NATIONAL TRACTION ENGINE TRUST

Preserving our heritage with steam on the road

ENGINE OWNER'S CODES OF PRACTICE

PART 3

LAYING-UP AND STORAGE

of Traction Engines and other Steam Driven Vehicles

Registered Charity Number 291578

PART 3 LAYING-UP AND STORAGE of Traction Engines and other Steam Driven Vehicles

Note: Part 3 has been re-titled. The 'Transport' sub-section included in earlier versions of the Code of Practice has been removed. It is planned to re-introduce the sub-section following revision.

3.1 LAYING UP

3.1.1 Introduction

There are several approaches to the laying up of an *engine* and the method chosen will depend upon the facilities available and the preference of the owner. For example, if the *engine* is housed in a heated shed, requirements are less onerous than when an *engine* has to stand outside. It will also depend up on how soon; after laying up, it is intended to access the *boiler* or other components for repairs or inspection, so the following should be read with this in mind.

The procedure outlined below is for the laying up of a locomotive *boiler* type vehicle over winter, where the *boiler* is to be left open but with air allowed to freely circulate. Different and equally valid approaches are mentioned in the relevant section and reference is also made to other requirements for vehicles with vertical water tube *boilers*.

The *engine* should be carefully prepared to give the best possible protection from deterioration during its period in storage. Preparation should be done in such a way as to leave the *engine* in a convenient condition for the thorough *examination* of the *pressure system* by the *Boiler Inspector* (if due) and convenient access for inspection and repairs.

3.1.2 Outline

Laying up is dealt with as follows:

- *Boiler*
    - Treatment of the water side of the *boiler*.
        1. Hot blow down
        2. Cold washout
        3. Alternative approaches.
    - Treatment of the fire side of the *boiler*.
      Additional Notes for vertical water tube *boilers*
    - Treatment of the outside of the *boiler*.
    - Maintaining the *boiler* in a dry state.
- Other items requiring protection.
- Storage.

3.1.3 Boiler

For the *boiler*, the intention of any laying up procedure is to leave the inside clean and dry and to protect both the waterside and the fireside surfaces from further corrosion. The process to protect the fireside and waterside of the *boiler* may take place in either order, and is a matter of personal preference, but if it is decided to clean the fire side first, then the *boiler* will not be able to be blown down when warm.

3.1.3.1 Treatment of the water side of the boiler

Scale and sludge are much more easily removed from inside the *boiler* when the sludge is still wet than if allowed to dry out, so this should be removed at the start of the laying up process and not left until just before the *boiler inspector's* cold *examination*. This may be

done either by a blow down with the *boiler* in steam or a wash out when the *boiler* is cold or both.

It is not always possible to perform a blow down at the end of the season and if so, it will be necessary to remove the sludge by washing out when cold. It is not essential to blow the *boiler* down hot; it just means that there will be less sludge to wash out later.

1 - Hot blow down.

This final blow down is done while the *boiler* is still hot so that much of the sludge will be in suspension in the water and come out more easily.

Whilst the *engine* has enough pressure to run, turn the *engine* over slowly and work the mechanical lubricator by hand to get a good coating of oil onto the valve(s) piston(s) and cylinder bore(s).

Once the steam pressure has fallen to 20 - 30 psi., the *boiler* should be blown right down so as nearly as possible to empty it. Make sure that the fire is completely out before doing this. Attach the hose to the *blowdown valve* and prevent its free end from snaking. Get the hot water and sludge well away from the *engine*. ***Further advice can be found in PM60 HSE Guidance Note - Steam boiler blowdown systems ISBN 0 11 883949 7"***

DO NOT 'knock in' a mud door whilst there is still pressure in the *boiler*. At any pressure the water is still well above boiling temperature and can cause very serious scalding. The *boiler* should be depressurised and vented before any doors or *fittings* are loosened or removed.

Allow the *boiler* to cool with the *blowdown valve* open, then remove the manhole and mudhole doors and any wash-out plugs; check that they are marked to identify the openings to which they belong, and also their orientation, and then set them aside. The geometry of many *boiler* doors prevents them being fully removed from the *boiler* unless the joint is separated from the door. For some joint types this means that the joint is destroyed during removal. Ensure a replacement set is available to avoid delay when the *boiler* is brought back into service.

SAFETY NOTE:
Any old asbestos joints or gaskets which are to be discarded should be soaked with water before removal and then placed in a strong plastic bag, sealed, marked and disposed of in a safe manner.

2 - Cold wash out.

Unless the *boiler* is already reasonably clean there will still be loose scale and sludge in some areas. Thoroughly wash out the water space using a high volume hose, if available. To help water drain from the bottom of the barrel, ensure the engine is standing so that the barrel slopes slightly backwards. Pressure washers are good at loosening scale but may have insufficient flow rate to properly clear the scale from around the foundation ring. Start at the highest point of the boiler so that any debris is progressively washed downwards. Pay particular attention to the top of the firebox, the top of the firehole door ring, the bottom of the barrel, and other near horizontal surfaces. Wash along the top of the firebox, the firehole ring, the top row of tubes and then between them, then along the bottom of the barrel. Then the water spaces around all four sides of the firebox. Ensure that the washout hose is poked into all manholes, plugs, and doors and wash upwards as well as along the foundation ring. A piece of hard pipe, with a right angle nozzle on the end (and/or a flattened end to create a fan jet) attached to the hose can be very useful for directing the water along the back edge of a foundation ring, down the back of the firebox from above, or between tubes etc, where a straight hose or pipe will not reach. (A very

useful accessory available for some models of pressure washer is a drain cleaning attachment. This has a cleaning head with both forward and rear facing jets, mounted on a length of hose and will tend to pull itself around the foundation ring and other difficult to reach areas, but take care to avoid it becoming entangled around the stays or tubes).

The water flushed from the lowest *boiler* openings will initially be dark brown, but when running clear it can be considered that the suspended material has been removed. It will then be necessary to rake out the large debris from around the foundation ring, followed by a final swill out. Try to avoid scratching the surface of the plates and exposing bare metal to corrosion and take care not to damage the threads of the tapped holes for the washout plugs. To completely empty the water round the foundation ring drape pieces of wet absorbent cloth through the lowest openings on to the top of the foundation ring making sure that the outer length of cloth hangs below the foundation ring. Allow the *boiler* to dry out and ensure freedom for through flow of air by keeping all doors etc unsealed.

3 - Alternative approach

An alternative approach, which allows for quicker drying out and where it is known that the *boiler* is already reasonably clean, is as follows:

Before draining the *boiler*, light a small wood fire to warm it through, but with the injector steam cock open to prevent pressure build up. After the fire is dead, knock in the mudholes and allow the water to run out. Open the manhole and any other openings to promote through flow of air. The residual heat will dry the *boiler* plates internally.

3.1.3.2 Treatment of fireside surfaces

Once the *boiler* has dried out, remove the ash pan and fire bars. Sweep the tubes, wire brush the inside of the firebox to remove all soot and scale and thoroughly clean out the smokebox. With care, a pressure washer may be used instead but ensure the water does not run behind lagging or between the plates of a double skinned smokebox such as on a Foden wagon. Clean soot from around the blast pipe or remove this item and use the opportunity to clear away excessive unburnt carbonised deposits inside the pipe. Clean the fire bars and store them in the order that they were removed from the firebox. Clean the ash pan. A brush over with oil will help to protect the ash pan and bars from damp.

SAFETY NOTE:
When brushing off soot, etc. in a confined space, always wear a suitable dust mask. These are readily available, at modest cost, from preservation suppliers, safety equipment dealers, etc. A disposable overall of the full hood type will also be found useful. In most circumstances an inspection lamp will be in use during the cleaning of the firebox and smokebox, and wire brushing will be greatly facilitated by the use of power tools where access is possible. Take care especially if the engine is surrounded by standing water that any electrical equipment used is in good condition, suitably insulated, and earthed. It is recommended that tools designed to use 110V centre tapped transformers are used. Where not practical, 240V mains operated items must be double insulated and protected by an RCD at the plug head.

Take the opportunity to examine the fireside surface for any signs that may indicate a leaking tube, seam, or stay. The condition of the ends of the tubes and the fireside stay heads can also be checked. Remove the fusible plug and examine the condition of the threads on both plug and firebox plate, note any scaling on the plug water side or visible deterioration of the fusible metal. Note also whether there is any “moating” wastage of the plate around the plug hole. Any observations should be noted and brought to the attention of the *inspector* prior to his commencing the thorough *examination*. It is a good idea to make

a diagram of the inside of the firebox and smoke box so that defects can be marked up on this diagram and readily identified later.

After cleaning the fire side of the *boiler*, the tubes should be swabbed through with a rag dipped in oil (see following paragraph) and pulled through on the tube brush rod or using a spray applicator. Replace the fusible plug temporarily to prevent oil finding its way into the water space.

Used engine oil contains acids and other corrosive substances and should not be used. Special proprietary compounds, such as lanolin, or Ankor D which may be brushed or sprayed on, are readily obtainable from motor accessories stores and specialist traction engine consumables stockists. Grease diluted with white spirit gives a good protective coating and chain saw chain oil is 'clingy' and works well. A “Schutz” underseal applicator gun will spray sticky oils such as chain saw oil, which a paraffin gun will not cope with.

Brush or spray the inside of the firebox and smokebox with preservative. This may be deferred until after the *Boiler Inspector* has carried out the thorough *examination*, if one is due, and if it will be done within a reasonably short time, but serious corrosion will occur if the tubes and plates are left unprotected through any part of the mid-winter months.

After surplus oil has drained off, remove any newspapers, etc., which may have been placed under the *engine*, and dispose of them so that they will not be a fire hazard.

If an *engine* is to be laid-up for longer than a few months, it is best to use a proprietary protective compound, which will stay in place much longer than oil or light grease.

Additional notes for vertical water tube boilers.

Water side cleaning

Access to the waterside of a vertical *boiler* is generally more restricted than for a locomotive *boiler*, so blowing down during the last steaming period is advantageous. Superheater elements are prone to corrosion and can retain water internally. If access is available to an air compressor, the superheater and water heater elements can be blown through to remove standing water as follows:

After blowing down, or draining the *boiler*, make up an adaptor to connect the airline to a threaded connection on the *boiler* such as the filler hole. Remove the clack valve from the feed pump clack but keep its isolation valve shut. Using the *boiler* as an air receiver, pressurise to 100psi or thereabouts with air. With the engine and any other relevant controls set to the “drain” position, quickly open the regulator and trapped water will be expelled via the cylinder drains. Undo the water supply pipe to the feed water heater and repeat the blow through by opening the isolation valve on the clack. Vent down the *boiler* completely and remove the compressor.

As with the locomotive *boiler*, remove manholes and plugs and direct the water to wash out the sludge and scale, starting at the highest opening and finishing at the foundation ring. Place rags in the bottom openings to siphon out any standing water.

Fire side cleaning

See SAFETY NOTE at the beginning of this section.

The procedure for a vertical *boiler* is different owing to the less accessible nature of the inner firebox surface due to the tube nest and superheater.

Remove the ashpan and firebars, and if the design permits it, the stoking chute.
Wash the inside of the firebox with a pressure washer or steam cleaner washing downward from above, and upward between the tubes to remove the soot. The use of the drain cleaning type attachment will be found especially useful. Ensure that the *boiler* is cold before doing this. Allow the fireside surface to dry out. Once dry, descale the fireside plate

surfaces as much as possible with a wire brush. Pay particular attention to locations where the tubes cross each other or lie close to the plate edge (spiral tube type) as soot can build up and harden in these locations and if wet will promote rapid tube corrosion. In these locations, a hacksaw or other thin blade can be used to remove this soot. Use the opportunity to closely inspect the fireside surface for any signs of leakage etc and make a note of these and their locations. If repairs are not to be affected immediately, apply preservative compound by spray to ensure, as far as possible that the fireside surface is fully protected.

3.1.3.3 Treatment of the outer surfaces of the boiler

The outside of the *boiler* requires protection as well as the inside.

Brush away any ash and ensure there is no standing water or damp areas.

Painted surfaces should be well maintained and any chips or scratches should be touched in. Unpainted areas of the *boiler* can be given a protective coating by painting on a thin film of cylinder oil whilst the *boiler* is still hot. The oil is much easier to apply if it is slightly warmed first. Some alternative protective treatments are listed as follows:

- A good quality paint.
- Flaked graphite and cylinder oil mixture
- Lanolin
- Preservative wax
- Boiled linseed oil.

3.1.3.4 Maintaining the boiler in a 'Dry State'

The *boiler* should be stored so as to allow free flow of air through it by opening all manholes, gauge frame fittings, cocks etc. Airflow by convection may be promoted by use of an ordinary (not energy saving) light bulb hung in the firebox, or a small tubular heater. The top of the chimney should be covered so as to prevent rain entering but with a small air gap below the cover to allow the chimney to draw the warmed air through the tubes. Tannin based water treatment compounds usually leave a coating, which provides a fair degree of protection, on the surfaces of the *boiler.*

Oily compounds must never be used to protect the metal surfaces in the water space of a *boiler* (see Part 1.4.7).

If the boiler is undergoing repairs allowing full access or the inner firebox on a vertical boiler has been dropped, a suitable boilerplate preservative can be used to protect the internal plate surfaces, applied in accordance with the manufacturer's instructions.

An alternative approach to eliminate moisture and reduce the oxygen content of the air within the *boiler* during the storage period is to replace the mud doors (ensuring any gaskets fitted are in good condition and not hardened by service or age) and any washout plugs, seal all other boiler openings including the regulator, then place a small dehumidifier such as a Kilrock type, (obtainable, with refills, from hardware stores) on top of the tubes, together with a small metal tray on which are placed 3 or 4 nightlights. Place them where they will not be displaced when the manhole door is replaced and subsequently removed.

Once in position, light the nightlights; replace the manhole door and nip it up sufficiently to stop air movement. The nightlights inside will burn-up most of the oxygen and the dehumidifier will absorb any stray moisture, The *boiler* may easily be opened up and the process repeated if required such as after an *examination*. If it is found that the nightlights have completely burnt out, use one or two more next time.

The wet layup method, with the *boiler* completely filled with treated water, is not recommended. UK designed traction *engine* boilers do not have *boiler* mounted stop valves

or air vents so there is a risk of water getting up in to the cylinder and steam chest where severe corrosion could occur. There is also the risk of freezing.

3.1.4 Other Items requiring protection

3.1.4.1 Tender

Drain the tender and any other water tanks, wash out any sludge and loose scale, and then allow the interior to dry out. If there are large enough access covers, a coat of suitable water tank corrosion prevention paint applied in accordance with the manufacturer's instructions on the inner surfaces will give a measure of corrosion protection. **Do not use oil or any other greasy coatings**.

3.1.4.2 'Bright' Work

Several compounds are available for protecting burnished steel and other bright work, for example lanolin, light grease, Vaseline etc. If the engine stands outside, additional protection of treated parts against the weather and the unwanted collection of grit can be cheaply obtained by wrapping the coated part in cling film.

3.1.4.3 Coal Bunker and Footplate

Coal dust retains moisture and is acidic, and so it is worthwhile to empty the bunker and give the inside a coat of paint or oil. Lift any duckboards, brush the footplate clear of coal dust and ash, particularly at the edges and next to the bunker, where damp coal dust tends to collect. Touch up any damaged paintwork.

3.1.4.4 Lubricators

Ensure that the displacement lubricator is drained of water. Similarly, the mechanical lubricator should be checked for any water that may have accumulated in its base and drained away if found.

3.1.4.5 Waterside fittings

Lift all non-return valves. If an airline is available blow through any open pipes to remove trapped water. **Take care to protect the eyes**. Leave all cocks and gauge frame fittings etc open to drain water (when fully drained and dry, close them, if intending to lay up the *boiler* in a sealed condition, otherwise leave open.) ***Further advice on the safe use of compressed air can be found in HSE document HSG39 "Compressed Air Safety ISBN 9 78 071761531 5"***

Remove drain plugs from clacks, water pump, water filters (wagon water tanks), feed pipes, and feed water heater (if fitted). Withdraw injector internals or remove injectors completely and store inside. Remove water filter internal parts (if fitted) to ensure they are fully drained. Remove the pressure gauge and siphon pipe and store inside. Turn the engine over to ensure all water is removed from the pump, lifting the check valves if necessary. Keep any removed bits in separate marked tins to avoid getting them lost or mixed up.

Briefly open the cylinder drains to ensure any condensed water collected there is removed. Close the drains.

3.1.4.6 Bearings

Remove all wicks and trimmings from lubricators to avoid them continuing to act and dripping oil over the *engine*.

3.1.4.7 Steam and Cylinder chests

For some *engines*, particularly those with outside valve chests or non steam jacketed cylinders, water can collect in the bottom of the valve chests. The valve chest covers may

be removed, water drained off/swabbed out and the faces of valve and ports given a coating of cylinder oil, or other more durable preservative if being laid up for a lengthy period. For long periods of laying up the regulator face should be similarly treated.

3.1.4.8 Undertype Waggons

For undertype waggons, some owners may prefer to remove the valves over winter to avoid their becoming stuck, and allow access to protect the valve seats with oil or preservative. The crankcase should also be drained of any condensed water and topped up to the required level. To prevent pistons sticking, remove the cylinder heads and spray the bores with a preserving fluid, or ensure that the engine is occasionally turned over during any period of layup. For designs with direct drive, this will require removal of a drive chain or jacking up the rear axle to allow the engine to be turned over.

Sentinel S type wagons are prone to trapped water in the camshaft galleries. This cannot be removed without stripping the engine so in prolonged periods of cold weather (2 or more days and nights below zero), place a small heater below the engine to prevent frost damage.

3.2 STORAGE

3.2.1 General Arrangements

Whenever possible, *engines* should always be stored under cover in a dry, well ventilated building. Corrugated iron and asbestos cement sheet structures are very prone to condensation on the inner surfaces and therefore should, if possible, be lined with timber or similar material. A good concrete floor, laid over a damp proof membrane is best. Dirt floors tend to 'give up damp' and also create dust which gets into bearings, etc., so should therefore be avoided. If an inspection pit 2-3ft deep can be provided below the firebox, it makes access and working inside the firebox much easier. Steel wheeled *engines* or rollers can be run onto timber to reduce rusting. Rubber tyred *engines* and wagons can be jacked up to avoid flats forming.

3.2.2 Storing Undercover

Even when stored in a suitable building, and certainly in all other cases, cover the top of the *boiler*, cylinder and motion work with a light tarpaulin. This should be supported by poles or a light timber frame, to keep it clear of surfaces that have been coated with preservative.

3.2.3 Storing Outside

If stored outside the *engine* should be prepared as described above and then securely sheeted to provide the best possible weather protection. The sheeting should be arranged so as to provide sufficient ventilation to prevent “sweating” inside the enclosed area. Typically this means sheeting down to approximately axle height. Proofed cotton tarpaulins are best as they can 'breathe' and are less prone to condensation on the inner surface than reinforced plastic sheeting. The sheeting and corresponding places where the sheeting tends to rub such as edges of rear wheels, can be protected by first tying sacks onto those parts.

3.2.4 Other Considerations

To help avoid localised corrosion and pitting in the cylinder bores and on valve rods and bearings during the storage period, it is advisable, after providing due lubrication, to pull the flywheel round by hand at about monthly intervals. This will spread residual lubricant, which has gravitated to the bottom of the cylinder, and redistribute it over bearing surfaces. After turning the engine over, leave the crankshaft in a different position to that which it was in when you started.

Note – It is recommended that the piston rods are entered into the bores as far as is as possible.

For undertype wagon engines, note the precautions in 3.2.4.10 above.

At the same time it is a wise precaution to check that none of the surfaces, which have been given protective coatings, have been missed.

3.2.5 Bringing out of Storage

At the end of the storage period, protective coatings can be cleaned-off with paraffin or gas oil or proprietary compounds. Be careful not to let surplus paraffin, etc. run down into the *boiler* lagging.

SAFETY NOTE*: Never use petrol, 'thinners' or other industrial solvents as these are a serious fire risk and give off toxic vapour (particularly in an enclosed space) and all can cause problems if they come into contact with the skin.*

Oil or grease applied to the fire side of the *boiler* may be left – it will burn off - but do not forget to remove the nightlights and dehumidifier from inside the *boiler*, if these have been used.