

AS 3633—1989

Australian Standard[®]

**Private swimming pools—
Water quality**

This Australian Standard was prepared by Committee CS/61, Sanitization of Private Swimming Pools. It was approved on behalf of the Council of Standards Australia on 27 November 1989 and published on 15 December 1989.

The following interests are represented on Committee CS/61:

Australian Chemical Specialties Manufacturers Association
Australian Consumers Association
Australian Federation of Consumer Organizations
Australian Government Analytical Laboratories
Australian Institute of Health Surveyors
Australian Retailers Association
Confederation of Australian Industry
Department of Health, N.S.W.
Department of Sport, Recreation and Racing, N.S.W.
Health Department, Vic.
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National Health and Medical Research Council
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Swimming Pool and Spa Association of Australia
The Royal Australian Chemical Institute
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PREFACE

This Standard was prepared by the Standards Australia Committee on Sanitization of Private Swimming Pools.

This Standard specifies requirements for the sanitization and maintenance of water quality in private swimming pools. Further, this Standard aims at providing information about the various types of treatments available, their effectiveness, and the hazards associated with swimming pools when sanitary levels have not been maintained. Moreover, the Standard includes Appendices which provide detailed information about pool chemicals as well as an explanation of the chemistry of pool treatment. As such, the Standard provides basic information required by the private pool owner as well as technical information for the water treatment specialist.

A Standard dealing with test kits intended for testing the water quality of private swimming pools, as outlined in Section 6, is in course of preparation.

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STANDARDS AUSTRALIA

Australian Standard
Private swimming pools—Water quality

SECTION 1. SCOPE AND GENERAL

1.1 SCOPE. This Standard applies to private swimming pools and sets out requirements and information for achieving and maintaining sanitary water conditions for the protection of bathers' health and comfort, ensuring the aesthetic appeal of the water as well as protecting the pool, its fittings and its accessories.

1.2 PURPOSE. The purpose of achieving and maintaining a sanitary level of water quality, as well as the efficient operation of equipment, is as follows:

- (a) To disinfect the water by killing disease-producing bacteria, viruses and other organisms (e.g. amoebae, pseudomonas, etc) which could be responsible for—
 - (i) primary amoebic meningoencephalitis;
 - (ii) gastro-intestinal infections, e.g. shigellosis;
 - (iii) skin infections, e.g. 'athlete's foot', plantar warts;
 - (iv) eye infections, e.g. conjunctivitis ('pink eye');
 - (v) ear infections, e.g. otitis externa (inflammation of the outer ear);
 - (vi) throat infections, e.g. tonsillitis; and
 - (vii) respiratory infections, e.g. bronchitis.

NOTE: Although each of the above infections may be transmitted through inadequately treated swimming pool water, they may also, and usually more often, be transmitted through physical contact with other bathers, pool surrounds, towels, showers, toilets and animals.

- (b) To prevent eye irritation, see Appendix E.
- (c) To prevent algal growth, see Paragraph A8 of Appendix A.
- (d) To remove pollutants introduced by the bathers, e.g. perspiration and urine.
- (e) To minimize obnoxious odours and tastes.
- (f) To improve the appearance of water by upgrading its clarity and 'sparkle'.

NOTE: Clear, 'sparkling' water does not indicate that the pool is free from bacteria, viruses, amoebae or other disease-causing organisms. It merely indicates that the pool water includes an effective algacide and that the recirculation/filtration system is operating satisfactorily.

- (g) To prevent build up of scale.
- (h) To prevent corrosion to fixtures and plant, see Paragraph A9 of Appendix A.

1.3 RELATED DOCUMENTS. For additional information about swimming pools and their accessories attention is drawn to the following related Standards.

AS	
1838 and	
1839	Premoulded reinforced plastics swimming pools
1900	Children's flotation toys and swimming aids

1926	Fences and gates for private swimming pools
2020	Safety covers for private swimming pools and wading pools (for the protection of children 5 years of age and under)
2160	Contract for the supply and construction of a swimming pool
2610	Spa pools
2610.1	Part 1: Public spas
2610.2	Part 2: Private spas
2783	SAA Concrete Swimming Pools Code
2818	Guide to swimming pool safety

1.4 DEFINITIONS. For the purpose of this Standard, the definitions below apply.

1.4.1 Acid demand—a measurement of the amount of acid that needs to be added to the pool water to lower the pH and total alkalinity to acceptable levels.

1.4.2 Acidic—water with a pH between 0 and 7.

1.4.3 Algicide—a chemical that is capable of killing algae.

1.4.4 Alkaline—water with a pH between 7 and 14.

1.4.5 Alkalinity, total—a measure of the total amount of dissolved alkaline compounds in the pool water.

NOTE: Total alkalinity is a measurement of the resistance of the pool water to a change in pH. For example, if the pool water has high pH and low total alkalinity, the addition of a small amount of acid will lower the pH sharply.

1.4.6 Bactericide—a chemical that is capable of killing bacteria and preferably other micro-organisms such as viruses and amoebae.

1.4.7 Bromine, combined—bromine that has combined with ammonium compounds or organic matter containing nitrogen to form bromamines.

NOTES:

- Ammonium compounds and organic matter containing nitrogen are normally transmitted to pool water by body wastes e.g. perspiration and by organic contamination e.g. leaves, etc.
- Combined bromine (i.e. bromamine) is a more effective disinfecting agent than combined chlorine (i.e. chloramine).

1.4.8 Bromine, free—bromine that has not combined with ammonia or organic matter containing nitrogen.

1.4.9 Bromine, total—the sum of combined bromine and free bromine.

1.4.10 Chlorine, combined—chlorine that has combined with ammonium compounds or organic matter containing nitrogen to form chloramines.

NOTES:

- Ammonium compounds and organic matter containing nitrogen are normally transmitted to pool water by body wastes (e.g. perspiration) and organic contamination (e.g. leaves).

2. Bactericidal properties of combined chlorine (i.e. chloramines) are only approximately one hundredth as effective as that of a similar level of free chlorine in water.

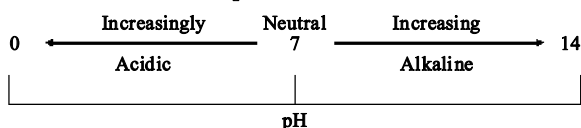
1.4.11 Chlorine, free—chlorine that has not combined with ammonia but is free to kill bacteria and algae and to destroy organic contamination introduced into the pool water.

NOTE: Free chlorine is also known as 'free available chlorine' and 'free residual chlorine'.

1.4.12 Chlorine, total—the sum of combined chlorine and free chlorine.

1.4.13 Hardness, calcium—a measure of the amount of dissolved calcium compounds in the water.

1.4.14 pH—a scale (ranging from 0 to 14) that indicates the amount of acid or alkali present in the water. Water with a pH of 7 is neutral.



NOTES:

1. See Clauses 1.4.2 and 1.4.4.
2. Since pH is logarithmic, a solution with a pH of 5 is ten times more acidic than a solution with a pH of 6, whilst a solution with a pH of 4 is one hundred times more acidic than a solution with a pH of 6.

1.4.15 Sanitizer—a compound or system which, when applied as instructed to a swimming pool, kills algae and harmful microorganisms in order to achieve

and maintain an effective level of disinfection in the pool water, and in this way renders that pool suitable for swimming.

1.4.16 Shock dose—the addition to pool water of five to seven times the normal daily dose of chlorine (without stabilizer) for treatment of excessive algae growth, discoloured water, odour, or to restore the pool after it has been neglected for an extended period of time.

1.4.17 Solids, total dissolved—a measure of the total amount of dissolved compounds in the pool water.

1.4.18 Stabilizer—a compound added to pool water to reduce the rate of loss of chlorine due to sunlight (i.e. ultraviolet light).

1.4.19 Superchlorination—the addition to pool water of two to four times the normal daily dose of chlorine for destruction of combined chlorine (i.e. chloramines) and for treatment of impurities introduced by prolonged use, increased number of bathers or debris resulting from inclement weather.

1.4.20 Swimming pools, private—any swimming pool located in the grounds of a private dwelling and intended to be used by members of the household and their invited guests.

SECTION 2. FILTRATION SYSTEMS

2.1 FILTRATION SYSTEM VARIABLES. The ability of a filtration system to maintain a clean pool is dependent on the following:

- (a) Filter size
- (b) Filter medium (e.g. sand, diatomaceous earth or cartridge).
- (c) Strainer size.
- (d) Pipe sizes.
- (e) Type and number of skimmers.
- (f) Number of inlets.

- (g) Pool water turnover rate.
- (h) Pump characteristics (i.e. pressure vs volume).
- (i) Size, shape and location (i.e. whether indoor or outdoor) of pool.
- (j) Number of normal, and maximum expected bathers.

2.2 MINIMUM TURNOVER RATE. The minimum turnover rate shall be a single turnover of the full volume of the pool water within the period that the pump would normally be operating in order to maintain water clarity.

SECTION 3. CHEMICAL AND SANITIZER CONCENTRATIONS

3.1 CHEMICAL CONCENTRATION REQUIREMENTS. For all private swimming pools that are liable to be used for bathing the chemical concentrations indicated in Table 3.1 for—

- (a) pH and the appropriate total alkalinity shall be complied with; and
- (b) the appropriate calcium hardness requirement should be complied with.

NOTES:

- 1. This Clause indicates that private swimming pools need not comply with the requirements in the Table if the pool is not *liable* to be used such as during the non-swimming season.
- 2. The pH and appropriate total alkalinity requirements are mandatory because these properties relate largely to the well-being of bathers. However, compliance with the appropriate calcium hardness requirement is only recommended because this property relates to the protection of the pool.

- 3. To prevent scaling and etching of the pool and fixtures the pool water should be chemically balanced as described in Appendix C.

3.2 SANITIZER CONCENTRATION REQUIREMENTS. All private swimming pools that are liable to be used for bathing shall comply with the appropriate sanitizer concentration indicated in Table 3.2.

Salt water chlorinated pools shall maintain a salt concentration that complies with the requirements specified by the salt water chlorinator manufacturer.

NOTES:

- 1. See Note 1 in Clause 3.1.
- 2. Appendix B describes water treatment products.
- 3. No specific salt concentration can be specified because the properties of the various salt chlorinators differ.
- 4. For salt chlorinators, see Clause 6.2.6 and Note 2 of Clause 6.2.7 as well as Paragraph B1.2.4 of Appendix B.

TABLE 3.1
CHEMICAL CONCENTRATIONS

Property	Concentration		Comment
	Minimum	Maximum	
<i>pH</i>	7.0	Optimum 7.2 to 7.6 7.8	If pH is— <i>BELOW 7.0</i>, then possibility of— (a) rapid loss of chlorine; (b) eye discomfort due to accelerated formation of chloramines; (c) etching of exposed cement in cement finished pools; and (d) corrosion of metals <i>ABOVE 7.8</i>, then possibility of— (a) reduction of chlorine disinfecting efficiency; (b) increased chlorine requirement; (c) eye discomfort; (d) drying of skin; (e) cloudy water; and (f) scale formation.
<i>Total alkalinity</i> , (calculated as CaCO ₃) mg/L ¹ when sanitized with— calcium hypochlorite sodium hypochlorite sodium dichloroisocyanuric acid salt chlorinator sodium hypochlorite/sodium hypobromite } trichloroisocyanuric acid bromine (BCDMH) } polyhexamethylene biguanide hydrogen peroxide system }	60	200	If total alkalinity is— <i>BELOW 60</i>, then possibility of— (a) pH fluctuations due to weak buffering effect; and (b) corrosion of metals. <i>ABOVE 200</i>, then possibility of— (a) high pH; (b) cloudy water; and (c) scale formation.
<i>Calcium hardness</i> , (calculated as CaCO ₃) mg/L ¹ for— Cement finished pools² Inert finished pools³	100 0	500 500	
<i>Calcium hardness</i> , (calculated as CaCO ₃) mg/L ¹ for— Cement finished pools² Inert finished pools³	100 0	500 500	If hardness is— <i>BELOW 100</i>, then possibility of— etching of exposed cement in cement finished pools <i>ABOVE 500</i>, then possibility of— (a) cloudy water; (b) scale formation; and (c) short filter runs.

NOTES:

- 1 mg/L = 1 ppm (parts per million).
- Cement finished pools include Marblesheen, pebble, plaster, and tile (grouting).
- Inert finished pools include acrylic, epoxy paint, fibreglass, gel coat, reinforce resin and vinyl liner.

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TABLE 3.2
SANITIZER CONCENTRATIONS

			Chlorine ⁽²⁾					Bromine (including mixed chlorine/ bromine systems)	Polyhexamethylene biguanide hydrogen peroxide system ⁽⁶⁾		Ozone ⁽⁷⁾	
			Unstabilized		Stabilized (Not suitable for indoor pools)			Free bromine	Polyhexamethylene biguanide	Hydrogen peroxide	Ozone	Supplementary sanitizer (i.e. chlorine, bromine or polyhexamethylene biguanide, hydrogen peroxide system)
			Free chlorine	Total chlorine ⁽²⁾	Free chlorine	Total chlorine ⁽²⁾	Isocyanuric acid ⁽⁵⁾					
			mg/L ⁽¹⁾ min	mg/L ⁽¹⁾ max	mg/L ⁽¹⁾ min	mg/L ⁽¹⁾ max	mg/L ⁽¹⁾	mg/L ⁽¹⁾ min	mg/L ⁽¹⁾	mg/L ⁽¹⁾ <i>each</i> fortnight	mg/L ⁽¹⁾ max	
Limit	Pool water temperature < 26°C	Indoor pool	1.5	Free chlorine (as measured) +1.0	Indoor pools must <i>not</i> use a stabilizer ⁽⁴⁾			2.0	10 for 100% product	30 for 100% product	Nil	As specified for chlorine, bromine or polyhexamethylene biguanide hydrogen peroxide system
		Outdoor pool	1.0	Free chlorine (as measured) +1.0	2.0 ⁽³⁾	Free chlorine (as measured) +1.0	30-50					
	Pool water temperature ≥ 26°C	Indoor pool	2.0	Free chlorine (as measured) +1.0	Indoor pools must <i>not</i> use a stabilizer ⁽⁴⁾			4.0	(i.e. 50 for 20% product as available commercially)	(i.e. 100 for 30% product as available commercially)		
		Outdoor pool			3.0	Free chlorine (as measured) +1.0	30-50					

⁽¹⁾ 1 mg/L = 1 ppm (parts per million).

⁽²⁾ When sanitizing with chlorine, ideally the total chlorine concentration should be the *SAME* as the free chlorine concentration (i.e. there should be *NO* combined chlorine). Nevertheless, the total chlorine concentration is *not* to exceed the *sum* of the actual free chlorine concentration as measured by the test kit, and 1.0 mg/L.

⁽³⁾ Free chlorine concentrations of 2.0 mg/L may be inadequate in stabilized outdoor pools in areas where amoebic meningoencephalitis outbreaks have been reported. In such areas a minimum free chlorine of 3.0 mg/L is to be used.

⁽⁴⁾ As indoor pools are protected from sunlight, a chlorine stabilizer (i.e. isocyanuric acid) is *NOT* to be used because it reduces the effectiveness of chlorine as a sanitizer.

⁽⁵⁾ A minimum of 30 mg/L of isocyanuric acid is necessary to stabilize chlorine so that it is not depleted excessively by sunlight. Ideally, the concentration should not exceed 5 mg/L, however, concentrations of 100 mg/L or more *MUST be avoided* because the isocyanuric acid at such high concentrations renders chlorine almost totally ineffective as a sanitizer.

⁽⁶⁾ Polyhexamethylene biguanide is NOT compatible with chlorine. Algicides such as quaternary ammonium compounds or those based on copper salts are NOT RECOMMENDED. An example of polyhexamethylene biguanide is BAQUACIL, manufactured by ICI Aust. Ltd.

⁽⁷⁾ Ozone does not have any residual effect and *MUST* be used in conjunction with chlorine, bromine or polyhexamethylene biguanide, hydrogen peroxide system.

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SECTION 4. STORAGE AND HANDLING OF CHEMICALS

4.1 GENERAL. All pool chemicals should be handled with caution.

Pool chemicals should NEVER be mixed together. Acids will react with sodium hypochlorite and calcium hypochlorite to release chlorine gas which is very toxic. Chlorinated isocyanurates will react with either acid or alkaline substances to produce explosive conditions due to release of chlorine dioxide.

Solid hypochlorites in contact with organic or oxidizable and combustible materials (especially other chlorine products), may form a mixture that spontaneously bursts into flames. In some instances the mixture may even explode.

Do not use a fire extinguisher as this is not effective.

Extinguish pool chemical fires using copious quantities of water only.

4.2 PRECAUTIONS. When handling pool chemicals the following precautions should be observed:

- (a) Read the instructions on the labels of each of the pool chemical containers and follow these precisely.
- (b) Do *not* store or carry pool chemicals close to each other or to other household chemicals such as motor mower fuel, turpentine or pesticides.

WARNING: FIRE AND EVEN EXPLOSIONS, MAY RESULT, IF POOL CHEMICALS ARE MIXED TOGETHER OR ARE MIXED WITH SOME HOUSEHOLD CHEMICALS.

- (c) Store pool chemicals in a cool, clean, dry area. Pool chemicals should be stored—
 - (i) in a well-ventilated locked shed to prevent children gaining access;
 - (ii) at ground or near ground level to minimize the possibility of the chemicals being accidentally dropped or spilt; and
 - (iii) so that liquid chemicals are kept well away from and *not* stored on top or above solid chemicals.
- (d) For maximum protection use protective gloves and safety goggles when handling pool chemicals. Do not wear leather or cloth gloves because of the danger of impregnation.
- (e) Wash hands before *and* after handling any pool chemicals.
- (f) Pool chemicals are dangerous if swallowed. Avoid contact with skin, eyes or clothing and avoid breathing the dust or vapour.
- (g) When dispensing pool chemicals use a separate scoop for each chemical. Each scoop should be clean, dry and made from a non-breakable material (e.g. plastics).
- (h) When dispensing a pool chemical from its container to the mixing container or pool, always pour

the chemical into clear water. *Never add water to the pool chemical* (except during cleaning of spillage).

- (i) Avoid spillage. Preferably, dispense the pool chemical over a plastics polythene sheet so that any spillage can be readily removed and disposed. Dispose of any spillage by flushing with copious quantities of clean water.

Never return spillage to its container because it may have become contaminated with other chemicals and could be hazardous (see Clause 4.1).

- (j) If a pool chemical is spilt on clothing, remove the contaminated clothing and wash away the chemical immediately, using copious quantities of water.

NOTE: See Clause 4.4 if the pool chemical is spilt directly onto the skin or onto clothing through which the chemical penetrates and contacts the skin.

- (k) After dispensing and when not in use, the pool chemical should be tightly sealed with its *original* closure. Do *not* interchange closures.
- (l) Empty containers should be thoroughly washed with clean water before discarding. The wash water may be added to the pool.

NOTE: The washwater must *not* be discarded into any sewer (whether it is a septic tank system, a home package sewerage treatment plant, a common effluent drain (CED) scheme or a reticulated sewerage), stormwater drain or watercourse.

4.3 DISPOSAL OF UNWANTED POOL CHEMICALS. Pool chemicals that are no longer wanted, (e.g. because there has been a change in pool water treatment methods, the 'use-by' date has expired or the chemicals have deteriorated) shall be disposed of in a manner required or recommended by the local council or the State environmental protection agency.

Do **NOT** mix different pool chemicals together.

NOTE: See Clauses 4.1 and the warning in Clause 4.2(b) which stress that a fire or even an explosion may occur if different pool chemicals are mixed.

Do **NOT** dispose of pool chemicals with domestic garbage.

Do **NOT** dispose of pool chemicals into any sewer (whether it is a septic tank system, a home package sewerage treatment plant, a common effluent drain (CED) scheme or a reticulated sewerage), storm water drain or watercourse.

4.4 FIRST AID. Most pool chemicals are harmful if swallowed and *damaging* to the skin and eyes.

If poisoning occurs, contact a doctor or Poisons Information Centre (Appendix G lists the telephone numbers of each of the Poisons Information Centres).

If swallowed, do **NOT** induce vomiting. Give a glass of water.

If splashed into the eyes, hold eyes open, flood with water for at least 15 minutes and seek medical aid.

If skin contact occurs, remove contaminated clothing and wash skin thoroughly.