



Ref No: HGR-B9160  
Issue No: 02  
Issue Date: October 2025  
Review Date: October 2027



## GUIDANCE NOTE

# EXAMINATION IN SERVICE of Steam Locomotive Boilers

### Purpose

This document describes good practice in relation to its subject to be followed by Heritage Railways, Tramways and similar bodies to whom this document applies.

### Development

This document has been developed by boiler experts in consultation with His Majesty's Railway Inspectorate (HMRI) a directorate of the Office of Rail and Road (ORR). The document HGR B9000 sets out the background to setting up the Boiler Code of Practice Committee (BCOP).

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## Table of Contents

1.	Introduction .....	3
2.	Recommendations.....	3
3.	Scope of this Guidance .....	3
4.	Dimensional Notation.....	3
5.	Personal Protective Equipment .....	3
6.	General .....	4
7.	Daily examination by footplate crew .....	4
8.	Periodic examination by fitting/boiler staff .....	4
9.	Examination at washout by fitting/boiler staff .....	4
10.	Examination at annual intervals by Competent Person.....	4
11.	Examination at overhaul by Competent Person .....	5
12.	Examination following any in service repair .....	6
13.	Examination Records.....	6
	Appendix A: Typical record sheets for various boiler maintenance activities .....	7

**1. Introduction**

- a) This Guidance Note is one of a series dealing with Locomotive Boilers that were produced by the "Steam Locomotive Boiler Code of Practice" practitioners' meetings.
- b) Railway locomotive boilers are designed to create, store and distribute steam at high pressure. The working life of such a boiler can be considerably shortened if due care is not taken at all stages of inspection, repair, running maintenance and day-to-day running.
- c) In the past there have been a series of accidents and explosions due to work being undertaken without having due regard to the inherent risks involved. It is with that in mind that HMRI and HRA set up the series of meetings of boiler practitioners to discuss the issues, distil good practice and codify it into this series of Guidance Notes.
- d) This guidance is written for the assistance of people competent to perform these tasks. In places the terminology used may be specific to such practitioners.
- e) This guidance should also be useful to those in a supervisory or more general role. However, no work should be undertaken unless the persons concerned are deemed competent to do so.

**2. Recommendations**

- a) This guidance note is issued as recommendations to duty holders.
- b) Where duty holders decide to take actions that are not in agreement with these recommendations following appropriate risk assessments or for other reasons, it is recommended that those decisions are reviewed by the senior management body of the organisation concerned and a formal minute is recorded of both the decision reached and the reasons for reaching it.

**3. Scope of this Guidance**

- a) This guidance is ONLY concerned with those actions that could adversely affect the life and/or the safe operation of the boiler. Duty holders should consider all aspects of each of the sections covered before determining their procedures.

**4. Dimensional Notation**

- a) The dimensions in this document are variously described in a mixture of imperial and metric units. Where practical, equivalent dimensions have been shown but in some cases the dimensions do not easily equate and so the units in force at the time that the original designs were documented have been used.

**5. Personal Protective Equipment**

- a) Before undertaking any work, a risk assessment must have been conducted.
- b) Protective equipment is to be supplied and used at work wherever there are risks to health and safety that cannot be adequately controlled in other ways.
- c) The equipment must be:
  - i) Compliant with the latest Personal Protective Equipment Regulations;
  - ii) Properly assessed before use to ensure it is suitable;
  - iii) Maintained and stored properly;
  - iv) Provided with instructions on how to use it safely; and
  - v) Used correctly by those undertaking the work.

**6. General**

- a) Boiler examinations fall into several categories:
  - i) Daily examination by footplate crew.
  - ii) Periodic examination by fitting/boiler staff, according to local arrangements.
  - iii) Examination at washout, usually 14 to 28 day intervals, by fitting/boiler staff.
  - iv) Examination at annual intervals by Competent Person.
  - v) Examination at overhaul, usually 7 to 10 year intervals, by the Competent Person.
  - vi) Examination following any in-service repair.

**7. Daily examination by footplate crew**

- a) Details of the procedure for this examination are contained in Guidance Note HGR-B9140.

**8. Periodic examination by fitting/boiler staff**

- a) The requirements for intermediate inspections by fitting and boiler staff beyond those carried out by footplate crew will reflect the circumstances applicable for a particular railway's requirements. If intermediate examinations are required, they are likely to contain items which are normally part of the examination at washout. These might include:
  - i) Cleaning of tubes and firebox;
  - ii) Testing of water gauge frame;
  - iii) Testing of boiler water quality; and
  - iv) Blowing down.

**9. Examination at washout by fitting/boiler staff**

- a) Details of the procedure for this examination are contained in Guidance Note HGR-B9155.

**10. Examination at annual intervals by Competent Person**

- a) Annual or 14 monthly examinations are undertaken by the Competent Person, these will consist of an internal examination with the boiler empty of water followed by an in-steam examination to test the functionality of the boiler and fittings.
- b) Annual examinations shall be in accordance with the "Written Scheme of Examination" for the boiler. The Competent Person will require the "Written Scheme of Examination" available to view at the time of the examination.
- c) The Competent Person has the authority to request any additional testing, surveys, examinations, stripping of components, cleaning as he may require and any associated paperwork.
- d) To prepare the boiler for internal examination, it should be washed out and inspected by fitting/boiler staff to ensure that it is clean in accordance with the written scheme. In addition, the following will be required:
  - i) All accessible washout plugs to be removed, cleaned and laid out for inspection.
  - ii) All mud hole doors to be removed, cleaned and laid out for inspection.
  - iii) Water gauge frames to be stripped down, components cleaned and laid out for inspection.
  - iv) Water level test cocks, where fitted, to be removed, cleaned and laid out for inspection.
  - v) Safety valves that cannot be inspected in the assembled condition are to be stripped down, components cleaned and laid out for inspection.
  - vi) Fusible plugs to be removed cleaned and laid out for inspection.

- vii) Pressure gauges to be calibrated against a suitably certified master gauge or dead weight tester and adjusted as required.
- viii) The brick arch should be removed to allow examination of any stays, rivets, studs and plate work normally covered by it.
- ix) The boiler identification number must be clearly marked upon the boiler shell.
- e) The Competent Person shall conduct a thorough examination including:
  - i) The internal surfaces and components of the boiler;
  - ii) The external surfaces of the boiler where visible;
  - iii) The firebox, tubes and stay ends;
  - iv) The smokebox and internal components;
  - v) All stays, testing by hammer testing or other means for any that are cracked or broken;
  - vi) Boiler fittings;
  - vii) Super heater elements and header; and
  - viii) Any other items associated with the boiler and all paperwork that he may require.
- f) At any time, the Competent Person may require repairs to be undertaken prior to proceeding to the next stage of examination.
- g) To prepare the boiler for steam examination it should be boxed up, filled and steamed by fitting/boiler staff.
- h) The Competent Person shall conduct a thorough examination including:
  - i) The functional operation of:
    - (1) The safety valves;
    - (2) The water gauge frames;
    - (3) The water test cocks, where fitted and
    - (4) Both means of feeding boiler water, injectors or pumps.
  - ii) The correct calibration of pressure gauges.
  - iii) When both safety valves are fully operational, checking that the boiler pressure has not accumulated above the safe operating limit.
  - iv) Visible signs of leakage from boiler shell, fittings or pipework.
  - v) Superheater header and elements for signs of leakage.
- i) Following examinations, the Competent Person will issue a written report summarising the findings of the examinations, observations and details of any repairs required. If the boiler is fit for further service the report will also include the date beyond which the boiler cannot be steamed without further examination.

### **11. Examination at overhaul by Competent Person**

- a) In addition to the examinations and maintenance listed above, the following items will need attention at intervals and may be grouped together at an overhaul, this will normally be at 7 to 10 year intervals:
  - i) All items as required by the "Written Scheme of Examination" for the boiler which will normally include the following:
    - (1) Complete examination of the inside and outside of the boiler shell and firebox, entailing removal of all tubes and cladding and lifting the boiler from the locomotive frame where necessary, e.g. on narrow firebox locomotives;

- (2) Examination of all steam pipes;
- (3) Examination of all copper pipes after they have been annealed;
- (4) Examination of all boiler fittings.
- (5) Establishing the thickness of all plate work subject to corrosion or erosion.
- (6) Testing for cracking of plate work and welds.
- (7) Hydraulic and steam testing.

## **12. Examination following any in service repair**

- a) Prior to any repair the Competent Person should be consulted and their approval regarding the procedure for the repair confirmed. The extent of any examinations required following repair will be at the discretion of the Competent Person and may include an hydraulic test.

## **13. Examination Records**

- a) A written record of all examinations and findings must be kept for each boiler. This includes both records kept by fitting/boiler staff at washout etc and those provided by the Competent Person. In addition, records of any additional surveys such as thickness testing must be kept.
- b) At the time of any repair/overhaul details of the repairs must be kept. These should include:
  - i) Material test certificates.
  - ii) Copies of welder competence certificates.
  - iii) Details of the person undertaking the repairs.
  - iv) Extent of repairs.
  - v) Date of repairs.
- c) All records should, where possible, be retained for the life of the boiler and securely archived using the unique boiler number as the means of identification.
- d) Typical record sheets for various boiler maintenance activities are shown in Appendix A.

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**Appendix A: Typical record sheets for various boiler maintenance activities**

Boiler number ..... Locomotive name/number .....  
 Date of preceding annual Examination by a Competent Person .....  
 Washout period .....days

Date	Duty performed	Working days since last washout

**Typical record of boiler washouts, examination and repairs**

Boiler number ..... Locomotive name/number .....  
 Date of preceding annual Examination by a Competent Person .....  
 Washout period .....days Working pressure .....

Date	Washout	Inspection	Clean/test water fittings	Fusible plugs changed	Other work, examinations etc

**Typical record of boiler defects**

Boiler number ..... Locomotive name/number .....  
 Working pressure .....

Date	Defect and when reported	How repaired	Date and signature