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AUSTRALIAN ASSOCIATION OF  
**LIVE STEAMERS**

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CODE OF PRACTICE  
GAS FIRING OF AMBSC BOILERS

**DRAFT**



**GAS FIRING**

## Document control

This document consists of the following sections with the version dates shown.

Sections 1 to 9 dated: 13 February 2012

This document consists of 12 pages (including cover).

**This version is dated 13 February 2012 and is a draft!  
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## Authoring, Consultation and Approval

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## About this code

This Code of Practice has been compiled by the Australian Association of Live Steamers for use by Member Societies so that a minimum standard of competency can be achieved by their Society Members.

By adopting the requirements and procedures outlined in this code the Association and its Member Societies recognise their obligation to provide a safe environment for visiting public and members alike which will be engendered at the many operating locations throughout Australia.

This Code of Practice for the Gas Firing of AMBSC Boilers was drafted in 2010 and is a working draft. Comments on this Code are welcome.

## Distribution and change

The AALS maintains the master for this document and publishes the current version on the AALS website [www.aals.asn.au](http://www.aals.asn.au)

Any changes to the content of this publication will also update this control page. The control page defines the current version of this document. Changes to this document are approved by vote by the member Society's of the Association in accordance with the Association's Constitution and Standing Orders.

## Disclaimer

This document has been produced for use by the member Societies of the Australian Association of Live Steamers. Use by others for any purpose is at the user's risk. This document is not approved. Its purpose is purely for the stimulation of discussion and comment during its development phase.

## Contents

1. General.....	4
2. Context.....	4
3. Definitions.....	5
4. Scope.....	5
5. General Requirements.....	6
6. Construction of the System.....	7
7. Operating the System.....	8
8. Appendix 1 - LPG circuit.....	9
9. Appendix 2 - LPG Circuit Definitions.....	10

## **1. GENERAL**

- 1.1 This Code of Practice is intended to cover minimum safe operating requirements of affiliated societies operating miniature railways of gauges between 88.9mm (3-1/2") and 204mm (8"), operating at a speed not exceeding 20 km/h, road vehicles and plant, as non-commercial hobby operations.
- 1.2 This code is in accordance with the Aims and Objects as detailed in the Australian Association of Live Steamers Constitution.
- 1.3 With changes to Amusement Device Legislation in various States of the Commonwealth and the trend for self-regulation by industry and business in general the need for a high standard of competency in operators is required.
- 1.4 The Australian Miniature Boiler Safety Committee (AMBSC) is a subcommittee of the Australian Association of Live Steamers and produces codes for the safe design, construction and operation of miniature boilers. It is to these boilers that this code for Gas Firing applies.

## **2. CONTEXT**

- 2.1 This Code of Practice for the Gas Firing of AMBSC Boilers should be read in conjunction with:
  - 2.1.1 AALS Code of Practice:- Operation of Miniature Railways, Road Vehicles and Plant;
  - 2.1.2 AALS Code of Practice:- Interoperability and Safety of Miniature Railways, Road Vehicles and Plant;
  - 2.1.3 AALS Code of Practice:- Training of Operators and Attendants of Miniature Railways, Road Vehicles and Plant; and
  - 2.1.4 AMBSC Boiler Codes parts 1, 2, 3 and 4.
  - 2.1.5 AS 3533 - 2009 Amusement Rides and Devices.
  - 2.1.6 AALS Constitution.
  - 2.1.7 AALS Standing Orders.
  - 2.1.8 AS 2658-2008 LP Gas—Portable and mobile appliances.
  - 2.1.9 AS1596-2008 - Storing and Handling LP Gas.
  - 2.1.10 AS/NZS 1869:1996 -- Hose and hose assemblies for liquefied petroleum gases (LP Gas), natural gas and town gas
  - 2.1.11 AS 3814 Industrial and Commercial gas-fired appliances. (Section 2.23 Main Burner)

### **3. DEFINITIONS**

- 3.1 For definitions used within AALS Codes of Practice, see the AALS Code of Practice: Operation of Miniature Railways, Road Vehicles and Plant.

### **4. SCOPE**

- 4.1 This Code of Practice applies to anyone from an AALS affiliated club using LP Gas as a fuel for AMBSC boilers.
- 4.2 The intention of this Code of Practice is to provide information about setting up an LP Gas firing system for your AMBSC boiler and the procedure of obtaining certification.
- 4.3 This Code of Practice will also provide AALS affiliated club executives information regarding LP Gas firing systems should their members wish to pursue this method of firing AMBSC boilers or to establish safe practice to allow visiting members from other AALS affiliated clubs with LP Gas firing systems to operate their equipment
- 4.4 This Code of Practice applies to an LP Gas firing system supplied from a separate gas container with vaporized LP Gas to the inlet at the vapour pressure at 2.75 kPa or above and designed to be used for connection by flexible hose assembly to an LP Gas supply cylinder complying with AS 2030.1 (or equivalent).
- 4.5 Having an integral gas supply with gas storage container(s) of more than 2kg total capacity.
- 4.6 Autogas shall not to be used as a fuel for gas firing of AMBSC boilers.
- 4.7 See section 9.17 for the definition of LP Gas used within the scope of this Code.
- 4.8 This Code of Practice is intended to outline the safety requirements for LP Gas fired AMBSC boilers with regard to:
- 4.8.1. Satisfactory operation of the AMBSC boiler;
  - 4.8.2. Prevention of fire hazards and explosions;
  - 4.8.3. Prevention of injury to persons or property;
  - 4.8.4. Compliance with Gas rules and regulations now in force.

#### **NOTES:**

1. Requirements for storage and handling of LP Gas indoors and outdoors are specified in AS/NZS 1596.
2. Requirements for gas cylinders are specified in AS 203

## **5. GENERAL REQUIREMENTS**

### **5.1 General Requirements**

5.1.1 All gas fitting arrangements shall provide adequate support and ventilation for the associated LP Gas cylinder/s and operate only from the associated LP Gas cylinder/s.

### **5.2 Components within the Gas Firing System**

5.2.1 Certification of safety components.

Only components should be used that are clearly marked with the certifying body e.g. AGA.

5.2.2 Holes for screws, pins, etc.

Screws, Pins etc., intended for the assembly of components shall not penetrate the gas circuit leading to the gas injector.

5.2.3 Metal-to-metal joint or joints

The soundness of parts and assemblies connected to the gas circuit shall be assured by means of metal-to-metal joint or joints with seals (for example, flat-faced joints, O-rings or gaskets), i.e. excluding the use of any product which ensures soundness in the threads. For parts that do not require to be dismantled during normal maintenance the use of certified thread sealing compounds is permitted.

5.2.4 Soft Solder

Soft solder shall not be used to ensure that the gas circuit is leak proof. However it is permitted for internal connections within the gas circuit when they do not involve potential gas leakage. All sections of the gas circuit subject to leakage that require soldering shall be silver soldered with silver brazing materials containing more than 20% silver content.

## **6. CONSTRUCTION OF THE SYSTEM**

- 6.1 A certified gas fitter shall carry out construction of the fixed LPG supply system.
- 6.2 The LPG cylinder shall be mounted securely in a carriage or tender. This prevents bending of the piping.
- 6.3 The LPG cylinder shall be used as designed. (Horizontal cylinder shall be used in horizontal position, vertical cylinder in vertical position.) The gas outlet would deliver liquid if the cylinder is not used correctly. For large installations a gas fuse may be fitted.
- 6.4 If the system is not designed for use with vapour pressure, a pressure regulator shall be mounted in the same wagon or tender as the LPG cylinder. Any "warming" coils or piping between LPG cylinder and regulator shall be protected from bumping or damage if the regulator is not mounted right at the LPG cylinder.
- 6.5 When a regulator is fitted, a pressure gauge shall be mounted on the outlet side.
- 6.6 Enclosed spaces. The wagon where the LPG cylinder is "hidden" shall be well vented, Vents shall be in the floor (propane is 1.5 times heavier than air and butane is 2.0 times heavier) and at the sides or top of the carriage. Venting is required to prevent any accumulation of gases and provides air convection to warm the LPG cylinder.
- 6.7 All hoses and pipe work shall comply with AS/NZS 1869.
- 6.8 LPG cylinder wagon to locomotive connection: a regular link and pin coupler which could uncouple during normal operation is not satisfactory. A separate chain or link with bolts and locknuts shall be used to prevent car separation during train operation (see Appendix 1). Couplings are detailed in the AALS Code of Practice: Interoperability and Safety of Miniature Railways, Road Vehicles and Plant.
- 6.9 A Propane flashback arrestor shall be used in the gas circuit as shown in Appendix 1. If this location is not possible then another suitable location, e.g. tender, may be used.
- 6.10 Wherever possible, it is preferred that a 90 degree manual cut-off valve with clear ON/OFF markings shall be fitted to the main gas supply hose within reach of the operator (e.g. at the front of the tender of a locomotive or within reach of the driver/operator of other plant) to shut off the gas flow in case of an emergency. For small or stationary plant where such a cut-off valve is impractical, the cylinder valve may be used for this purpose.
- 6.11 The Burner Control Valve shall be located in the engine where the operator can shut it off if the fire is blown out. This can occur when the regulator is opened up suddenly or if the driver has the burner control valve on "Station" and tries to pull out of the station.
- 6.12 Wherever possible a commercial gas controller shall be used and it shall be fitted with pilot light and thermocouple to cut off gas flow to the main burner in the event of a flame failure.
- 6.13 Main burners may be constructed by the builder to a size to suit the particular boiler it is intended for.
- 6.14 The main Burner Valve should have an indicator to show the setting.  
Example: OFF – LIGHT UP – STATION – RUN.

## **7. OPERATING THE SYSTEM**

### 7.1 Starting Up

- 7.1.1 Assemble and securely tighten all hose connections.
- 7.1.2 Close the burner valve.
- 7.1.3 Turn on the LPG cylinder valve.
- 7.1.4 Set the regulator to the desired pressure (usually 20 to 80 kPa).
- 7.1.5 If necessary, with compressed air or other means, create a draft through the firebox. Electric blowers (for steam raising) are not recommended due to the risk of arcing and igniting the gas.
- 7.1.6 Crack open the burner valve and light the burner, adjust the flame and air flow.

### 7.2 Relighting After a Blow Out

- 7.2.1 Shut off the burner valve.
- 7.2.2 Use the steam blower to clear the firebox of accumulated gas.
- 7.2.3 Crack open the burner valve and relight the burner.
- 7.2.4 Adjust the flame.

### 7.3 Derailment or Accident

- 7.3.1 Shut off the burner valve and tank valve immediately.
- 7.3.2 Allow the steam blower to run for at least 10-20 seconds.
- 7.3.3 Check the system for loose or broken lines before restarting.

### 7.4 Shutdown

- 7.4.1 Turn off the LPG cylinder valve.
- 7.4.2 Let the fire burn out.
- 7.4.3 Allow the blower to clear the firebox of gas.
- 7.4.4 Disassemble the connections between the carriages.

### 7.5 Maintenance

- 7.5.1 Check the connections regularly for leaks with a soapy water leak detector.
- 7.5.2 Replace worn hose and/or fittings.
- 7.5.3 Keep the LPG cylinder carriage or tender clean. Do not store other gear or "junk" in the LPG cylinder wagon that could hinder ventilation.

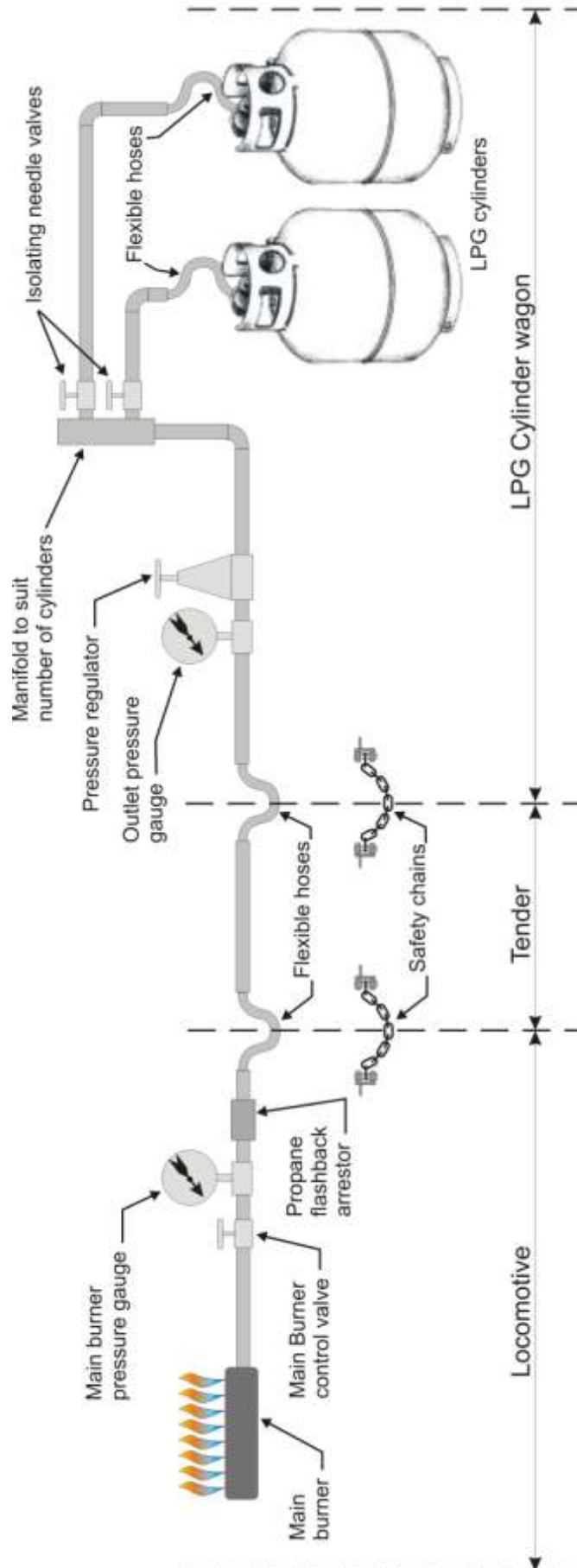
### 7.6 Changing over LPG cylinders

- 7.6.1 LPG cylinders shall be changed over in an isolated area well away from live steam locomotives or other areas where fire or sparks are present.
- 7.6.2 Ensure that all hose connections are securely tightened.
- 7.6.3 The empty LPG cylinder shall be placed immediately in a safe storage area.



**8. APPENDIX 1**

8.1 Example of an LPG circuit for locomotive firing.



## **9. APPENDIX 2**

### **9.1 LPG Circuit Definitions**

for a better understanding of an LP Gas firing system and for the purpose of this Code of Practice, the definitions below apply.

### **9.2 Burner**

#### **9.2.1 General definition**

a device that positions a flame in the desired location by delivering gas and air to that location in such a manner that continuous ignition is accomplished.

#### **9.2.2 Main burner**

a burner designed to fulfil a thermal function of the appliance.

NOTE: Main burners are also referred to as 'burner' throughout this Code of Practice. Main burners, used in the context of this Code of Practice, are not required to be certified.

### **9.3 Burner port**

the opening in a burner through which gas or an air/gas mixture issues to be ignited and burned.

### **9.4 Certified/Certification**

Assessed by a certifying body and having a certificate number to demonstrate a Standard compliance.

### **9.5 Certifying body**

a body acceptable to the Technical Regulator that provides assurance of compliance of appliances and components with nominated Standards and other accepted safety criteria.

### **9.6 Control**

component designed to be operated manually so as to operate a control of the appliance, such as a valve, thermostat, etc.

### **9.7 Detachable**

that which can be dismantled without using a tool.

### **9.8 Flame abnormality**

A flame condition that results in lifting, floating, lighting back, extinction, yellow tipping causing carbon deposition, carbon deposition or objectionable odour and undue noise.

### **9.9 Flame safeguard**

a safety device that automatically cuts off the gas supply if the actuating flame is extinguished.

### **9.10 Flame supervision device**

device that, due to the presence of a flame on the sensing element, permits gas flow to the burner and any pilot and which cuts off the gas supply to the burner in the event of extinction of the supervised flame.

### **9.11 Flame lift**

phenomenon characterized by the partial or total movement of the base of the flame away from the burner port.

### **9.12 Flame stability**

phenomenon characterized by absence of flame lift or light-back.

### **9.13 Gas circuit**

the pipe work and components between the gas supply inlet and the injector.

### **9.14 Gas consumption**

a measure of the energy introduced into an appliance under specified conditions, expressed in megajoules per hour (MJ/h).

- 9.15 **Ignition device**  
device to ignite one or more burners directly or indirectly.
- 9.16 **Injector**  
a device that causes air to mix with a stream of gas. In the case of an aerated burner it incorporates an orifice discharging gas into the mixing throat or tube.
- 9.17 **LP Gas (Liquefied petroleum gas)**  
a hydrocarbon fluid composed predominantly of any of the following hydrocarbons, or mixtures of all or any of them: propane (C<sub>3</sub>H<sub>8</sub>), propylene (C<sub>3</sub>H<sub>6</sub>), butane (C<sub>4</sub>H<sub>10</sub>) or butylenes (C<sub>4</sub>H<sub>8</sub>). Unless specifically stated otherwise, any reference to 'propane', 'butane', etc. means the commercial grade of that product.  
NOTE: The characteristics of the various LP Gases, either pure or of commercial grades, together with methods for their determination, are given in the Australian LPG Association publication, *Liquefied petroleum gas for heating use - Specification 2000*.
- 9.18 **Light-back**  
phenomenon characterized by the return of the flame inside the body of the burner.
- 9.19 **Mixing tube**  
that part of an aerated burner in which the air and gas are mixed.
- 9.20 **Nominal gas consumption**  
the gas consumption as stated by the manufacturer on the appliance data plate, in instructions and in general communications.
- 9.21 **Normal pressure**  
in the case of vapour pressure appliances the gas pressure at the appliance inlet as nominated by the manufacturer to give the nominal gas consumption.  
In the case of appliances supplied with gas from a refillable container and using a regulator, the gas pressure at the appliance inlet or test point (if provided), as nominated by the manufacturer to give the nominal gas consumption.
- 9.22 **Orifice**  
a precise aperture in an injector that functions as a metering device to control the gas consumption of a burner. It is also a directional guide for the gas injected into the burner throat.
- 9.23 **Outdoor**  
an above ground open air situation with natural ventilation, without stagnant areas, where gas leakage and products of combustion are rapidly dispersed by wind and natural convection.
- 9.24 **Regulator**  
a device that automatically regulates, to a predetermined value, the outlet pressure or outlet volume of gas passing there through.
- 9.25 **Removable**  
components that are intended to be removed with or without the use of a tool.
- 9.26 **Safety shut off valve**  
an automatic valve that shuts off the gas supply to an appliance when a signal level indicates that a dangerous condition has developed.
- 9.27 **Spitting; sputtering**  
flame phenomena where the escape of non-evaporated liquefied gas produces a shower of burning liquid droplets that separate from the main flame.
- 9.28 **Valve**  
a device for the purpose of controlling or shutting off flow.

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