HERITAGE RAILWAY ASSOCIATION

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BOILER CODE OF PRACTICE (BCOP)

GUIDANCE NOTE

WRITTEN SCHEME OF EXAMINATION and its application.

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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1. Introduction

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.

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.

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.

This guidance will also be useful to those in a supervisory or more general role. However, no work should be undertaken unless the people concerned are deemed competent to do so.

2. Recommendations

This guidance note is issued as recommendations to duty holders. 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. Dimensional Notation

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 the original designs were documented have been used.

4. Personal Protective Equipment

Before undertaking any work, a risk assessment must be conducted.

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.

The equipment must be

- In accordance with the latest Protective Equipment at Work regulations;
- Properly assessed before use to ensure it is suitable;
- Maintained and stored properly;
- Provided with instructions on how to use it safely; and
- Used correctly by employees.

5. General

The Pressure Systems Safety Regulations 2000 specify the legal requirements to ensure the safe operation of pressure vessels and pipelines. This guidance note is concerned with the sections dealing with boiler examinations, specifically Regulation 8 - Written Scheme of Examination, and Regulation 9 – Examination in accordance with the Written Scheme. **All users and owners of steam boilers have a duty of care and a legal responsibility to comply with these regulations and to have a Written Scheme in place for every operating boiler.**

Any person responsible for the maintenance, operation and examination of the boiler should have access to an up-to-date copy of the Written Scheme.

The regulations identify pressure systems into one of 3 categories; all but the very largest locomotive boilers fall into the **"**Intermediate systems" category. With regard to the attributes and role of competent persons all locomotive boilers may be considered as **"**Intermediate systems".

6. Regulation 8 – Written Scheme of Examination

This regulation requires that: -

- The user/owner of a boiler shall not operate a boiler without a written procedure (the Written Scheme of Examination) detailing the periodic examinations of that boiler by a person suitably competent to undertake that examination. The examination to include protective devices, and to include pipework/fittings in which a defect may give rise to danger. It does not include any Prime Mover (i.e. cylinders or turbo generator). The boiler and all parts must be identified in the procedure.

- The user/owner writes, or has written for them by a person suitably experienced, a Written Scheme of Examination detailing the examination regime for the particular boiler. This document must be approved by a suitably competent person. The production of the Written Scheme is the responsibility of the user/owner.

- The user/owner must ensure that the Written Scheme of Examination is periodically reviewed by a suitably competent person to ensure that it remains suitable for current conditions, and that it is modified in accordance with any recommendations made by the suitably competent person.

- The Written Scheme of Examination must include the type, extent and frequency of all examinations, special preparation requirements, and any examinations prior to first use and following any repairs.

Definitions.

- "User". The user of boiler is the operating organisation or company (the railway), not the locomotive crew who will be working to the instructions of the operating organisation. For who is responsible and for the role they play, see Appendix A.

- "Owner". The owner of the boiler. For who is responsible and for the role they play, see Appendix A.

- "A suitably competent person". This is generally the person commonly referred to as the "Boiler Inspector" or the "Competent Person" who is usually an employee or agent of a corporate body specialising in the inspection of steam locomotive boilers. Advice on selecting a Competent Person is attached as Appendix B.

- "Protective devices." These include any manual or automatic device intended to assist with the safe operation of the boiler, such as Safety Valves, Fusible Plugs, Pressure gauges, Water level gauges, etc.

- "Pipework." All metal tubes and hoses used to carry steam on locomotives are defined as "pipework" and are to be included in the scope of the written scheme. (The term "Pipeline" as used in the regulations has a different meaning which does not apply to locomotives and can be ignored).

7. Contents of a Written Scheme.

The Written Scheme should provide all of the information required to ensure that suitable examination procedures are in place to enable the boiler to function safely. The following subjects are to be detailed: -

- **Identification of boiler**. Each and every boiler should have a unique identification number, or code, stamped into the boiler, alternatively onto a plate attached to the boiler. This number or code should be used to identify the boiler and all of its accompanying records/paperwork. Use of the locomotive number is to be avoided due to the risk of boilers being interchanged between locomotives at some stage in their long life. If the locomotive number is required it should only supplement the boiler number i.e. “Boiler number xxxx (presently fitted to locomotive yyyy)”.

- **Identification of fittings**. Each fitting should have a unique identification number stamped on it applicable to that fitting.

- **Safe operating limit**. This is the maximum pressure at which the boiler should be operated. In the case of locomotive boilers, it usually corresponds to the settings of the safety valves and the maximum working pressure on the pressure gauge. Where the safe operating limit (design pressure) is higher than the normal working pressure the boiler and fittings must be examined and tested in accordance with the higher limit.

- **Name and address of user/owner**. Being mobile, users/owners can change and become confused. The name/address identified on the Written Scheme should always reflect the organisation responsible for ensuring that the procedures contained within the Written Scheme are being complied with.

- **Scope**. The scope details the components covered by the Written Scheme, generally the boiler, protective devices, fittings, superheaters, pipework to cylinders and any pipework containing steam including carriage heating pipework on the locomotive. The scope may also detail components not specifically covered such as cylinders and steam chests.

Types of examination to be detailed in the Written Scheme.

- **Thorough examination**. The thorough examination is undertaken before the boiler is first put into service and annually throughout the life of the boiler. It consists of two parts. Part 1 is a detailed examination internally and externally, part 2 is an examination when in steam. The boiler may be operated for a maximum of 14 months from the date of the part 1 examination. The maximum period between thorough examinations should be detailed in the Written Scheme.

- **Review.** The boiler shell and riveted seams shall be examined at periods not in excess of 7 years, for welded seams a lesser period, before exposure and examination may apply at the discretion of the Competent Person. Under certain circumstances this may be extended in stages up to a maximum of 10 years subject to a review involving additional inspections as required by the Competent Person. Such inspections may also involve partial removal of fittings, tubes, cladding and lagging. The extent of dis-assembly required to undertake such a review should be specified.

- **Additional inspections.** During any examination the Competent Person, at his discretion, may instruct additional intrusive and/or non-destructive inspections to be undertaken such as: - Ultrasonic, Magnetic, Radiographic, Endoscopy, Hammer testing, Drilling, Sampling, etc.

- **Hydraulic test.** The hydraulic test is an overpressure test using cold water and examination before the boiler is first put into service, after overhaul and usually following major repairs. It will also apply to selected fittings and pipework such as the superheater. For the boiler and each component, the method of test, applied pressure and duration should be specified and noted.

- **Washout inspections.** Internal examinations at routine washout do not form part of the examination regime covered by the Written Scheme. However, they do form an important tool for monitoring boiler condition.

- **Preparation for examination.** The Written Scheme should detail any preparation and appropriate cleaning necessary for satisfactory examinations to take place. Preparation may include removal of washout plugs, mud hole doors, removal of brick arch or grate, erection of access equipment, lighting, etc. Cleaning may involve washing out, tube sweeping, firebox cleaning etc. It should highlight any unusual risks associated with inspecting the boiler and measures to mitigate those risks i.e. access to confined space.

- **Repairs and overhaul.** The Written Scheme should detail procedures for agreeing the required repair and the periodic monitoring for routine repairs and overhauls.

- **Legislation and reference documentation.** A list of current statutory legislation that applies to the boiler is not a requirement but it is recommended that it should be included in the Written Scheme. In addition, it is recommended that a list of reference documentation should also be included.

- **Record of review of the Written Scheme.** A record of the regular reviews and any changes to the Written Scheme should form part of the scheme. The record should be signed by the Competent Person on first issue and on every review or change. The period of review should be specified.

8. Regulation 9 - Examination in Accordance with the Written Scheme.

- This regulation requires that the user/owner of a pressure system, and the Competent Person, carry out the requirements of the Written Scheme to properly examine the boiler at the prescribed intervals, and that they make a suitable record of such examinations. Such records are to be stored and made available to the Chief Mechanical Engineer of the railway whether as a resident engine on the railway or when visiting another railway on request.

- **Responsibilities of the user/owner.**

    - The user/owner is responsible for ensuring that the Competent Person has examined the boiler prior to first use.

    - The user/owner is responsible for arranging that the Competent Person examines the boiler at intervals specified in the Written Scheme, and that the boiler is not used beyond the date specified in the current examination report.

    - The user/owner is responsible of preparing the boiler prior to any examination and undertaking all safety measures required for the safe examination of the boiler.

- **Responsibilities of the Competent Person.**
    - The Competent Person is responsible for undertaking any examination arranged by the user/owner, and for carrying out that examination in accordance with the Written Scheme.
    - The Competent Person is responsible for making a signed written report of the examination and for sending it to the user/owner as soon as is practicable.

9. Undertaking an Examination

- **Preparation of the boiler.** The user/owner needs to arrange for the boiler to be correctly prepared for examination. Points to consider depending upon type of examination to include:
    - Cooling and emptying the boiler;
    - Erecting suitable staging for access;
    - Cleaning the boiler, water side and fire side;
    - Removal of fixtures and coverings such as grate, brick arch and lagging;
    - Removing protective devices;
    - Removing washout plugs/mudhole doors;
    - Removing cladding/lagging from boiler or pipework;
    - Providing lighting;
    - Raising steam ready for inspection;
    - Providing water supply and hydraulic equipment; and
    - Stripping protective devices for examination.
- **Competent Persons examination.** The Competent Person to undertake the inspection in accordance with the Written Scheme. Points to consider to include: -
    - Age and history of boiler;
    - Storage arrangements when out of use; e.g. was water drained from the boiler over winter, as not having done so has proven to have caused internal damage to boiler tubes and may also affect the inside of the boiler;
    - Nature of feed water;
    - Periods between examinations;
    - Unusual design features;

- Historic repairs and associated paperwork
- Recent repairs and associated paperwork;
- Age and condition of protective devices and fitting;
- Effect of age on unconventional materials; and
- Satisfactory operation of protective devices.

- **Contents of the written report.** The written report should include the following information: -
  - Name and address of user/owner;
  - Name and address of the examination location;
  - Identification of system;
  - Safe operating limit;
  - Condition of system/parts examined;
  - Parts not examined;
  - Result of examination;
  - Details of any repairs required and timescale for repairs to be completed if the boiler is to remain in operation;
  - Date by which the next examination must be completed;
  - Date examination took place;
  - Name and address of the Competent Person;
  - Signature of Competent Person and date;
  - Depending upon level of examination, some items may not apply, or some items may require repeating for different parts of the system i.e. boiler, superheater, safety valves especially where any of these components have been recently fabricated or restored and refitted.

10. References

- The Pressure Systems Safety Regulations 2000
  http://www.legislation.gov.uk/uksi/2000/128/contents/made

- The PSSR Approved Code of Practice and guidance (HSE)
  www.hse.gov.uk/pUbns/priced/l122.pdf

- Pressure Systems, A Brief Guide to Safety http://www.hse.gov.uk/pubns/indg261.htm

- PSSR 2000: Written Schemes of Examination www.hse.gov.uk/pubns/indg178.htm

Appendix A: – Guidance on controlling the allocation of responsibility between a host railway (or private owner) and a hiring railway.

Boiler maintenance and the supervising of examinations for a boiler on hire must be the sole responsibility of only one organisation (or person). The organisation undertaking responsibility for the maintenance and the supervising of examinations must be in possession of the Written Scheme of Examination and examination reports.

In practice: -

Where a boiler is owned by railway A which agrees a 15 month hire to railway B. Where railway B undertakes all maintenance and supervises examinations by Competent Person. Railway B is responsible and should hold the Written Scheme and reports.

Where a boiler is owned by railway A which agrees a 15 month hire to railway B. Where railway A continues to undertake all maintenance and supervises examinations by Competent Person at railway B's site. Railway A remains responsible and should hold the Written Scheme and reports. In practice this means that railway A's representative is available on site at railway B at all times.

If a boiler is being maintained by staff of both railways whilst on hire then only one can be responsible and the other must become a sub-contractor under the control of the responsible railway.

For a privately owned locomotive that is based on a railway for a long term hire the above arrangements i), ii), & iii) above still apply between the owner and the railway.

For a locomotive that is on hire for a short term of less than 12 months the above arrangements i), ii), & iii) above still apply between the owner and the railway.

For a locomotive that is on hire from railway A for a very short term of 1 or 2 days that does not involve any maintenance, responsibility can remain with railway A provided the hirer does not undertake any maintenance. However, copies of the Written Scheme and most recent examinations must be available to the hirer as evidence of the operating limits of the boiler and what work has been carried out.

In all cases the split of responsibility must be clearly specified in an agreement between the parties, normally as part of the hire agreement.

Appendix B: – Selecting a Competent Person

Users/owners of pressure systems are free to select any competent person, but they should take all reasonable steps to ensure that the person selected can actually demonstrate competence, i.e. the necessary breadth of knowledge, experience and independence.

Railways are recommended to hold public liability insurance against injury to staff and the public. A condition of this insurance will be that any pressure system will be maintained, and inspected in accordance with legislation by a competent person. Insurers will be able to recommend an independent body in the event that a railway wishes to have an independent assessment of the Written Scheme and any work carried out on an engine before it is allowed to steam. This may be especially appropriate where the owner and the railway's Chief Mechanical Engineer (CME) are unable to come to an agreement over the potential steaming of a resident or visiting locomotive even when it has been inspected and certified by a Competent Person.

The Competent Person will be independent of any insurance provider, although they may be employed by an engineering inspection company with a similar name.

When selecting a competent person, it is suggested that users/owners should seek positive written responses to the following lines of questioning before making the appointment:

- What are the qualifications of the person? Are they suitably qualified in the appropriate discipline, typically chartered engineer or equivalent, or part of an organisation supported by such staff?
- What is the experience of the person? Are they suitably experienced in the standards and characteristics of locomotive type boilers?
- What back-up does the person have if a further in-depth review of findings is required? Are they experienced in or have access to knowledge of applicable legislation, examination techniques, materials, NDT applications, failure modes, corrosion issues?
- What arrangements are there should the person not be available? Are they part of a larger organisation with resources to cover for staff non-availability or out of hours contact?
- How long has the person been undertaking this role? Is it long enough to gain a variety of applicable experience and training?
- What scope and cover of professional indemnity & public liability insurance does the person carry? Is it sufficient to cover all losses in the event of their being negligent? If not, does the railway's own insurance cover such inspections?
- How quickly can the person respond to a request to undertake an inspection? What notice do they require and how far away are they based?

