

AS 2593:2021



STANDARDS
Australia



Boilers — Safety management and supervision systems

Currently in preview, click buy full version

AS 2593:2021

This Australian Standard® was prepared by ME-001, Pressure Equipment. It was approved on behalf of the Council of Standards Australia on 01 March 2021.

This Standard was published on 19 March 2021.

The following are represented on Committee ME-001:

Australasian Institute of Engineer Surveyors
Australian Aluminium Council
Australian Industry Group
Australian Institute for Non-Destructive Testing
Australian Institute for the Certification of Inspection Personnel
Australian Institute of Petroleum
Bureau of Steel Manufacturers of Australia
Compressed Air Association of Australasia
Energy Networks Australia
Engineers Australia
Gas Energy Australia
Insurance Council of Australia
Materials Australia
National Association of Testing Authorities Australia
Office of Industrial Relations, Qld
Better Regulation Division (Fair Trading, SafeWork NSW, TestSafe)
SafeWork SA
Weld Australia
WorkSafe Division — Department of Mines, Industry Regulation and Safety (DMIRS), WA
Victorian WorkCover Authority (WorkSafe Victoria)

This Standard was issued in draft form for comment as DR 2593:2019.

Keeping Standards up-to-date

Ensure you have the latest versions of our publications and keep up-to-date about Amendments, Rulings, Withdrawals, and new projects by visiting:

www.standards.org.au

Boilers — Safety management and supervision systems

Originates as AS 2593—1983 and part of AS 3653—1993.
Previous edition AS 2593—2004.
Sixth edition AS 2593:2021.

© Standards Australia Limited 2021

All rights are reserved. No part of this work may be reproduced or copied in any form or by any means, electronic or mechanical, including photocopying, without the written permission of the publisher, unless otherwise permitted under the Copyright Act 1968 (Cth).

Preface

This Standard was prepared by the Australian members of Standards Australia/Standards New Zealand Committee ME-001, Pressure Equipment to supersede AS 2593—2004, *Boilers — Safety management and supervision systems*.

After consultation with stakeholders in both countries, Standards Australia and Standards New Zealand decided to develop this Standard as an Australian, rather than as an Australian/New Zealand Standard.

The inclusion of roles and responsibilities in AS 2593:2021 was approved by the Standards Development and Accreditation Committee on 4 February 2021, as a one-off exemption to the directives of Standardisation Guide 009, Preparation of Standards for Legislative Adoption.

The objective of this Standard is to —

- (a) specify clear, safe, minimum requirements for the operation of all boilers and other devices;
- (b) assist all parties involved in the provision of safe boilers and other devices;
- (c) provide a basis for determination of the boiler attendance category with any supervision, checking, testing and maintenance with a view to support safety; and
- (d) specify emission requirements that will support an overall reduction in greenhouse gas emissions from boilers.

The major changes made in this revision include —

- (i) defining the criteria for different boiler attendance categories with limited attendance operation no longer being part of this Standard;
- (ii) specifying that devices connected to the boiler, such as any economizer or superheater or deaerator, are also to be treated as part of any boiler in the attendance category;
- (iii) defining the minimum safety requirements for any economizer or superheater or deaerator when connected to a boiler;
- (iv) defining the minimum safety requirements for boilers with greater than 500 kW power output with a boiler attendance category of “unattended”, to have only one flame safeguard of the continuous self-checking type equipped with a flame detector;
- (v) defining the minimum criteria for feedwater pumps and feedwater tanks in relation to any necessary consideration of capacity and net positive suction head (NPSH) requirement;
- (vi) defining the minimum criteria for feedwater tanks in relation to low-water safety devices fitted in the feed tank (or other feedwater storage device) for all boiler power outputs with a boiler attendance category of “unattended”;
- (vii) defining the requirements for automatic modulating water level control in all boilers exceeding 1 MW power output;
- (viii) defining installation requirements for vertical boiler types fitted with down-fired packaged burners that include sufficient head room and mechanical lifting equipment to allow for safe and complete burner removal, and to provide platforms, walkways, stairways, and ladders to enable all round access to the boiler for its safe operation, inspection, maintenance and complete burner removal; and
- (ix) specifying that the combustion equipment for all boilers is to be capable of effecting satisfactory combustion and provide for reduced greenhouse gas emissions.

Users of this Standard are reminded that it has no legal authority in its own right, but may acquire legal standing in one or more of the following circumstances:

- (A) Adoption by a government authority.
- (B) Adoption by a purchaser as a required standard of construction when placing a contract.
- (C) Adoption where a manufacturer states that a boiler and other devices are in accordance with this Standard.

The terms “normative” and “informative” are used in Standards to define the application of the appendices to which they apply. A “normative” appendix is an integral part of a Standard, whereas an “informative” appendix is for information and guidance only.

Currently in preview, click buy full version

Contents

Preface	ii
Section 1 Scope and general	1
1.1 Scope.....	1
1.2 Application.....	1
1.3 Normative references.....	2
1.4 Terms and definitions.....	3
1.5 New designs, materials and construction methods.....	6
Section 2 Design and construction for all types of boilers and other devices	8
2.1 General requirements.....	8
2.1.1 Basic design.....	8
2.1.2 Tube diameter.....	8
2.1.3 Water level indicators.....	8
2.2 Steam boilers (other than electric boilers).....	8
2.2.1 General.....	8
2.2.2 Water-tube steam boilers.....	8
2.2.3 Steam boilers other than water-tube or electric boilers.....	8
2.3 Hot water boilers.....	9
2.3.1 General.....	9
2.3.2 Hot water systems.....	9
2.4 Waste heat boilers.....	9
2.5 Electric boilers.....	10
2.6 Economizers.....	10
2.7 Superheaters.....	10
2.8 Deaerators.....	10
Section 3 Boiler management system for unattended boilers	11
3.1 General.....	11
3.2 Fail-safe techniques.....	11
3.3 Temperature suitability of component.....	11
3.4 Combustion management.....	11
3.4.1 General.....	11
3.4.2 Power-operated fuel valves.....	12
3.4.3 Flame detectors.....	12
3.5 Water management systems.....	12
3.5.1 Blowdown.....	12
3.5.2 Feedwater tanks.....	12
3.5.3 Steam boiler, other than coil-type forced circulation boilers and electric boilers.....	13
3.5.4 Water management systems for coil-type forced circulation boilers.....	15
3.5.5 Water management systems for hot water boilers.....	15
3.5.6 Water management systems for waste heat boilers.....	16
3.5.7 Water management systems for electric boilers.....	16
3.6 Electrical power isolation.....	17
3.7 Power failure and overheating protection.....	18
3.7.1 Design and construction.....	18
3.7.2 Hazard of overheating.....	18
3.8 Electrical control equipment.....	18
3.9 Alarms.....	18
3.10 Visual display for boilers up to and including a power output of 500 kW.....	19
3.10.1 General.....	19
3.10.2 Fuel-fired boilers.....	19
3.10.3 Water level security.....	19
3.11 Visual display for boilers exceeding a power output of 500 kW.....	20
3.11.1 General.....	20
3.11.2 Fuel-fired boilers.....	20

3.11.3	Water level security.....	20
3.12	Combustion equipment for fuel-fired boilers.....	21
3.12.1	General.....	21
3.12.2	Alternative firing of main fuels.....	21
3.12.3	Alternative firing of main fuels, fluidized bed combustion boilers.....	21
3.12.4	Supplementary fuel firing.....	21
3.12.5	Combustion characteristics.....	22
3.12.6	Secure mounting.....	22
3.12.7	Heat effects to combustion equipment.....	23
3.12.8	Visual flame-checking provisions.....	24
3.13	Multiple-burner installations.....	23
3.14	Air supply and control system.....	23
3.14.1	General.....	23
3.14.2	Start flame or pilot ignition.....	23
3.14.3	Ignition electrodes.....	23
3.14.4	High voltage components.....	23
3.14.5	Location and fixing.....	24
3.14.6	Start gas rate.....	24
3.15	Main fuel firing rate.....	24
3.15.1	Low-fire rate operation.....	24
3.15.2	Low-fire interlock.....	24
3.15.3	Main flame turn down and modulation.....	24
3.15.4	Main flame firing rate.....	25
Section 4	Additional requirements for oil-fired, gas-fired and solid-fuel-in-suspension-fired unattended boilers.....	26
4.1	Application.....	26
4.2	Operational requirements for oil, gas and solid-fuel-in-suspension management systems for boilers with a power output above 500 kW.....	26
4.2.1	Pre-start safety interlocks.....	26
4.2.2	Starting and operating sequence.....	26
4.2.3	Fault shutdown and lockout condition for other than forced circulation boilers.....	27
4.2.4	Fault complete shutdown and lockout condition for other than forced circulation boilers.....	28
4.2.5	Purging.....	28
4.2.6	Flame — Extraneous light.....	28
4.2.7	Fuel admission.....	28
4.2.8	Spark ignition period.....	28
4.2.9	Flame establishment period for spark ignition.....	28
4.2.10	Start flame proving.....	29
4.2.11	Main flame establishment period for start flame ignition.....	29
4.2.12	Ignition failure.....	29
4.2.13	Flame failure response.....	29
4.2.14	Controlled shutdown.....	29
4.3	Operational requirements for oil, gas and solid-fuel-in-suspension management systems for boilers up to and including a power output of 500 kW.....	29
4.3.1	Pre-start safety interlocks.....	29
4.3.2	Starting and operating sequence.....	30
4.3.3	Fault shutdown and lockout condition for other than forced circulation boilers.....	31
4.3.4	Flame — Extraneous light.....	31
4.3.5	Fuel admission.....	31
4.3.6	Spark ignition period.....	31
4.3.7	Flame establishment period for spark ignition.....	31
4.3.8	Start flame proving.....	31
4.3.9	Main flame establishment period for start flame ignition.....	31
4.3.10	Ignition failure.....	32
4.3.11	Flame failure response.....	32

4.3.12	Controlled shutdown	32
4.4	Specific requirements for oil-fired boilers.....	32
4.4.1	Oil fuel pre-treatment.....	32
4.4.2	Gas pilot.....	32
4.4.3	Controls and safety devices.....	32
4.4.4	Fuel bypass valve.....	33
4.4.5	Steam and air atomized burners.....	33
4.4.6	Fuel oil installation.....	33
4.5	Specific requirements for gas-fired boilers.....	33
4.6	Specific requirements for solid-fuel-in-suspension-fired boilers.....	33
4.6.1	General.....	33
4.6.2	Controls and safety devices.....	33
4.6.3	Valve and piping arrangement.....	34
4.6.4	Fuel quality.....	34
Section 5	Additional requirements for solid-fuel-fired (bed or grate) unattended boilers.....	35
5.1	Application.....	35
5.2	Operational requirements for solid fuel (bed or grate) management system.....	35
5.2.1	Pre-start interlocks.....	35
5.2.2	Start-up.....	35
5.2.3	Controlled shutdown.....	36
5.2.4	Fault shutdown and lockout.....	36
5.2.5	Purging.....	36
5.3	Specific requirements for solid-fuel-fired (bed or grate) boilers.....	36
5.3.1	General.....	36
5.3.2	Fuel quality.....	36
5.3.3	Combustion equipment.....	36
5.3.4	Ignition of bed fuel.....	36
5.3.5	Controls and safety devices.....	37
5.3.6	Burn-back protection.....	37
5.3.7	Power failure protection.....	37
5.3.8	Solid fuel and residue handling plans.....	37
Section 6	Inspection, checking, testing and maintenance for unattended boilers.....	38
6.1	General.....	38
6.2	Periodic checking, testing and maintenance personnel.....	38
6.3	Checking, testing and maintenance procedures.....	38
6.3.1	Program and procedures.....	38
6.4	Checking and testing.....	38
6.4.1	Additional checking and testing — Unattended operation.....	38
6.4.2	Daily checking and testing — Unattended operation.....	39
6.4.3	Weekly checking and testing — Unattended operation.....	39
6.4.4	Periodic checking, testing and maintenance — Unattended operation.....	40
6.4.5	Changes to procedures.....	40
6.4.6	Logging — Daily and weekly checking — Unattended operation.....	40
6.4.7	Records — Periodic checking, testing and maintenance.....	41
6.5	Yearly and required maintenance — Unattended operation.....	41
6.5.1	Required maintenance.....	41
6.5.2	Yearly inspection, testing and maintenance.....	41
6.5.3	Records — Yearly and required maintenance.....	42
6.6	Retention of records.....	42
6.7	Maintenance checklist/instructions.....	42
Section 7	Attended boilers.....	43
7.1	General.....	43
7.2	Electrical control equipment.....	43
7.3	Power failure and overheating protection.....	43
7.4	Management system.....	43
7.5	Manual operation.....	43
7.6	Automatic operation.....	43

7.6.1	General	43
7.6.2	Automatic water level management	44
7.6.3	Alarms	44
7.6.4	Controls and boiler mountings	44
7.7	Low-water cut-out and alarm	44
7.8	Water feed control	44
7.8.1	General	44
7.8.2	Modulating water control	45
7.9	Operational supervision	45
7.10	Testing and checking programs	45
7.10.1	General	45
7.10.2	Checks	45
7.10.3	Records — Checking Attended operation	45
Section 8	Water level management and security for all types of boilers	47
8.1	Water level devices and interlocks	47
8.1.1	General	47
8.1.2	Electrical requirements	47
8.2	Water level indicators	47
8.2.1	Number and type	47
8.2.2	Length of water level indicators on boilers	48
8.2.3	Glass diameter	48
8.2.4	Drains	48
8.2.5	Guards	48
8.2.6	Water level indicator connections and location	48
8.2.7	Connecting pipes for water level indicators	50
8.3	Feedwater systems	50
8.3.1	Design pressure	50
8.3.2	Design temperature	50
8.3.3	Feedwater arrangements	50
Section 9	Installation requirements of all types of boilers	53
9.1	General requirements	53
9.1.1	Gas installations	53
9.1.2	Fuel oil installations	53
9.1.3	Solid fuel installations	53
9.1.4	Electrical installations	53
9.2	Housing, access and security	53
9.3	Feedwater supply	53
9.4	Water treatment	53
9.5	Blowdown	53
9.6	Flues and chimneys	54
9.7	Electrical equipment	54
Section 10	Marking, instructions and statements for all types of boilers	55
10.1	Marking	55
10.2	Electrical data	55
10.3	Instructions	55
10.4	Language and units	55
10.5	Boiler attendance-category statement	55
Section 11	Energy input for all types of boilers	56
11.1	Combustion systems	56
11.1.1	Suitability	56
11.1.2	Emission requirements	56
11.1.3	Combustion heat flux limitation	56
11.1.4	Automatic oil and gas firing equipment	56
11.1.5	Other oil, gas or solid-fuel-in-suspension firing equipment	57
11.1.6	Solid-fuel firing systems	57
11.2	Waste heat energy recovery system	57

11.2.1	Input control.....	57
11.2.2	Input location.....	57
11.3	Electric energy input systems.....	58
11.3.1	General.....	58
11.3.2	Electricity supply.....	58
11.3.3	Load adjustment.....	58
11.3.4	Electrodes, elements and internal parts.....	58
11.3.5	Pressure and temperature control.....	59
11.3.6	Access.....	59
Section 12	Valves for all types of boilers.....	60
12.1	General.....	60
12.2	Valves and fittings for steam boilers.....	60
12.2.1	Minimum requisite fittings.....	60
12.2.2	Safety valves.....	60
12.2.3	Discharge capacity.....	61
12.2.4	Accumulation.....	62
12.2.5	Reseating pressure.....	62
12.2.6	Valve settings.....	62
12.2.7	Connections to the boiler.....	62
12.2.8	Expansion joints.....	63
12.2.9	Pilot pipes.....	63
12.2.10	Safety valve discharge system.....	63
12.2.11	Discharge restriction.....	63
12.2.12	Blowdown valves.....	63
12.2.13	Main steam isolating valve.....	64
12.2.14	Main feedwater isolating valve.....	64
12.2.15	Isolating valves.....	64
12.3	Valves and fittings for hot water boilers.....	64
12.3.1	Minimum requisite fittings.....	64
Section 13	Integral and boiler pressure piping for all types of boilers.....	65
13.1	General.....	65
13.2	Water-heating boiler system design.....	65
13.2.1	General.....	65
13.2.2	Expansion vessels.....	65
13.2.3	Piping system.....	66
13.2.4	Make-up water systems.....	66
13.2.5	Energy input interlock.....	66
Appendix A (normative)	Type test for a boiler subject to power failure.....	67
Appendix B (informative)	Typical oil or gas burner firing sequences.....	69
Appendix C (informative)	Typical oil supply and control systems.....	70
Appendix D (informative)	Typical boiler attendance-category statement.....	72
Appendix E (informative)	Example of steam boiler piping and other equipment covered by this Standard.....	73
Bibliography	75

Australian Standard®

Boilers — Safety management and supervision systems

Section 1 Scope and general

1.1 Scope

This Standard specifies the requirements for the operation of boilers and other devices including any connected economizer or superheater or deaerator. It includes the special features within the control, management and supervision systems, associated valves and fittings, housing, access and installation for those boilers and other devices operating in the unattended or attended modes. It also details the checking, testing, supervision and maintenance requirements for each category of attendance to support continued safety.

1.2 Application

This Standard is intended to be used in the design, manufacture, use (with and without attendance) and modification of new and existing boilers as follows:

- (a) Boilers for fixed land installations.
- (b) Boilers having a design pressure as shown in [Table 1](#).
- (c) Boilers having a power output within the capacities specified in [Table 1](#) for the boiler type and category.
- (d) Boilers in accordance with the checking, testing, supervision and maintenance requirements specified in [Table 1](#) for the boiler type and category.
- (e) Boilers for the generation of steam, or other vapour, for which the types of boilers permitted are —
 - (i) water-tube type or fire-tube type or combination of water-tube and fire-tube types or electric type or all boiler types up to 500 kW (see [Table 1](#)) for unattended operation; and
 - (ii) any type of boiler for attended operation (see [Table 1](#)).
- (f) Boilers for the heating of water or other liquids at a pressure above that of the atmosphere and to a temperature not less than the normal atmospheric boiling temperature of the liquid, for which application any type of boiler conforming to AS/NZS 1200 is permitted.
- (g) Boilers having any of the following sources of energy input:
 - (i) Gas fuel (mains or other gases).
 - (ii) Oil fuel with a closed flashpoint greater than 23 °C.
 - (iii) Solid fuels, including solid-fuel-in-suspension.
 - (iv) Waste heat fluids.
 - (v) Electric power.
 - (vi) Solar energy.

NOTE 1 This Standard may also be applied to boilers outside the limits specified in Items (a) to (g) where equivalent safety and reliability are required by the owner.

NOTE 2 This Standard is not intended to apply to miniature boilers in accordance with AMBSC Code Parts 1, 2, 3 and 4.