Kent & East Sussex Railway

Operating Department Mutual Improvement Class

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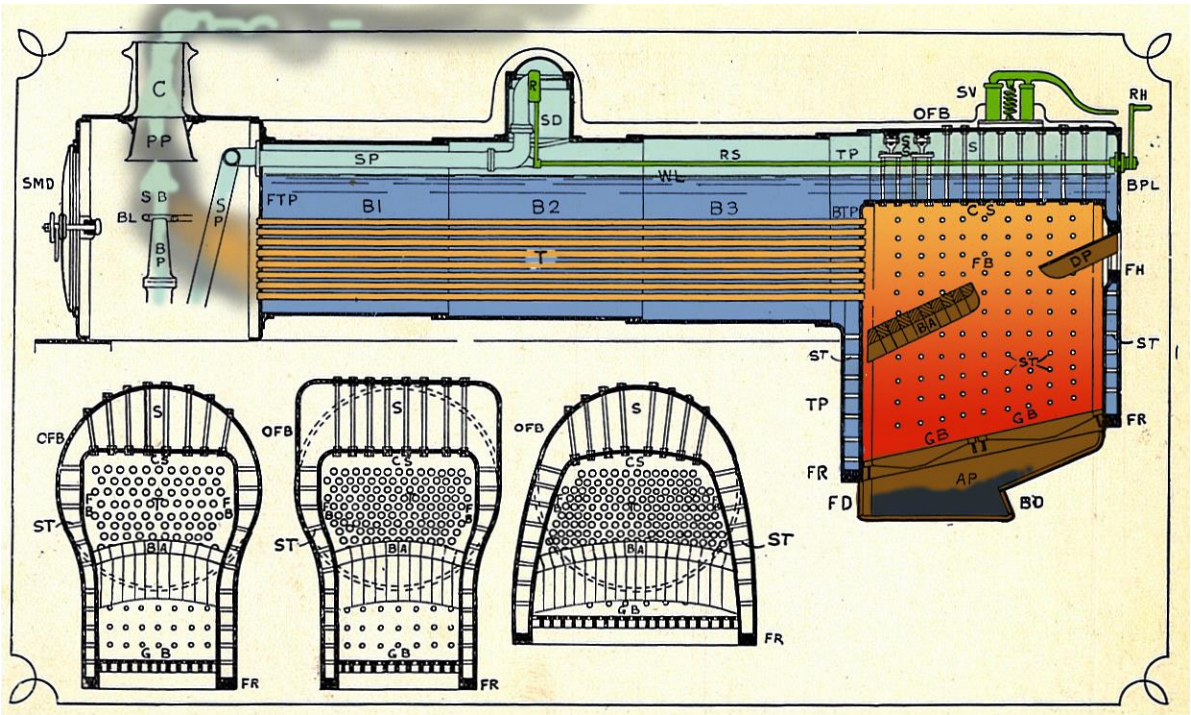
Boiler Basics and Boiler Fittings



AP	Ash Pan	CS	Crown Sheet	RS	Regulator Spindle	WL	Water Level
B1	Boiler Barrel (Ring 1)	DP	Deflector Plate	S	Stays		
B2	Boiler Barrel (Ring 2)	FB	Firebox (inner)	SB	Smokebox		
B3	Boiler Barrel (Ring 3)	FD	Front Damper	SD	Steam Dome		
BA	Brick Arch	FH	Fire Hole	SMD	Smokebox Door		
BD	Back Damper	FR	Foundation Ring	SP	Steam Pipe		
BL	Blower	FTP	Front Tube Plate	SS	Sling Stays		
BP	Blast Pipe	GB	Grate Bars	ST	Screw Stays		
BPL	Back Plate	PP	Petticoat Pipe	SV	Safety Valves		
BTP	Back Tube Plate	R	Regulator	T	Tubes		
C	Chimney	RH	Regulator Handle	TP	Throat Plate		

J.F. Gairns (1923). Railways for All, facing p.49, Ward Lock. Public Domain.

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General description of a locomotive boiler

The boiler consists of a steel shell, which includes the boiler barrel, the outer firebox wrapper plate, the inner firebox, boiler back plate (or back head), smokebox tubeplate, throat plate and foundation ring.

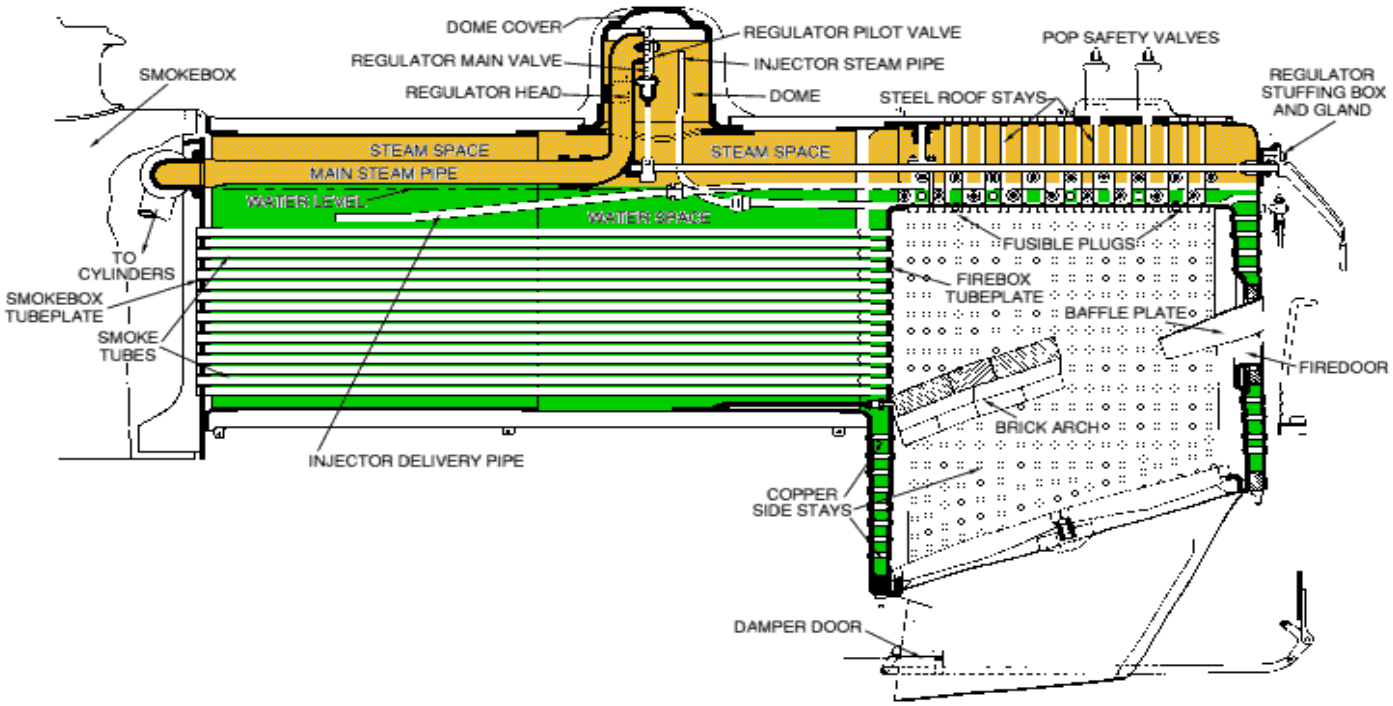
The inner firebox is supported from the outer firebox by the foundation ring at the bottom, crown stays at the top and palm stays between the firebox tubeplate and the boiler barrel. In addition, copper or steel side stays run between the firebox and the outer firebox wrapper plate, the boiler back plate and throat plate.

The tubes run between the firebox tubeplate and the smokebox tubeplate. One some locomotives all the tubes are an identical size, however on some designs larger tubes can be found near the top of the boiler. In superheated boilers these larger tubes contain the superheater elements.

The dome is positioned at the highest part of the boiler barrel where it forms a collector for steam above the surface of the water. Domes are mainly found on saturated steam locomotives, with superheated boilers often having a very low dome or none at all.

Steam collected in the dome or at the top of the boiler is fed into the main steam pipe via the regulator valve to either the superheater header (on superheated boilers) or direct to the steam chest (on saturated engines).

The smokebox is located at the front end of the boiler barrel and contains the blast pipe, blower ring, spark arrester, main steam pipes to the steam chests and the exhaust for the vacuum ejector and superheater header where fitted. Exhaust steam from the cylinders passes through the blast pipe into the chimney and creates a partial vacuum. This causes hot gases to be drawn through the tubes which, in turn, draw air into the firebox through the grate and firehole door.



Boiler and Firebox fittings

Attached to the boiler are several important fittings and footplate staff must know and understand their function and their correct usage

Brick Arch

The brick arch serves several purposes. It protects the firebox tubeplate from the direct flame of the fire, radiates heat to prevent rapid fluctuation of the tubeplate temperature, and ensures thorough combustion of volatiles by lengthening their path from the fire to the tubeplate.

Firedoor

Firehole door types vary from locomotive to locomotive. These give access for firing and can be adjusted to control the flow of secondary air.

Baffle Plate

The baffle plate placed in the firehole is designed to direct the secondary air down towards the firebed in order to mix it thoroughly with the hot gases and flames and also to help avoid cold air coming into contact with the firebox tubeplate.

Fusible Plugs

Fusible plugs are screwed into the firebox crown. They are made of brass and have a lead core. If the water level in the boiler drops to low and uncovers the firebox crown, the lead melts allowing steam to escape into the firebox. This warns the footplate crew that the water level is exceedingly low. Both injectors should be put on immediately and steps taken to remove or deaden the fire should this occur.

Superheater

The superheater consists of the superheater header and superheater elements. Steam from the main steam pipe arrives at the saturated steam chamber of the superheater header and is fed into the superheater elements. Superheated steam arrives back at the superheated steam chamber of the superheater header and is fed into the steam pipe to the cylinders. Superheated steam is more expansive and helps to create higher fuel efficiency.

Washout plugs, Handhole and Mudhole doors

Washout plus, handhole and mudhole doors are fitted to the boiler to facilitate the inspection and cleaning of locomotive boilers. Locomotive crews must check these before preparing the locomotive for service, however if leak is found the crew should inform the locomotive fitters. Only competent persons should carry out maintenance on these fittings.

Gauge Glasses

All locomotive boilers are fitted with at least two methods of determining the boiler water level. Usually this comprises of two independent gauge glasses, however ex-GWR locomotives and some industrial locomotives are only fitted with one gauge glass and test cocks. For more detailed information see the separately issued hand-out.

Blower

The blower is fitted inside the smokebox and usually consists of a perforated tube ring fitted around the top of the blastpipe. Steam is fed through the pipe, controlled via a valve in the locomotive cab and as this draws air out of the smokebox and creates a partial vacuum.

Safety Valves

Safety valves are fitted to prevent the boiler pressure from exceeding the registered working pressure. Safety valves come in three main types; Salter, Ross Pop and Ramsbottom. For more information please see the separate handout on safety valves.

Injectors and Clack Valves

Injectors are fitted to locomotives to ensure the supply of feed water to the boiler by using steam from the boiler to force water from the locomotive tanks or tender into the boiler via a non-return, or clack valve. For more information on injectors, please see the separate handout.

Pressure Gauge

All locomotive boilers are fitted with a pressure gauge to show the boiler pressure. A red line on the gauge indicates the maximum working pressure at which the boiler safety valves will open to exhaust excess pressure.