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CODE OF PRACTICE FOR THE
DESIGN, SAFE
OPERATION,
MAINTENANCE AND
SERVICING OF BOILERS

Includes attended, limited-attendance, under 15hp, unattended and low-hazard boilers
and pressurised hot water boilers.



DEPARTMENT OF
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T E T A R I M A H I

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Important Note:

All the publications in the Publications Archive contain the best guidance available at the time of publishing. However, you should consider the effect of any changes to the law since then. You should also check that the Standards referred to are still current.

Published by the Occupational Safety and Health Service,
Department of Labour,
Wellington,
New Zealand.
March 1996

ISBN 0-477-03573-6

OSH 3120 AEC

Price: \$10 (incl. GST)

ARCHIVE

CONTENTS

<i>NOTICE OF ISSUE</i>	7
<i>FOREWORD</i>	8
<i>SUMMARY OF THE HEALTH AND SAFETY IN EMPLOYMENT ACT 1992</i>	9
Regulations	9
Approved codes of practice	9
Employers' duties	9
Hazard management	10
Information for employees	11
Employers to involve employees in the development of health and safety procedures	11
Training of employees	11
Safety of people who are not employees	11
Employees' and self-employed persons' duties	11
Accidents and serious harm (Recording and notification)	12
 <i>PART 1: GENERAL</i>	 13
1.1 Preface	13
1.2 Scope	14
1.3 Background	14
1.4 Definitions	14
1.5 General	19
1.6 Supervision	20
1.7 Existing boilers	20
1.8 Upgrading existing shell boilers	21
1.9 Coupled boilers	22
1.10 Combustion	22
1.11 Shell-type steam boilers tube plate temperatures	23
1.12 Fittings	24
1.13 Water level gauges	24
1.14 Safety valves	25
1.15 Pressure gauge	26
1.16 Blow down valve	27
1.17 Seismic requirements	27
1.18 Water treatment	27

ARCHIVE

1.19	Feed pumps	28
1.20	Feedwater systems	28
1.21	Electrical equipment and supply	28
1.22	Control components	29
1.23	Fault alarms and lockouts	30
1.24	Testing of controls and alarms	31
1.25	Boiler management control systems including PLC	30
1.26	Documents and marking	31
1.27	Obligations of controllers	33
1.28	Maintenance	33
1.29	Security and protection	34
1.30	Quality management quality system for boilers	35
1.31	System auditing/monitoring	35
1.32	Method of application for limited-attendance and unattended boilers	35

PART 2: ATTENDED BOILERS 39

2.1	Boilers with output greater than 20MW	39
2.2	Attended boilers with outputs not exceeding 20MW	39
2.3	Controls and mountings	40
2.4	Low-water cutouts and alarms	40
2.5	Feedwater control	40
2.6	Operational supervision	41
2.7	Daily tests	41

PART 3: LIMITED-ATTENDANCE BOILERS 43

3.1	Controls and mountings	43
3.2	First low-water cutout and alarm	44
3.3	Second low-water cutout and alarm	45
3.4	Feedwater control	45
3.5	Feedwater availability	45
3.6	Feedwater low-pressure alarm	45
3.7	Forced circulation	46
3.8	Combustion controls	46
3.9	Combustion chamber thermal cut out	47
3.10	Feed pumps/safeguarding against unacceptable evaporation in solid fuel boiler installations	47
3.11	Alarms	48
3.12	Visual display	48
3.13	Operational supervision	48
3.14	Testing of cutouts and alarms	49
3.15	Periodic tests	50
3.16	Water treatment	50
3.17	Maintenance of the boiler management and safety systems	50

ARCHIVE

PART 4: UNDER 15 HP BOILERS	51
4.1 General	51
4.2 Controls and mountings	51
4.3 Operational supervision	51
4.4 Under 15 hp boilers built to standards other than BS 2790:1982, or earlier editions of that standard	52
4.5 Under 15 hp boilers designed and built to BS 2790:1982, or to later editions of that standard	52
4.6 Coupled boilers	52
4.7 Existing boilers	52
PART 5: UNATTENDED BOILERS	53
5.1 Operation	53
5.2 Controls and mountings	53
5.3 First low-water cut out and alarm	54
5.4 Second low water cut out and alarm	55
5.5 Feedwater control	55
5.6 Feedwater availability	56
5.7 Feedwater low-pressure alarm	56
5.8 Forced circulation	56
5.9 Combustion controls	56
5.10 Combustion chamber thermal cut out	57
5.11 Feed pumps /safeguarding against unacceptable evaporation in solid fuel boiler installations	58
5.12 Alarms	58
5.13 Visual display	59
5.14 Operational supervision	59
5.15 Testing of cut outs and alarms	60
5.16 Quarterly tests	61
5.17 Water treatment	62
5.18 Maintenance of boiler management and safety systems	62
PART 6: ONCE-THROUGH FORCED CIRCULATION COIL BOILERS	63
6.1 Standards for controls	63
6.2 Forced circulation coil boilers	63
6.3 Feedwater pump	64
6.4 Pressure safety	64
PART 7: LOW-HAZARD BOILERS	65
7.1 Standards for controls	65
7.2 Operational supervision	65

ARCHIVE

PART 8: PRESSURISED HOT WATER BOILERS 66

- 8.1 Standards 66
- 8.2 Types of system 66
- 8.3 Automatic controls 67
- 8.4 Independent overriding controls 68
- 8.5 Electrical failure to safety 68
- 8.6 Interruption of the electricity supply 68
- 8.7 Boilers using mixing valves 69
- 8.8 Safety valves 69
- 8.9 Training 69
- 8.10 Testing and maintenance 69

PART 9: UNFIRED WASTE HEAT BOILERS 70

- 9.1 Definition 70
- 9.2 Design 70
- 9.3 Safety protection devices 70

APPENDIX A: PRINCIPAL STANDARDS ACCEPTED FOR USE IN NEW ZEALAND IN CONNECTION WITH BOILERS 72

- 1. New Zealand Standards 72
- 2. Joint Australian/New Zealand Standards 72
- 3. Australian Standards 72
- 4. British Standards 72
- 5. USA Standards 73
- 6. Existing boilers 73

APPENDIX B: CLAUSES FROM AS 2593:1990 TO BE CONSIDERED FOR BOILER DESIGN PURPOSES 75

APPENDIX C: INFORMATION REQUIRED BY AUTHORITY WITH FIRST APPLICATION TO OPERATE AN UNATTENDED OR LIMITED-ATTENDANCE BOILER 76

SECTION A: Method of application for limited-attendance boiler operation and unattended boiler operation 76

SECTION B: Quality management systems for boiler installations 78

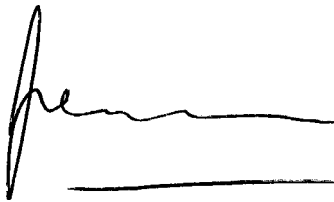
APPENDIX D: CLASSIFICATION SOCIETIES ACCEPTED IN NEW ZEALAND BY THIS AUTHORITY 80

APPENDIX E: VERIFICATION OF BOILER MANAGEMENT SYSTEM FOR LIMITED-ATTENDANCE AND UNATTENDED BOILERS 81

ARCHIVE

NOTICE OF ISSUE

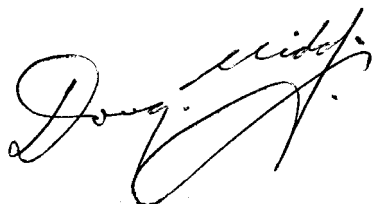
I have issued this *Approved Code of Practice for the Design, Safe Operation, Maintenance and Servicing of Boilers*, being a statement of preferred work practices or arrangements for the purpose of ensuring the health and safety of persons to which this code applies and persons who may be affected by the activities covered by this code.

A handwritten signature in black ink, appearing to read 'J. M. Chetwin', with a horizontal line underneath it.

J. M. Chetwin
Secretary of Labour
March 1996

FOREWORD

I have approved this statement of preferred work practices, which is an *Approved Code of Practice for the Design, Safe Operation, Maintenance and Servicing of Boilers*, under section 20 of the Health and Safety in Employment Act 1992. When a code is approved, a Court may have regard to it in relation to compliance with the relevant sections of the Health and Safety in Employment Act. This means that if an employer in an industry or using a process to which an approved code applies can show compliance with that code in all matters it covers, a Court may consider this to be compliance with the provisions of the Act to which the code relates.

A handwritten signature in black ink, appearing to read 'Doug Kidd', with a large, stylized flourish at the end.

Hon. Doug Kidd
Minister of Labour
March 1996

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SUMMARY OF THE HEALTH AND SAFETY IN EMPLOYMENT ACT 1992

The principal object of the Health and Safety in Employment Act 1992 is to prevent harm to employees at work. To do this, it imposes duties on employers, employees, principals and others, and promotes excellent health and safety management by employers. It also provides for the making of regulations and codes of practice.

REGULATIONS

Regulations are promulgated from time to time under the HSE Act. Regulations may impose duties on employers, employees, designers, manufacturers, and others relating to health and safety. These regulations may apply with respect to places of work, plant, processes or substances and may have been made to deal with particular problems that have arisen.

APPROVED CODES OF PRACTICE

“Approved Codes of Practice” are provided for in section 20 of the HSE Act. They are statements of preferred work practice or arrangements, and may include procedures which could be taken into account when deciding on the practicable steps to be taken. Compliance with codes of practice is not mandatory. However, they may be used as evidence of good practice in court.

EMPLOYERS’ DUTIES

Employers have the most duties to perform to ensure the health and safety of employees at work.

Employers have a general duty to take all practicable steps to ensure the safety of employees. In particular, they are required to take all practicable steps to:

- Provide and maintain a safe working environment;
- Provide and maintain facilities for the safety and health of employees at work;
- Ensure that machinery and equipment is safe for employees;
- Ensure that working arrangements are not hazardous to employees; and

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- Provide procedures to deal with emergencies that may arise while employees are at work.

Taking “all practicable steps” means what is reasonably able to be done to achieve the result in the circumstances, taking into account:

- The severity of any injury or harm to health that may occur;
- The degree of risk or probability of that injury or harm occurring;
- How much is known about the hazard and the ways of eliminating, reducing or controlling it; and
- The availability, effectiveness and cost of the possible safeguards.

HAZARD MANAGEMENT

Employers must have an effective method to identify and regularly review hazards in the place of work (existing, new and potential). They must determine whether the identified hazards are significant hazards and require further action.

If an accident or harm occurs that requires particulars to be recorded, employers are required to investigate it to determine if it was caused by or arose from a significant hazard.

“Significant hazard” means a hazard that is an actual or potential cause or source of:

- Serious harm; or
- Harm (being more than trivial) where the severity of effects on a person depends (entirely or among other things) on the extent or frequency of the person’s exposure to the hazard; or
- Harm that does not usually occur, or usually is not easily detectable, until a significant time after exposure to the hazard.

Where the hazard is significant, the HSE Act sets out the steps employers must take:

- Where practicable, the hazard must be eliminated.
- If elimination is not practicable, the hazard must be isolated.
- If it is impracticable to eliminate or isolate the hazard, the employer must minimise the likelihood that employees will be harmed by the hazard.

Where the hazard has not been eliminated or isolated, employers must:

- Ensure that protective equipment is provided, accessible and used;
- Monitor employees’ exposure to the hazard;
- Seek the consent of employees to monitor their health; and
- With their informed consent, monitor employees’ health.

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INFORMATION FOR EMPLOYEES

Before employees begin work, they must be informed by their employer of:

- Hazards employees may be exposed to while at work;
- Hazards employees may create which could harm people;
- How to minimise the likelihood of these hazards becoming a source of harm to themselves and others;
- The location of safety equipment; and
- Emergency procedures.

Employees should be provided with the results of any health and safety monitoring. In doing so, the privacy of individual employees must be protected.

EMPLOYERS TO INVOLVE EMPLOYEES IN THE DEVELOPMENT OF HEALTH AND SAFETY PROCEDURES

Employers need to ensure that all employees have the opportunity to be fully involved in the development of procedures for the purpose of identifying and controlling significant hazards, or dealing with or reacting to emergencies and imminent dangers.

TRAINING OF EMPLOYEES

Employers must ensure employees are either sufficiently experienced to do their work safely or are supervised by an experienced person. In addition, employees must be adequately trained in the safe use of all plant, objects, substances and protective clothing and equipment that the employee may be required to use or handle.

SAFETY OF PEOPLE WHO ARE NOT EMPLOYEES

Employers also have a general duty towards persons who are not employees. Employers must take all practicable steps to ensure that employees do not harm any other person while at work, including members of the public or visitors to the place of work.

EMPLOYEES' AND SELF-EMPLOYED PERSONS' DUTIES

Employees and self-employed persons have a responsibility for their own health and safety while at work. They must also ensure that their own actions do not harm anyone else.

However, these responsibilities do not detract from the employer's responsibilities.

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ACCIDENTS AND SERIOUS HARM (RECORDING AND NOTIFICATION)

The HSE Act requires employers to keep a register of work-related accidents and serious harm. This includes every accident that harmed (or might have harmed):

- Any employee at work;
- Any person in a place of work under the employer's control.

Employers are also required to investigate all accidents and near-misses to determine whether they were caused by or arose from a significant hazard.

Employers are required to notify serious harm that occurs to employees while at work to the Secretary of Labour (in practice, the nearest Occupational Safety and Health Service (OSH) office), as soon as possible. In addition, the accident must also be notified in the form prescribed within 7 days. (Suitable forms for notification are available from OSH offices and selected stationers).

If a person suffers serious harm, the scene of the accident must not be disturbed unless to:

- Save life or prevent suffering;
- Maintain public access for essential services, e.g. electricity, gas;
- Prevent serious damage or loss of property.

The OSH office will advise whether it wishes to investigate the accident and what action may be taken in the meantime.

PART 1: GENERAL

1.1 PREFACE

This code of practice has been prepared by a technical committee comprising representatives from the Insurance Council, Classification Societies, Employers' Federation, Manufacturers' Association, Heavy Engineering Research Association, NZ Combined Trade Unions, Association of Marine, Aviation and Power Engineers and the Engineering Safety Branch, previously of the Maritime Transport Division and now of the Occupational Safety and Health Service of the Department of Labour. Its purpose is to update and bring together into one document the minimum requirements for the design and safe operation, maintenance and servicing of boiler plant.

With the advent of more stringent boiler manufacturing standards (chiefly relating to weld inspection and tubesheet design) and the availability of high-integrity, self-monitoring controls, boiler plant now presents no more danger to personnel than many other pressure equipment items in general use. Accordingly, the committee has seen fit to extend the limits for unattended steam boilers in line with current practice in Great Britain and Europe. This relaxation of the manning requirements imposes substantial obligations on the controller to ensure that this code of practice is followed, and that boiler supervisory and maintenance staff have adequate training.

Limited-attendance and unattended boilers with outputs greater than 6 MW shall be operated and maintained within a certified AS/NZS 9001 or 9002 Quality Management System, as specified in clause 1.30.

Limited-attendance and unattended boilers with outputs less than 6MW may be operated and maintained within a documented boiler operation and maintenance system, as specified in clause 1.30.

This code also includes high-temperature hot water boilers. This plant has been unregulated in New Zealand until now (contrary to other countries) but presents many of the same safety risks as steam boilers.

In some circumstances, and with suitable technical backup, proposals for changes to this code of practice may be submitted to the Manager, Engineering Safety, for consideration by the industry group concerned.

1.2 SCOPE

This code of practice applies to the safety features and controls of all commercial or industrial boilers.

Only the following categories of boilers can be operated as unattended or limited-attendance boilers:

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- Water tube boilers of welded construction designed and built to BS 1113.
- Water tube boilers of welded construction designed and built to the ASME *Boiler and Pressure Vessel Code* Section 1 “Power Boilers”.
- Shell boilers of welded construction designed and built to BS 2790:1982, and later editions of this standard.
- Water-tube boilers of welded construction, designed and built to AS 1228.
- Shell boilers of welded construction, designed and built to AS 1797.
- Some shell boilers of welded construction built to earlier editions of BS 2790, and some welded shell boilers designed and built to the *New Zealand Boiler Code*.

For other boiler types, the standards listed in Appendix A shall apply.

NOTE: The 1982 edition of BS 2790 was the first edition of this standard to contain requirements which recognised and reflected the influence of thermal aspects of combustion on tube plate design and NDE on determination of scantlings.

This code of practice does not apply to boilers of an historic type (vintage locomotives, traction engines, etc.) Nor does it apply to boilers operated solely for educational or display purposes.

In addition to this, the Secretary may, on written application for special case boilers, grant an exemption in writing, in specified instances, from some or all of the clauses and/or limits in this code of practice.

1.3 BACKGROUND

At the time of writing, approximately 75% of steam boilers in New Zealand are under 15 horsepower. They do require supervision but not necessarily by a full-time qualified operator. While there have been no fatalities associated with the explosion of these boilers in the past 30 years, there have been a number of collapsed furnaces due to lack of water, and other potentially serious failures. Adoption of this code of practice will provide an increased level of safety for all types of boiler plant.

1.4 DEFINITIONS

Attended boiler means a boiler which is under the direct control of a qualified operator at all times that steam is being raised or is being taken from the boiler.

Authorised means approved by the Authority.

Authority means the Occupational Safety and Health Service of the Department of Labour, which is currently the Government agency having the delegated responsibility from the Secretary for administering these requirements.

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Boiler except where preceded by the words “hot water”, means a device comprising an arrangement of mainly pressure containment parts such as drums, vessels, tubes, coils and interconnecting parts used, or intended to be used, to generate steam at temperatures above 100°C by the use of a directly applied combustion process, or by the application of heated gases. It includes all superheaters, reheaters, economisers, boiler piping, supports, mountings, valves, gauges, controls and water level and combustion management systems as are necessary to ensure the pressure integrity of the boiler, or are necessary for its safe operation.

NOTE: The perimeter of a boiler is generally to be taken as the outlet connection from the main and auxiliary steam stop valves, the inlet connection to the feedwater valves or feedwater controller, the first connection to the inlet of the reheat inlet header, the first connection to the outlet of the reheat outlet header, the point of release to atmosphere of both the safety valve discharge piping and the blowdown discharge piping, the last connection of fuel supply, hot gas supply, air supply and the first connection of the flue gas discharge piping or ducting.

Boiler management system means a system that controls the entire boiler function including the energy input management system, the water level management system, the alarm system, the pressure controls, trip devices, all instruments and circuitry.

Boiler manufacturer means the person who oversees the fabrication, installation, commissioning and certification of the boiler with all its systems and ancillary equipment, and the training of the operating staff. For boilers being relocated or refurbished, the person carrying out that operation is considered to have the same responsibilities as detailed above for the boiler manufacturer.

Boiler safety controls means those items on which the safety of the boiler depends and are required to be of a fail-safe nature. These include low-level lockouts, flame scanners, over/under pressure switches, etc.

Certification body means an organisation carrying out certification to the AS/NZS 9000 Series Quality Management Standards which holds an authorisation issued under the Joint Accreditation System for Australia and New Zealand (JASANZ) and which has been approved by the Authority.

Complete shutdown means a condition in which the boiler is immediately and effectively isolated from all sources of fuel and power (or combustion air and power for solid fuel boilers), and where the controls can be reset only by hand. The safety control and alarm system shall not be isolated.

Controller in relation to an item of equipment operated, or intended to be operated, in a place of work means a person who is the owner, lessee, sublessee, or bailee, of that equipment.

Data logger means an automatic device which gives a printout of all safety-related events and functions, together with the times that they

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occur and details of the corrective actions applied. The printout may also include regular details of critical or essential operational data.

Designer means the individual or organisation that determines the shape, dimensions and thickness of the boiler, and selects the materials and the details and methods of construction.

Design pressure means the pressure used by the designer for the purpose of calculating the scantlings of the boiler.

Design verification means the establishment by a design verifier through design control measures that the design complies with relevant specifications and standards in all respects and with particular regard to safety.

Design verifier means a suitably qualified and experienced person, who is totally independent of the designer and the design team and who is registered as a design verifier by the Secretary for nominated types and classes of equipment under the Pressure Equipment, Cranes and Passenger Ropeways (PECPR) Regulations.

Equipment inspector means a person employed by an Inspection Body, who meets the criteria specified by the Authority and who has been authorised by the Authority in writing to carry out safety inspection tasks or safety-related activities on specified categories of equipment.

Fail-safe means a feature which ensures that absence of any critical control or safety component, system, signal, or function will not result in an unsafe condition.

Flame establishment period means the period that begins when the fuel valve is energised and ends when the flame supervision system is first required to supervise that flame.

Flame failure means an abnormal loss of flame as detected by the flame supervision system.

Flame supervision system means a system consisting of flame detector plus associated circuitry, integral components, valves and interlocks, the function of which is to shut off the fuel supply to the combustion equipment in the event of ignition failure or flame failure.

From and at 100°C is an abbreviation indicating the evaporation from feedwater at 100°C to steam at 100°C and as such is the basis of determining the peak load equivalent evaporation of a steam boiler. It is a means of standardising the evaporation rating of a boiler relative to the heat transfer.

High-integrity controls in the case of low water alarms, for example, this means controls which are fail-safe and self-monitoring incorporating a regular self-test routine. The design must be such that faults which could compromise the effectiveness of the safety device cannot occur (by fault-avoidance techniques) *or* that in the event of internal faults or the occurrence of external influences in or at the safety device, then its effectiveness remains unaffected or the plant remains in a safe condition, or is brought to a safe condition, or, in some cases, the failure is brought to the operator's attention.

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Fail-safe, self-monitoring controls incorporating a regular self-test are the preferred control system and may be termed “high-integrity.”

Horsepower This was a classification of boiler output, based on the area of heat transfer surface, and was equal to the heating surface area in m² of the boiler divided by 1.5. It is not proposed to continue this measurement method but it is included here for comparative purposes.

Hot water boiler means an item of pressure equipment and includes an arrangement of mainly pressure-containing parts such as drums, vessels, tubes, coils, and interconnecting parts used to heat water at pressures exceeding 200 kPa and temperatures exceeding 100°C by the use of a directly applied combustion process, or by the application of heated gases. It includes all piping, supports, mountings valves, gauges, controls for water temperature and flow and combustion management systems as are necessary to ensure the pressure integrity of the hot water boiler, or as may be necessary for its safe operation. The term does not include domestic heating equipment for hot water.

Ignition failure means the failure of the ignition system to establish flame by the end of the flame establishment period.

Incident means an event involving equipment within the scope of these requirements which causes structural damage to that equipment or damage to other property which in turn may in any manner affect its ongoing safety, or which in different circumstances may have caused an accident.

Inspection body means an organisation totally independent, both of the organisation which is providing the product or service and that which is purchasing the product or service, which meets the criteria specified by the Authority and has been authorised by them in writing to act in that capacity to carry out safety inspection tasks on boilers.

Interlock means a device that makes the operation of an item of equipment dependent upon the fulfilment of predetermined conditions by another item of equipment.

Internal means inside the boiler drum or boiler shell.

Immediate vicinity means on or around the boiler itself, or in the control room or at the control position designated for that boiler.

Limited-attendance boiler means a boiler which is checked at regular and specified intervals by a qualified operator, who shall be on site and within range of the audible or visual alarms at all times. A limited-attendance boiler may be started up or shut down automatically or under manual control. A limited-attendance boiler may be brought under the direct manual control of a qualified operator at any time that it is desired, in which case all requirements relating to an attended boiler shall apply.

Lockout means a condition in which the device or system under consideration has been turned off and can be restarted only after the fault has been corrected and the system checked by the qualified operator or responsible person.

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Low-hazard boiler means a boiler with a total volume less than 1000 litres, an operating pressure not exceeding 7 bar and an output less than 350 kW.

Maintenance contractor means a person who is suitably skilled and fully understands the functions and purposes of the boiler management system. They must meet the requirements of the boiler manufacturer or inspection body to maintain the boiler management system. Within an AS/NZS 9002 Quality Management System (QMS), this function may also be carried out “in-house”.

Manufacturer means the individual or organisation that fabricates, or assumes responsibility for the fabrication of, the boiler or any component of the boiler.

Operation and maintenance system means a documented management system for the operation, maintenance and control of a boiler or boilers (limited-attendance or unattended) with an aggregate output not exceeding 6MW. This system incorporates the relevant main parts of a quality management system and is to be audited by an equipment inspector holding a current certificate as a boiler inspector (with no restrictions or limitations). Further details in Appendix C.

Power output means the heat transferred to the water/steam between the feed inlet and the boiler outlet and is a maximum continuous rating specified by the manufacturer.

Pressure relief means the controlled and automatic relief of pressure to a safe disposal location or system by the operation of a safety valve.

Pressure test means a hydraulic or pneumatic test carried out by applying a pressure greater than the safe working pressure to pressure-retaining parts or sections of pressure equipment to prove the pressure integrity of the construction, or, the adequacy of modifications or repairs made to it.

Proved means that the relevant conditions have been sensed and registered as being correct.

Purging means the use of air or inert gas to remove and replace a potentially dangerous atmosphere.

Qualified operator means a person who holds the appropriate competency certificate for the control of the combined size of the boilers in question.

Quality management system means a system which has been independently assessed by a Certification Body and certified as complying with the requirements of AS/NZS 9001 or AS/NZS 9002 for the operation and/or maintenance of boilers.

Responsible person means a person who is appointed by the controller and who is trained by the controller to the level specified by the manufacturer of the boiler, or, to a level acceptable to an Inspection Body, to exercise general supervision of the safe operation of the boiler.

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Safe working pressure means the pressure at which the equipment has been designed to safely operate and is normally the highest pressure at which any safety valve, or safety relief valve, has been set to commence lifting, releasing, or opening; or a lower pressure assigned to the equipment for safety reasons.

Secretary means the chief executive of the Department of Labour.

Self-checking system a sub-circuit within the boiler management system, designed and arranged to automatically and regularly test the integrity of low water and flame-failure devices by dynamic testing of each and every component on which safe and correct operation is dependent, usually by creating a change of state.

Self-monitoring system a sub-circuit within the boiler management system that continually monitors the integrity of the control components and their interconnections.

Steam means water vapour at a pressure equal to or greater than atmospheric and a temperature equal to or greater than 100°C.

Supervise, supervision means having effective control over the related operations or functions.

Unattended boiler means a boiler which can only start up, operate and shut down under the control of the boiler management system and monitoring of the safety system. If a control systems fault condition arises, the boiler shuts down automatically until the fault is rectified by a maintenance contractor, and the complete system has been tested and proven satisfactory by the responsible person. These boilers may not be operated manually in the attended mode.

1.5 GENERAL

- 1.5.1 Every new boiler shall comply with a Standard that is acceptable in New Zealand, as listed in Appendix A, and with this code of practice.
- 1.5.2 This code of practice is directed at the hazards associated with:
- Control system malfunction;
 - Fire;
 - Fire side explosion;
 - Loss of power supply;
 - Loss of water;
 - Overpressure;
 - Overheating;
 - Unauthorised access;
 - Unauthorised modifications and repairs.
- 1.5.3 Overheating as a result of low water is the most common cause of boiler damage or explosions, usually a result of the malfunction of the automatic controls. The main reasons for these incidents has been shown to be:

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- Build-up of scale;
- Inadequate supervision;
- Isolation of float control chambers and safety controls;
- Lack of maintenance of controls and alarms;
- Lack of testing of controls and alarms.

NOTE: Under no circumstances should feedwater be pumped into a boiler that is subjected to low water and is overheated.

- 1.5.4 All boilers should be warmed through from cold according to the manufacturer's instructions. Automatic boilers' start-up and shut down sequences shall be designed to ensure that the boiler does not suffer thermal shock through rapid heating or cooling.
- 1.5.5 All boilers with a perceptible water level shall be bolted down to seismic requirements and shall be reinspected when relocated. This does not apply to small coil boilers with output less than 250 kW.
- 1.5.6 Special-application water tube boilers that are outside the limits shown in the table in this code may be assessed for attended or limited-attendance operation on their ability to guarantee at least the same levels of safety required by this code of practice. Such special applications shall be made to the Secretary.
- 1.5.7 Persons installing boiler management systems or controls, for both new installations and upgrades of existing plant, shall be suitably qualified, trained and experienced with boiler management systems to be able to assure a safe system.

1.6 SUPERVISION

- 1.6.1 Automatic controls are not a complete substitute for supervision. A measure of supervision by a qualified operator or responsible person familiar with the automatic controls and the operation of the boiler house plant is an essential feature of safe operation.
- 1.6.2 In deciding the extent of supervision, the following points and the table on pages 36-37 should be taken into account.
- (a) The complexity of the installation;
 - (b) The extent of automation and integrity of the boiler controls; and
 - (c) The operating conditions of the boiler and controls.

1.7 EXISTING BOILERS

- 1.7.1 Existing boilers may continue to be operated under their present condition as long as they remain in good enough condition to be issued with a certificate of inspection.
- 1.7.2 The following general requirements and restrictions shall apply to all existing boilers.

ARCHIVE

- 1.7.3 Boilers which are relocated, structurally damaged or are taken back into service after a period of 24 months without having a certificate of inspection or being inspected “in-house” by the controller’s CBIP qualified inspector under a Quality Management System, or having been stored, shall be upgraded to meet the requirements for that class of boiler specified in this code of practice in full.

The following specific requirements and restrictions apply:

1.7.4 ATTENDED BOILERS

Existing attended boilers that have a level of equipment less than that required in Part 2 of this code of practice may continue to be operated by a qualified operator in the immediate vicinity of the boiler at all times. The 50 m limit given in clause 2.6 only applies to boilers that fully comply with this code of practice.

1.7.5 LIMITED-ATTENDANCE BOILERS

Controllers of existing limited-attendance boilers operating with a statutory exemption originally issued by the Marine Division of the Ministry of Transport shall have the boiler upgraded to meet the requirements specified in this code of practice as soon as practical, but not later than 31 December 1996. Limited-attendance boilers which do not meet the requirements specified in this code of practice will be deemed to be attended boilers from 31 December 1996.

1.8 UPGRADING EXISTING SHELL BOILERS

- 1.8.1 Controllers wishing to have their existing attended shell boiler, or under 15 hp boiler, upgraded to unattended or limited-attendance operation shall have the boiler examined by an equipment inspector to determine its suitability for this conversion.
- 1.8.2 *T-butt weld between the furnace tube and the tube plate on shell boilers.* Shell boilers that do not have a full penetration, double-sided weld of the required quality for the full circumference of the furnace tube shall not be considered suitable for upgrading.
- 1.8.3 Flat plates attached to reversal chambers or firebox wrapper plates shall have reverse side fillet welds, with a minimum leg length of 5 mm, inserted for the full circumference of the seam.
- 1.8.4 Flat plates attached to shells and furnace shall have reverse side fillet welds, with a minimum leg length of 6 mm, inserted for the full circumference of the seam.
- 1.8.5 Welds, including T-butt welds, in the shell, end plates, furnace and reversal chamber shall be checked and shall be free from cracks caused through operation.
- 1.8.6 Upgrade work shall take into consideration all the relevant aspects of the original design standard, including stress-relieving where necessary:

ARCHIVE

- Small, isolated upstands welded into the shell according to the design standard need not be stress-relieved.
 - Stress-relieving will be required if the thickness of any welded joint exceeds 30 mm, this thickness being as defined in BS 2790.
 - Any weld repairs carried out on main structural strength welds, e.g. on main shell, endplates or furnace, shall be stress-relieved in accordance with the design standard.
- 1.8.7 The back tube plate shall be inspected, using appropriate NDE methods, and confirmed free of cracking.
- 1.8.8 Factors which will adversely affect a boiler's suitability for upgrading include:
- Lack of double full-penetration weld furnace/tubeplate, or defects outside the specified limits.
 - Previous repair to tube plate, shell or other major component.
 - Signs of forced firing, overheating, cracked back tube plate, etc.
 - Inadequate boiler or feedwater treatment, moderate to heavy scale, etc.
 - Inadequate shelter or security for the boiler.
- 1.8.9 Any change from the existing attended operation to unattended or limited-attendance operation must be applied for to the Engineering Safety Branch of OSH.

1.9 COUPLED BOILERS

- 1.9.1 In installations where two or more boilers are coupled together, all common piping shall be fitted with a non-return valve and an isolating valve at every boiler as a minimum.
- 1.9.2 Two or more unattended boilers having a total output greater than 10 MW, or limited-attendance boilers having a total output greater than 20 MW, may be coupled to a common steam main provided that every individual boiler complies with this code of practice and is controlled independently of the other boilers.
- 1.9.3 The largest limited-attendance boiler in a coupled installation governs the manning requirements for that installation.

1.10 COMBUSTION

- 1.10.1 The requirements in this code of practice apply to all types of boiler. Where there are fuels other than coal, oil or gas, such as wood chips or refuse, or where special firing conditions apply, then consideration shall be given to the special combustion needs, to ensure that the intent behind this code of practice is met.
- 1.10.2 Because of the risks associated with a fire side explosion, gas-fired boilers exceeding 1.2 MW shall be fitted with self-checking flame monitoring. Ionisation rod flame monitoring is considered to be self-checking. Flame

monitors that self-check on flame establishment only are not considered to be self-checking.

- 1.10.3 *Purging.* The controls shall incorporate a purge period immediately before the ignition period. This period shall be to the relevant code in Appendix A, or to the manufacturer's recommendations but the volume of purge air shall be at least 5 times the volume of the combustion and gas path space in the boiler. Full purging shall be completed before ignition starts.
- 1.10.4 Gas-fired burners and controls shall comply with NZS 5261 or to the relevant ANSI/NFPA standard. (See Appendix A.)
- 1.10.5 Flame supervision shall be self-checking in boilers with outputs greater than 1.2MW.
- 1.10.6 Burners shall be tuned with proper consideration to oxygen trim and carbon monoxide monitoring. With excess carbon monoxide remaining after combustion, besides being inefficient, there is a danger of explosion. Permanent carbon monoxide monitoring may be necessary in some installations.
- 1.10.7 In oil-burning installations, a pressure-monitoring device shall be installed to cut out the firing system if the oil pressure is less than the pressure required for atomisation.
- 1.10.8 Other requirements relating to combustion equipment for fuel-fired boilers not covered by the above clauses shall comply with AS 2593 or with the relevant ANSI/NFPA Standard. (See Appendix A.)

1.11 SHELL-TYPE STEAM BOILERS TUBE PLATE TEMPERATURES

- 1.11.1 The designer shall designate the maximum value for the gas temperature at the tube entry to the first pass from the combustion chamber and shall undertake the tube plate design based on this value.
- 1.11.2 Shell boilers that are being upgraded and that do not have a designated maximum value for the gas temperature shall have this value determined by reference to the latest edition of BS 2790. This calculation shall be submitted to an inspection body for design verification.
- 1.11.3 In unattended and limited-attendance boilers, the manufacturer shall demonstrate that this value is not exceeded during commissioning tests with the boiler at full load under maximum firing conditions by use of an accurately calibrated multishield high-velocity suction pyrometer. A permanent access point shall be provided for such a pyrometer. The manufacturer shall ensure that the controller understands the importance of regularly checking the combustion chamber temperature and knows the maximum safe value.
- 1.11.4 The controller shall arrange for annual calibration checks of the pyrometer measuring the combustion chamber gas temperature, using an accurately calibrated multishield high-velocity suction pyrometer when the boiler is operating at full load under maximum firing conditions. These temperatures shall be recorded.

- 1.11.5 The controller shall ensure that the specified maximum temperature is not exceeded through changes in fuels, firing methods or deposits on the gas or water side of heating surfaces which could reduce heat transfer rates and so increase gas temperatures.
- 1.11.6 The requirements of this section are waived for low-hazard boilers.

1.12 FITTINGS

- 1.12.1 All valves, fittings and mountings shall comply with the standards designated in Appendix A to this code of practice, or to an appropriate national standard approved by an inspection body or an authorised classification society, and shall be specifically rated for the temperature and pressure conditions of the boiler plant.
- 1.12.2 Associated pipework, flanges, joint materials, etc. shall be of an appropriate type, complying with the standards designated in Appendix A.
- 1.12.3 The bore of pipes connecting water level gauges, safety controls or alarm devices to the boiler shall not be less than 25 mm, and they shall be as short as practicable. This does not necessarily apply to once-through coil boilers, electrode boilers or to small low-hazard boilers.

1.13 WATER LEVEL GAUGES

- 1.13.1 With certain exceptions, every steam boiler shall have at least two independent means of indicating the water level, each capable of being isolated from the boiler and both of which shall be water level gauges in which the water level can be observed. The exceptions are:
 - (a) Once-through coil boilers.
 - (b) Certain electrode boilers.
 - (c) Boilers of less than 100 kW output (145 kg/h evaporative capacity), where one water level gauge is sufficient.
 - (d) In appropriate cases approved alternative remote water level indicators, e.g. Hydra-step, may be used.
 - (e) In certain cases, two approved alternative devices, in which the water level can be observed, may be used in place of one of the two required water level gauges.
- 1.13.2 The water level gauges, with isolating valves or cocks, shall be connected directly to the boiler and no outlet or other connections, except a drain for the gauge glass, shall be attached to the water gauge or to the pipes connecting the water gauge to the boiler.
- 1.13.3 Tubular-type water gauges shall be fitted with safety balls on both the steam and water side. Tubular-type water gauges are not recommended for unattended boilers with a design pressure exceeding 11 bar.
- 1.13.4 Water level gauges shall be fitted with protective guards satisfactory to the inspector.

ARCHIVE

- 1.13.5 The required gauge in which the water level can be directly observed shall be mounted so that all operational water levels such as feed pump start and stop (or full flow and stop), the lowest alarm level and the high level cutout take place with the water still visible in the gauge glass.
- 1.13.6 For *shell boilers*, the lowest alarm level shall be at the greater of either:
- (a) 100 mm above the highest heated surface; or
 - (b) A height which will give a sufficient volume of water above the highest heated surface to allow a sinking time of not less than 5 minutes, or 7 minutes for solid fuel boilers. This sinking time is the time for the water to fall from the lowest alarm level to the level of the highest heated surface, at a steam generation rate equal to the maximum capacity of the boiler with no feedwater being supplied.
- 1.13.7 For *water tube boilers*, the lowest alarm level shall be at least 100 mm above the lowest water level at which there will be no danger of overheating any part of the boiler when in operation at that level.
- NOTE: Water level gauges, or alternative devices in 13.1(e), shall not be used to initiate alarms.
- 1.13.8.1 On boilers with all drum safety gauges set at or above 62 bar, two independent remote water level indicators may be provided instead of one of the two required gauge glasses, to indicate the drum water level. When both remote level indicators are in reliable operation, the remaining gauge glass may be shut off, but shall be maintained in serviceable condition.
- 1.13.8.2 When the operator, at the main control point for the boiler, is unable to read the gauge glass water level, two dependable indirect indications shall be provided, either by transmission of the gauge glass image or by remote level indicators. A gauge glass image transmitted to the control point by means of a fibre optic cable, with no electrical operation of the optical signal, is considered to provide direct reading of the gauge glass water level.

1.14 SAFETY VALVES

- 1.14.1 Safety valves shall comply with BS 6759 or an approved equivalent standard, and shall be set in the presence of an equipment inspector, or a specialist organisation authorised to set safety valves, or, within an organisation operating and maintaining equipment to a recognised quality management system, an appropriately qualified person working within that quality management system.
- 1.14.2 A steam boiler of more than 2.3 MW output (3700 kg/h evaporative capacity) shall be fitted with not less than two single-safety valves or one double-safety valve. Every superheater and every economiser that is capable of being isolated shall have at least one safety valve on the outlet side.

1.14.3 DISCHARGE CAPACITY

- 1.14.3.1 The total rated discharge capacity of all the safety valves mounted on the boiler (and integral superheater) calculated in accordance with BS 6759: Part 1

ARCHIVE

(or equivalent) shall be at least equal to the maximum evaporative capacity of the boiler. Where the feedwater temperature, and hence the actual evaporative capacity of the boiler is not known, the installed safety valve capacity shall be 115% of the specific peak load evaporation “from and at 100°C”.

- 1.14.3.2 The maximum evaporative capacity of the boiler shall be discharged without causing the boiler pressure to increase to more than 10% above the safe working pressure.

1.14.4 ACCUMULATION TEST

- 1.14.4.1 An accumulation test shall be carried out on new safety valves, when output conditions are changed or when otherwise considered necessary and shall be witnessed by an equipment inspector before the boiler is put into normal operation. This test shall be carried out at the maximum evaporative capacity with the stop valve closed, to demonstrate the full rated discharge capacity.
- 1.14.4.2 During this test, no more feedwater shall be supplied than is necessary to maintain a safe working water level. Tests with the stop valve closed should not be carried out on boilers fitted with superheaters or reheaters where overheating may occur, and special consideration shall be given to boilers fired with solid fuels.

1.14.5 SIZING OF SAFETY VALVES

- 1.14.5.1 All steam boiler safety valves shall be sized according to BS 1113 or BS 2790, as appropriate, or, for boilers designed to other approved codes (Appendix A) according to the rules of those codes.
- 1.14.5.2 All hot water boiler safety valves shall be sized according to BS 855.

1.14.6 SUPERHEATER

For boilers fitted with superheaters, safety valves used shall have a guaranteed throughput at the design conditions, and it shall be demonstrated by flowmeter tests that the maximum output of the boiler is not more than 85% of the guaranteed throughput of the safety valves. Documentation from the manufacturer detailing the safety valve tests shall be made available to the inspection body.

1.15 PRESSURE GAUGE

- 1.15.1 Every boiler shall be fitted with at least one pressure gauge of the bourdon tube type complying with BS 759: Part 1, indicating the internal pressure of the boiler. The diameter of the pressure gauge shall be at least 150mm, although for low-hazard boilers this may be reduced to 100mm. Every gauge shall be marked with a red line at the maximum working pressure of the boiler.

- 1.15.2 The boiler pressure gauge which is used to set the safety valves shall be checked and calibrated at intervals not exceeding two years by a TELARC registered laboratory approved for the function of testing and calibrating pressure gauges to the requirements of BS 1780.
- 1.15.3 A test point shall be provided on the pressure gauge connection.

1.16 BLOW DOWN VALVE

All boilers shall be fitted with blow down valves which shall comply: shell boilers with BS 2790, water tube boilers with BS 1113, or, for boilers designed to other approved codes (Appendix A) according to the rules of those codes.

1.17 SEISMIC REQUIREMENTS

Supports, and the boiler shell, or drums and headers, in the general region of the supports, shall be designed to additionally include the following seismic requirements:

- 1.17.1 For shell boilers and water tube boilers, this coefficient shall not be less than that required in Engineering Safety Notice ES Doc. 012: *Design Requirements Relating to Water Tube and Shell Boilers*.
- 1.17.2 With the seismic forces applying in any horizontal or vertical direction, the boiler at design pressure and temperature, and with the contents at normal water level, the limiting stresses permitted by the applicable design standard shall not be exceeded.
- 1.17.3 Special consideration shall be given to boilers installed in elevated locations, or to components which, because of the size of the boiler, are installed at a significant height above ground level.
- 1.17.4 Boilers shall not be relocated in a seismic zone which has a higher seismic coefficient than the one for which they were approved without design verification of their suitability.

1.18 WATER TREATMENT

- 1.18.1 Boiler feedwater and boiler water shall be treated and maintained at least in accordance with BS 2486, or an appropriate equivalent document listed in Appendix A, and according to the boiler water treatment company's recommendations. Regular blowing down will not prevent scale formation if the feedwater is untreated and therefore external treatment plant and/or suitable conditioning chemicals shall be incorporated into the system. Regular blowdown, testing and monitoring of the feed and boiler water shall be carried out and the necessary records kept (clause 1.26).
- 1.18.2 With correct water treatment, and the application of correct monitoring procedures, the problems of scale formation and foaming should not arise.
- 1.18.3 Controllers who use acid cleaning methods to remove scale shall ensure that the operation is fully controlled by trained and experienced persons.

- 1.18.4 Controllers employing longer term chemical removal of scale shall open the boiler up at frequent intervals, as recommended by the boiler chemical company, to check on the condition of the boiler.

1.19 FEED PUMPS

- 1.19.1 All new boilers exceeding 1.2 MW power output (except coil boilers: see clause 6.3) shall be served by at least two feed pumps.
- 1.19.2 Where boilers are individually served by a dedicated set of feed pumps, except for certain large industrial plant where the industry practice dictates otherwise, the total feed pump capacity shall be not less than 240% of the amount of water required to generate steam at the output of the boiler calculated on the basis of feedwater at 100°C and with the boiler at design pressure.
- 1.19.3 Where the feed pumps supply more than one boiler, the system shall be such that under all combinations of feed water supply and steam demand, there shall be at least two feed pumps available for service, and the installed feed pump capacity shall be at least 120% of the maximum feed water demand from the combined boiler plant plus sufficient reserve feed pump capacity to cover any pump failure.
- 1.19.4 The feed pumps shall be capable of responding automatically to changes in feedwater demand.
- 1.19.5 Boilers fitted with a water circulation pump shall have an interlock to prevent firing if the water flow is not established and maintained.
- 1.19.6 Section 1.19 does not apply to once-through forced circulation coil boilers, neither does it apply to installations with outputs greater than 20 MW.

1.20 FEEDWATER SYSTEMS

- 1.20.1 All unattended and limited-attendance boilers shall be fitted with an automatic means of maintaining the feedwater flow within the limits specified by the boiler designer.
- 1.20.2 Boilers exceeding 3 MW capacity shall be fitted with continuous modulating feedwater systems.
- 1.20.3 Make up feed from mains water supply shall incorporate back flow prevention as required under the Building Act and local authority requirements.

1.21 ELECTRICAL EQUIPMENT AND SUPPLY

- 1.21.1 Electrical equipment and supply shall comply with the New Zealand Electricity Regulations and relevant codes of practice.
- 1.21.2 *Isolation* Every boiler shall have a main isolator or emergency stop switch adjacent to the normal boiler house access. This shall be clearly labelled. The main isolator or emergency stop switch shall be capable of both being locked in the open position, and closed only by manual means. Over 20 MW boilers may have an alternative arrangement.

- 1.21.3 The reset facility shall be located in the vicinity of the boiler, so that it may be easily verified that the situation that demanded the isolation of the boiler has been rectified, and the boiler is safe to start.
- 1.21.4 *Power Failure or Phase Failure* The boiler and combustion and control equipment shall be designed and constructed so that loss of electric power to the boiler management system at any time shall cause a shutdown to a safe condition. *A back-up power supply will meet the intent of this requirement.*
- 1.21.5 The combustion chamber, bed or grate system shall be designed and operated to minimise the stored energy in the system upon power failure.
- 1.21.6 Where a potential hazard may exist, e.g. where the combustion chamber is substantially refractory lined, a type test shall be performed by the manufacturer to the satisfaction of an equipment inspector to ensure that the boiler complies with these requirements.
- 1.21.7 Restarting on restoration of the mains supply is subject to the same requirements as normal start-up for oil and gas burners. Start-up for solid fuel burners will depend on the system installed. Interruption and subsequent restoration of the electricity supply shall not override any uncorrected fault condition which existed prior to the mains supply failure or interruption.
- 1.21.8 A number of problems have arisen where an incorrect grade of wiring has been installed in flexible conduit, which has been allowed to touch the boiler casing.
- 1.21.9 The manufacturer shall make sure that all cabling for the boiler management system is installed with due regard for temperature conditions. All wiring in situations where it could contact the boiler casing or be subjected to heat in normal operation shall have appropriate high-temperature insulation.

1.22 CONTROL COMPONENTS

- 1.22.1 Every component of the boiler control system shall operate reliably and safely within the temperature and humidity limits specified by the manufacturer. The lower temperature limit shall be 0°C or less and the higher temperature limit shall be at least 50°C.
- 1.22.2 Control components will be acceptable with a statement from the component manufacturer that they comply with a recognised applicable standard.
- 1.22.3 Boiler safety controls shall be contained in secure, tamper-proof, dust-proof and splash-proof cabinets. The designer shall ensure that component temperature limits will not be exceeded. These shall be sealed or locked, with the key in the charge of a responsible person in the organisation. Where the boiler controls are integrated with the process controls, alternative arrangements shall be made to meet the intent of this sub-clause.
- 1.22.4 Boiler safety controls shall be of a type approved by a design verifying body or a recognised classification society (see Appendix D).
- 1.22.5 Any modifications to the boiler or the boiler control system shall be authorised by the manufacturer or approved by an inspection body or authorised design verifier, and shall be clearly documented.

- 1.22.6 The independent means of indicating the water level shall directly indicate the level of the water in the boiler and shall not be attached to any external control chamber or alarm chamber.
- 1.22.7 Where necessary for the safe operation of the plant, power-operated valves shall move immediately to a safe condition on power failure, or when de-energised, or on failure of the actuating medium.
- 1.22.8 For internally mounted boiler controls, any failure of the system shall cause the burner to shut down and lock out.
- 1.22.9 The signals transmitted by electronic safety equipment need to be verified as falling between certain strength levels. Where signals fall outside these strength levels, the controls shall recognise a system failure rather than an operation failure, and take appropriate action.

1.23 FAULT ALARMS AND LOCKOUTS

- 1.23.1 The first low water safety cut out and alarm system may be incorporated into the automatic water level controller.
- 1.23.2 All faults affecting the safety of the plant shall initiate an audible and visual alarm.
- 1.23.3 In addition, all faults causing the risk of an unsafe condition shall also lock out the firing system.
- 1.23.4 Alarms shall be provided at points where they can be heard by persons who are able to take appropriate action. The presence of unrectified faults is to be clearly indicated at all times.
- 1.23.5 If arrangements are made to silence audible alarms, they are not to extinguish visual alarms. The muting of alarms shall be clearly indicated.
- 1.23.6 Alarms associated with the boiler and steam plant shall be clearly distinguishable from other alarms, and shall be clearly identified.
- 1.23.7 Where alarms are displayed as group alarms, provision is to be made to identify individual alarms at the main control station (if fitted) or alternatively at subsidiary control stations.
- 1.23.8 Acknowledgment of visual alarms is to be clearly indicated.
- 1.23.9 Acknowledgment of alarms at positions outside a boiler house or away from the boiler control position, shall neither silence the audible alarm nor extinguish the visual alarm in that boiler house or control position.
- 1.23.10 If an alarm has been acknowledged and a second fault occurs prior to the first being rectified, audible and visual alarms are again to operate.
- 1.23.11 For the detection of transient faults which are subsequently self-correcting, alarms are required to lock in until accepted.
- 1.23.12 The alarm system and all alarms shall be provided with test functions and are to be capable of being tested during normal boiler operation or start-up sequence.
- 1.23.13 The alarm system is to be designed as far as is practicable to function independently of control and safety systems such that a failure or malfunction

ARCHIVE

in these systems will not prevent the alarm from operating. Water level alarms shall not be connected to water level gauges, or alternative devices as in clause 1.13.1(e).

- 1.23.14 Any temporary disconnection or manual overriding of any part of the alarm system by the maintenance contractor shall be clearly indicated.
- 1.23.15 When alarm systems are provided with means to adjust their set point, the arrangements are to be such that the final settings can be readily identified (possibly by a tag) and, where possible, the settings sealed or locked.
- 1.23.16 For shell-type steam boilers, an alarm shall be provided to warn when the gas temperature at the tube entry to the first pass from the combustion chamber approaches the maximum temperature designated by the manufacturer. This alarm shall be set by the manufacturer to some limit below this maximum temperature.
- 1.23.17 Specific details of all major events causing the alarms to operate shall be recorded in the boiler room log book, except where they are automatically recorded by a continuous data recorder.
- 1.23.18 Remote alarms and paging systems may be used when desired, in addition to the above.

1.24 TESTING OF CONTROLS AND ALARMS

- 1.24.1 At no time during a test of the water level controls should the water be lowered to the extent that it disappears from the gauge glass.
- 1.24.2 Specific details relating to the testing of the controls and alarms shall be entered in the boiler room log book, except where they are recorded automatically by a continuous data recorder.

1.25 BOILER MANAGEMENT CONTROL SYSTEMS, INCLUDING PLC

- 1.25.1 Boiler management control systems, including those that are plc-based, should be designed according to the American National Standards, National Fire Protection Association Standards, or equivalent.
- 1.25.2 All boiler management control systems shall be automatically monitored in such a manner that any failure of any component or system failure of the monitoring device shall immediately initiate a complete shut down of the boiler.
- 1.25.3 All critical safety cutouts which ensure the safety of the boiler shall be either:
 - (a) Directly hard-wired and shall not rely on the integrity of a plc or pc-based control system for their operation; or
 - (b) Controlled by a purpose-built electronic processor system which is suitable for the operating conditions and is properly engineered to ensure reliable and safe operation. The design of this system shall be verified as being suitable for the purpose, and it shall be proved under test, by a third party.

ARCHIVE

NOTE: The use of a “two out of three” system of triple redundancy specifically designed to provide a high level of operational integrity and reliability is acceptable and not excluded by (b) above.

- 1.25.4 The boiler management control system, including plc, shall only be adjusted by persons authorised to do so by the boiler manufacturer.
- 1.25.5 Purpose-built electronic controllers such as burner sequence controllers may be used provided they have the appropriate type approvals.

1.26 DOCUMENTS AND MARKING

1.26.1 INSTRUCTIONS

Operating instructions, including circuit diagrams for the boiler and ancillary steam plant, shall be developed from the manufacturer’s recommendations and kept available in the boiler house or at the control position.

1.26.2 OPERATION LOG BOOKS, ETC.

A continuous record shall be kept of the boiler operating conditions. This shall include alarm calls, breakdowns, routine maintenance and testing, boiler water and feedwater testing and treatment and records of the gas temperature checks in the combustion chamber required in 1.11.3. This record shall be signed by the operator or responsible person at the change of every working period, and it shall be made available for audit as required.

1.26.3 MAINTENANCE RECORDS

Full records shall be kept of all maintenance and repairs carried out on the boiler and the associated fittings, controls, alarms and pipework. The person responsible for the maintenance shall identify themselves on the record, and these records shall be made available for audit as required.

1.26.4 ALTERATIONS AND ADDITIONS

All changes to the boiler structure, the boiler management system and associated equipment or hot water boiler, shall be fully documented with drawings and all relevant data. No changes shall be made to the boiler or the boiler management system without the consent and backing of the boiler manufacturer and/or the equipment inspector.

1.26.5 RETENTION OF RECORDS

Records are to be maintained in good and readable condition. Operation records shall be retained for a period of two years. Maintenance records of major or annual overhauls or of major repairs, and records of alterations and

ARCHIVE

additions, shall be retained for the life of the boiler. Routine defect maintenance records shall be retained for five years.

1.26.6 MARKING

- 1.26.6.1 Each boiler and separate type of plant shall be permanently and legibly marked to show its identity and origin, in the manner required by BS 1113 or BS 2790 or the approved design standard. (Appendix A.)
- 1.26.6.2 In addition to this, the attendance category and the period of operational supervision according to the table in this code of practice shall be displayed prominently adjacent to the boiler.

1.27 OBLIGATIONS OF CONTROLLERS

- 1.27.1 Every controller commencing or setting up or recommencing a business or process which involves the use of a boiler shall notify the authority in writing of their proposals prior to the commencement.
- 1.27.2 Every controller shall ensure that their equipment is supervised by appropriately qualified or trained persons at all times that the boiler plant is operating.
- 1.27.3 Every controller shall ensure that all persons are adequately protected from potential danger arising from sources of heat, noise and harmful substances or gases. Boiler gauge glasses shall be adequately guarded.
- 1.27.4 Every controller shall ensure that appropriate records (clause 1.26) are kept.
- 1.27.5 Every controller who allows the pressure in a boiler to be increased above the safe working pressure commits an offence and is liable to prosecution.
- 1.27.6 Every controller shall at all reasonable times furnish the means for an entry, inspection, examination and inquiry or the exercise of any other power prescribed by legislation required by: any member of the authority, or any person specifically delegated by the authority, or an equipment inspector, acting on the instruction of the authority or performing duties in connection with the Certificates of Inspection.
- 1.27.7 Every controller shall provide good access to the boiler and its fittings and devices, such as are necessary for the safe operation and maintenance of the boiler.

1.28 MAINTENANCE

- 1.28.1 The controller shall set in place procedures which ensure that maintenance is carried out as necessary. These procedures should include the boiler manufacturer's recommendations and shall ensure that the boiler remains in good and safe condition at all times.

ARCHIVE

1.28.2 PERIODIC MAINTENANCE TO THE BOILER VALVES, GAUGE GLASSES, FITTINGS, ETC.

- 1.28.2.1 Maintenance of these items shall be carried out by an appropriately trained and experienced person.
- 1.28.2.2 Coupled boilers shall be effectively isolated before any persons enter them for inspection or maintenance.

1.28.4 MAINTENANCE OF THE STEAM BOILER MANAGEMENT SYSTEM

- 1.28.4.1 Maintenance of the boiler management system of limited-attendance and unattended boilers shall be carried out by a maintenance contractor, who meets the requirements of the manufacturer and/or the controller, and who has in place a quality management system to AS/NZS 9001 or AS/NZS 9002, for the maintenance of boiler controls and management systems, including combustion systems.
- 1.28.4.2 Where the controller's maintenance activities are certified to AS/NZS 9001 or 9002, and this covers the maintenance of the boiler management control systems, they are permitted to carry out this maintenance themselves, or the maintenance contractor may work under the owner's quality management system.

1.28.6 MAINTENANCE SYSTEM

- 1.28.6.1 For limited-attendance and unattended boilers operated under a quality management system, this system shall embrace all aspects of maintenance, including outside contractors, maintenance records and the treatment of the boiler feedwater and boiler water. This maintenance system shall be certified to AS/NZS 9001 or AS/NZS 9002.
- 1.28.6.2 For limited-attendance and unattended boilers not operated under a quality management system, the equipment inspector shall verify the maintenance records and the boiler water and feedwater records of the controller.
- 1.28.6.3 For all other boilers, the equipment inspector shall verify the maintenance records.

1.29 SECURITY AND PROTECTION

- 1.29.1 Boilers shall be installed in such a manner as to ensure that the boiler, its fittings, controls and ancillary equipment cannot be tampered with by unauthorised persons.
- 1.29.2 Adequate protection shall be provided against the weather and the ingress of moisture and dust.

1.30 QUALITY MANAGEMENT SYSTEM FOR BOILERS

- 1.30.1 Unattended and limited-attendance boilers shall be operated within a quality management system, except as provided for in 1.30.2
- 1.30.2 For new installations, a period of time not exceeding one year will be allowed during which the unattended or limited-attendance boiler may be operated while the quality management system is being established.
- 1.30.3 Unattended and limited-attendance steam installations with one or more coupled boilers with a combined rating larger than 6 MW will require the boiler quality management system to be certified.
- 1.30.4 Unattended and limited-attendance steam installations with one or more coupled boilers with combined rating smaller than or equal to 6 MW will require either:
 - (a) A documented boiler operation and maintenance quality system approved and audited annually by an inspection body; or
 - (b) A boiler quality management system, audited and certified to AS/NZS 9001 or 9002 by a certification body.
- 1.30.5 The equipment inspector will verify the maintenance records of all other boilers.
- 1.30.6 It is recommended that the larger attended boiler installations should be operated within a documented and certified AS/NZS 9002 or 9001 Quality Management System.

1.31 SYSTEM AUDITING/MONITORING

- 1.31.1 Adequate provision shall be made for the regular and frequent monitoring of the boiler quality management system or the boiler operating and maintenance system.
- 1.31.2 Internal and external audits of the boiler operating and maintenance system shall be carried out at regular intervals (at least twice-yearly) by persons with a technical background trained in auditing procedures and not directly involved with the routine operation of that boiler.
- 1.31.3 The authority will carry out their own audits of boiler operating and maintenance systems, in addition to the above requirements.

1.32 METHOD OF APPLICATION FOR LIMITED-ATTENDANCE AND UNATTENDED BOILERS

- 1.32.1 Within the jurisdiction of the Boilers, Lifts and Cranes Act 1950*, it is proposed that for boilers that meet the requirements specified for limited-attendance boilers, and for unattended boilers, an exemption be issued by the authority under the provisions of section 37(3) of the Act.

* The Boilers, Lifts and Cranes Act 1950, sections 3, 4, 10-35, 54, 56, 59 and 60 were repealed by the Health and Safety in Employment Act 1992. Sections 1, 2, 5-9, 36-53, 55, 57 and 58 remain effective at the time of publication.

CRITERIA FOR TYPE, CAPACITY AND ASSOCIATED SUPERVISION AND MAINTENANCE FOR UNATTENDED, LIMITED-ATTENDANCE AND UNATTENDED BOILERS

Attendance category	Boiler types	Capacity ¹	Notes	Operational supervision		Maintenance		
				By	When	How	By	When
ATTENDED OPERATION	All types	<= 20 MW		Qualified operator	Continuously ²	Normal boiler checks & logging of results	A responsible and experienced person	Manufacturer's recommendations but at least every 3 months
		> 20 MW	Special conditions apply for manning, controls and alarms	Qualified operator	Continuously ²	Normal boiler checks and logging of results	A responsible and experienced person	Manufacturer's recommendations but at least every 3 months
LIMITED ATTENDANCE OPERATION	(a) Water-tube steam boilers and hot water boilers with a steam space.	> 6 MW <= 20 MW	Formal ISO 9000 series standards Quality Management System to apply	Qualified operator	4-hour intervals max.	Normal boiler checks and logging of results	Approved maintenance contractor as per this guidance note	Manufacturer's recommendations but at least every 3 months
	(b) All types	<= 6 MW <i>max pressure 17 bar</i>	Quality Management System to apply (see clause 27) or operation and maintenance system	Qualified operator	8-hour intervals max	Normal boiler checks and logging of results	Approved maintenance contractor as per this guidance note	Manufacturer's recommendations but at least every 3 months
UNDER 15 HP BOILERS	(c) Shell boilers: i) Not suitable for upgrading (Cl. 1.2, 1.7.)	<= 14.9 hp (1.2MW)	Only run under existing conditions. Not suitable for upgrading to limited attendance or unattended operation	Responsible person	2-hour intervals max.	Normal boiler checks & logging results	A responsible and experienced person	Manufacturer's recommendations but at least every three months
		<=14.9hp	May be upgraded to limited attendance or unattended operation	Responsible person	Intervals as authorised following upgrade	Normal boiler checks and logging results	Approved maintenance contractor as per this guidance note	Manufacturer's recommendations but at least every three months
ONCE THROUGH FORCED CIRCULATION COIL BOILERS	Existing	<= 14.9 hp (1.2MW)	Full compliance with this code of practice	Responsible person	Continuously ²	Normal boiler checks and logging results	Approved maintenance contractor	Manufacturer's recommendations
	New	< = 3 MW	Full compliance with this code of practice	Responsible person				
	Existing & New	All other coil boilers	Full compliance with this code of practice	Qualified operator				

Attendance category	Boiler types	Capacity ¹	Notes	Operational supervision			Maintenance	
				By	When	How	By	When
UNATTENDED OPERATION	(a) Water-tube steam boilers and all types of hot water boilers with a steam space (excluding electric element)	<= 10 MW	An ISO 9002 series Quality Management System to apply	Responsible person	24-hourly intervals max.	Normal boiler checks and either logging results every 24 hrs or data logger printout.	Approved maintenance contractor as per this guidance note	Manufacturer's recommendations but at least every 3 months
	(b) Shell boilers	<= 6 MW <i>max pressure 17 bar</i>	Quality Management System to apply (see clause 30) or operation and maintenance system	Responsible person				
	(c)(i) Electrode or electric element (element fails on low water)	No limit		Responsible person	7 days max		Approved maintenance contractor as per this guidance note	
	(ii) Electric element (element may not fail on low water)	<= 250 kW >250kW <=6MW						
SMALL LOW-HAZARD BOILERS	P max 7 bar V max 1000 litres	<350 kW	Special considerations apply for controls and instruments	Responsible person				Manufacturer's recommendations but at least every 3 months
PRESSURISED HOT WATER BOILERS	Fully flooded hot water boilers	No upper limit Output exceeding 100°C and 250kW		Responsible person	As appropriate	Normal boiler checks and logging of results experienced person		
UNFIRED WASTE HEAT BOILERS	Water tube or shell	No limit	Controls as per this code	Responsible person	4-hourly	Normal boiler checks and logging of results experienced person	Approved maintenance contractor	Manufacturer's recommendations

- Capacity denotes maximum power output that can be derived from the boiler.
- Not necessarily continuous but sufficiently frequent to ensure that the attendant will observe and take action in as short a time as possible on any malfunction or change in conditions that may occur.

ARCHIVE

- 1.32.2 When the Boilers, Lifts and Cranes Act 1950 is repealed and is replaced by regulations made under the provisions of the Health and Safety in Employment Act, authority to operate limited-attendance and unattended boilers will be given by the authority on proof of compliance with these requirements (see Appendix C).
- 1.32.3 In the event of this proof not being available at that time, an interim authority may be given by the authority.

PART 2: ATTENDED BOILERS

2.1 BOILERS WITH OUTPUT GREATER THAN 20 MW

- 2.1.1 Boilers with output greater than 20MW shall comply with this part. More than one operator may be required and special testing provisions may be necessary.
- 2.1.2 For large boilers and special-purpose boilers, the control panel may be remote from the boiler. A qualified operator shall be in attendance at the control panel and may control more than one boiler or other plant at the same time, provided such operating can be safely done. The controller shall determine the boiler(s) and other plant which a qualified operator can safely control. The controller shall also determine any further staffing requirements to assist that qualified operator.
- 2.1.3 Safe manning levels shall be verified by the equipment inspector or be documented within the owner's AS/NZS 9002 certified quality management system. Special cases may be referred to the Authority.
- 2.1.4 Where the boiler is part of an integrated process, the requirements of that process can be used to determine the design philosophy of the boiler auxiliaries, ancillary equipment and use of specialised fittings. The design philosophy shall include the design codes and guidelines to which the process equipment and its controls shall be built. This design philosophy shall be approved by the Authority.
- 2.1.5 Operating, testing, inspection, repairs, maintenance and minor modifications shall be either:
- (a) As specified in the certified AS/NZS 9002 quality management system for the plant; or
 - (b) As in a plan approved by an inspection body.
- Major modifications shall be subject to design verification.
The remainder of Part 2 does not necessarily apply.

2.2 ATTENDED BOILERS WITH OUTPUTS NOT EXCEEDING 20 MW

- 2.2.1 Attended boilers with outputs not exceeding 20 MW shall comply with the following sections of Part 2.
- 2.2.2 Existing attended boilers that have a level of control equipment less than that required in clauses 2.3 and 2.4 may continue to be operated by a qualified operator in the immediate vicinity of the boiler at all times.

2.3 CONTROLS AND MOUNTINGS

In addition to the safety valves, water level gauges, pressure gauges, blowdown valve(s), and combustion chamber thermal alarm required in Part 1, attended boilers shall have at least the following controls and mountings, which shall comply with BS 759, or, for boilers designed to other approved codes (Appendix A), according to the rules of those codes:

- (a) Two low-water cutouts and alarms (with the second low-water alarm mounted internally to the boiler);
- (b) Automatic feedwater control;
- (c) One safety valve on outlet side of superheater;

NOTE: The first low-level alarm sounder may be combined with other alarms, but the second low-level alarm sounder must be independent and unique to the second low-level alarm.

2.4 LOW-WATER CUT OUTS AND ALARMS

- 2.4.1 Two independent low-water cut outs and alarms shall be fitted to the drum or shell. On a low-water level condition, the heat source shall be cut off and an audible and visible alarm initiated. Both cut outs shall be of the lockout type requiring manual resetting. This does not apply to once-through coil boilers where a steam drum is not fitted.
- 2.4.2 Both the first and second low-water cut outs and alarms shall be set to actuate while the water level is still visible in the water level gauges.
- 2.4.3 Where equipment is available (generally below 30 bar operating pressure), at least one of the low-water cut outs and alarms shall be internally mounted. For high-pressure boiler plant where internal controls are not available, isolation equipment and procedures shall be in place to ensure that operation of the boiler cannot occur with the cut out isolated.

2.5 FEEDWATER CONTROL

- 2.5.1 Automatic water level controls shall be so arranged that they positively control the boiler feed pumps or regulate the water supply to the boilers and effectively maintain the level of water in the boiler between certain predetermined limits set by the boiler manufacturer.
- 2.5.2 Water level controls and the first low-water alarm and cut out may be combined and housed in the same external chamber or internal protection tube.
- 2.5.3 Modulating water level controls are required for boilers of 3 MW output and above.
- 2.5.4 The second low-water alarm and fuel cut out shall be unable to be isolated and shall be housed in an internal protection tube. A test function may be provided.

2.6 OPERATIONAL SUPERVISION

An attended boiler shall be attended by a suitably qualified operator at all times that it is being operated. For attended boilers that comply in full with these requirements, the qualified operator need not supervise the boiler continuously but should always be in a position to respond immediately to any alarms, with not more than 50 m to travel to the boiler, or the boiler control position, and shall only be employed on tasks that can be ceased immediately.

The owner shall ensure that there are no aspects of the operators' duties that would impede their supervision of the boiler at critical times and that the safety of the boiler is not compromised.

2.6.1 SUPERVISION AT START-UP SEQUENCES

Where an attended boiler is started up, a qualified operator shall be present at start-up and remain with the boiler until it is up to pressure and they are satisfied that it is operating correctly. Complete and detailed start-up procedures developed by the controller from the boiler manufacturer's recommendations shall be provided to the operator.

2.6.2 SUPERVISION AT SHUTDOWN SEQUENCES

When an attended boiler is shut down, a qualified operator shall be present at shutdown and remain with the boiler until satisfied that it has been shut down correctly.

2.7 DAILY TESTS

2.7.1 Routine operation tests and observations shall be carried out on at least a daily basis, by a qualified boiler operator, as laid down in and developed from the boiler manufacturer's recommendations and/or company operating procedures.

2.7.2 Tests and observations include the following and any other tests considered necessary by the manufacturer:

(a) *Water level control*

Observe, and test where appropriate by blowing through the gauge glass, that the water level is being maintained between the proper upper and lower levels.

For modulating feedwater controls, the water level should be maintained without feed valve oscillations (hunting).

(b) *Low-level alarms and cut out*

A functional test shall be carried out for each alarm and cut out to ensure that on a low-level condition, the heat source is cut off and audible and visible alarms are initiated.

ARCHIVE

Internal alarms and cut outs shall be tested, either by a self-checking function on float switches, or for probe-type controls or float switches without self-checking functions, by lowering the water level.

NOTE: In situations where tripping the boiler on a daily basis is impractical, e.g. in a continuous operating plant, then alternative tests may be carried out on a daily basis, to prove the effectiveness of the low-level trip, with the functional tests being carried out at appropriate regular intervals.

PART 3: LIMITED-ATTENDANCE BOILERS

Limited-attendance boilers shall be operated and maintained within a Certified AS/NZS 9001 or 9002 Quality Management System (see clause 1.30).

3.1 CONTROLS AND MOUNTINGS

3.1.1 In addition to the safety valves, water level gauges, pressure gauges, blowdown valve(s) and combustion chamber thermal alarm required in Part 1, limited-attendance boilers shall have at least the following control mountings, which shall comply with BS 759:

- (a) First low-water cut out and alarm.
- (b) Second, independent low-water fuel cut out and alarm, internally mounted, self-checking, of special design.
- (c) Feedwater control, modulated on boilers over 3 MW.
- (d) Feedwater availability indicator and alarm.
- (e) Feedwater low-pressure alarm, or no flow alarm.
- (f) Combustion chamber thermal cut out.
- (g) Superheater and reheater temperature controls and alarms (for boilers with superheaters or reheaters).
- (h) Flame detector(s) to supervise both pilot and main flames (for every burner where necessary in multi-burner furnaces).

Where there is a risk of condensate contamination by oil or grease:

- (i) Condensate oil and turbidity detector and alarm, and condensate diversion system.

Where there is the risk of hardness penetration into condensate returns, or feedwater streams (e.g. by water softening plant unsupervised for depletion):

- (j) Feedwater monitoring alarm (e.g. conductivity) and diversion.

Where there is a risk to high-velocity steam lines or damage to equipment such as turbines may occur:

- (k) A high-level control to prevent overfilling of the boiler.

NOTE: In (a) above, the first low-water alarm and cut out may be self-monitoring, of special design. In this case, the test period in 3.14.3 may be extended to one month.

3.2 FIRST LOW-WATER CUT OUT AND ALARM

- 3.2.1 On a low-water level condition (clause 1.13), the heat source shall be cut off and an audible and visible alarm initiated. The cut out shall require manual resetting.
- 3.2.2 The first low-level alarm may be combined with other alarm sounders.
- 3.2.3 Where alarms or cut outs are housed in external chambers they shall be:
 - (a) Fitted with sequencing blowdown valves; and
 - (b) Not be fitted with isolating valves; or
 - (c) If isolating valves are required to be fitted, they shall be interlocked with the boiler controls to shut the boiler down if the valves are closed.
- 3.2.4 The low-water cut out device shall comply with clause 1.21.

3.3 SECOND LOW-WATER CUT OUT AND ALARM

- 3.3.1 Limited-attendance boilers shall be fitted with an independent second water level cut out and alarm. Independent means there shall be complete mechanical and electrical separation between this and the first cut out. This device shall be of special design and comply with clause 1.21. Special design means that tests of the electrical and mechanical parts of the devices are automatically and regularly performed.
- 3.3.2 The second automatic self-checking device shall be internally mounted, fail-safe and not able to be isolated.
- 3.3.3 The second low-level alarm sounder must be independent and unique to the second low-level alarm.
- 3.3.4 The independent second low-water cut out shall cut off the fuel supply to the boiler or air to solid fuel fired boilers and cause an audible alarm to sound when the water level in the boiler falls to a predetermined low-low water level below that in 3.2. The control or its electrical circuit shall be so arranged that it has to be reset manually before the boiler can be brought back into operation.

NOTE: In certain circumstances, it may also be desirable to cut off the fuel supply to solid-fuel-firing equipment. The general requirement is to dissipate the heat from the fuel bed quickly and the means by which this is achieved will vary according to the firing and combustion equipment, e.g. chain grate stoker, fluid bed, etc. Manufacturer's advice shall be followed. The control should cut off the FD air supply to the boiler, not the ID air flow.

3.3.5 FLOAT-TYPE DEVICE

- 3.3.5.1 Float-type low-level devices shall incorporate a functional test facility. This may be of the electromagnetic coil type, or of the cup type. They shall self-

ARCHIVE

check automatically at intervals not exceeding the time taken for the boiler water level to fall from normal to 100 mm below normal, when the boiler is steaming at maximum output and no feedwater is being supplied.

- 3.3.5.2 The heat source cut out interruption during this test shall not exceed 300 seconds. The heat source shall be locked out if:
- (a) The water level control fails the test; or
 - (b) The test sequence fails; or
 - (c) The test interval is exceeded; or
 - (d) The cut out interruption period specified is exceeded.

The result of each functional test shall be clearly recognisable to the qualified operator, e.g. by light signals.

3.3.6 PROBE-TYPE DEVICE

- 3.3.6.1 Probe-type devices shall be of high-integrity design, incorporating double circuits and automatic insulation-resistance testing. Insulation-resistance testing shall be carried out at intervals not exceeding 150 seconds.
- 3.3.6.2 The heat source shall be locked out if:
- (a) One or both of the circuits indicates low level;
 - (b) The insulation test fails.

3.4 FEEDWATER CONTROL

- 3.4.1 Automatic water level controls shall be so arranged that they positively control the boiler feed pumps or regulate the water supply to the boilers and effectively maintain the level of water in the boiler between certain predetermined limits set by the boiler manufacturer.
- 3.4.2 Water level controls and the first low-water alarm and cut out may be combined and housed in the same external chamber or internal protection tube.
- 3.4.3 Modulating water level controls are required for boilers of 3 MW output and above.

3.5 FEEDWATER AVAILABILITY

The control system shall incorporate equipment to lock out the heat source and raise a visible and audible alarm in the event of feedwater not being available. This would normally be in the form of a low-level device in the feed tank or deaerator.

3.6 FEEDWATER LOW-PRESSURE ALARM

The feedwater pump outlet shall incorporate a low-pressure or low-flow

lockout and alarm to lock out the heat source in the event of a feedpump fault. For boilers that do not incorporate modulating feedwater control, the lockout may be interlocked with the feed pump. The pressure switch must incorporate fail-safe circuitry, i.e. when the pump is not running, the pressure switch action must be proved.

3.7 FORCED CIRCULATION

Where forced circulation is required to maintain a thermal balance in the boiler, two additional reliable safety devices shall be provided to automatically cut off the heat supply if the flow rate is reduced to a value below the allowable limit.

3.8 COMBUSTION CONTROLS

- 3.8.1 Automatic firing controls, in addition to maintaining combustion products within specified limits, shall be so arranged that they effectively control the supply of fuel to the boilers, or air to solid-fuel-fired boilers, and effectively shut off the supply in the event of any one or more of the following circumstances:
- (a) Flame/pilot flame failure on oil or gas fired boilers.
 - (b) Failure to ignite the fuel on oil or gas fired boilers within a predetermined time.
 - (c) When a predetermined high pressure at or below the safety valve set pressure is reached.
 - (d) When the water level falls to a predetermined point below the normal operating level. When the water level is restored the burner may be automatically refired.
 - (e) Failure of forced or induced draught fans, or any automatic flue damper, when these are provided.
 - (f) When the combustion chamber thermal cut out is activated (shell boilers only).
 - (g) When the water level falls to a predetermined point below that in (d) above. When the water level is restored, the cut out must be manually reset.

NOTE: In the case of (a), (b), (e) and (g), these controls shall be of the lockout type requiring manual resetting. In the case of (d), this control shall cut off the fuel/air supply and cause an audible alarm to sound.

- 3.8.2 Continuous self-checking flame scanners shall be fitted to gas-fired boilers in excess of 2 MW to prevent injury through fire side explosions.
- 3.8.3 In the event of a flame, pilot flame or ignition failure, the control system shall proceed to the lockout condition.

3.9 COMBUSTION CHAMBER THERMAL CUT OUT

For shell boilers, a thermal cut out shall be provided in the back end combustion chamber and shall be set to operate at a temperature below the design temperature nominated by the boiler manufacturer. The maintenance contractor shall establish that the cut out operates below the design temperature as measured by a multishield high-velocity pyrometer. The position(s) of the thermal sensor(s) shall be specified by the boiler manufacturer and shall not be altered.

NOTE: Bare combustion chamber thermocouples often register a substantially lower temperature than the true gas temperature.

3.10 FEED PUMPS/SAFEGUARDING AGAINST UNACCEPTABLE EVAPORATION IN SOLID FUEL BOILER INSTALLATIONS

- 3.10.1 In the event of a cut out of the feedwater or boiler management system, provision shall be made to ensure that the water contained in the boiler is not evaporated to the extent that it disappears from the gauge glass. Excessive heat shall be dissipated from the boiler to eliminate this danger.
- 3.10.2 For boilers containing sufficient water reserves, on cut out of the firing system from steady maximum-design, full-load operation with the water level at the “pump-on” level (lowest controlled water level), the flue gas temperature at the highest point of the heating surface shall be reduced to below 400°C before the water level has sunk to 50 mm above the highest point of the heating surface. The water level at this position shall be visible in the gauge glass.
- 3.10.3 For boilers not containing sufficient water reserves, two independently driven and controlled feed pumps shall be provided. At least one of these must be capable of starting automatically and functioning independently in the event of a complete power failure. This requirement may be fulfilled in boilerhouses provided with an automatic standby generator if this generator is of sufficient capacity to meet the requirements of the feedwater pumps plus any other connected load.

The following conditions shall be fulfilled:

- (a) Both feed pumps shall be provided with independent control devices.
 - (b) Sufficient water reserves shall always be available for safe start up operation, with the water level being monitored by a water level limiter of special design.
 - (c) In the event of failure of an operating pump, the standby pump shall start automatically, and a feed pump failure alarm shall be raised.
 - (d) A feed pump alarm shall remain displayed until the associated fault has been rectified.
- 3.10.4 At commissioning, functional tests shall be made to prove:
- (a) The boiler’s ability to comply with 3.11.2 at full steam extraction and cut off feed-in; or

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- (b) The boiler's ability to comply with 3.11.3 at full steam extraction and with the water at the lowest attainable level in the feedwater tank.

3.11 ALARMS

In addition to the requirements in clause 1.23, the following conditions apply:

- 3.11.1 For all limited-attendance boilers, an emergency device which will shut off the heat source shall be located remote from the boiler house and shall be clearly marked.
- 3.11.2 The alarm system shall be designed with self-monitoring properties. In so far as is practical, any fault in the alarm system shall cause it to fail to the system fault alarm.
- 3.11.3 Depending on circumstances, a suitable connection may be allowed to a dialling system and pagers.

3.12 VISUAL DISPLAY

A visual display shall be provided to indicate the status of all the critical operating and safety devices at all stages of operation and to identify the alarm condition. This display shall indicate power-on, the initiation of the start-up sequence and which of alternate components, e.g. pumps, are operating. Other conditions to be displayed are as in AS 2593.

3.13 OPERATIONAL SUPERVISION

- 3.13.1 A limited-attendance boiler shall have a suitably qualified operator available on site and in the near vicinity at all times that it is being operated.
- 3.13.2 Limited-attendance boilers not operated under a certified AS/NZS 9000 series quality management system may be operated under a management system audited by an inspection body for a maximum of one year, after which time they shall have achieved AS/NZS 9002 or 9001 certification, for operation and maintenance.
- 3.13.3 Where there is a situation where the AS/NZS 9000 series quality management system is not yet fully in place, or it has lapsed, then the limited-attendance boiler which should have been covered by this system shall be operated on a one-hourly check basis.

3.13.4 SUPERVISION AT START-UP SEQUENCES

- 3.13.4.1 Where a limited-attendance boiler is started up manually or automatically, a qualified operator shall be present at start-up and remain with the boiler until it is up to pressure and that operator is satisfied that it is operating correctly.
- 3.13.4.2 Complete and detailed start-up procedures as recommended by the boiler manufacturer shall be provided to the operator and be available in the boilerhouse.

ARCHIVE

NOTE: The controls shall be subjected to the daily operating test shortly after start-up but when operating conditions have stabilised and before the qualified operator leaves the immediate vicinity of the boiler.

3.13.5 SUPERVISION AT SHUT-DOWN SEQUENCES

- 3.13.5.1 Where a limited-attendance boiler is shut down manually or automatically a qualified operator shall be present at shut down and remain with the boiler until satisfied that it is shut down correctly.
- 3.13.5.2 In the event of failure of the automatic controls, and where the boiler is capable of being brought under manual control safely, operation under manual control shall be in accordance with a clearly defined operating procedure that shall include the immediate presence of an appropriately qualified operator. Continuous manual supervision shall be provided until the fault in the controls has been rectified and a suitable period of time has elapsed to ensure by testing that the boiler and its controls are operating normally.
- 3.13.5.3 Whenever a limited-attendance boiler is transferred to “attended operation”, the reasons and time shall be recorded by data logger or by an entry in the boiler room log book, which shall be signed by the “Qualified Operator”.

3.14 TESTING OF CUT OUTS AND ALARMS

- 3.14.1 Routine operation tests and observations shall be carried out periodically by a qualified operator as laid down in and developed from the boiler manufacturer’s instructions or the company operating procedures. The boiler shall remain attended at all times during tests.

3.14.2 WATER LEVEL CONTROL

- 3.14.2.1 Observe and test where appropriate, by blowing through the gauge glass, that the water level is being maintained between the proper upper and lower levels.
- 3.15.2.2 For modulating feedwater controls, the water level should be maintained without feed valve oscillations (hunting).

3.14.3 LOW-LEVEL ALARMS AND CUT OUT

- 3.14.3.1 At least weekly, a functional test shall be carried out for every alarm and cut out to ensure that on a low-level condition the heat source is cut off, and audible and visible alarms are initiated.
- 3.14.3.2 In installations where the first low-water alarm and cut out is self-monitoring, of special design, this test period in 3.14.3.1 may be extended to one month.
- 3.14.3.3 A functional test shall consist of lowering the water level in the boiler and verifying that the heat source is cut off, and the audible and visual alarms are initiated.

- 3.14.3.4 It may be necessary to disable the first cut out and alarm to verify the full function of the second cut out and alarm. The first alarm shall only be disabled by active means, i.e. the operator shall hold a push-button depressed. There shall be no possibility of permanent disablement.
- 3.14.3.5 At no time during a test of the water level controls shall the water be lowered to the extent that it disappears from the gauge glass.
- 3.14.3.6 The automatic start and operation of the independently driven standby feed pump, on failure of the duty feed pump, shall be included in the functional testing programme of clause 3.14.3.1.

3.15 PERIODIC TESTS

The approved maintenance contractor shall carry out a functional test of all alarm and lockout safety systems at regular intervals (recommend quarterly). The results of these tests shall be recorded. Where set points are disturbed in order to carry out such tests, then the maintenance contractor shall record and verify on the report that the set point has been reset correctly. At least once per year, safety controls which require setpoint adjustment to test shall be fully tested for the complete physical operation of the device.

3.16 WATER TREATMENT

In addition to normal in-house boiler water testing for limited-attendance boilers, the boiler water shall be analysed at monthly intervals by a laboratory that is accredited by TELARC for the testing of boiler water and boiler feedwater, or an AS/NZS 9001/9002 certified laboratory specifically approved for testing boiler water and feedwater.

3.17 MAINTENANCE OF THE BOILER MANAGEMENT AND SAFETY SYSTEMS

- 3.17.1 Maintenance of the boiler management and safety systems shall be carried out by a maintenance contractor who is nominated by the controller, acceptable to the boiler manufacturer and who is certificated to AS/NZS 9002 for the maintenance of boiler management systems.
- 3.17.2 Controllers who are certified to AS/NZS 9002 for the maintenance of boiler management systems may nominate themselves to conduct their own maintenance of the boiler management and safety system provided:
 - (a) The boiler manufacturer is satisfied that the persons doing the maintenance are suitably qualified and have had adequate training; and
 - (b) All the necessary information, drawings and details are held on site and all processes and procedures are detailed within the quality management system.

PART 4: UNDER 15 HP BOILERS

4.1 GENERAL

- 4.1.1 Under 15 hp boilers are not required to be operated by a qualified boiler operator; however, they are not classified as unattended boilers.
- 4.1.2 In terms of power output, this class of boiler is seen as being under 1.2 MW and/or having a steam output from and at 100°C not exceeding 1814 kg of steam per hour.
- 4.1.3 All new boilers in this category shall comply in full with the requirements relating to clauses 4.2 and 4.3, limited-attendance boilers or unattended boilers as specified in this code of practice.
- 4.1.4 Under 15 hp boilers may be upgraded to limited-attendance or unattended boilers provided they meet the requirements of this code of practice.
- 4.1.5 Boilers that are not upgraded need to be fitted with the minimum controls and mountings specified in clause 4.2 and are required to be checked every two hours by a responsible person.
- 4.1.6 New boilers may be built to unattended or limited attendance operation, or if fitted with controls and mountings required in clause 4.2 will be required to be checked every 2 hours.
- 4.1.7 Boilers which comply with clause 4.2 will need to be operated by a qualified operator where two or more are coupled together.

4.2 CONTROLS AND MOUNTINGS

In addition to the safety valves, water level gauges, pressure gauges, blowdown valve(s) and combustion chamber thermal alarm required in Part 1, under 15 hp boilers shall have at least the following control mountings, which shall comply with BS 759:

- (a) Two independent low water alarms and cut outs;
- (b) On-off feedwater control.

4.3 OPERATIONAL SUPERVISION

- 4.3.1 An under 15 hp boiler shall have a responsible person available at all times that it is being operated. That person should be within hearing distance of the boiler alarms and employed on a task that can be ceased immediately.

- 4.3.2 Direct observations of the boiler running conditions shall be made by the responsible person at intervals not exceeding 2 hours.

4.4 UNDER 15 HP BOILERS BUILT TO STANDARDS OTHER THAN BS 2790:1982, OR EARLIER EDITIONS OF THAT STANDARD

Numerically, the majority of boilers in New Zealand fit in this category. Existing under 15 hp boilers may continue to be operated under their present supervision conditions, as long as they remain in good enough condition to be issued with a certificate of inspection.

These boilers may not be suitable for upgrading to limited-attendance or unattended operation (see clause 1.8).

4.5 UNDER 15 HP BOILERS DESIGNED AND BUILT TO BS 2790:1982, OR TO LATER EDITIONS OF THAT STANDARD

Existing boilers in this category may be suitable for upgrading to limited-attendance or unattended operation, provided that they have been maintained in good condition.

4.6 COUPLED BOILERS

When two or more boilers which are not classed as limited-attendance or unattended boilers are connected to a common steam main and their aggregate horsepower exceeds 15, or their combined output exceeds 1814 kg of steam per hour from and at 100°C, they shall comply with all attendance requirements applying to “attended boilers” and shall be attended by a qualified operator or responsible person, according to the table.

4.7 EXISTING BOILERS

Boilers which are damaged or which have the pressure parts structurally modified, shall have the water level controls, alarms and fuel cut outs upgraded to the “limited-attendance” specifications. Upgrade work shall include all relevant aspects of the original design standard, including stress relieving where necessary. Small, isolated upstands welded into the shell according to the design standard need not be stress relieved (see also clause 1.8).

NOTE: Part 4 is included to ensure compliance with the sections of the Boilers, Lifts and Cranes Act 1950 which are still in force at the time of publication.

PART 5: UNATTENDED BOILERS

5.1 OPERATION

- 5.1.1 Unattended boilers shall be operated and maintained within a Certified AS/NZS 9001 or 9002 Quality Management System where specified in clause 1.30.
- 5.1.2 Unattended boilers may only be run in unattended mode, they may not be run attended even for brief periods. Failure of the boiler management system shall result in the boiler being shut down until the boiler management system has been repaired.
- 5.1.3 Clause 5.1.2 does not apply to the operator surveillance of the firing system and ash handling system deemed necessary for solid fuel boilers by the manufacturer or the boiler controller.

5.2 CONTROLS AND MOUNTINGS

In addition to the safety valves, water level gauges, pressure gauges, blowdown valve(s) and combustion chamber thermal alarm required in Part 1, unattended boilers shall have at least the following control mountings, which shall comply with BS 759:

- (a) First low water cut out and alarm.
 - (b) Second, independent low-water cut out and alarm, self-checking, internally mounted, of special design.
 - (c) Feedwater availability indicator and alarm.
 - (d) Feedwater low-pressure alarm, or low flow alarm.
 - (e) Steam temperature and pressure controls.
 - (f) Superheater and reheater temperature controls and alarms (for boilers with superheaters or reheaters).
 - (g) Continuous automatic blowdown control (TDS control).
 - (h) Flame detector(s) or ionisation rod flame monitoring to supervise both pilot and main flames (for every burner where necessary in multi-burner furnaces).
- Where there is a risk of condensate contamination by oil or grease:*
- (i) Condensate oil and turbidity detector and alarm, and condensate diversion system.

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Where there is the risk of hardness penetration into condensate returns, or feedwater streams (e.g. by water softening plant unsupervised for depletion):

(j) Feedwater monitoring alarm (e.g. conductivity) and diversion).

Especially where there is a risk to steam mains, or damage to equipment such as turbines may occur:

(k) A high-level control to prevent overfilling of the boiler is strongly recommended.

(l) A steam limiting valve is strongly recommended in installations where there is a heavily fluctuating steam demand.

NOTE: In (a) above, the first low-water alarm and cut out may be self-monitoring, internally mounted, of special design. In this case, the test period in 5.15.2 may be extended to one month.

5.3 FIRST LOW-WATER CUT OUT AND ALARM

- 5.3.1 On a low-water condition (clause 1.13) the heat source shall be cut off and an audible and visible alarm initiated. The cut out shall require manual resetting.
- 5.3.2 The first low-level alarm sounder may be combined with other alarm sounders.
- 5.3.3 Where alarms or cut outs are housed in external chambers they shall be:
 - (a) Fitted with sequencing blowdown valves; and
 - (b) Not fitted with isolating valves; or
 - (c) If isolating valves are required to be fitted, they shall be interlocked with the boiler controls to shut the boiler down if the valves are closed.
- 5.3.4 The low-water cut out device shall comply with clause 1.22.

5.4 SECOND LOW-WATER CUT OUT AND ALARM

- 5.4.1 Unattended boilers shall be fitted with an independent second water level cut out and alarm. "Independent" means there shall be complete mechanical and electrical separation between this and the first cut out. This device shall be of special design and comply with clause 1.22. Special design means that tests of the electrical and mechanical parts of the devices are automatically and regularly performed.
- 5.4.2 The second automatic self-checking device shall be internally mounted, fail-safe and not able to be isolated.
- 5.4.3 The second low-level alarm sounder must be independent and unique to the second low-level alarm.
- 5.4.4 The independent second control shall cut off the fuel supply to the boiler or air to solid fuel fired boilers and cause an audible alarm to sound when the

water level in the boiler falls to a predetermined low-low water level below that in 5.9.1 (d) below. The control or its electrical circuit shall be so arranged that it has to be reset manually before the boiler can be brought back into operation.

NOTE: In certain circumstances, it may also be desirable to cut off the fuel supply to solid fuel firing equipment. The general requirement is to dissipate the heat from the fuel bed quickly and the means by which this is achieved will vary according to the firing and combustion equipment, e.g. chain grate stoker, fluid bed, etc. Manufacturer's advice shall be followed. The control should cut off the FD air supply to the boiler, not the ID air flow.

5.4.5 FLOAT-TYPE DEVICE

5.4.5.1 Float-type low-level devices shall incorporate a functional test facility. This may be of the electromagnetic coil type, or of the cup type. They shall self-check automatically at intervals not exceeding the time taken for the boiler water level to fall from normal to 100 mm below normal, when the boiler is steaming at maximum output and no feedwater is being supplied.

5.4.5.2 The heat source cut out interruption during this test shall not exceed 300 seconds. The heat source shall be locked out if:

- (a) The water level control fails the test; or
- (b) The test sequence fails; or
- (c) The test interval is exceeded; or
- (d) The cut out interruption period specified is exceeded.

5.4.5.3 The result of each functional test shall be clearly recognisable to the qualified operator, e.g. by light signals.

5.4.6 PROBE-TYPE DEVICE

Probe-type devices shall be of high-integrity design incorporating double circuits and automatic insulation-resistance testing. Insulation-resistance testing shall be carried out at intervals not exceeding 150 seconds.

The heat source shall be locked out if:

- (a) One or both of the circuits indicates low level;
- (b) The insulation test fails.

5.5 FEEDWATER CONTROL

5.5.1 Automatic water level controls shall be so arranged that they positively control the boiler feed pump(s) or regulate the water supply to the boilers and effectively maintain the level of water in the boiler between certain predetermined limits set by the boiler manufacturer.

5.5.2 The control system shall incorporate equipment to lock out the heat source

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and raise a visible and audible alarm in the event of a low-level in the feed tank or deaerator.

5.5.3 CHANGEOVER

- 5.5.3.1 The feedwater pump system shall be controlled so that every time a pump is stopped automatically, the operating pump shuts down and the alternate pump is started. Where the pump operation is continuous, an automatic or manual changeover shall be made once at least in every 24 hours. In the event of the failure of the operating pump, the other pump shall take over automatically and the failure of the first pump shall be clearly indicated.
- 5.5.3.2 For solid fuel boiler installations, two independently driven feed pumps shall be provided. These shall comply with the relevant subclause of 5.11. A test function to prove the system shall be provided.

5.6 FEEDWATER AVAILABILITY

The control system shall incorporate equipment to lockout the heat source and raise a visible and audible alarm in the event of feedwater not being available. This would normally be in the form of a low-level device in the feed tank or deaerator.

5.7 FEEDWATER LOW-PRESSURE ALARM

The feedwater pump outlet shall incorporate a low-pressure or low-flow lockout and alarm to lock out the heat source in the event of a feedpump fault. For boilers that do not incorporate modulating feedwater control, the lockout may be interlocked with the feedpump. The pressure switch must incorporate fail-safe circuitry, i.e. when the pump is not running, the pressure switch action must be proved.

5.8 FORCED CIRCULATION

Where forced circulation is required to maintain a thermal balance in the boiler, two additional reliable safety devices shall be provided to automatically cut off the heat supply if the flow rate is reduced to a value below the allowable limit.

5.9 COMBUSTION CONTROLS

- 5.9.1 Automatic firing controls, in addition to maintaining combustion products within specified limits, shall be so arranged that they effectively control the supply of fuel to the boilers, or air to solid fuel fired boilers, and effectively shut off the supply in the event of any one or more of the following circumstances:

ARCHIVE

- (a) Flame/pilot flame failure on oil- or gas-fired boilers.
- (b) Failure to ignite the fuel on oil- or gas-fired boilers within a predetermined time.
- (c) When a predetermined high pressure at or below the safety valve set pressure is reached.
- (d) When the water level falls to a predetermined point below the normal operating level. When the water level is restored the burner may be automatically refired.
- (e) Failure of forced or induced draught fans, or any automatic flue damper, when these are provided.
- (f) When the combustion chamber thermal cut out is activated (shell boilers only).
- (g) When the low-water level falls to a predetermined level below that in (d) above. When the water level is restored, the cut out shall be required to be manually reset.

NOTE: In the case of (a), (b), (e) and (g), these controls should be of the lockout type requiring manual resetting. In the case of (d) this control should cut off the fuel/air supply and cause an audible alarm to sound.

5.9.2 CONTINUOUS SELF-CHECKING FLAME SCANNERS

5.9.2.1 Boilers with large combustion spaces can cause injury through fire side explosions. Gas-fired boilers in excess of 1.2 MW shall be fitted with self-checking flame scanners.

5.9.2.2 In the event of a flame, pilot flame or ignition failure, the control system shall proceed to the lockout condition.

5.10 COMBUSTION CHAMBER THERMAL CUT OUT

For shell boilers, a thermal cut out shall be provided in the back end combustion chamber and shall be set to operate at a temperature below the design temperature nominated by the boiler manufacturer. The maintenance contractor shall establish that the cut out operates below the design temperature as measured by a multishield high-velocity pyrometer. The position(s) of the thermal sensor(s) shall be specified by the boiler manufacturer and shall not be altered.

NOTE: Bare combustion chamber thermocouples often register a substantially lower temperature than the true gas temperature.

5.11 FEED PUMPS / SAFEGUARDING AGAINST UNACCEPTABLE EVAPORATION IN SOLID FUEL BOILER INSTALLATIONS

- 5.11.1 In the event of a lockout of the firing system, provision shall be made to ensure that the water contained in the boiler is not evaporated to the extent that it disappears from the gauge glass. Excessive heat shall be dissipated from the boiler to eliminate this danger.
- 5.11.2 For boilers containing sufficient water reserves, on cut out of the firing system from steady full-load operation with the water level at the “pump on” level (lowest controlled water level), the flue gas temperature at the highest point of the heating surface shall be reduced to below 400°C before the water level has sunk to 50 mm above the highest point of the heating surface. The water level at this position shall be visible in the gauge glass.
- 5.11.3 For boilers not containing sufficient water reserves, two independently driven and controlled feed pumps shall be provided. At least one of these must be capable of starting automatically and functioning independently in the event of a complete power failure. This requirement may be fulfilled in boilerhouses with a standby generator if this generator is of sufficient capacity to meet the requirements of the feedwater pumps plus any other connected load.

The following conditions shall be fulfilled:

- (a) Both feed pumps shall be provided with independent control devices.
 - (b) Sufficient water reserves shall always be available for safe start-up operation, with the water level being monitored by a water level limiter of special design.
 - (c) In the event of the failure of the operating pump, the standby pump shall start automatically.
 - (d) Failure of the operating feed pump shall remain indicated.
 - (e) The feedwater pump system shall be controlled so that every time a pump is stopped automatically, the operating pump shuts down and the alternate pump is started. Where the pump operation is continuous, an automatic changeover shall be made every 24 hours.
- 5.11.4 At commissioning, functional tests shall be made to prove:
- (a) The boiler’s ability to comply with 5.11.2 at full steam extraction and cut off feeding; or
 - (b) The boiler’s ability to comply with 5.11.3 at full steam extraction and with the water at the lowest attainable level in the feedwater tank.

5.12 ALARMS

In addition to the requirements in clause 1.23, the following conditions apply:

- 5.12.1 All unattended boilers shall have an emergency device which will shut off the heat source. This shall be located remote from the boiler house and be clearly marked.

- 5.12.2 Acknowledgment of alarms at positions outside a boiler house should not silence the audible alarm or extinguish the visual alarm in that boiler house.
- 5.12.3 The alarm system shall be designed with self-monitoring properties. In so far as is practical, any fault in the alarm system should cause it to fail to the fault condition or raise a system fault alarm.
- 5.12.4 For shell boilers, an alarm shall be provided to warn when the gas temperature at the tube entry to the first pass from the combustion chamber approaches the maximum temperature designated by the manufacturer (see clause 1.11).
- 5.12.5 Depending on the circumstances, a suitable connection may be allowed to a dialling system and pagers.

5.13 VISUAL DISPLAY

A visual display shall be provided to indicate the status of all the critical operating and safety devices at all stages of operation and to identify the alarm condition. This display shall indicate power-on, the initiation of the start-up sequence and which of the alternate components, e.g. pumps, are operating. For other conditions to be displayed, reference should be made to AS 2593.

5.14 OPERATIONAL SUPERVISION

- 5.14.1 An unattended boiler shall have a responsible person designated at all times that it is being operated. This person shall be capable of verifying that all the control and alarm systems are functioning correctly. In addition to this responsible person, the services of an approved maintenance contractor should be available.
- 5.14.2 Where control systems are fitted which have automatic testing facilities and are self-monitoring, then the controls shall still be checked by the responsible person on a weekly basis and after a cold start, including during periods such as the night and weekends. While the boiler is in operation, and during such periods, there should always be somebody available who is competent to respond to alarms, and to take appropriate action which, at a minimum, may be to ensure that the boiler shuts down safely before calling for assistance. In some installations, alarms may be relayed via a phone dialler.

5.14.3 AUTOMATED START-UP

The control system shall check that all boiler conditions are within predetermined limit ranges. If conditions are outside these limits, then the system shall shut down.

These controls and conditions include:

- (a) Electric power supply is available;
- (b) Operation of fuel valves;
- (c) Boiler water at correct level;

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- (d) Feedwater supply;
- (e) Circulation pump;
- (f) Purge/combustion air;
- (g) Fuel supply in correct condition of temperature, viscosity, etc.;
- (h) Burner low/high fire control;
- (i) Atomising medium available at correct pressure if required;
- (j) Ignition;
- (k) Flame sensor;
- (l) Water at correct level in the feedwater tank.

For solid fuel fired boilers they also include:

- (m) Fuel supply system in start position.

5.14.4 DATA LOGGERS

Data loggers should be incorporated in the control system to regularly log the boiler operating conditions and alarms.

5.14.5 AUTOMATED MAIN STEAM STOP

Where an automated main steam stop is fitted, provision shall be made to warm through all the steam lines and drains downstream.

5.14.6 MANAGEMENT OF SHUTDOWN SEQUENCE

Automated boiler shutdown procedures shall be in accordance with the boiler manufacturer's recommendations.

5.15 TESTING OF CUT OUTS AND ALARMS

Routine operation tests and observations shall be carried out periodically by a responsible person, as laid down in and developed from the boiler manufacturer's recommendations and company operating procedures. The boiler shall remain attended at all times during the tests.

5.15.1 WATER LEVEL CONTROL

- 5.15.1.1 Observe and test, where appropriate, by blowing through the gauge glass, that the water level is being maintained between the proper upper and lower levels.
- 5.15.1.2 For modulating feedwater controls, the water level should be maintained without feed oscillations (hunting).

5.15.2 LOW-LEVEL ALARMS AND CUT OUT

- 5.15.2.1 At least weekly, a functional test shall be carried out for every alarm and cut out to ensure that on a low-level condition the heat source is cut off, and audible and visible alarms are initiated.
- 5.15.2.2 In installations where the first low-water alarm and cut out is self-monitoring, internally mounted, of special design, this test period in 5.15.2.1 may be extended to one month.
- 5.15.2.3 A functional test shall consist of lowering the water level in the boiler and verifying that the heat source is cut off, and the audible and visual alarms are initiated.
- 5.15.2.4 It may be necessary to disable the first cut out and alarm to verify the full function of the second cut out and alarm. The first alarm shall only be disabled by active means, i.e. the operator shall hold a push button depressed. There shall be no possibility of permanent disablement.

NOTE: In situations where tripping the boiler on a daily basis is impractical, e.g. in a continuous operating plant, then alternative tests may be carried out on a daily basis, to prove the effectiveness of the low-level trip, with the functional tests being carried out at appropriate regular intervals.

5.15.3 STANDBY FEED PUMP

The automatic start and operation of the independently driven standby feed pump, on failure of the duty feed pump, shall be tested.

5.16 QUARTERLY TESTS

The approved maintenance contractor shall carry out a functional test of all alarm and lockout safety systems quarterly. The results of these tests shall be recorded. Where set points are disturbed in order to carry out such tests, then the maintenance contractor shall record and verify on the report that the set point has been reset correctly. At least once per year, safety controls which require setpoint adjustment to test shall be fully tested for the complete physical operation of the device.

5.17 WATER TREATMENT

In addition to normal in-house boiler water testing, for unattended boilers the boiler water shall be analysed at monthly intervals by a laboratory registered by TELARC for the testing of boiler water and boiler feedwater, or an equivalent laboratory recognised by TELARC.

5.18 MAINTENANCE OF BOILER MANAGEMENT AND SAFETY SYSTEMS

- 5.18.1 Maintenance of the boiler management and safety systems shall be carried out by a maintenance contractor who is nominated by the controller, acceptable to the boiler manufacturer and who is certificated to AS/NZS 9002. The authority shall take part in this audit process. These systems and devices shall be checked at regular intervals, at least three-monthly, and additionally when problems arise. The three-monthly check shall include the control and limiting devices that are not subject to daily checking.
- 5.18.2 Controllers who are certified to AS/NZS 9002 for the maintenance of boiler management systems may nominate themselves to conduct their own maintenance of the boiler management and safety system provided:
- The boiler manufacturer is satisfied that the persons doing the maintenance are suitably qualified and have had adequate training; and
 - All the necessary information, drawings and details are held on site and all processes and procedures are detailed within the quality management system.

PART 6: ONCE-THROUGH FORCED CIRCULATION COIL BOILERS

This section refers to coil boilers, which shall comply with BS 1113 or the ASME *Boiler and Pressure Vessel Code* Section 1.

6.1 STANDARDS FOR CONTROLS

The fuel management system for coil boilers shall be the same as for unattended boilers. The same purging, pilot ignition and self-checking flame supervision requirements apply (see clause 5.14).

6.2 FORCED CIRCULATION COIL BOILERS

- 6.2.1 Forced circulation coil boilers shall have at least the following controls:
- 6.2.2 The feedwater and fuel supplies shall be controlled automatically and these controls shall be interconnected.
- 6.2.3 *Overheating interlock:* At least two separate devices shall be provided, operating on coil temperature, steam temperature or flue temperature, to protect against overheating due to loss of feedwater flow or scale buildup. The actuation of any overheating protection device shall cause complete shut-down and shall require manual reset.
- 6.2.4 *Water circulation pump, flow/combustion interlock:* Every boiler shall be fitted with a controlled circulation pump which shall be interlocked to prevent operation of the combustion equipment unless water flow is established and maintained.

NOTE: In some boilers, the circulating pump may be the feedwater pump.

- 6.2.5 *Combustion controls:* The boiler management system of a forced circulation boiler shall shut down the fuel input and cause lockout to occur in the event of any of the following:
 - (a) Inadequate air for satisfactory combustion or purging.
 - (b) Incorrect pressure/temperature in the fuel supply.
 - (c) Start or main flame ignition failure.
 - (d) Flame failure.
 - (e) Failure of flame detector to pass self-check test.

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- (f) Detection of gas leakage during the gas valve tightness check where required by NZS 5261.

6.3 FEEDWATER PUMP

- 6.3.1 Every boiler over 500 kW shall be fitted with two automatically controlled feedwater pumps, each capable of supplying not less than 110% of the mass of steam generated at the power output of the boiler calculated on the basis of feedwater at 100°C and at design pressure.
- 6.3.2 The feedwater pump system shall be controlled such that after each automatic pump stop, the operating pump shuts down and the alternative pump is started. Where pump operation is continuous, a manual changeover shall be made at regular intervals.
- 6.3.3 Notwithstanding the above, one feedwater pump shall be acceptable provided that the feedpump is individual to the boiler and that means are provided to automatically shut down and lock out the energy input system in the event of the temperature of the fluid leaving the coil system exceeding that corresponding to the saturation temperature at design pressure.

6.4 PRESSURE SAFETY

Coil boilers, including the uptake and all fittings to the boiler, shall be provided with a casing capable of withstanding the forces created due to a burst tube.

PART 7: LOW-HAZARD BOILERS

In terms of power output this class of boiler is seen as being under 350 kW with a maximum pressure of 7 bar and a maximum volume of 1,000 litres.

7.1 STANDARDS FOR CONTROLS

Low-hazard boilers shall have at least the following control mountings, in addition to those required in Part 1, which shall comply with BS 2790:

- (a) Safety valves as required in BS 2790 (see clause 1.14).
- (b) Two independent means of indicating the water level (see clause 1.13).
- (c) One pressure gauge.
- (d) Two low-water alarms and cut outs.
- (e) Automatic feedwater control.
- (f) Blowdown valve.

7.2 OPERATIONAL SUPERVISION

- 7.2.1 A low-hazard boiler shall have a responsible person available at all times that it is being operated. That person should be within hearing distance of the boiler alarms and employed on a task that can be ceased immediately.
- 7.2.2 Direct observations of the boiler running conditions must be made at intervals not exceeding 2 hours.

PART 8: PRESSURISED HOT WATER BOILERS

The following requirements apply specifically to the design, manufacture (including controls) and operation of hot water boilers with working temperatures exceeding 100°C, and pressure exceeding 200 kPa, or output exceeding 250 kW.

8.1 STANDARDS

Hot water boilers exceeding the temperature/output/pressure limits above shall be designed, fabricated and tested in accordance with BS 2790, BS 1113, BS 855 or AS 1797, and the provisions of this code of practice.

8.2 TYPES OF SYSTEM

- 8.2.1 For the purpose of ensuring compliance with the requirements of this section, fully flooded boiler systems can be divided into four basic categories:
- Category A: Static head systems open to atmosphere.
 - Category B: Closed pressurised systems with separate gas-cushioned pressurising vessels and provision for make-up water.
 - Category C: Sealed pressurised systems with separate diaphragm or bladder-type pressuring vessels and provision for make-up water.
 - Category D: Continuously pumped pressurised systems with provision for make-up water.
- 8.2.2 Boilers in all these categories shall be part of a closed-circulation hot water system. Not all boilers within these categories may come within the scope of these requirements.
- 8.2.3 Boilers pressurised by steam are classified as steam boilers and shall comply with the requirements for steam boilers. Category A boilers are not suitable for high-temperature operation.
- 8.2.4 In fire tube boilers, the water inlet and outlet shall be located at the top of the boiler in such a way as to promote circulation to minimise both thermal shock and loss of water in the event of external pipe breakage.
- Every hot water system shall:
- (a) Be a closed circulation system with no steam or water consumed during operation;

- (b) Be designed and constructed so that loss of water or loss of flow cannot create a hazard in the boiler or system;
- (c) Be equipped with the provision to expand to accommodate the volume fluctuations in the system, such expansion vessel maintaining a positive system pressure at all times that the boiler is in operation, using inert gas, steam or liquid head; and
- (d) Have a difference between the water flow temperature (outlet) and the return flow temperature not exceeding the following:
 - fire tube boilers 25 K.
 - natural circulation water tube boilers 50 K.
 - forced circulation water tube boilers 80 K.

An external or internal mixing device shall be fitted, where necessary, to raise the return flow temperature to bring the differential to within the above limits.

8.3 AUTOMATIC CONTROLS

- 8.3.1 The categories of fully flooded hot water boilers operating with minimum supervision shall be provided with automatic controls. Such controls should shut off the supply of fuel to oil or gas burners, the electricity supply to heaters on electric boilers or should shut off the air supply and, if necessary, the fuel supply to solid fuel firing equipment in the event of one or more of the following circumstances arising:
- (a) Flame failure or pilot flame failure on oil, gas or dust burners. This control should be of the lockout type requiring manual resetting.
 - (b) Failure to ignite the fuel within a predetermined time. This control should be of the lockout type requiring manual resetting.
 - (c) Failure of forced or induced draught fan, or an automatic flue damper.
 - (d) When the water at or near the boiler flow outlet rises to a predetermined temperature. This temperature shall provide a margin of at least 17°C below the temperature of saturated steam corresponding with the pressure prevailing at the most vulnerable point in the heating circuit.
 - (e) When the water level in the pressurising equipment in a Category B system falls to a predetermined level below the normal operating level. This control should also cause an audible alarm to operate.
 - (f) When the pressure in a Category B, C, or D system falls to a predetermined pressure below the specified operating pressure. This predetermined pressure should be at a level which will ensure that the water does not reach boiling point in any part of the system whilst the working temperature is maintained.
 - (g) When the pressure in a Category C system increases to within 0.35 bar of safety valve set pressure. The safety valve set pressure should be such that it will not allow the design pressure of any part of the system to be exceeded.

- 8.3.2 For a finned tube-type hot water boiler, a sequenced lockout device should be fitted to ensure that the burner can not be operated at any time unless the circulating pump is running.

8.4 INDEPENDENT OVERRIDING CONTROLS

- 8.4.1 In addition to the automatic controls required by clause 8.3, all categories of fully flooded hot water boilers should be provided with independent overriding controls which cut off the fuel supply to oil or gas burners, the electricity supply to heaters on electric boilers, or cut off the air supply and, where required, the fuel supply to solid fuel firing equipment in the event of one or more of the following circumstances arising:
- (a) When the temperature of water at or near the boiler flow outlet rises to a predetermined temperature providing a margin below the temperature of saturated steam corresponding with the pressure at the highest point of the circulating system above the boiler. For oil- or gas-fired boilers, this margin should be at least 6°C and for solid fuel fired boilers be at least 10°C. This control should be the lockout type requiring manual resetting.
 - (b) When the water level in the pressurising equipment of a Category B system falls to a predetermined level below the normal operating level than indicated in clause 8.3 (e). This control should lockout the firing equipment and should be of a type which requires manual resetting.

NOTE: In certain circumstances, it may be desirable to cut off the fuel supply to solid fuel firing equipment. The general requirement is to dissipate the heat from the fuel bed quickly and the means by which this is achieved will vary according to the firing and combustion equipment, e.g. chain grate stoker, fluid bed, etc. Manufacturer's advice should be sought.

- 8.4.2 Fully flooded hot water boilers shall have provision to prevent the boiler being fired unless it is fully flooded.

8.5 ELECTRICAL FAILURE TO SAFETY

- 8.5.1 All electrical equipment and systems used for operating controls shall be designed to fail-safe in the event of mains supply or single component failure.
- 8.5.2 All electrical conductors and equipment in connection with water level or temperature and firing controls should be of adequate size, and be properly insulated and protected to prevent danger including, where necessary, adequate protection against the ingress of moisture and the effects of high temperature.

8.6 INTERRUPTION OF THE ELECTRICITY SUPPLY

- 8.6.1 In the event of the electricity supply to water level and firing control equipment being interrupted or failing, the fuel and air supply to the burner

should be cut off automatically. Restarting procedure on restoration of the mains supply should be subject to the same requirement as normal start-up for oil and gas burners. Start-up for solid fuel burners will depend on the system installed. Interruption and subsequent restoration of the electricity supply should not override any lockout condition which existed prior to the mains supply failure or interruption.

- 8.6.2 In the event of a flame, pilot flame or ignition failure, the control system shall proceed to the lockout condition.

8.7 BOILERS USING MIXING VALVES

Where mixing valves are used to blend return water with flow water, solid fuel boilers should serve at least one circuit which is independent of the mixing valve and which is capable of dissipating residual heat in the fuel bed when the mixing valve closes against the boiler, e.g. during mild weather, otherwise a heat dissipation thermostat which will override the mixing valve control in the event of excessive temperature rise, should be fitted in the boiler flow line.

NOTE: The method for maintaining boiler circulation shall be considered for all operating conditions.

8.8 SAFETY VALVES

In all categories, a suitable safety valve shall be fitted on or as near as possible to the boiler. Safety valves should be sized and set to the relevant British Standards BS 759, BS 855, BS 2790 and BS 6759. It shall not be possible to isolate the safety valve from the boiler.

8.9 TRAINING

Controllers shall ensure that persons entrusted with the supervision of hot water boilers are familiar with the controls and the conditions for the safe working of the boiler and system. The amount of training required will depend on the extent and complexity of the plant and may require some input from the boiler manufacturer.

8.10 TESTING AND MAINTENANCE

- 8.10.1 Owing to the diversity of controls for fully flooded hot water boilers, it is not possible to give details of testing and maintenance in these notes. The boiler manufacturer's instructions or advice on regular testing and periodic maintenance and servicing shall be strictly followed. Servicing and maintenance by competent personnel is essential to ensure that controls are kept in good working order.
- 8.10.2 It is recommended that a full inspection of pressure parts and controls be carried out at least annually, followed by testing of all safety systems on start-up.

PART 9: UNFIRED WASTE HEAT BOILERS

In process industries, steam is often generated in heat exchangers, which perform the same function as boilers in generating steam.

9.1 DEFINITION

An unfired waste heat boiler is a heat exchanger (boiler) that recovers heat from a gas stream. These boilers shall not be exposed to radiant heat or flame impingement.

9.2 DESIGN

- 9.2.1 Where the design is such that the heat exchanger can operate safely under the most adverse conditions, without any water in it, then it may be designed to the unfired pressure vessel standards, provided it falls within the ranges of temperatures permitted.
- 9.2.2 Unfired waste heat boilers that are not able to be run dry shall be designed to the appropriate approved boiler design standards.

9.3 SAFETY PROTECTION DEVICES

- 9.3.1 Safety devices such as safety valves, blowdown valves and some means of measuring the water level are regarded as essential.
- 9.3.2 Where the design is such that the heat exchanger can operate safely under the most adverse conditions, without any water in it, then the requirements to fit all the safety devices according to this code of practice may be relaxed.
- 9.3.3 Where the design is such that the unfired waste heat boiler cannot operate safely under adverse conditions (dry) then full safety protection devices shall be provide as listed:
 - (a) First low-water alarm and cut out.
 - (b) Second low-water alarm and cut out, internally mounted, self-checking and of special design.
 - (c) Feed water availability indicator and alarm.
 - (d) Feed water low-pressure or low-flow alarm.
 - (e) Steam temperature and pressure controls.

ARCHIVE

- (f) Superheater and reheater temperature controls and alarms (for heaters with superheaters or reheaters).
- (g) Continuous automatic blowdown control (TDS control).

9.4 Special-application unfired waste heat boilers that are outside the limits of this code will be assessed on their ability to guarantee the same levels of safety to be achieved within this code of practice. Generally, for standard applications, these will be variations of water tube type boilers.

APPENDIX A: PRINCIPAL STANDARDS ACCEPTED FOR USE IN NEW ZEALAND IN CONNECTION WITH BOILERS

Wherever a Standard is referred to in this code of practice, it shall be taken to be the latest issue and amendments of that Standard, unless otherwise specified.

1. NEW ZEALAND STANDARDS

NZS 5261 *Code of practice for the installation of gas burning appliances and equipment.*

NZS 5351 *Code of practice for the installation, operation and maintenance of building service and small industrial boilers.*

NZS 4203 *General structural design and design loadings for buildings.*

2. JOINT AUSTRALIAN/NEW ZEALAND STANDARD

AS/NZS 1200 *Pressure equipment.*

3. AUSTRALIAN STANDARDS

AS 1228 *Water tube boilers.*

AS 1797 *Boilers: fire tube, shell and miscellaneous.*

AS 1210 *Unfired pressure vessels.*

AS 2593 *Boilers: Unattended and limited-attendance (see Appendix B).*

4. BRITISH STANDARDS

BS 759 *Valves, gauges and other safety fittings for application to boilers and to piping installations for and in connection with boilers. Part 1 Specification for valves, mountings and fittings.*

BS 799 *Oil burning equipment.*

BS 806 *Specification for design and construction of ferrous piping installations for and in connection with land boilers.*

ARCHIVE

- BS 855 *Specification for welded steel boilers for central heating and indirect hot water supply (rated output 44 kW to 3 MW).*
- BS 1113 *Specification for design and manufacture of water-tube steam generating plant (including superheaters, reheaters and steel tube economisers).*
- BS 1780 *Specification for Bourdon tube pressure and vacuum gauges.*
- BS 2486 *Recommendations for treatment of water for land boilers.*
- BS 2790 *Specification for design and manufacture of shell boilers of welded construction.*
- BS 5410 *Code of practice for oil-firing.*
- BS 5500 *Specification for unfired fusion welded pressure vessels.*
- BS 5885 *Automatic gas burners.*
- BS 5978 *Safety and performance of gas-fired hot water boilers (60kW to 2 MW input).*
- BS 6759 *Safety valves. Part 1: Specification for safety valves for steam and hot water.*
- PM 60 *HSE Guidance Note: Steam boiler blowdown systems.*
- CEGB/VGB/EPRI *Guidelines for fossil-fired boiler chemistry.*

5. U.S.A. STANDARDS

American National Standards, American Society of Mechanical Engineers. Designs of water tube boilers complying fully with the latest issue of the *Boiler and pressure vessel code*, Section 1, "Power boilers" (including all amendments) published by the American Society of Mechanical Engineers, are acceptable subject to the conditions stated in ES.Doc 012.

ASME *Boiler and pressure vessel code*, Section V11
"Recommended rules for care of power boilers".

ANSI/ASME B 31.1 *Power piping.*

American National Standards, National Fire Protection Association:

ANSI/NFPA 85A *Single burner boiler furnaces.*

ANSI/NFPA 85B *Prevention of furnace explosions in natural gas fired multiple burner boiler furnaces.*

ANSI/NFPA 85C *Standard for the prevention of furnace explosions/implosions in multiple burner boiler furnaces.*

ANSI/NFPA 85F *Pulverised fuel systems.*

6. EXISTING BOILERS

Any boiler designed and approved to an earlier issue and amendment of these standards should be maintained and repaired to the design issue. However, the advances in the engineering knowledge and experience reflected in the

ARCHIVE

subsequent issues of the codes should be taken into consideration when carrying out the boiler maintenance.

Weld repairs and alterations of boilers designed to ASME *Boiler and pressure vessel code*, Section 1, may be carried out in accordance with the rules of the *National Board Inspection Code*, published by the National Board of Boiler and Pressure Vessel Inspectors.

ARCHIVE

APPENDIX B: CLAUSES FROM AS 2593:1990 TO BE CONSIDERED FOR BOILER DESIGN PURPOSES

For the following points, not covered fully in this code of practice, you should refer to the clauses listed below from AS 2593.

Start-rate energy input of start gases

Clause 3.14.5 specifies requirements in detail.

Main flame turn down and modulation

Clause 3.15.3 specifies requirements in detail.

Additional and specific requirements for oil-fired, gas-fired and solid fuel in suspension fired boilers

Clause 4.1 indicates requirements.

APPENDIX C: INFORMATION REQUIRED BY AUTHORITY WITH FIRST APPLICATION TO OPERATE AN UNATTENDED OR LIMITED-ATTENDANCE BOILER

SECTION A: METHOD OF APPLICATION FOR LIMITED- ATTENDANCE BOILER OPERATION AND UNATTENDED BOILER OPERATION

The following documentation is required by the Authority in respect of any application to operate any boiler in the limited or unattended mode:

1. From the boiler manufacturer or person carrying out the conversion to limited or unattended operation, statements certifying that:
 - (a) The boiler has been designed and constructed in accordance with a specified and nominated standard listed in Appendix A, (including any supplementary requirements listed in Appendix B).
 - (b) The boiler and its boiler management system complies in full with the requirements of this code of practice for limited-attendance operation, or, unattended operation, as the case may be.
 - (c) That those persons who will be responsible for the maintenance of the boiler management system are familiar with the operation of the boiler and its boiler management system and have been trained to a satisfactory level of ability in all those functions.
 - (d) The training needs of the person responsible for operating the boiler have been identified, documented and supplied to the controller.
 - (e) The criteria required to be met by the person responsible for maintaining the boiler management system have been identified, documented and supplied to the controller.
2. From the controller, statements certifying that:
 - 2.1 (a) The requirements applying in this code of practice relating to the operation and maintenance of limited-attendance operation boilers, or, unattended operation boilers (as the case may be) have been read and are fully understood.

ARCHIVE

- (b) The organisation undertakes to ensure that the boiler is operated and maintained at all times in accordance with the requirements of this code of practice.
- (c) Those persons responsible for the operation of the boiler have been trained to the extent necessary to satisfy the training needs specified by the boiler manufacturer.
- (d) Those persons responsible for the maintenance of the boiler management system have been trained to the extent necessary to satisfy the training needs specified by the boiler manufacturer.
- (e) The organisation undertakes to operate the boiler in accordance with an AS/NZS 9002 quality management system which will be certified by an approved Certification Body in accordance with the provisions of Section B.
- (f) The organisation undertakes to maintain, internally audit, continuously review and seek to improve the operation and maintenance system relating to that boiler in consultation with the boiler manufacturer.

2.2

- (a) (i) If the Quality Management System applies to boilers with an aggregate power of 6 MW or greater:

An undertaking that the system will be brought up to the full standard required by a recognised Certification Body within a stated time (which shall not exceed one year).

- (ii) If the Quality Management System applies to boilers with an aggregate power not exceeding 6 MW:

A copy of an interim document issued by the Inspection Body stating that the Quality Management System is installed to their complete satisfaction, has been examined and that it is considered to make adequate provision for all essential safety purposes as a short-term measure.

- (b) For limited-attendance and unattended boilers with an aggregate power of 6 MW or greater:

A copy of the AS/NZS 9002 Quality Management System certificate from the Certification Body, complete with any schedules to that certificate.

- (c) For limited and unattended boilers with an aggregate power not exceeding 6 MW:

A copy of the document issued by the Inspection Body certifying that the operation and maintenance system complies with the essential requirements of AS/NZS 9002 in respect of the safe operation and maintenance of the boiler as is required by this code of practice. The inspector must certify that the operational and maintenance system has been established to their complete satisfaction, has been audited and that it is considered to make adequate provision for all safety purposes; or

A copy of the AS/NZS 9002 Quality Management System certificate from the Certification Body, complete with any schedules to that certificate.

ARCHIVE

3. From the Inspection Body, statements certifying that:
 - (a) The boiler design has been verified as complying with the requirements of the design standard and that the seismic requirements have been also considered and verified.
 - (b) The design of the boiler management system and its components have been verified and that they comply in full with the requirements of this code of practice for limited or unattended operation as the case may be.
 - (c) The boiler has been fully tested under operating conditions and that it performs in all respects with the requirements of this code of practice and that the boiler is considered safe to operate as a limited-attendance boiler or an unattended boiler, as the case may be.

NOTE: Statements 3(a) and 3(b) shall be signed for the Inspection Body by approved design verifiers and statement 3(c) shall be signed for the Inspection Body by an equipment inspector with skills related to the boiler and boiler management systems.

RENEWAL

Exemptions may be renewed by the Authority on reconfirmation from the controller of all the statements in Part 2 above. The Authority will want to see a copy of the current AS/NZS 9002 certificate or a copy of the document issued by the Inspection Body and the current certificate of inspection or inspection report for the boiler.

SECTION B: OPERATION AND MAINTENANCE SYSTEMS FOR BOILER INSTALLATIONS

1. Limited-attendance or unattended boilers with an aggregate power not exceeding 6 MW may be operated and maintained using a documented operation and maintenance system other than full implementation of ISO 9002.

Such an operation and maintenance system shall contain all the essential elements of AS/NZS 9002; it shall not depart in any manner from the intent of AS/NZS 9002 and shall be subject to approval and audit by a Certification Body or Inspection Body.

“Operation and maintenance system” in relation to the operation, maintenance, repair and testing of the boiler, shall include:

Management and organisation:

Who reports to whom. What the accountabilities and responsibilities of each person are, including any limitations. Who supervises whom. Who conducts the internal audits of the system and how any shortcomings are to be rectified and by whom.

Staff training:

Full details of the training system given to those responsible for operating and

ARCHIVE

maintaining the boiler, including any appropriate qualifications. Details of who conducts the training and how its effectiveness is monitored.

Operation and maintenance:

Full details of the procedures for operating the boiler. What action is to be taken when alarm indications arise. Full details of the procedures for testing and treating the boiler and feed water. Full details of the procedures for testing the boiler equipment and its safety functions. Full details of the maintenance contract for the boiler management system. Full details of how faults and defects are to be reported, recorded, rectified and tested.

Documents and records:

Instructions, test and calibration reports and records, lab reports, maintenance and repair records.

2. In the case of limited or unattended boilers with an aggregate power greater than 6 MW being installed, the controller may seek from the Authority permission to operate the limited or unattended operation boilers which exceed 6 MW in aggregate power for a limited period (which shall not exceed 12 months) until a system which has the approval and is under the audit of a Certification Body is fully operational.
3. Such Quality Management Systems authorised under the provisions of paragraph 2 shall be under internal audit by the controller and external audit by the Independent Inspection Agency, or by a Certification Body.

NOTE: In such cases, the owner shall ensure that when they engage a Certification Body, they advise the agency that a representative of the Authority is required to take part in the audit.

APPENDIX D: CLASSIFICATION SOCIETIES ACCEPTED IN NEW ZEALAND BY THIS AUTHORITY

American Bureau of Shipping

West Plaza Building
18th Floor
3 Albert Street
Auckland 1
PO Box 1974

Nippon Kaiji Kyokai

Suite 1902, 19th Floor
American Express Tower
388 George Street
Sydney
NSW 2000
Australia

Bureau Veritas

27 Bath Street
Parnell
Auckland
PO Box 37644, Parnell

Det Norske Veritas

218 Lake Road
Northcote
Auckland
PO Box 36133

Germanischer Lloyd

Suite 3
10 Victoria Road
Parramatta
NSW 2150
Australia

Lloyds Register

Price Waterhouse Centre
11th Floor
66 Wyndham Street
Auckland 1
PO Box 2682

ARCHIVE

APPENDIX E: VERIFICATION OF BOILER MANAGEMENT SYSTEM FOR LIMITED- ATTENDANCE AND UNATTENDED BOILERS

See check sheets on following pages.

Verification of Boiler Management System for Limited-Attendance and Unattended Boilers

Manufacturer Owner
 Boiler type Address
 MW rating Pressure bar
 Stream output kg/hr Fuel
 Design Verifier
 Inspection Body

Clause	Requirement	Description	Manufacturer's Signature	Inspector's Signature
3.2 / 5.3	First low water cut out and alarm			
3.3 / 5.4	Second low water cut out and alarm, independent of first cut out			
3.5 / 5.6	Feedwater availability cut out and alarm			
3.6 / 5.7	Feedwater low-pressure alarm			
5.2 (g)	Continuous automatic blowdown control			
5.9.1 (a) 3.8.1 (a)	Flame / pilot flame failure			
3.8.1 (b) 5.9.1 (b)	Failure to ignite fuel within a predetermined time			

Clause	Requirement	Description	Manufacturer's Signature	Inspector's Signature
3.8.1 (e) 5.9.1 (e)	Failure of fan or automatic flue damper			
3.7 / 5.8	Failure of forced circulation			
3.10 / 5.10	Combustion chamber thermal cut out			
1.13	Two independent means of indicating the water level			
1.14.3	Safety valve discharge capacity			
1.14.4	Safety valve accumulation test			
1.15.2	Calibration of pressure gauge			
3.15.3.5 / 5.15.3	Auto start and operation of standby feed pump (both ways)			
1.21.2	Main isolator or emergency stop - shuts down burner but allows alarms to operate			
1.21.4	Shut down on power failure - or back-up power supply. Restoration / prior fault still shown			

Clause	Requirement	Description / Comment	Manufacturer's Signature	Inspector's Signature
1.22.7	Power-operated valves to fail-safe			
1.23.2	Audible and visual alarms			
1.23.4	Alarms can be seen and/or heard			
1.23.5	Visual alarms not extinguished			
1.23.6	Alarms distinguishable			
1.23.7	Identify individual alarms			
1.23.8	Acknowledgment of visual alarm			
1.23.9	Alarms in boiler house still operate on remote acknowledgment of alarms			
1.23.10	Alarms reactivate on second fault occurring			
1.23.11	Alarms lock-in			

Clause	Requirement	Description / Comment	Manufacturer's Signature	Inspector's Signature
1.23.12	Alarm test functions			
1.23.13	Alarms independent of control			
1.23.15	Alarm settings identified			
3.1.1 (k) 5.2 (k)	High-level cut out (if fitted)			
	Deaerator high- / low-level (if fitted)			