NZS 4305:1996 ENERGY EFFICIENCY – DOMESTIC TYPE HOT WATER SYSTEMS

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NEW ZEALAND STANDARD

ENERGY EFFICIENCY – DOMESTIC TYPE HOT WATER SYSTEMS

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STANDARDS NEW ZEALAND

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COMMITTEE REPRESENTATION

This Standard was prepared by the Domestic Type Hot Water Systems Committee (P4305A) for the Standards Council established under the Standards Act 1988.

The Domestic Type Hot Water Systems Committee consisted of representatives of the following organizations:

Auckland Manufacturers' Association
– Gas Appliances Manufacturing Association
Building Officials Institute of New Zealand
Electrical Development Association
Energy Efficiency and Conservation Authority
Institution Professional Engineers New Zealand
New Zealand Society of Master Plumbers and Gasfitters
Plumbers Gasfitters and Drainlayers Board
Victoria University of Wellington

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AMENDMENTS

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CONTENTS **PAGE**

RELATED DOCUMENTS

Reference is made in this Standard to the following:

NEW ZEALAND STANDARDS

NZS 4602:1988	Low pressure copper thermal storage electric water heaters
NZS 4603:1985	Installation of low pressure thermal storage electric water heaters with copper cylinders (open-vented systems)
NZS 4606:- - - - Part 1:1989	Storage water heaters General requirements
NZS 4614:1986	Installation of domestic solar water heating systems

NEW ZEALAND LEGISLATION

The Building Regulations 1992 – First Schedule: New Zealand Building Code (NZBC)

OTHER PUBLICATIONS

AG 102–1989, The Australian Gas Association and Australian Liquefied Petroleum Gas Association Ltd.

US Department of Energy (DOE) Federal Register 10 CFR Part 430 – Energy Conservation Program for Consumer Products: Final rule regarding test procedures and energy conservation standards for water heaters.

New Zealand Building Code Approved Document G12 Water Supplies.

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

FOREWORD

NZS 4305:1996 *Domestic type hot water systems* is developed as a new Standard and forms part of a current Standards New Zealand suite of energy related Standards.

The purpose of this Standard is to provide details and guidance to meet acceptable energy efficiency performance requirements for domestic type hot water systems. This includes such systems that may be found in residential, industrial and commercial buildings. Domestic type hot water may also be known as "service water" and excludes systems used exclusively for space heating, cooling or for processes.

This Standard reflects changes in energy efficiency installation practices and methods to meet minimum acceptable levels.

The requirements are based on a practical and economic analysis of insulation costs and energy savings and common sense. Energy efficient systems provide economic, comfort and health benefits to the nation and the householder by reducing overall energy consumption while retaining or improving on the existing levels of service. These benefits are particularly marked in the colder zones.

REVIEW OF STANDARDS

Suggestions for improvement of this Standard will be welcomed. They should be sent to the Chief Executive, Standards New Zealand, Private Bag 2439, Wellington 6020.

NOTES

NEW ZEALAND STANDARD

ENERGY EFFICIENCY – DOMESTIC TYPE HOT WATER SYSTEMS

1 GENERAL

1.1 Scope

1.1.1
This Standard applies to domestic type hot water systems that supply sanitary appliances and sanitary fixtures. It sets out minimum energy efficiency requirements in terms of heat losses from domestic type hot water systems.

1.1.2
This Standard is applicable to all domestic type hot water systems irrespective of the energy source. Domestic type hot water systems are those which:

(a) Supply hot water to sanitary appliances and sanitary fixtures. This includes water used for domestic type uses such as personal washing, showering, bathing, utensil washing and clothes washing regardless of the classified use of the building (e.g. commercial or industrial).

(b) Have a storage capacity, for individual water heaters up to 700 litres, or have instantaneous water heaters.

1.1.3
This Standard does not include:

(a) Electric storage water heaters installed in non-domestic situations and with an energy input rating greater then 10 kW;

(b) Gas storage water heaters installed in non-domestic situations and with an energy input rating greater than 45 MJ/h;

(c) Industrial or commercial applications with the same usage stated in 1.1.2(a), e.g. commercial washing machines in commercial laundries.

1.2 Definitions

1.2.1
For the purposes of this Standard the following definitions shall apply:

COLD WATER EXPANSION CHAMBER. A compartment or enclosed space for air or water to allow expansion of water without loss from the system.

DOMESTIC TYPE HOT WATER SYSTEM. All parts of the installation including the water heater and all equipment and materials necessary to provide a supply of hot water at the specified outlets.

HEAT TRAP. An arrangement of water piping constructed to counteract the heat loss due to convection of the hot water.

HOT WATER STORAGE VESSEL. A vessel in which heated water is stored and includes the container, insulation and outer casing.

HOUSEHOLD UNIT. A building, group of buildings or part of a building or group of buildings, occupied or intended to be occupied for residential purposes as the home or residence of not more than one household.

R-VALUE or THERMAL RESISTANCE. A measure of the resistance to heat flow through a layer of given thickness of a material. It can be determined by measuring the temperature difference between the hot and cold surface under constant conditions where there is unit heat flow in unit time through unit area ($m^2 \cdot {}^oC/W$).

STORAGE WATER HEATER. A hot water storage vessel with integral heating.

THERMAL CONDUCTIVITY (*k*). The heat flow (thermal transmission) in unit time through unit area of a slab of a uniform homogeneous material of unit thickness when unit difference of temperature is established between its two surfaces ($W/m \cdot {}^oC$).

UNVENTED WATER HEATER (including valve vented). A water heater in which no provision is made for a vent permanently open to atmosphere.

VENTED WATER HEATER (open vented). A water heater in which provision is made for a vent permanently open to atmosphere.

1.2.2
For the purposes of this Standard the word "shall" refers to practices which are mandatory for compliance with the Standard. The word "should" refers to practices which are advised or recommended.

2 WATER HEATER AND STORAGE VESSEL ENERGY EFFICIENCY

2.1 Electric storage water heaters – standing heat loss

2.1.1
Electric storage water heaters when tested according to NZS 4606:Part 1 or NZS 4602, shall achieve a 24-hour standing heat loss not greater than the value specified in table 1.

Table 1 – Storage water heater – maximum standing heat loss by size

Capacity (L)	Maximum heat loss (kWh/d)
135	1.4
180	1.6
200	1.7
225	1.8
270	2.0
300	2.2
360	2.5
450	2.9

2.1.2

For water heaters of other sizes, the maximum permitted 24 hour standing heat loss shall be determined according to the following formulae in table 2 and rounded up to the nearest 0.1 kWh/d.

Table 2 – 24 hour standing heat loss formulae

Capacity (L)	Heat loss (kWh/d)
≤ 90	0.0084 L + 0.40
> 90	0.0048 L + 0.72

2.2 Gas water heaters – energy efficiency rating

2.2.1

The thermal efficiency of storage and instantaneous heaters operating at nominal gas consumption shall not be less than that shown in table 3.

Table 3 – Minimum thermal efficiency of storage and instantaneous heaters

Type	Thermal efficiency
Instantaneous	75 %
Storage < 200 L	75 %
Storage ≥ 200 L	70 %

2.2.2

The rate of gas consumption required to maintain the average temperature of water in a storage water heater at 45 °C above ambient temperature shall not exceed that shown in table 4.

Table 4 – Maximum gas consumption rate required to maintain average water temperatures

Capacity	Maximum gas consumption rate (kW)
Storage < 200 L	0.27
Storage ≥ 200 L	0.35

2.2.3
Acceptable methods of test are as follows:

(a) The Australian Gas Association AG 102;

(b) The US Department of Energy (DOE) Federal Register 10 CFR Part 430 Energy Conservation Program for Consumer Products: Final rule regarding test procedures and energy conservation standards for water heaters;

(c) Other methods approved by a suitable authority.

2.3 Hot water storage vessels

2.3.1
Hot water storage vessels other than those in 2.1 and 2.2 shall meet the requirements of 2.1 (e.g. indirectly heated storage vessel).

2.4 Reverse circulation

2.4.1
Hot water systems shall not allow the uncontrolled reverse circulation (back siphonage) of stored hot water to any point in the system.

NOTE –
Controlled circulation is sometimes used for frost protection e.g. solar water systems.

3 INSTALLATION

3.1 General

3.1.1
All installations shall be installed according to the manufacturer's instructions, and appropriate Standards.

3.1.2
To minimize heat loss from long pipe runs and from water standing in pipes between draw-offs, water heaters should be located as close as practicable to areas they service. Where substantial heat loss may occur from long pipe runs, consideration shall be given to the installation of independent hot water systems close to the individual serviced areas.

3.2 Pipe-runs

3.2.1
In a household unit, the developed length of the pipe-run from the water heater to the kitchen sink outlet shall be minimized. Table 5 provides acceptable maximum pipe lengths. Where the pipe supplying the sink unit is composed of sections of different diameters, the total volume of water in the pipe run shall not exceed 2 litres.

Table 5 – Acceptable maximum pipe lengths

Nominal pipe size (mm)	10	15	20
Length (m)	25	12	7

3.3 Relief valves

3.3.1
Pressure relief valves and temperature and pressure relief (TPR) valves shall be thermally insulated. Where a pressure relief valve is not fitted directly to the water heater the connecting pipe-work shall not exceed 1 metre. Figure 1 provides diagrammatic guidance.

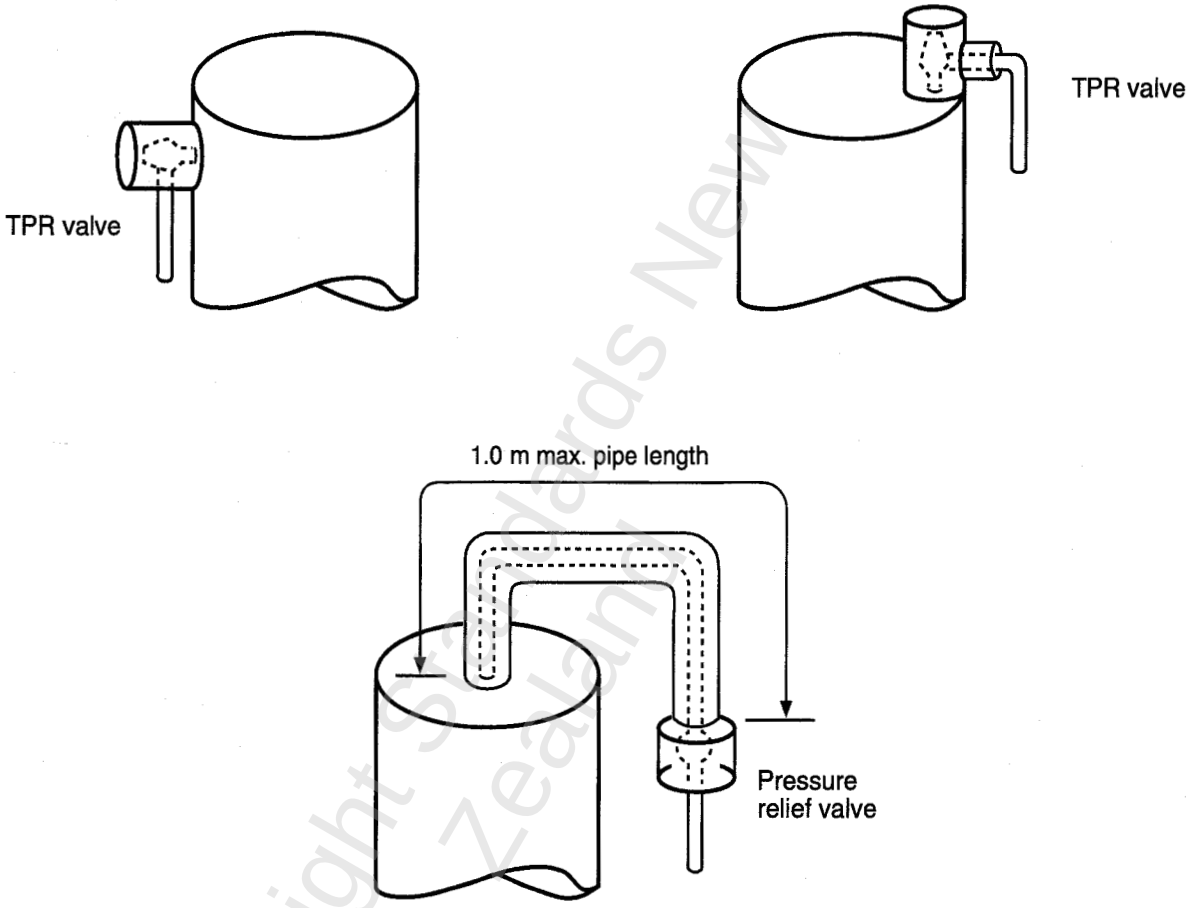


Figure 1 – Relief valve thermal insulation

3.3.2
Thermal insulation shall be fitted around valves without preventing the free operation or obstruction of the valve mechanism and inflow of air. The thermal insulation must be easily removed to allow for maintenance of the valve.

3.4 Water expansion

3.4.1
A device shall be fitted to unvented (valve vented) storage water heaters to allow expansion without discharge of hot water. Acceptable devices are cold water expansion valves and expansion chambers.

NOTE –
Further reference may be made to the requirements of BIA Approved Document G12/AS1 Paragraph 4.3.

3.5 Vent pipes

3.5.1
The vent pipe fitted to vented (open vented) storage systems shall be thermally insulated from the top of the storage water heater to a point 300 mm above the maximum standing water level in the vent pipe as shown in figure 2.

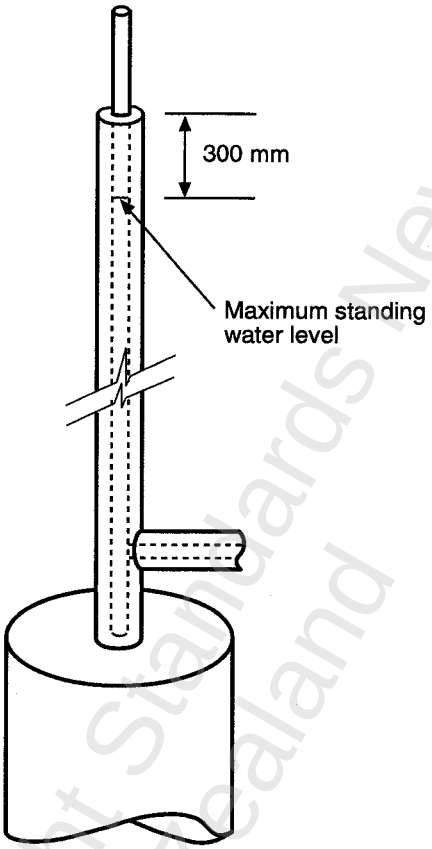


Figure 2 – Vent pipes

3.6 Flow and return pipes

3.6.1
Connecting pipes between a hot water storage vessel and a separate heating device such as a wet back, solar panel or heat pump, shall be thermally insulated.

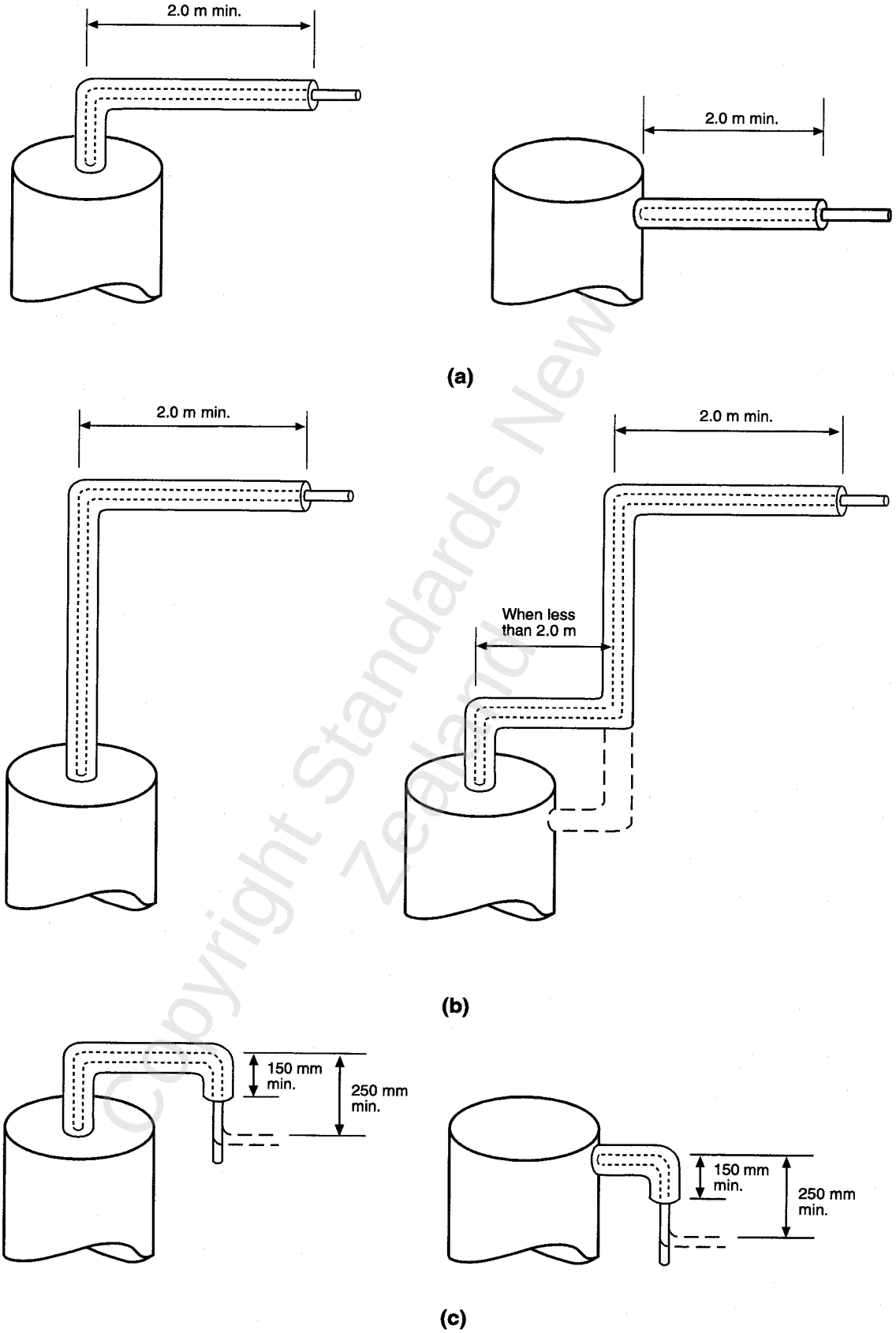
3.7 Distribution pipes

3.7.1
Hot water distribution pipes shall be thermally insulated between the storage water heater and one or more of the following points (refer figure 3):

(a) For horizontal pipe, to not less than 2 m (refer figure 3(a));

(b) To the end of the first continuous 2 m of horizontal pipe, if the pipe has not followed a downward direction (refer figure 3(b));

(c) To the first pipe drop of at least 250 mm, i.e. heat trap. The insulation shall extend at least 150 mm past the top of the heat trap (refer figure 3(c)).



NOTE –

For clarity, distribution pipe only shown.

Figure 3 – Distribution pipe thermal insulation

3.7.2
The kitchen sink distribution pipe from the water heater to the outlet should be insulated.

3.7.3
All hot water pipes outside the building shall be thermally insulated. Once within the building, the pipes from storage water heaters shall meet the requirements of 3.7.1.

3.7.4
Hot water pipes embedded in concrete or buried underground shall be thermally insulated and installed within a duct.

3.7.5
Hot water distribution systems with hot water continuously circulating in a loop shall have all pipework in the loop thermally insulated.

3.8 Pipe insulation material

3.8.1
Pipe insulation shall have an R-value (thermal resistance) not less than 0.3 $m^2 \cdot {}^oC/W$ or a thermal conductivity value (k) of not more than 0.04 $W/m \cdot {}^oC$.

3.8.2
The following are acceptable materials for the thermal insulation of hot water pipes:

(a) Closed cell foam polymer insulation 12 mm nominal thickness;

(b) Fibreglass insulation with a nominal thickness of 12 mm, which is preformed to the shape of the pipe.

3.8.3
Any insulation material that absorbs moisture shall be protected by a waterproof coating or cladding when installed in damp or exposed conditions. Any insulation material affected by weather or sunlight must be protected.

3.8.4
Materials used must be capable of withstanding the temperatures generated by the system.

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