in accordance with, or better than, Classification IP 31 of AS 1939 where the water heater is intended for use indoors, or Classification IP 34 of AS 1939 where the water heater is intended for use outdoors."

(Amendment No. 2, October 1991)

APPENDIX A

METHOD OF TEST FOR DETERMINING STANDING HEAT LOSS

A2

In paragraph 4 amend "10⁻³" to read "10³".

(Amendment No. 2, October 1991)

To ensure receiving advice of the next amendment to NZS 4606:Part 1:1989 please complete and return the amendment request form.

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STORAGE WATER HEATERS

Pr Gratis

Part 1
GENERAL REQUIREMENTS

AMENDMENT No. 3

November 1993

EXPLANATORY NOTE – Amendment No. 3 recognizes the use of AS 1308:1987 *Electric water heaters – Thermostats and thermal cutouts* and is consistent with the New Zealand Building Code Amendment 1993 to G12/AS1.

APPROVAL

Amendment No. 3 was approved on 8 November 1993 by the Standards Council to be an amendment to NZS 4606:Part 1:1989 pursuant to the provisions of section 10 of the Standards Act 1988.

(Amendment No. 3, November 1993)

RELATED DOCUMENTS

Add:

"AS 1308:1987 Electric water heaters – Thermostats and thermal cutouts"

(Amendment No. 3, November 1993)

3.2

Thermostats and over-temperature protective devices

3.2.1

At the end of the sentence **add** "or AS 1308."

3.2.4

Delete the first sentence and **substitute**:

"Any over-temperature protective device (thermal cut-off) shall comply with NZS 6214 or AS 1308 providing that devices complying with AS 1308 are set such that the cut-off temperature shall not exceed 90°."

3.2.5

In line 2 **delete** "cutouts" and **substitute** "cut-offs".

(Amendment No. 3, November 1993)