

Determination

under the

Building Act 1991

No. 96/002: Provisions to avoid the likelihood of scalding

1. The matter to be determined

- 1.1 The matter before the Authority was whether it was acceptable to install a new shower with a proprietary mixing valve (not a tempering valve) over an existing bath.
- 1.2 The Authority took the view that it was being asked in effect to determine whether the building work concerned complies with clause G12.3.4 of the building code (the First Schedule to the Building Regulations 1992). This determination is not about the mixing valve itself but about the entire shower system of which the mixing valve is a part.
- 1.3 The Authority understands that provisions in respect of scalding were introduced into the building code because of experience with accidental scaldings, in many cases causing severe injuries, in the absence of such provisions.
- 1.4 In making its determination, the Authority has not considered the other provisions of the building code.

2. The parties

- 2.1 The applicant was the territorial authority, the owner was the only other party.
- 2.2 The owner was the landlord of various residential buildings throughout New Zealand. As part of a programme of improving its buildings it was installing showers over existing baths in many of its household units. Those showers were specified as having a proprietary mixing valve (“the mixer”) incorporating an anti-scalding device.
- 2.3 The owner advised that territorial authorities throughout New Zealand had issued building consents for the installation of showers incorporating the mixer, but this particular territorial authority was unwilling to do so and accordingly applied to the Authority for this determination.

3. The building work

- 3.1 The building work concerned was the new plumbing work associated with the installation of the shower. In essence that work was the installation of a new shower system consisting of the new hot and cold water connections, the mixer, the shower head, and associated piping.
- 3.2 The mixer incorporates an anti-scald device consisting of a 'peg-in-a-hole' mechanism which limits the movement of the mixer control and thus limits the maximum proportion of hot water in the mixed hot and cold water delivered from the shower. The device is set so that the shower water is below scalding temperature when the hot water supply is at its maximum storage temperature and the mixer control is fully open in its maximum shower temperature position.
- 3.3 The mixer is to be contrasted with a tempering valve, which is defined in New Zealand Standard 4617 *Tempering (3-port mixing) valves* as follows

TEMPERING VALVE: A temperature-actuated valve which is connected to the outlet of a water heater (or other hot water supply) and to a cold water supply and which automatically controls the water at the outlet of the valve to a set temperature within specified limits. A tempering valve may be either a separate valve or be combined with another valve at the outlet of a water heater.

- 3.4 Thus a tempering valve limits the temperature of the water delivered from the shower whereas the mixer limits the proportion of hot water in the mixture of hot and cold water delivered from the shower.

4. The parties' contentions

4.1 General

- 4.1.1 Both parties made submissions, and also commented on technical reports which the Authority obtained and copied to them.
- 4.1.2 In the light of submissions received before 12 March 1996 the Authority prepared a draft determination which was sent to the parties, who were asked whether they accepted the draft or wished to make further submissions at a hearing under section 19 of the Building Act. Such a hearing was held on 3 April 1996, at which both parties appeared and made submissions, and the territorial authority called evidence from one of its officers, two principals of a firm of energy consultants, and three experts employed by valve manufacturers.
- 4.1.3 Those extensive submissions and the oral and written evidence, including the reports obtained by the Authority and comments on them, will not be described or discussed. Suffice it to say that the Authority has carefully considered all of them in the course of arriving at this determination. This determination is based on the draft determination but has been amended as a result of the hearing.

4.2 The territorial authority

4.2.1 The territorial authority submitted in effect that the shower would not comply with clause G12.3.4 of the building code because in some circumstances the mixer could deliver water at a temperature likely to scald people.

4.2.2 Witnesses called by the territorial authority also submitted:

- (a) That the matter before the Authority was not as stated in 1.2 above but whether the particular proprietary mixer concerned met the requirements of the building code, and in particular the requirements of clause G12.3.4.

The Authority disagrees. A determination is not a suitable procedure for establishing the acceptability of a proprietary product in terms of the building code. That should be done by the accreditation procedure specified in Part VIII of the Building Act.

- (b) That the Authority should not exclude from its determination the consideration of provisions of the building code other than clause G12.3.4 as stated in 1.3 above. In particular, the Authority should consider clause B2 "Durability".

The Authority accepts that clause B2.3 requires that the fittings concerned shall with only normal maintenance continue to satisfy clause G12.3.4 for not less than 5 years and the rest of the building work concerned for not less than 15 years. However, the Authority received no evidence or submission as to the durability of the various components of the system but understood that the question was raised in relation to the possibility that users of the building might alter the system, and in particular might re-set the thermostat controlling the temperature of the hot water supply. That is a management matter which was also claimed to be relevant in respect of compliance with section 38 of the Building Act (see 7.4.3) below, but the Authority does not consider that it is a matter of durability.

4.3 *The owner*

4.3.1 The owner said:

[The owner] is not seeking approval of [the mixer] per se, but rather approval for the use of that mixer in a particular limited set of circumstances which in combination meet the requirement of the building code to avoid the likelihood of scalding.

4.3.2 The owner detailed the elements of the new installation system as:

- the installation of a new shower above an existing bath;
- the use of [the mixer] (integral mixer and rose);
- low pressure hot and cold water systems, with hot water supplied by a header tank and cold water supplied either from a header tank or reduced mains pressure;
- hot water stored in a temperature controlled storage cylinder (hot water cylinder) set at 65°C;

- thermostat not readily adjustable by the consumer;
- [the mixer] supplied with control pin in lowest temperature position;
- installation by registered craftsman plumber;
- installation in accordance with [the owner's] regime which requires specific setting of the control pin to obtain the appropriate outlet temperature and measurement by the registered craftsman plumber of the maximum outlet temperature and flow, and a quality inspection by the owner.

5. The relevant requirements of the Building Act

5.1 The installation of a shower comes within the definition of “building work” in section 2 of the Building Act. It does not come within any of the exemptions listed in section 32 and the Third Schedule, so that a building consent is required unless the territorial authority concerned issues an exemption under paragraph (m) of that schedule. Section 7(1) provides that:

All building work shall comply with the building code to the extent required by this Act, whether or not a building consent is required in respect of that building work.

5.2 The installation of the shower is part of an alteration to the building concerned, and section 38 provides that:

No building consent shall be granted for the alteration of an existing building unless the territorial authority is satisfied that after the alteration the building will -

- (a) Comply with [certain provisions of the building code] as nearly as is reasonably practicable to the same extent as if it were a new building; and
- (b) Continue to comply with the other provisions of the building code to at least the same extent as before the alteration.

5.3 The provisions with which the building is to comply “as nearly as is reasonably practicable” do not include the provisions for the temperature of hot water. Thus the only question arising under section 38 is whether the building will comply with those provisions to at least the same extent as before.

5.4 The owner contended that it would not, but the Authority disagreed for the reasons given in 7.4 below.

5.5 The Authority concludes, therefore, that section 38 does not prevent the issuing of a building consent for the building work concerned, and that section 7(1) requires all of that work to comply with the building code. Thus the new shower systems are required to deliver water at a temperature which avoids the likelihood of scalding in accordance with clause G12.3.4 of the building code, but subject to any waiver or modification issued by the territorial authority or by the Authority.

6. Complying with the building code

6.1 The relevant provisions of the building code are:

G12.1 The objective of this provision is to:

(c) Safeguard people from injury . . . from contact with excessively hot water.

G12.3.4 Where hot water is provided to *sanitary fixtures* and *sanitary appliances*, used for personal hygiene, it shall be delivered at a temperature which avoids the likelihood of scalding.

6.2 The territorial authority contended that the words “avoid the likelihood” were stronger than the words “reduce the likelihood” used elsewhere in the building code, and were to be read as requiring that “if there is the slightest possibility for any reason whatsoever of an event occurring, then every reasonable precaution must be taken to avoid the event”. That was said to be the effect of a legal opinion obtained by the Plumbers Gasfitters and Drainlayers Board. The quoted words, however, are those the Chairman of the Board and do not appear in the opinion itself, which does not actually refer to clause G12.3.4 but in the context of other clauses says that “the test that would be applied is whether the system has been built in such a way that it is foreseeable that the undesirable consequence could occur”.

6.3 The Authority places no weight on the distinction between the phrases “avoid the likelihood” and “reduce the likelihood”, and takes the view that in clause G12.3.4 the words “avoid the likelihood of scalding” do not require that scalding shall be an absolute impossibility but do require that the probability of scalding shall be low.

6.4 The Authority’s preferred approach to assessing the extent to which a building complies with a provision of the building code is to use the acceptable solution for that provision as a bench-mark or guideline. That approach has been upheld in the High Court¹.

6.5 In this case, the only acceptable solution is paragraph 4.13 of Approved Document G12/AS1. That solution requires that the temperature of the water delivered at a sanitary fitting in the types of building concerned shall be controlled, by the use of a tempering valve complying with NZS 4617, so as not to exceed 55°C.

6.6 Witnesses called by the territorial authority were of the opinion that the general use of tempering valves to comply with the relevant provisions of the building code was a major step forward in safe building design. They were concerned lest the use of the system proposed by the owner would detract from that level of safety.

6.7 The Authority considers that the real step forward was taken with the introduction of the building code. There was no equivalent to clause G12.3.4 in the previous bylaws. The question before the Authority is whether the system complies with the building code, not whether it would reduce the usage of tempering valves.

¹ *Auckland City Council v New Zealand Fire Service*, 19/10/95, Gallen J, HC Wellington AP 336/93.

6.8 When comparing the proposed system with the acceptable solution, the Authority recognises that the acceptable solution is only a bench-mark or guideline, it is not the building code.

7. Assessment of the relative likelihood of failure with the acceptable solution as compared with the proposed system incorporating a mixer

7.1 General

7.1.1 The Authority compared the ways in which it understood that each of the systems could fail (in the sense of delivering water from the shower at a temperature likely to cause scalding). In making that assessment the Authority took account of how the likelihood of each type of failure could be minimised. The possibility of such a failure does not mean that scalding will occur, but it does mean that it is possible.

7.1.2 With the acceptable solution, evidence called by the territorial authority was to the effect that there is a possibility of scalding only if the tempering valve is located at the shower rose and the cold water supply fails. However, a tempering valve is a mechanical device and the Authority does not accept that the temperature control of the tempering valve cannot possibly fail in such a way as to cause scalding, although it does accept that the possibility of that happening is so remote that it may be ignored.

7.1.3 With the system incorporating a mixer there is a possibility of scalding in the circumstances discussed in 7.2 to 7.7 inclusive below.

7.1.4 The Authority has no statistical evidence as to the comparative probabilities of those circumstances occurring. In the absence of such evidence the Authority must use its own informed opinion.

7.2 If the cold water supply fails but the hot water supply does not.

7.2.1 If the cold water supply to the mixer was from the main, whether or not through a pressure reducing valve, and the hot water supply from a heater fed by a header tank, then if the mains supply was interrupted for whatever reason, including repairs to the main, then the shower would deliver water at storage temperature and there would be a possibility of scalding.

7.2.2 That possibility would be eliminated if the hot and cold water supply to the mixer came from the same source. In practice that means that if the hot water comes from a heater fed from a header tank then the cold water must also come from that header tank. (The owner said that it did not intend to install the system in buildings with mains-pressure water heaters.)

7.2.3 The important point is that if the cold water supply fails then the hot water supply must fail simultaneously so that the shower cannot deliver hot water.

7.3 If there is no control over the temperature of the hot water supply.

- 7.3.1 There is a clear possibility of scalding if there is no control over the temperature of the hot water supply, for example if it is supplied from a wet back heater.
- 7.3.2 The mixer should not be used in a system where there is no control over the temperature of the hot water supply.
- 7.4 *If the temperature control of the hot water supply fails.*
- 7.4.1 The thermostat in the water heater might not be as accurate or as reliable as is required in the acceptable solution.
- 7.4.2 The risk of thermostat failure would be minimised if the water heater thermostat complied with NZS 6214 or AS 1308 in accordance with paragraph 4.5.1 of Approved Document G12/AS1. The draft determination accordingly required that if the water heater thermostat did not comply with NZS 6214 or AS 1308 then it was to be replaced with one which did comply.
- 7.4.3 The territorial authority called evidence to the effect that:
- (a) Thermostats complying with AS 1308 could not easily be installed in the types of hot water cylinders used in the owner's units;
 - (b) Thermostats complying with NZS 6214 were consumer adjustable; and
 - (c) Over time, deposits on thermostats complying with NZS 6214 could cause them to operate as if the temperature of the stored water were lower than it actually was.
- 7.4.4 The fact that thermostats complying with AS 1308 might be difficult to install does not mean that they should not be permitted. The Authority assumes, although it was given no evidence to that effect, that such thermostats are generally similar to thermostats complying with NZS 6214, and the remarks below apply to both types as appropriate.
- 7.4.5 As mentioned in 5.4 above, the territorial authority contended that the fact that thermostats complying with NZS 6214 are consumer-adjustable meant that occupants were likely to increase the temperature if they experienced a shortage of hot water. Any such increase would increase the likelihood of scalding in the original sanitary fixtures such as baths and handbasins. The result of installing a consumer-adjustable thermostat, argued the territorial authority, would therefore be to make the building comply with clause G12.3.4 to a lesser extent than before the alteration contrary to section 38(b) of the Building Act.
- 7.4.6 At the hearing, the owner offered to ensure that the thermostats, although otherwise complying with NZS 6214, were not readily consumer-adjustable. That effectively countered the argument about scalding resulting from the use of such thermostats.

7.4.7 The Authority noted that the Foreword to NZS 6214 says:

Recognition of the fact that water temperature affects the severity and outcome of burns has led in recent times to proposals for a reduction in the temperature is available from hot water systems. . . . [Thermostats complying with the predecessor to NZS 6214] performed less satisfactorily at these lower temperatures.

7.4.8 It might also be inferred that a consumer-adjustable thermostat allows consumers to set their thermostats to the lowest acceptable temperature in order to reduce standing losses and therefore facilitate the efficient use of energy, which is one of the principles of section 6 of the Building Act and the objective of clause H1 of the building code.

7.4.9 If the owner had not undertaken to ensure that the thermostats were not consumer-adjustable, the Authority would have had some reluctance in requiring it to do so because:

- (a) The Authority does not generally take account of management matters in the course of a determination, and the adjustment of a thermostat is seen as a management matter; and
- (b) The Authority does not accept the argument that the occupier is likely to adjust the thermostat to a higher temperature because of a shortage of hot water. That argument does not take account of the facts that water usage for a shower is generally less than for a bath and that the installation of a shower would be likely to decrease the usage of the bath. For any given setting of the thermostat, therefore, a shortage of hot water would be less likely after the alteration than it was before.

7.4.10 The territorial authority also submitted that a thermostat complying with NZS 6214 could operate as if the temperature of the hot water supply were lower than it actually was. The Authority understood that to be because the thermostat actually reacts to the temperature of a metal probe into the lower part of the storage cylinder whereas the hot water drawn from the top of the cylinder will be at a somewhat higher temperature than the probe. That difference could apparently increase as solids carried by the water were deposit on the probe, thus in effect adding a layer of insulation between the probe and the water. The Authority has no information as to the likelihood that a water supply might contain such solids or of the extent to which they might cause the hot water temperature to increase. In the absence of such information, the Authority's impression is that the effect will occur infrequently and will lead to only a small increase in hot water temperature.

7.4.11 The Authority considers that the possibility of scalding resulting from either or both the hot or the cold water supply (see 7.6 below) being at a higher temperature than when the mixer was originally installed and adjusted should be minimised by appropriate installation procedures, as discussed in 7.7 below.

7.5 *If the anti-scald device fails.*

7.5.1 The device is such that failure seems unlikely. Admittedly, it would be possible for occupants to tamper with the device, but there seems to be no reason why they should wish to do so and the Authority considers the possibility to be negligible.

7.6 *If the temperature of the cold water supply is higher than when the mixer was installed and adjusted.*

7.6.1 Calculations submitted by the owner indicate were said to establish that:

. . . if the shower mixer with the anti-scald device is set up to deliver water at around 48 to 50 °C, under normal conditions, i.e. cold water temperature between 4 and 14 °C and hot water temperature between 65 to 70 °C, the mixed water temperature will not rise above 55 °C even at full hot setting.

7.6.2 The Authority considered that those calculations were based on assumptions as to the procedure for installing and adjusting the mixer, and could be relied on only if that procedure was formalised and applied in each case, see 7.7.3 below.

7.7 *If there is an error in the original installation and adjustment of the mixer*

7.7.1 The importance of correctly adjusting the mixer when it is initially installed are apparent from 7.4 and 7.6 above.

7.7.2 The procedure to be used for that adjustment needs to be such as to achieve safe water temperatures at the outlet despite possible differences between the actual hot water temperature and the temperature at which the thermostat operates and despite any seasonal variations in the temperature of the cold water supply.

7.7.3 In the course of the determination, the owner submitted revised instructions for installing and adjusting the system. Those instructions are based on conservative allowances for the possibilities that the thermostat could act as if the temperature of the hot water were lower than it actually was (see 7.4.10 above) and that the temperature of the cold water supply could be higher than when the mixer was installed and adjusted (see 7.6 above).

8. Conclusion

8.1 The Authority concludes that if a system incorporating a mixer is installed in such a way as to minimise or eliminate the possibilities of failure discussed above, then the likelihood of scalding is greater but not significantly greater than with a system incorporating a tempering valve. The Authority considers that such a system will comply with clause G12.3.4 of the building code.

9. The Authority's decision

9.1 In accordance with section 20(a) of the Building Act the Authority hereby determines that the territorial authority is to issue building consents for shower systems incorporating a mixer with an anti-scald device in the form of a 'peg-in-a-hole' mechanism provided that:

- (a) Systems where there is no control over the temperature of the hot water supply, as with a “wet back” water heater, are excluded.
- (b) The hot and cold water supplies to the mixer shall be from the same source so that if the cold water supply fails the hot water supply will fail simultaneously.
- (c) If the temperature of the hot water supply is controlled by a thermostat which does not comply with NZS 6214 or AS 1308, then that thermostat shall be replaced with one which does comply.
- (d) The system shall be installed and adjusted in accordance with the Housing New Zealand document “Installation of New Shower System (Turbostream)” HNZ-M-DU19 Issue 1 dated 18 April 1996.

9.2 The dispute to be determined was whether a building consent was to be issued. However, this determination is not to be read as derogating from any territorial authority’s power under paragraph (m) of the Third Schedule to exempt any particular proposed installation of such a system from the need for a building consent if the territorial authority considers that the system is unlikely to be installed otherwise than in accordance with the building code.

Signed for and on behalf of the Building Industry Authority on this 29th day of April 1996

J H Hunt
Chief Executive