7¼ Gauge Society Ltd

Proficiency Scheme

Silver Award Booklet

The 7¼ ” Gauge Society Ltd Proficiency Award Scheme.

This Booklet covers the Silver Award and is a progression of the Bronze Award. The award is open to any members of the 7 ¼” Gauge Society Ltd. Those who achieve this award will receive a badge and a certificate and will be eligible to go on to the Gold award.

Whilst it sets standards of awareness it is not a licence to drive a locomotive. It is a way of rewarding enthusiastic participation; by setting goals that encourage courteous, safe involvement in 7¼” gauge railways.

No two railways are the same and although safety will be the main concern at all railways, most will have their own individual rules. This scheme dose not override them. It is up to you to make sure you learn these rules and obey them so that you and everyone else can enjoy themselves safely.

Railway Terminology.

There are lots of words within the railway world that have no meaning in the wider world and to be able to take a proper and safe interest in railways you will have to learn a lot of these. So that you are able to use them and understand what they mean, the society had produced a “Glossary of Terms” available to download from the website.

Railway Open Days

Whilst 7¼ gauge locomotives, trains and railways are absolutely wonderful for you to enjoy, it must be remembered at all times that they can be very dangerous and this could cause injury to you or other people if you are not careful.
Railways have to have ‘a due regard for health and safety’. This just means doing everything in a thoughtful way so that it is done safely and within the rules. Then everything will run properly.

Even if the railway you visit is not open to the public it is essential that it operates safely and a few simple precautions are all it takes.
Most railways have a person who is in charge, responsible for running the whole railway. They may even have a special name such as “Responsible Officer” or “Station Master” and you should know who this is, so that if you see anything dangerous or important you can let them know what you have seen. You should report to the person in charge upon your arrival at the site, then you should follow any instructions that you may be given to help operate the railway.

Before the trains run

Unlike the full size railway many miniature railways are not in daily use, so before each running day starts, we have to check everything.
A thorough track inspection should be made by a ‘responsible person’ who walks the track looking for anything that is wrong, points not working correctly, rail damage or branches or twigs on the track, and that the passenger areas and platforms are clean and tidy, in fact anything that might cause a problem.
Finally a ‘test train’ should be run around the track by a qualified driver before any passenger running takes place. When signals are to be used, he can use this test run to check, with the signaller (signalman), that all is working correctly.

Taking on passengers

If your railway is open to the public and carrying passengers you should treat members of the public with courtesy. Should you have any problems you should immediately refer them to a responsible person.
Station staff must be appointed to ensure that no members of the public stray onto the track and that they stand well back from the edge of the platform or are kept behind the entrance barrier.
The station staff can be responsible for loading and unloading the train. Whilst telling the passengers the important things they need to know for their own safety, like how to get on and off carriages, to remain seated whilst the train is in motion, face the correct way, keep feet in/on the carriages and not to lean out too far. When everybody is on the train they should inform the Guard the train is ready and it may depart when the Guard has done his duties. At some railways the loading and unloading of the train is the responsibility of the Guard and the Station staff are there to assist as required.

This is because the Guard is in charge of the train. Some people think it is the Engine Driver, but he is in charge of the engine and that means he has enough to do just driving his train correctly and in a safe way. He also has to see and obey the signals and speed the railway as well as any other instructions given to him by the Guard.

The Guard is in charge of the train.

The Guard should have a whistle and preferably a red and green flag when he gets on the train. He will tell the driver when to start usually by blowing his whistle or waving his green flag. It is sensible that he should ride at the rear of the train so he can see everything that happens on or to his train. He must ensure the passengers are seated safely and properly before and during the journey and that they do not lean out to far or stick their hands out - to avoid injury. He should also have ensured the couplings between vehicles are properly connected before commencing the day's work.

He gives instruction to the driver usually by whistle as to when he should start or stop. Usually this is one whistle to stop, two whistles to go forward and three whistles to go backwards. If the Guard gives repeated whistles, then he requires an emergency stop. If the carriages are fitted with some form of brakes then ideally the Guard should be able to operate these in an emergency.

If the train has to stop for some time for an emergency on the railway line, the Guard should make sure the train has its brakes on, if they are fitted. If he considers the passengers are in any danger he should ensure that they leave the train safely and by a safe route. Then he walks back along the track and makes sure the next train has plenty of warning that there is danger ahead. He should use a red flag to do this.

Connecting our train together

Before the passengers can be carried there is a lot of preparation to ensure everything runs safely. One of the most important jobs the Guard has to do is ensure that the couplings between carriages or trucks are properly connected before starting the day.

The carriages, trucks or wagons can be connected or coupled together in several ways.

1) A metal bar held in place by metal pins which have a small hole at the bottom end so a locking pin can fit though it.
2) Three-link tensioning device with side buffers
3) Three link chain or loose chain (as on full size trucks) with side buffers.
4) Bolt and bar

At most railways you will see some form of item 1 but even this will vary almost everywhere you go. You can see pictures of these couplings in the Bronze Award booklet.

Where a locomotive has a tender or 'driving truck' (this is usually a separate small wagon pulled behind the loco to carry the driver in order for him to drive comfortably). This may be connected to the engine by both a bar as in item 1 and a safety chain to ensure the two do not accidentally come apart. It is the responsibility of the Driver to ensure that this is correctly fastened.

Metal bar couplings are examined in some detail in the 2019 Summer edition (Issue 169) of the 7¼ Gauge News, pages 6 to 7. You get this from the website.

Some railways also require safety chains between each vehicle.

Finally the Guard must ensure the engine and the carriages are coupled together correctly.

Now we are nearly ready to go

Whilst these preparations have been taking place the locomotive drivers, signalmen, ticket office staff and others, depending on the size of your railway, will also have been preparing for the day.

Before we go on can you answer these questions?
What name can be given to the person in charge or responsible for running the whole railway?
What should be done before the first trains are run?
When should a test train be run?
Who is responsible for loading the passengers onto the train?
What should station staff look out for when passengers are on the platform?
Who is in charge of a train carrying passengers?
What should the Guard carry with him on the train?
Who gives instructions to the driver?
What must a driver wait for before moving off from the station?
In an emergency what should the Guard do?
As well as driving his engine what must the Driver obey?
How does a Guard indicate to a driver to stop in an emergency?

Permanent Way also known as the Track

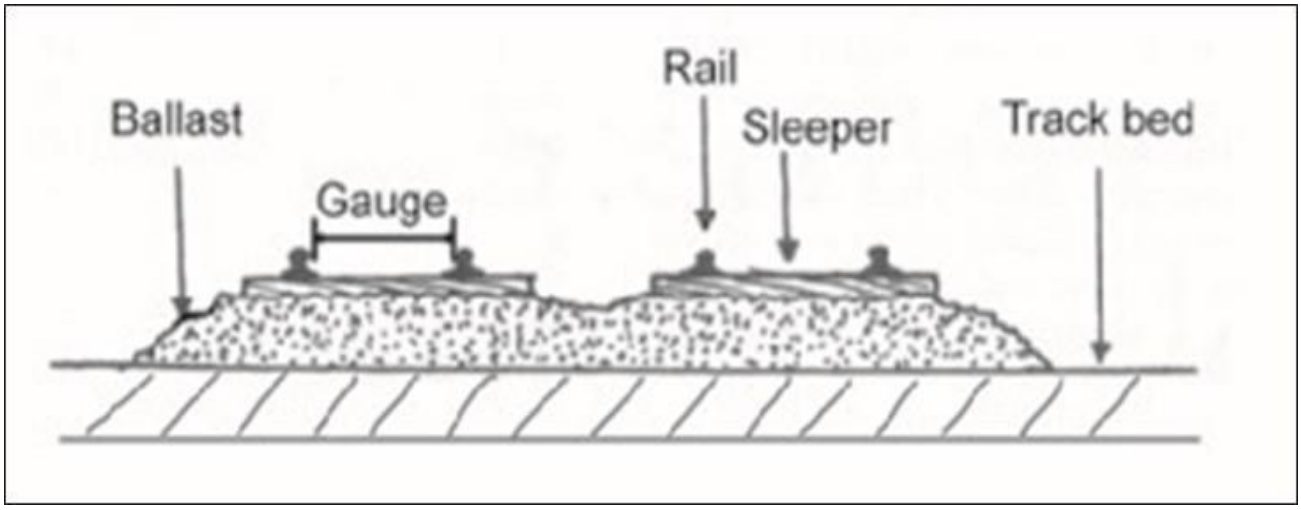
Railways are very complicated and clever pieces of engineering, and the purpose of the track is to support and guide locomotives and their trains.

The first thing to set out for a railway is the route, which for miniature railways is usually planned to have as few slopes or gradients on the journey, as possible.
To achieve this, an embankment (building the earth up), or a cutting (where you dig down into the ground) can be made to help the journey be as level as possible.
Bridges and tunnels are also built to assist with levelling.

Ballast is laid when all this work is completed. This is a bed of hard stone such as granite which is put on prepared ground; sleepers are put onto this and have more ballast put around them to keep them in place.

Sleepers can be made of wood, steel, concrete or even plastic. They are crossbeams that hold the rails in place and at the correct gauge.

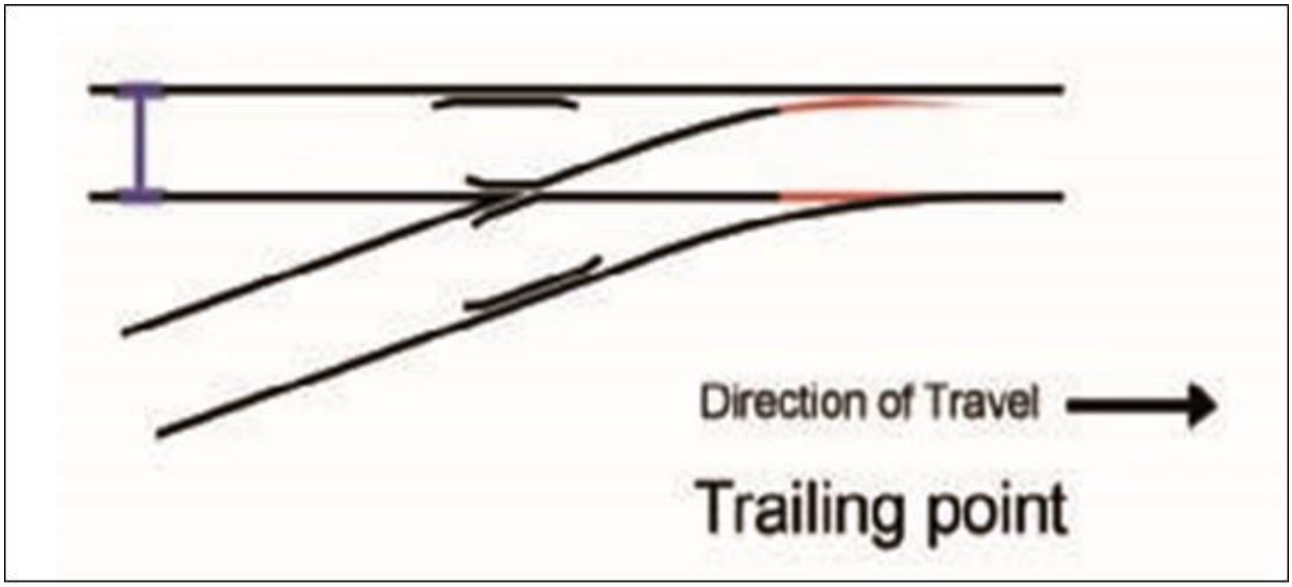
Rail comes in various shapes and sizes and is made of steel or aluminium, it is fixed to the sleepers by spikes (nails with a little hook on the top), bolts with a screw thread or sometimes a ‘chair’ which is a specially shaped fitting that slides on the rail and is screwed to the sleeper.

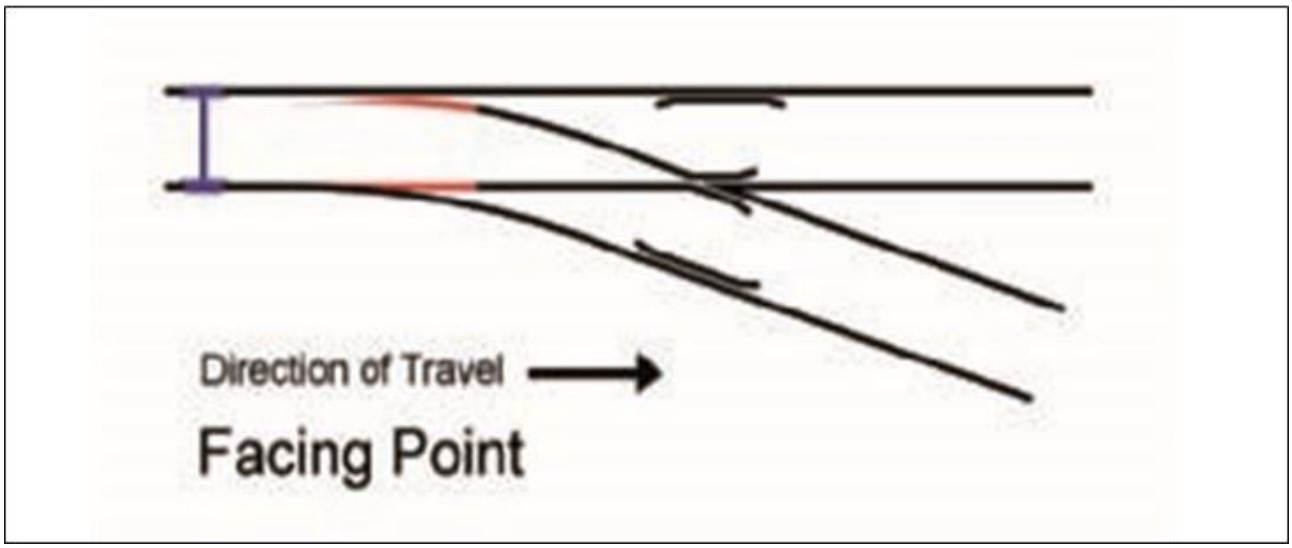


Fishplates are pieces of metal strip that fasten each section of rail together usually by two bolts through the end of each rail.

Line is made up of the Sleepers, Rail and fishplates bolted together and is sometimes called track. The track bed is the prepared base with the ballast on it which carries the line. There may be several lines on one track bed.

Points are used to guide trains from one line to another allowing them to take different routes. They have movable rails, called blades which guide the wheels towards one line or another by moving from side to side to divert the wheels along the correct route. On the main lines points are usually controlled by the signaller, along with the signals which tell the driver the route he is taking (Signals are explained further on in this book). Control can be by a lever at the side of the track or remotely from a signal box.





Points are described as either ‘facing’ or ‘trailing’ depending on the direction of travel. When approaching “facing points” a driver must check to see if the point blades are properly set for the route he is taking and should generally slow down whilst passing over them.

Gauge is the distance between the rails, which are held apart on the sleepers and for us this is seven and one quarter inches or 7¼” - that is of course the name of our Society (this is an old fashioned measurement but is about the same as 184mm). There are other gauges you may see, 3½” and 5” gauge are smaller, and 10¼” is a larger gauge. At some railways you will see more than two rails on the same sleepers. This is so that more than one gauge of train can use the line.

Track Maintenance

Such a complicated structure as a permanent way needs to be looked after. Spikes or bolts in sleepers can become loose in time and sleepers may be split or rotten so they must regularly be looked at and changed as and when required.

Should the rails settle due to the ground sinking (subsidence) then they will need to be lifted and additional ballast put down to form a level bed.

Points are checked to see they are working correctly. Rails, fishplates, and track gauge are checked for anything that might cause a problem.

Signals, bridges and tunnels should be inspected and any other areas such as drains, also checked and maintained.

Finally a 'test train' should be run around the track by an experienced driver before any passenger running takes place.

This picture shows a track under construction with the ballast, sleepers and chairs in place. It is going to be dual gauge with both trains using the righthand rail.

You should now be able to answer these questions

What is the Permanent Way?

What are the parts that make up the track?

What is the purpose of the track?

Why must the track be examined before trains are run?

Can you name three things to look out for when inspecting the track?

What is the track gauge?

What should a driver do when approaching a facing point?

What other general hazards could there be on your railway?

SIGNALLING

Railway signalling is a system used to control railway trains safely and to prevent trains from colliding. Only the most simple railways can run safely without signals.

Without proper signalling it would be very easy for trains to collide. Also as trains cannot stop quickly, and can operate at speeds that do not enable them to stop within sight of one another, at some tracks correct signalling is essential.

Signals are a means of giving permission to a driver to go forward to the next signal. The Signaller is the person who has control over all train movements. This sounds worse than it is really and just means the Signaller knows what is going on and keeps all the trains in the right and safe place. The Signaller has a very responsible job. He must learn all the features of the section of track he is controlling. He must follow a set of rules, otherwise trains may crash.

The set of rules and the signals and levers used to do this make up what is known as the 'method of working' and will be different for each railway. It is important before doing any job on the railway to learn the method that your track uses.

Some systems are of the interlocked block type; this means only one train can go into each separate section at a time which is the way it is done on most mainline railways. Drivers using a system without a block system must be aware that there could be a train in front of them before the next signal.

Some single track railways operate what is called a 'token' system instead of signals. These are also called 'staffs'. Only the driver holding the token can go into the section of track, he carries it to the next section then hands it over. Trains coming in the opposite direction can only proceed when the token has been handed to them. Without the token a driver must not proceed into the section. A token can be any shape, but there must only be one of them available for each section.

There are other types of systems operated by some railways, but the above are the most popular for 7¼" gauge railways.

Signals

A signal is a mechanical or electrical device put up beside a railway line (usually the left-hand side) so that a Signaller can let an Engine Driver know whether he may continue with his journey. The information given to the driver can be about many things:

1. That the line ahead is clear (free of any obstruction) or blocked (occupied).
2. That the driver has permission to proceed.

3. Which way points are set or that points are set correctly.
4. What the next signal along the line is showing.
5. Signals can be at various places
6. At the start of a section of track.
7. Before you get to movable things, such as points.
8. In advance of other signals as a warning.
9. Before a level crossing.
10. Ahead of platforms or other places where trains are likely to be stopped.

Signals have ‘Aspects’ and ‘Indications’.

An Aspect is the visual appearance of the signal, for instance a red, yellow and green colour light signal is said to be a ‘three aspect signal’

The indication is the meaning that the signal is giving. A signal with a red light showing would indicate to the driver that he must stop.

Semaphore Signals

Were first invented as long ago as 1840 by Joseph James Stevens and soon became the most widely used form of mechanical system.

The position and the colour of the arm on the signal shows the driver what he should do. All signals are defined as **ON** when showing ‘danger’ (horizontal) indication, and **OFF** when showing a ‘proceed’ (angled between 35 to 85 degrees from the horizontal) indication.

The shape and type of signal varies from one railway to another. The two main types of semaphore signal are ‘upper’ and ‘lower’ quadrant.

Upper quadrant signals allow the arm to be raised from the danger position ‘on’ (horizontal) so that gravity could be used to return signals to danger. Most railways thought this was the safest method.

Lower quadrant signal arms drop down from the horizontal to the 'proceed' or 'off' position.
The "Stop" signal has a red square-ended arm with a white vertical bar on the front (the side facing the on-coming train) and the back is painted white with a black vertical bar.

Trains must not pass stop signals when in the horizontal 'on' position except under specially authorised conditions. They are placed before any points, level crossings and at the 'starting end' of the platform. More complex layouts can have many stop signals per line usually guarding the entrance to a block section.
'Distant' signals have a yellow signal arm with a vee-notch (fishtail) at the left end of the arm and a black vee-stripe painted towards the left end. They give an early warning as to what the next signal is indicating; allowing the driver to adjust the speed of the train in good time in order to obey the next signal. They would be located a full braking distance from the stop signal, taking into account gradients and maximum permitted speeds.

Colour Light Signals

When in use, look something like traffic lights, but may have one or several lights within them and can indicate different things according to which light is lit.

It can also have lights attached to the top of the head of the signal, which are usually white and are known as feathers (correctly called Route Indicator), to indicate the direction the train will take at the next point.
Modern colour light signals come in various forms and some miniature railways have their own systems.
Signals can be mounted on posts at the side of the line, on gantries above the line or on short posts called ground signals. These are usually for sidings or reverse working.

Ground Signals

Standard signals, mounted on a post, are visible at considerable distance, but are unsuitable for shunting. Ground signals are used to help a driver to see which way the points are set, in sidings and railway yards.

Driver's Call Button.

These buttons are mounted in a box placed at the line-side. The driver uses the buttons to inform the Signaller of his chosen route. In some cases the button will operate points and signals.

Here are some questions about signalling—

Describe any differences you have noticed in the system used at your railway.
Name three things that signals tell the driver.
What is a Token?
Name three main places you will find a signal by the track.
Name two types of signals.
What is a stop semaphore signal telling a driver to do when the arm is horizontal?
What should the driver do when a semaphore signal is in the 'off' position?
What colour is the arm of a 'distant' semaphore signal?
How far from the next signal should a 'distant' signal be situated?
What does a yellow light signal tell the driver?
What are 'feathers' on a signal?
What is a 'Driver's Call Button'?
Which side of the line are signals normally placed?
What are ground signals and where are they most likely to be used?

Preparing for duty.

Locomotives are complicated pieces of machinery and require skills to drive them which can take some time to learn. It is important both for your own safety and all the other people at the railway that it is done correctly.

The correct dress is important, loose fitting clothes can get caught in machinery and flimsy shoes can be a danger if something is dropped on your foot.

Whilst working on the railway it is almost certain that items will have to be lifted. Ask to be shown how to do this correctly and get help if you need it with a heavy item.

The majority of people joining the 7¼" Gauge Society Ltd want to drive. On the full size commercial railways in the days when there was only steam, anyone wishing to become a driver had to start as a locomotive cleaner. It would take many years as a cleaner, then a fireman before he would start to learn to be a driver.

A clean locomotive is not only a pleasure to look at but is more efficient and safer to work with. Time spent cleaning the loco gives you time to learn about the locomotive in general, observe how it is constructed and what the driver has to do to prepare the engine.

Some clubs will not let their junior members drive engines. Also, due to insurance requirements persons under the age of 16 are not allowed to drive trains carrying members of the public. However, this should not stop you from learning all about the different locomotives and how they work.

The next few pages will give you the basic details to get you started.

How do we make our trains go?

Put simply, if we connect some kind of power onto a set of wheels and then put it all on a railway, this becomes a 'locomotive' (sometimes shortened to loco) or 'engine'.

There are three main ways of powering our locomotives. This is how we propel our locomotive and so it is called 'propulsion'.

Models of older locomotives are usually powered by steam. This is made in a pressure vessel known as a boiler, usually with a coal fire, to heat the water.

Other 7¼" gauge locomotives are made to look like the diesel or electric engines that we see today on full size railways. These are usually powered by electricity from a battery inside the locomotive or they can have a petrol or diesel engine.

Our 7¼" gauge track is very useful as it can take locomotives of all types from the smallest standard gauge tank engine to the largest mainline express as well as many narrow gauge models and even some locomotives which have been dreamed up by

the modeller - these are called freelance designs. You will even see trams on our railways.
The detailed operation and running of locomotives will be fully covered later in the Gold Award Scheme, but it is good for you to know how they run and some of the hazards of each type of locomotive.

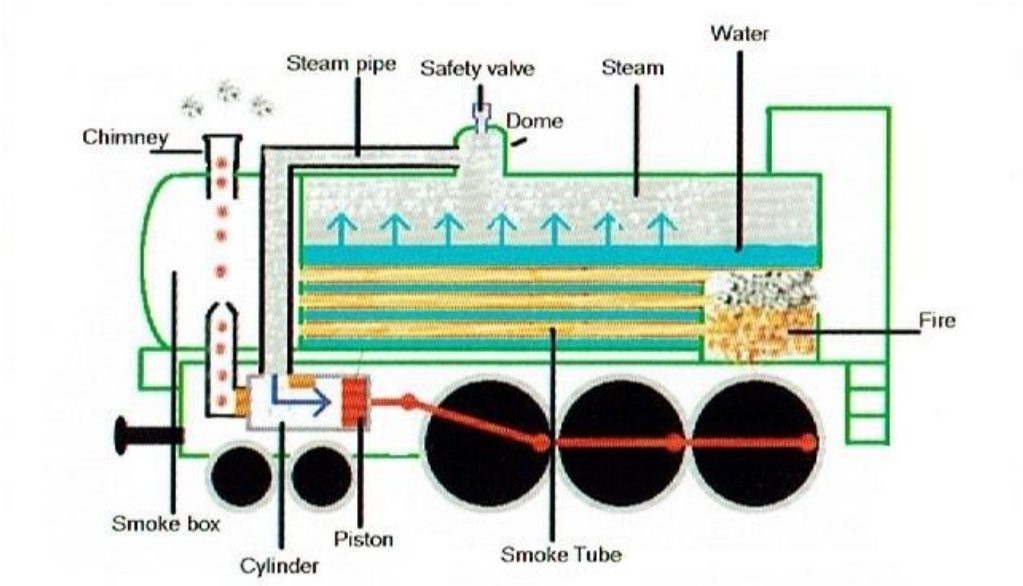
Locomotive or Train - which is it?

A locomotive is the engine, whether it is steam, battery or petrol driven with its tender, or driving truck attached.

A train is the locomotive with carriages or trucks of any kind coupled to it.

Steam locomotives have a boiler to heat the water, this may be made of copper or steel. These are made to an 'approved design' (this means someone has already built and tested the boiler type for safety).
Very simply, there are four major parts in a steam engine:
1. A firebox where the coal burns.
2. A boiler containing water that the fire heats up to make steam.
3. A cylinder and piston, rather like a bicycle pump but much bigger. Steam from the boiler is piped into the cylinder, causing the piston to move first one way then the other.
4. The piston is connected to the wheels and drives them round.

That's a very simplified description, of course. In reality, there are hundreds of parts in even the smallest locomotive.



This side on diagram shows how it works.

You load coal into the **firebox**. The fire heats up the water which then boils and produces steam. The boiler is a big cylinder with metal tubes running through it (for simplicity, we show only three here, coloured orange). These **tubes** run from the firebox to the smokebox, carrying the heat and the smoke of the fire with them.
The steam made in the boiler rises to the steam dome then flows down into a **cylinder** each side of the locomotive just ahead of the wheels, pushing a tight-fitting plunger, the **piston**, back and forth. A little mechanical gate in the cylinder, known as an **inlet valve** lets the steam in. The piston is connected to one or more of the locomotive's wheels through arms called a **crankpin** and **connecting rod** which in turn move the wheels. As the piston pushes, the crankpin and connecting rod turn the locomotive's **wheels**. When the piston has reached the end of the cylinder, it can push no further. The steam inlet valve closes. An **outlet valve** opens and the piston pushes the steam back through the cylinder and out up the locomotive's chimney.
The intermittent chuff-chuff noises that a steam engine makes, and its puffs of smoke, happen as the piston moves back and forth in the cylinder. The cylinder on each side of the locomotive work slightly out of step with one another to ensure there's always some power pushing the engine along.
In order to ensure the steam pressure in the boiler does not go higher than the boiler was designed to withstand, it is fitted with a **safety valve.** When the pressure starts to build up higher than the recommended working pressure the valve allows this excess to escape, bringing the pressure back down to a safe level.

Boiler Testing

The boiler is tested to make sure it is safe and operating correctly. Tests are made by **Boiler Testers**, usually a club official specially trained to do testing and the all important paperwork. Boilers usually operate between 80 and 120 pounds per square inch, usually called psi.
A Boiler Test is two parts, Hydraulic and Steam. Hydraulic Tests are repeated every two years for steel boilers and every four years for copper boilers. These are done by pumping water upto a known pressure, the boiler can be examined for leaks, minor leaks show up as minor "weeps".
All 7¼" gauge model boilers have to have a simple steam pressure test each year (known as the "steam test") in order to ensure the boiler is safe and the safety valves operate at the correct pressure. Once these tests have been passed, certificates will be issued.

A steam locomotive needs to be filled with water regularly as it evaporates when it is made into steam. It is essential that the water in the boiler is kept at the correct level above the fire or the boiler could be severely damaged, or even explode, if allowed to run dry. So that this does not happen each boiler has a **water gauge** fitted to the back of the boiler in the cab where the driver can see it. This shows him the level of water that is in the boiler.
Even when driven correctly steam engines are very hot and can send smoke, small cinders and steam out of their chimney, which could be a hazard to the driver, passengers or people around the track.

So how do you get water into at boiler when it's under pressure? The three methods used are:

Hand pump - this is a simple pump operated by hand and is usually only used by itself on very small miniature engines and as a back-up facility on the larger ones.

Axle Pump - this is a pump driven from the axle of the loco, this only works when the loco is moving, but as it is always working when the loco is moving overfilling can be a problem. A Bypass value is fitted to return water pumped to the tank to allow the axle pump to be inactivated.

Steam Injector - this device uses the steam pressure in the boiler to force the water into the boiler. At least one of these is fitted to the majority of engines, many have two. The way an injector works is similar to Ejectors and uses a vacuum to move water into the boiler.

What stops the water coming straight back out? A non-return valve called a **Clack Valve**, named for the distinctive noise it makes (particularly in full-size)
Your engine may be required to two or more ways to get water into a boiler for safety reasons.

Can you answer these questions about Steam Engines?

How do we know that a boiler has passed its safety tests?
What happens when the boiler working pressure is exceeded?
What does the boiler hold when working?
Where is the smokebox?
What does the piston do?
How is water fed into the boiler?
What do the tubes do?

Petrol driven locomotives

Most are petrol-hydraulic locos, but others are available. The engine can get hot and their exhausts have dangerous fumes.

Petrol is very dangerous and can catch fire very easily and so of course must be handled with great care especially when putting more petrol in the tank. This should only be done by an experienced person and should be done in a special area of the track.

Some of them have electric starting and so they will carry a battery, this may be full of acid which can cause burns if it touches your skin, and so must be handled very carefully.

The petrol engine is usually coupled to a hydraulic drive unit which drives a sprocket (A disc with teeth on the edge) that turns a chain, similar to that on a bicycle, which then turns the wheels. They will have the following controls:

1. Brake.
2. Forward, neutral and reverse control.
3. A speed controller (accelerator).

Before the locomotive is taken out on the track it requires checking for several things.

A. Enough fuel. Fuel must only be put in the tank in the open air by a fully trained person.

B. The engine oil level should also be checked and topped up if necessary.

C. Lubrication points should be inspected and the correct lubricant applied.

D. The controls should be checked to see if they are working properly.

E. Ensure the engine Forward and Reverse controller is in neutral, before starting the engine.

F. Test the horn sounds.

Can you now answer these questions?

What is the power source of a Petrol Hydraulic loco? What are the dangers when re-fuelling?

Before you use the locomotive what checks must you make?

What must you do before starting the engine?

Battery Electric Locomotives *can be either in the form of trams or modern style locomotives. As the name says they get their energy from the powerful 12 or 24 volt traction batteries which again may be filled with acid which could cause burns if it comes in contact with your skin.*

These locos are mainly controlled by a small lever set in a panel near the driver or on a handheld control box. They can have very rapid acceleration which can un-balance any passengers if the driver is too severe on the controls.

A traction motor is a special type of electric motor used to power the driving wheels of the vehicle, and their weight above the wheels will give them very good adhesion (grip on the rails).

Most battery electric locos have what is called regenerative braking, which means as the driver reduces the speed control to slow the locomotive down, the electric motors will put some electricity back into the battery. Whilst this is happening it will also give some braking to the wheels and helps to slow the locomotive.

This is very useful but will not stop the engine in an emergency and so some kind of extra brake should be available to the driver. Traction batteries ,like any other battery, lose their power as you use them so it is important you check that the batteries are fully charged. This cannot be done when you arrive at the railway as it may take more than a day to fully charge the batteries, so the driver must take responsibility to ensure they are fully charged when he reports for a running day.

Many locos have battery level indicators and other accessories like a free-wheeling facility, electronic speed limiting and digital sound.

Similar to petrol hydraulic engines they have three basic controls; a brake, a reverser and a speed controller.

Battery Electric Locomotives are probably the simplest to drive for the beginner but they still require attention before being taken on the track. The same awareness of the hazards of driving is required as with any of the other types of locomotive.

A. Check the battery level is OK

B. Lubrication points should be inspected and the correct lubricant applied.

C. The controls should be checked to see if they are working properly.

D. Ensure the engine Forward and Reverse controller is in neutral, before starting the engine.
E. Test the horn sounds

Having achieved the Silver award, you can continue your enjoyment of railways and go for the Gold award.
This award is to a much higher standard and gives you a wider working knowledge of miniature railways with as much hands on as we can work in.
The Gold award is in modules. You can pick which ones you do and when completed, points will be awarded. When you have enough points the Gold award will be awarded.
Ask your club Assessor for more details or check out the Seven and a Quarter Society Website, start with the Proficiency Scheme page where you will find downloadable manuals. Or email the proficiency scheme co-ordinator at proficiency@sevenandaquarter.org