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AUSTRALIAN ASSOCIATION OF  
**LIVE STEAMERS**

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CODE OF PRACTICE  
GAS FIRING for SMALL MODELS



**GAS FIRING for SMALL MODELS**

## Document control

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

Sections 1 to 11, Appendix A and B, dated 1 April 2016:

This document consists of 14 pages (including cover).

## Authoring, Consultation and Approval

This document was produced by the Australian Live Steamers Safety Committee, a committee of the Australian Association of Live Steamers Limited ABN 81 107 882 404 (AALS) For the registered office refer to the AALS Reference document.

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This Code of Practice for the Gas Firing of AMBSC Boilers was approved at the AALS Annual Convention in Cobden on 26 March 2016.

## 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.

## 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.

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## **1. GENERAL**

- 1.1 This Code of Practice is intended to cover minimum safe operating requirements of affiliated societies operating steam powered garden type railways and watercraft, 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 construction and operation 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. Boilers made to the Sub-miniature Boiler Code (Part 3) will be applicable to the gas firing that this Code prescribes.

## **2. CONTEXT**

- 2.1 This Code of Practice for Gas Firing for Small Models 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;
  - 2.1.4 AALS Code of Practice:- Gas Firing of AMBSC Boilers; and
  - 2.1.5 AMBSC Boiler Codes parts 1, 2, 3 and 4.
  - 2.1.6 AS 3533 - 2009 Amusement Rides and Devices.
  - 2.1.7 AALS Constitution.
  - 2.1.8 AALS Standing Orders.

## **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 for the building of small scale garden type steam locomotives or watercraft for operating by an AALS affiliated society in the presence of the public.
- 4.2 The intention of this Code of Practice is to provide information about the design, construction and operation of the gas equipment used for firing small scale garden type steam locomotives or watercraft.
- 4.3 This Code of Practice will also provide AALS affiliated club executives information regarding these systems should their members wish to pursue this method of firing small models and to establish safe practice to allow visiting members from other AALS affiliated clubs to operate their equipment.
- 4.4 This Code of Practice applies to a Butane Gas only firing system supplied from a separate gas container at the vapour pressure normally between 140 to 180 KPa at 25°C.
- 4.5 The pressures contained within the butane container are directly related to temperature. This Code uses 50°C as the container temperature to determine the pressure and thus structural requirements of the container. At this temperature the pressure falls within the scope of the AMBSC Code Part 3 for Medium Pressure boilers, permitting that code to be used for the structural aspects of the container. It is noted that commercial disposable canisters also have 50°C maximum operating conditions. Operators shall ensure that they do not operate this equipment where the temperature of the butane container is likely to exceed 50°C. For a typical tank locomotive situation, mathematical modelling and practical tests have confirmed that under normal operating conditions likely to be experienced on a typical garden railway, the expansion of the gas being drawn off provides a reduction in container temperature that offsets heat flow from the burner and boiler and maintains the container temperature below 50°C during the typical operating period. However it is recommended that locomotives should not be operated when ambient temperatures exceed 40°C. Designers of locomotives (in particular tank locomotives) should wherever possible arrange the butane container to minimise heat flow from burners and boilers to the butane container.
- 4.6 Gas storage containers specifically manufactured for engines or watercraft shall not exceed 200cc. The common size for garden railway locomotives is typically around 20 to 40 cc.
- 4.7 Where commercial gas containers are used in the system, the containers shall be of the type which incorporates an internal (Lindal) valve. Containers of the puncture type shall not be used.
- 4.8 This Code of Practice is intended to outline the safety requirements for Butane Gas firing 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.
- 4.9 Commercial builders of genuine model equipment will have their own standards and compliance regime to which their products are built, and are thus exempt from the design and construction requirements of this Code. Evidence to the consumer shall be by provision of a certified gas container test certificate from the manufacturer. However it is recommended that migration to this

Code occur wherever its requirements are greater than those currently being used by manufacturers. Certificates issued by dealers or agents are not acceptable unless retested in compliance with this code.

## **5. DESIGN**

### **5.1 General Requirements**

- 5.1.1 All gas fitting arrangements shall provide adequate support and ventilation for the associated Butane Gas container.
- 5.1.2 This code presumes two arrangements of construction:
  - a) A purpose built refillable gas container, or;
  - b) A commercial disposable gas container and burner adapted to suit the intended purpose.
- 5.1.3 Holes for screws, pins, intended for the assembly of components shall not penetrate the gas container, or gas circuit leading to the burner.
- 5.1.4 Metal-to-metal joint or joints.

The soundness of parts and assemblies connected to the gas circuit shall be provided by means of a metal-to-metal joint (such as screwed unions and nipples) 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.
- 5.1.5 Soft solder shall not be used for any gas component. All sections of the gas circuit subject to leakage that require soldering shall be silver soldered with silver brazing materials containing more that 20% silver content.
- 5.1.6 All gas containers shall have an outlet valve provided to isolate the gas supply.
- 5.1.7 All systems shall be designed to use the vapour, (ie the outlet fittings shall be on the top of the container, or designed to take vapour from the top of the container.)
- 5.1.8 Container design shall be for 520KPa with requirements as prescribed in the AMBSC Code Part 3 or Part 1 or as otherwise required by this Code.
- 5.1.9 A dimensioned drawing of the proposed container should be provided to the inspector prior to any inspection or test unless built to a published design. The drawing shall be filed with the Butane Container Register.

### **5.2 Purpose Built Gas Container**

- 5.2.1 The gas container may be of any shape, providing flat surfaces are sufficiently strong, or stayed to resist the required pressures.
- 5.2.2 Containers shall be of copper or brass fully silver soldered. Material shall be in accordance with AMBSC Code Part 3 or Part 1. Cylindrical containers may be fitted with ends machined from brass, with an engagement depth as for a flanged plate. Such ends shall not be hollowed out.



- 5.2.3 The use of 20mm square extruded brass section of minimum 1.2mm wall thickness is acceptable for butane container construction.
- 5.2.4 Bushes of copper, brass or bronze, shall be provided for fittings that are to be attached to the gas container. Such bushes shall be required for the gas filling connection, and for the gas supply valve. Other bushes may be needed for mounting, etc.
- 5.2.5 Provision shall be made for a descriptive number to be applied to the gas container without reducing the required plate thicknesses. A plate silver soldered to the container would be the usual practice for this.
- 5.2.6 The plate stress for the design of the gas container shall be 26MPa for copper, as provided for in the AMBSC code. Brass may be designed for 75MPa. However it is suggested that brass be used in accordance with the requirements for copper as described in the AMBSC codes (except for extruded brass tube as permitted in 5.2.3) unless an independent verification is obtained for the design. i.e. brass can be directly substituted for copper, where copper is specified in the AMBSC code or this code.
- 5.2.7 Construction shall be in accordance with AMBSC Code Part 3 for Medium Pressure Boilers or AMBSC Code Part 1. Stays shall be plain solid copper rod silver soldered in place. Plate thickness, stay sizes and pitch shall be as per AMBSC Code Part 3 or Part1.

### 5.3 **Commercial gas container.**

- 5.3.1 When a commercial gas container, connector and burner is adapted for use in a model, no change shall be made to the arrangement as designed and manufactured. The equipment shall be used in the manner for which the manufacturer has designed the equipment. Care shall be taken that the equipment is used with adequate ventilation, and that it is not enclosed to an extent beyond what the manufacturer had intended.
- 5.3.2 Only systems with disposable containers to BS/EN 417:2012 which incorporate a valve shall be used. Puncture type containers shall not be used.
- 5.3.3 The Butane canisters shall only ever be used in the vertical position to prevent flare ups due to liquid being drawn into the burner. In particular horizontal cylinder positions in watercraft present a risk with rolling of the hull, and thus shall not be used.

### 5.4 **Burner Connections**

- 5.4.1 Copper pipe with silver soldered unions and nipples is acceptable for the connection between the Butane Container and the burner. A disconnectable screwed connector with O ring seal may be provided if the container requires regular removal. The Butane container shall be mounted to avoid undue working or stress on the burner supply pipe.
- 5.4.2 The use of a flexible hose between the container and the burner is permissible. However, for ceramic type gas burners the first 100mm. of pipe must be of the appropriate size of copper or brass. For burners which mix gas and air within a combustion tube the first 150mm must be of copper or brass. The flexible hose shall be of silicone, with the ends a firm push fit over fittings designed to retain the hose through bulbs or barbs (ensuring the form of retainer does not damage the hose). Where possible a retaining clip should be fitted.

- 5.4.3 Connections between copper tube and flexible hose shall be provided with proper fittings to securely anchor the hose and shall be leak free.

## **6. CONSTRUCTION**

- 6.1 The construction of the gas containers shall be as for the AMBSC Code Part 3 Sub-miniature Boilers Section 2.4 Medium Pressure.
- 6.2 Commercially obtainable gas filling valves will usually be installed.
- 6.3 Containers shall be secured inside the engine or watercraft to avoid stress being placed on connecting pipework to the burner.
- 6.4 Adequate ventilation shall be provided to permit any escaping gas during refilling to vent harmlessly.
- 6.5 In the case of watercraft, containers shall have the connecting pipework easily disconnectable to permit removal of the gas container for refilling externally.
- 6.6 Any change to a previously tested container shall be reinspected and tested as for a new container.



## **7. INSPECTION AND TESTING**

- 7.1 The butane container, fittings and connecting pipework shall be inspected for compliance with this code.
- 7.2 Gas containers shall be hydrostatically tested to 1040KPa, which shall be held for 10 minutes during which inspection shall be made for leakage or distortion. Any leak or weep constitutes a failure.
- 7.3 Following a successful hydrostatic test the identifying number shall be engraved onto the identification plate fixed to the container or alternatively a previously stamped plate can be silver soldered on during construction, with the agreement of the inspector.
- 7.4 Once the filling valve and isolating valve are fitted, the container shall be charged with gas and immersed in water, to check for leakage. If it is not possible to perform this test, the container shall be tested by use of soapy water around all fittings. Once this test has been completed, a certificate shall be issued.
- 7.5 Certificates shall be valid for 10 years. A fresh hydrostatic test is not required after 10 years, however the container shall be charged with gas and immersed in water, or soapy water applied to test for leaks.
- 7.6 Systems constructed using commercial disposable butane canisters do not require testing nor will they be provided with certificates. However Societies should ensure such systems are not modified nor installed in a manner that would reduce the level of safety that would usually exist when used in the manner to which the manufacturer intended.
- 7.7 Model butane equipment provided by a commercial manufacturer, provided it is supplied with test certificates, will not require further testing, however retesting shall be carried out in accordance with this code.

## **8. MAINTENANCE**

- 8.1 It is recommended that rubber seals and O rings be replaced before the re-certification test.
- 8.2 Evidence of leakage of gas shall be immediately investigated and the equipment not used until rectified.

## **9. OPERATING THE SYSTEM**

- 9.1 Butane cylinders and containers (including cylinders or canisters used for refilling) shall not be left in the direct sun.
- 9.2 Butane containers shall be removed from watercraft for refilling unless it is not possible to fill the hull with gas during the refilling process. (For example, a butane container mounted above an enclosed deck would satisfy this requirement).
- 9.3 Refilling shall be carried out away from any source of ignition. Onlookers shall be kept a reasonable distance away.
- 9.4 When igniting the gas, if ignition is not achieved immediately, turn off the gas and allow it to vent before attempting to relight. Similarly isolate the gas to allow the gas to vent if the flame extinguishes while in operation.
- 9.5 Never refill the Butane container while the burner is operating.

## **10. INSPECTION AND TESTING PERSONEL**

- 10.1 Societies should nominate suitably competent people to inspect the standard of construction of Butane containers and supervise testing and certification in accordance with this code.
- 10.2 AMBSC Boiler Inspectors are considered as suitably competent. Societies may appoint others to perform this function providing they have similar qualifications and are agreed by the Secretary of the Australian Live Steamers Safety Committee.
- 10.3 Testing personnel shall not inspect or certify containers owned or built by themselves.
- 10.4 Testing personnel shall allocate Butane container register numbers and ensure the tested container is inscribed with the relevant number and details entered in the club Butane Container Register. Requirements for the Butane Container Register are in Appendix 3.

## **11. AMENDMENTS TO THIS CODE**

- 11.1 First approved issue 1 April 2016.

**APPENDIX 1 - BUTANE CONTAINER REGISTER AND CERTIFICATE**

The Butane Container Register shall contain the following details:

Date, Item & Loco/Boat Description, Test conducted, Pass/Fail, Builders Name/address, Owners Name/address, certificate and number issued, Name of Tester.

*(Butane register forms are available in soft copy format and should be filled in on computer. They may be printed out individually and filed in clear plastic sleeves in a folder if required).*

The certificate issued shall contain the following:

Butane Container Identification, Item & Loco/Boat Description container is fitted to, Date of Issue, Expiry Date, Owners Name, Name and signature of tester.

<b>AUSTRALIAN LIVE STEAMERS SAFETY COMMITTEE BUTANE GAS CONTAINER CERTIFICATE</b>	
Issued By .....	(Club)
Issued To.....	(Name)
Butane Container Identification.....	
Date of Issue.....	
Date of Expiry.....	
Container fitted to.....	
SIGNED:.....	Inspector.....
	PRINT NAME
SIGNED:.....	Witness.....
	PRINT NAME

**ALSSC BUTANE CONTAINER REGISTER**

CLUB.....  
Page.....

**General Details**

Builder.....

Owner.....

Club.....

Identification.....

Design Pressure.....520KPa

General Description.....

.....

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Application.....

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Design Details (Include design drawing).....

.....

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**Construction Inspection**

Date of Approval.....

Signed.....Print Name.....

Signed.....Print Name.....

**Hydrostatic Test 1040KPa**

Date of Approval.....

Signed.....Print Name.....

Signed.....Print Name.....

**Complete Assembly Leakage Test**

Date of Approval.....

Signed.....Print Name.....

Signed.....Print Name.....

**Certificate Issued**

Date.....

Signed.....Print Name.....

Signed.....Print Name.....

**Certificate Reissued:**

**Complete Assembly Leakage Test**

Date of Approval.....

Signed.....Print Name.....

Signed.....Print Name.....

Notes.....

**Certificate Reissued:**

**Complete Assembly Leakage Test**

Date of Approval.....

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**Certificate Reissued:**

**Complete Assembly Leakage Test**

Date of Approval.....

Signed.....Print Name.....

Signed.....Print Name.....

Notes.....

## **APPENDIX 2 - BUTANE CONTAINER IDENTIFICATION**

The Butane Container Identification may be stamped or engraved such that the identification is permanently attached to the container.

The registration number shall be in the following format:  
B. <Container Number>.<Club AMBSC ID>

where            B - Butane container.  
                    Container Number - Unique sequential number provided by issuing Society.  
                    Club ID - The issuing clubs AMBSC identification.

e.g.    B.21.NA means the twenty first Butane container approved by NSW Society 'A'.

Note: The date is not required on the tank ID as it is noted in the register.

AMBSC identifications are listed in the AALS Reference Document.