AS 1375—1985

Australian Standard®

SAA INDUSTRIAL FUEL-FIRED APPLIANCES CODE

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The following interests are represented on Committee ME/21:

- Australian Gas Association
- Australian Institute of Energy
- Australian Institute of Petroleum Ltd
- Bureau of Steel Manufacturers of Australia
- Confederation of Australian Industry
- Department of Labour and Industry, Vic.
- Department of Mines and Energy, N.T.
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PREFACE

This edition of this standard was prepared by the Association's Committee on Industrial Fuel-fired Equipment, to supersede AS 1375—1979.

The standard was first issued in 1973, and was revised in 1979 to incorporate amendments and to update it generally; it has now been completely reviewed to expand it in detail and make it generally more comprehensive.

In the main the amendments in preceding years had concentrated on the appendices which are a vital feature of this standard because of the importance of the design guidance which they provide. In a succession of amendments, the appendices dealing with explosion relief, with ventilation rates for ovens, and with data tables were clarified, adjusted, and modified.

The 1979 edition was fundamentally a reprinting to bring a degree of order to these various amendments, and did not constitute a general review.

This edition represents a general revision, the main features of which are as follows:

(a) Broadly, the alterations represent the result of further experience with the standard, developments in thinking arising from the publication and revision of AS 1853, Automotive Oil and Gas Burners—Mechanical Draught, and input from Committee ME/1, Boilers and Unfired Pressure Vessels.

(b) More attention is paid to the appliance management system, as distinct from the burner management system.

(c) The general subject of shutdown in the event of malfunction has received more detailed attention.

(d) It is made clearer in a number of places that the link between critical time and supervision response time applies only at the ignition phase.

(e) The treatment of flame failure during operation is expanded, to explain exemptions more clearly.

(f) A number of adjustments and clarifications have been made to the clauses on purging, without making any fundamental change of direction.

(g) Installation requirements have been expanded in detail, with the assistance of Committee ME/1.

(h) The commissioning clauses have been supported by a new appendix recommending a procedure.

(j) Flues and chimneys have been expanded considerably to cater mainly for the needs of very large appliances, boilers, and the like. No attempt has been made to touch on structural design, this being a specialist subject well covered in standards available elsewhere. The variable usage of words such as flue, chimney, stack, smokestack or funnel to mean the same thing, or sometimes different things, has caused an as yet unresolved difficulty. This edition uses the language of the industrial appliance industry, i.e. flue is used as a generic term to mean the same as the alternative words.

(k) Appendix B and Appendix C have been made more comprehensive.

(l) Appendix D has been expanded, mainly to include an additional option, i.e. using excess air to achieve infinity critical time. This technique has many attractions, notably it avoids the need to depend on very fast-reacting protective systems. Appendix D therefore reflects some change of emphasis.

(m) Appendix E and Appendix F remain unchanged, both being in regular use, and satisfactory, so there is no need for alteration.

(n) Appendix H has been added to give guidelines for a procedure for commissioning new equipment.

In addition, there has been considerable editorial change.

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STANDARDS ASSOCIATION OF AUSTRALIA

Australian Standard
for
INDUSTRIAL FUEL-FIRED APPLIANCES

FOREWORD

Safety, which is an essential in all industrial activity, can be achieved in even the most sensitive processes by adequate equipment design and operating procedures. Not only do fuel-fired appliances generate fuel/air mixtures, they may also contain or operate in atmospheres which include finely divided combustible materials. In such conditions, hazards are always a possibility and this standard gives principles for designing such appliances to operate with safety.

The most common accidents in heated industrial equipment are internal explosions that result from the accidental ignition of accumulations of fuel/air mixtures, volatile solvents, other vapours, or combustible dusts. An explosion becomes damaging when the internal pressure created exceeds the ability of the appliance to contain it, and, since few appliances are of sufficient strength to withstand pressures of a high order, it is necessary firstly to prevent the accumulation of combustible mixtures, secondly to avoid their ignition wherever possible, and thirdly, depending on the operating characteristics and reliability of these preventive measures, to provide means of relieving or mitigating the effect of an explosion.

When a finely divided fuel is introduced into an enclosed space, it is potentially unsafe until it is ignited; if the ignition attempt fails, or if the flame is extinguished at any time after initial ignition, unburnt fuel can accumulate in the enclosure, and may quickly reach potentially dangerous proportions.

Therefore, the principal and most important of all the safety devices on an appliance is its ignition system; all other protective measures should be considered as secondary provisions, i.e. back-up systems for which the need arises only when the primary protection, the ignition system, has failed.

Given a known fuel flow rate and a known combustion chamber volume, it is possible to calculate how long it would take for accumulated fuel to become dangerous if not ignited. This is called the critical time, and is a characteristic of each individual appliance. It indicates the maximum allowable delay in ignition, and also the maximum safe response time for any ignition failure protection system.

It is always preferable to extend the critical time to the greatest possible extent, rather than depend too much on sensitive flame-monitoring equipment. The use of pilot ignition, or low-fire starting, or the providing of high levels of dilution by excess air, all have the effect of extending the critical time, and in the period since this standard was first published the emphasis has developed in the direction of encouraging designers to extend critical time to infinity. Another alternative is to ensure that the structure is strong enough to be explosion proof.

Where the critical time is shorter than the reaction time of the ignition-failure protection system, and cannot be extended, the speed and efficiency and reliability of the ignition system becomes vital, and facilities for relieving excessive explosion pressures become essential.

This standard is based on the view that the hazard during the starting up phase is considerably greater than that at any other part of the operating cycle. Thus attention is concentrated on protection and supervision during ignition, and critical time considerations are applied only during this period. Lighting-off from a pilot, or turn-up after a low-fire start, or flame failure during operation, are not considered to be sufficiently problematical to warrant the application of critical time considerations.

Combustible vapours or dusts have essentially the same characteristics as fuel, i.e. they possess upper and lower combustible limits, stoichiometric ratios and characteristic flame speeds. Any material that will oxidize is potentially explosive if it is in a finely divided state and mixed with air. Since it is never possible to guarantee the absolute elimination of all possible sources of accidental ignition, first attention should be given to preventing the formation of combustible mixtures, the usual method being by dilution with air, but sometimes inert gases or products of combustion are used. Since these measures also cannot be guaranteed to be absolutely reliable, it is necessary to provide explosion-relieving facilities whenever such combustibles are present, unless the appliance can withstand any possible explosion pressure.

Some types of appliance make use of atmospheres that are rich in combustible materials, often well above the upper combustible limit, and at temperatures that are above the normal auto-ignition temperatures. For these appliances the same basic rules apply, i.e. the simultaneous occurrence of combustible mixtures and igniting temperatures must be prevented unless in strictly controlled circumstances.

Certain priorities should be kept clearly in mind when the protection needs of an appliance are being decided. The first priority should be that no injury to personnel results. The minimizing or containment of damage to the appliance or its surroundings, while important, is a secondary consideration.

Certain essential safety rules have widespread application irrespective of wide varieties of configuration, methods of heating, or types of control. For example a reaction to a fault or to a danger must be equally effective whether it is the reaction of an attendant or of an automatic device; adherence to a certain sequence of events may be equally important irrespective of whether the timing is provided manually or mechanically. The safety of an industrial appliance is a function of the features peculiar