Coronation Class 6229 Duchess of Hamilton

Release Version 1.0

1 Background

1.1 Locomotive

The LMS Coronation Class were main line steam locomotives designed by Sir William Stanier and built at Crewe Works between 1937 and 1948. 38 were produced in total and were the most powerful passenger steam locomotives ever built in the UK, with an impressive 3,300 horsepower (recorded by 6234 Duchess of Abercorn), which was more than the diesel locos that replaced them in future years.

Built specifically for the LMS Coronation Scot services, the first five locomotives to be built were painted in Caledonian Railway blue with silver stripes and hauled rakes of coaches painted in matching livery. These locomotives featured streamlining, designed by Tom Coleman, which was mainly added for publicity despite Stanier believing that it wasn't worthwhile as it added unnecessary weight, increased difficulty in terms of maintenance and wasn't effective at lower speeds.

In 1937, Coronation No. 6220 was put through some speed trials where it achieved a very impressive 114 mph - a new record at the time - just south of Crewe. Shortly after attaining this speed, however, the train reached a series of crossover points and, not having the distance to slow down, entered too fast. Although the train remained on the rails, despite traversing the 20mph crossovers at in excess of 55mph, a great deal of the crockery inside the dining car was destroyed! As a result it was decided to put an end to record-braking runs.

The second batch of five Coronations was also streamlined, although they featured the more traditional Crimson Lake with gold stripes livery, which originated on the former Midland Railway. One of these locomotives was 6229 Duchess of Hamilton. In 1939, Duchess of Hamilton had its identity temporarily swapped with 6220 as 6229 was taken to the United States for the 1939 New York World's Fair. This meant a Blue Duchess of Hamilton was still in the UK and a Red Coronation was in the States. The locomotives were given their identities back in 1943.

Today, three Coronation Class locos have been preserved, 6229 Duchess of Hamilton, 6233 Duchess of Sutherland and 6235 City of Birmingham.

6229 had its streamlining replaced at Tyseley Locomotive Works in recent years so that she could be displayed next to LNER Class A4 Mallard, the fastest steam locomotive in the world at the National Railway Museum in York.

6233 is owned by The Princess Royal Class Locomotive Trust and is used on railtours to this day.

6235 was taken to the site of the to-be-built Birmingham Museum of Science and Industry which was built around the in situ locomotive. Following the closure of the museum 6235 was taken to Thinktank in Birmingham where she resides today.

1.2 Design & Specification

Power Type	Steam
Locomotive Weight	105.25 t (106,938 kg)
Locomotive Length	73ft 9 ¾ in (22.498 m)
Build Date	1937-1948
Total Produced	38
Coal Capacity	10t (10,000 kg)
Water Capacity	4,000 gal (18,000 l) when built, 5,000 gal (23,000 l) in preservation

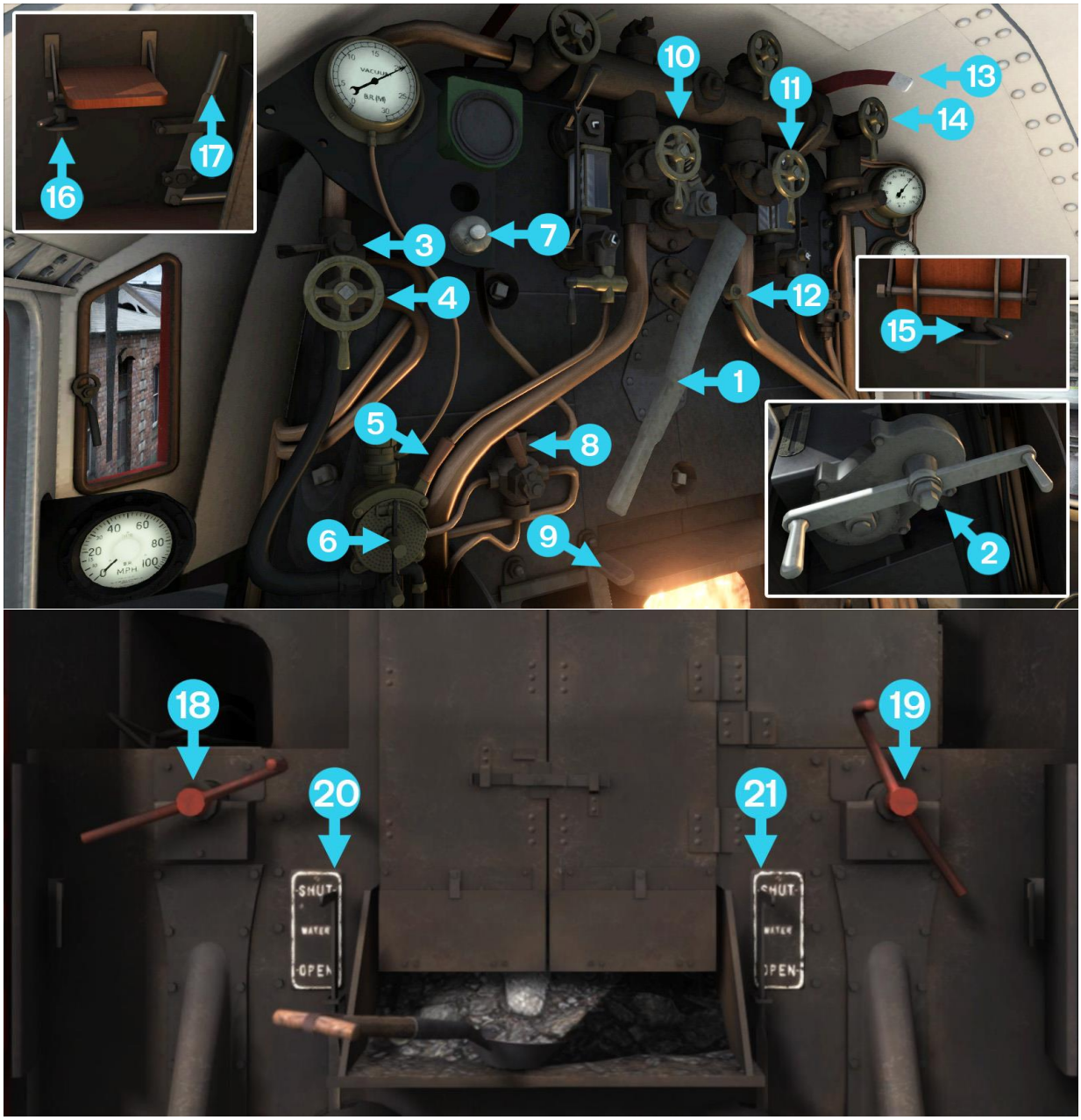
2 Rolling Stock

2.1 LMS Coronation Class – 6229 Duchess of Hamilton

2.2 Mk1 Coaches in BR Maroon

3 Driving the LMS Coronation Class

3.1 Cab Controls



1	Regulator
2	Reverser
3	Small Ejector
4	Large Ejector
5	Train Brake
6	Steam Brake
7	AWS Reset
8	Sander
9	Firebox Doors
10	Live Steam Injector Steam Valve
11	Exhaust Steam Injector Steam Valve
12	Blower
13	Whistle
14	Steam Heat Valve
15	Exhaust Steam Injector Trimmer
16	Live Steam Injector Trimmer
17	Cylinder Cocks
18	Handbrake
19	Water Scoop
20	Exhaust Injector Water Valve
21	Live Injector Water Valve

3.2 Basic Driving Controls

Key Equivalent	Action
D / A	**Regulator** Decrease or Increase
S / W	**Reverser** Decrease or Increase
; / ‘	**Train Brake** Decrease or Increase
H	**Lights** Repeatedly pressing will cycle through headlight states
Shift + H	
Space	**Whistle** Sound the locomotive whistle
V	**Crow Whistle** Sound a short blast of the locomotive whistle

3.3 General Keyboard Controls

Key Equivalent	Action
T	**Load/Unload** Press once to load/unload passengers or freight **(Expert)**
B	**Driving Mode Setting** Toggles between Legacy and Realistic Driving Modes. This affects the simulation of the steam chest and braking characteristics
Shift + Ctrl + C	**Couple Manually**
Tab	Request permission to pass a signal at danger
Ctrl + Tab	Request permission to pass a signal at danger when running in reverse

3.4 Basic/Advanced Driving Mode (Expert Train Controls Only)

From the Train Controls option in the main Settings/Gameplay TS2016 menu you are able to select whether you drive using Expert or Simple Controls.

In addition, the LMS Coronation Class locomotive features both “Basic” and “Advanced” modes which may be changed by pressing the **B** key. The mode selected will be displayed in a pop-up message in the top right-hand side of the screen.

Basic mode allows the user to drive the loco without using complex controls such as the ejectors, doesn’t use a realistic steam chest simulation and gives a simplified brake setup.

In Advanced mode, all controls need to be used to get the best performance and a realistic steam chest simulation is present.

3.5 Advanced Driving Controls

Q	**Alerter** The Alerter is a system used to ensure that the driver has seen a signal. If the alert sounds (a black/yellow striped symbol is shown in the cab) it must be acknowledged by pressing the Alerter button or the emergency brakes will be applied
X Shift + X	**Sander** Causes sand to be laid on the rails next to the wheels to assist with adhesion. Press X once to apply sand and Shift + X to stop
/	**Handbrake** On/Off This icon is displayed in the Coupling view
J	**Large Ejector** On/Off
U Shift + U	**Small Ejector** On/Off
C	**Cylinder Cocks** Open/Close. The cylinder cocks are valves that allow condensed water to be removed from the cylinders which power the wheels. If this water is not removed before pulling away from a stand, it can cause damage

Please be aware that the boiler water level reported in the HUD will vary dependent upon the gradient of the line

3.6 Fireman's Controls (Manual Fireman Control Only)

Key Equivalent	**Action**
F Shift + F	**Firebox Door** Open/Close To enable the fireman to shovel more coal.
R Shift + R	Increase or reduce the rate the fireman shovels coal into the firebox.
I	**Live Steam Injector** On/Off This uses steam direct from the boiler to move additional water into the boiler.
K Shift + K	Increase or reduce the flow of steam to the Live Steam Injector.
O	**Exhaust Injector** On/Off This uses waste steam from the cylinders to move additional water into the boiler.
L Shift + L	Increase or reduce the flow of steam to the Exhaust Injector.
N Shift + N	**Blower** Increase/Reduce The Blower is a device, powered by steam from the boiler, which increases airflow through the fire making it hotter. During normal running the blower is not often needed because the exhaust steam will draw sufficient air through the fire.

Key Equivalent	Action
	Damper Increase/Reduce
M Shift + M	The Damper covers an opening in the firebox that allows fresh air in. Closing the Damper reduces air flow and hence the temperature of the fire.
Home	**Smokebox Door** Open/Close
[	**Steam Brake Fulcrum** (See Section 4.1)
]	Press] to pull out and [to push in
P	**Steam Brake Fulcrum** (See Section 4.1) Press P to secure lever
Page Up Page Down	**Brake Difficulty Setting** (See Section 4.2)

4 LMS Coronation Class Brakes

4.1 General Description

The Coronation Class locomotive is fitted with the LMS standard combination steam and vacuum brake valve. The principle of the brake is that the locomotive and tender are retarded by a steam brake which is automatically actuated by the operation of the vacuum brake. The vacuum brake applies the brakes on the train but has no direct effect on the locomotive.

In practice this means that when the vacuum falls below around 14”Hg** the steam brake will begin to apply, being fully applied by around 12”Hg. However, as boiler pressure decreases the vacuum required to apply the brake will also fall so that at around 215psi the vacuum will need to be reduced to around 10”Hg to apply the steam brake.

The locomotive is fitted with two ejectors, namely a 25mm large ejector operated by the small brass wheel located above the brake valve (**J** key) and a 20mm small ejector operated by the short wooden handle directly above the large ejector (**U** and **Shift U** keys).

The small ejector is used to create a vacuum slowly and maintain it at 21”Hg, whereas the large ejector is used to quickly create a vacuum. The large ejector uses noticeably more steam than the small ejector and so its use is not recommended other than to quickly release the brake,

Both ejectors should not be used under braking, when it is preferable for the large ejector to be closed, as this will retard the action of the brake and reduce its effectiveness if the large ejector is open.

The brake valve also allows manipulation of the Steam Brake Fulcrum. When the steam brake is applied by vacuum, with the brake handle in the Off position, the steam brake can be released by pushing in the fulcrum lever, either by hand or by pressing the **[** key. The spindle can then be held in position by pressing the **P** key to secure it with the hook.

Movement of the handle slightly towards the On position will cause the hook to fall, and, if vacuum is less than 14”Hg, cause the steam brake to apply. The spindle will remain in position if the vacuum is greater than 14”Hg.

The reverse is also possible; with a vacuum created, the steam brake fulcrum can be pulled out with the **]** key, it can then be held open with by pressing the **P** key which moves the hook into position. Any movement of the handle will then cause the hook to fall and the fulcrum lever to assume its natural position.

Vacuum brakes are notable for being leaky due to imperfections in seals and connections, and therefore an ejector must be left open constantly in order to prevent the brakes from ‘leaking on’.

Do not let it concern you if the vacuum is not exactly 21”Hg when only the small ejector is open; the vacuum brake is released at anything above 18”Hg and the rules require only a minimum of 18”Hg to be created. For fully fitted goods trains this rule is relaxed to 16”Hg.

***Inches of Mercury*

At first glance the brakes may not seem to be self-lapping and impossible to hold a vacuum - moving the handle closer to On causes the vacuum to fall more rapidly and moving the handle closer to Off causes the vacuum to rise.

It is, however, perfectly possible to hold a set vacuum although there is somewhat of a knack to it. As the vacuum falls the rate at which air enters the train pipe also falls. Conversely, as the vacuum falls the rate at which the ejector draws a vacuum increases.

Therefore leaving the handle in a set position will eventually lead to the brake system reaching a steady state where the two flows are balanced and a constant vacuum maintained. A guide discussing how best to achieve this is described later.

4.2 Brake Difficulty Settings

The DTG Coronation Class has 4 pre-set brake modes which may be changed using the **Page Up** and **Page Down** keys:

1) Coaching stock fitted with Direct Admission valves – default brake mode

2) Wagon stock fitted with Direct Admission valves – designed for use on more modern wagon stock fitted with vacuum brakes (circa 1950s/60s). Brake applications times are slightly increased over mode 1 and release times are significantly greater.

3) Wagon stock not fitted with Direct Admission valves – Designed for older vacuum fitted stock. Release times are the same as brake mode 2 but application times are much greater.

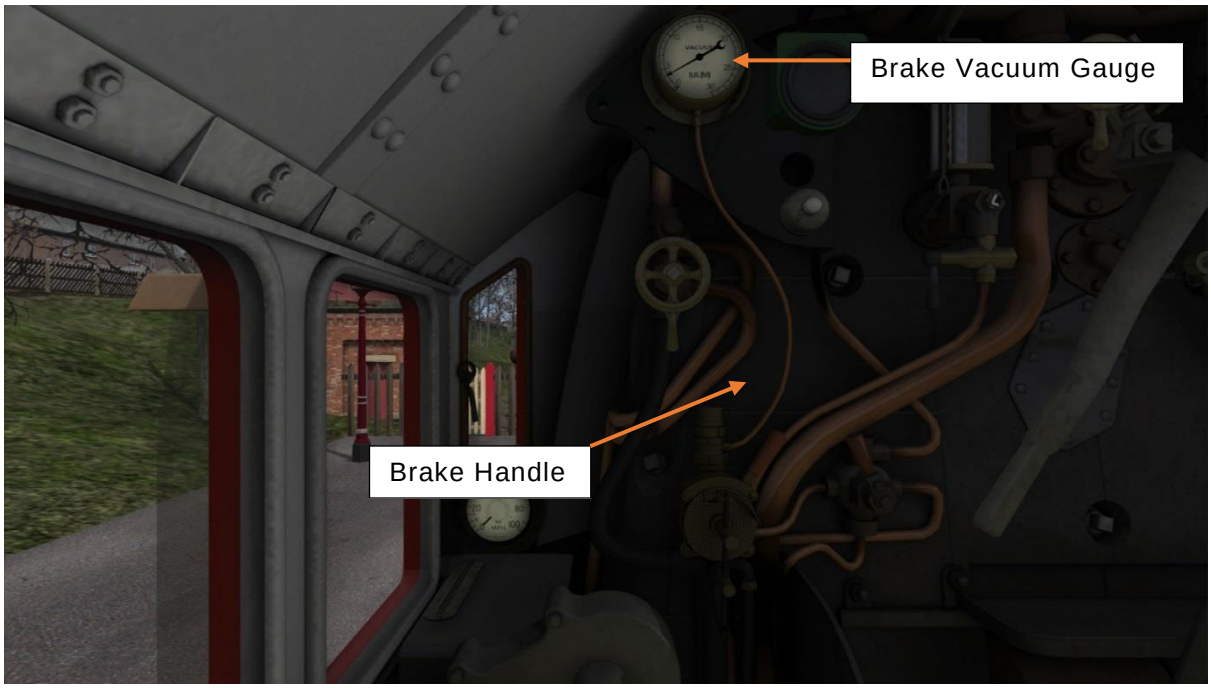
4) Light Engine/Unfitted stock – strictly speaking not needed for light engine work, being designed more for use with unfitted stock. The vacuum brake is only operative on the locomotive with the vacuum hoses on the dummy couplers. This can also be used for hauling vacuum fitted stock (provided the reservoir sides have been released (done automatically) without the use of the vacuum brake (e.g. when shunting around a yard to save time releasing the brakes).

4.3 Braking User Guide

This guide assumes the use of Advanced Mode

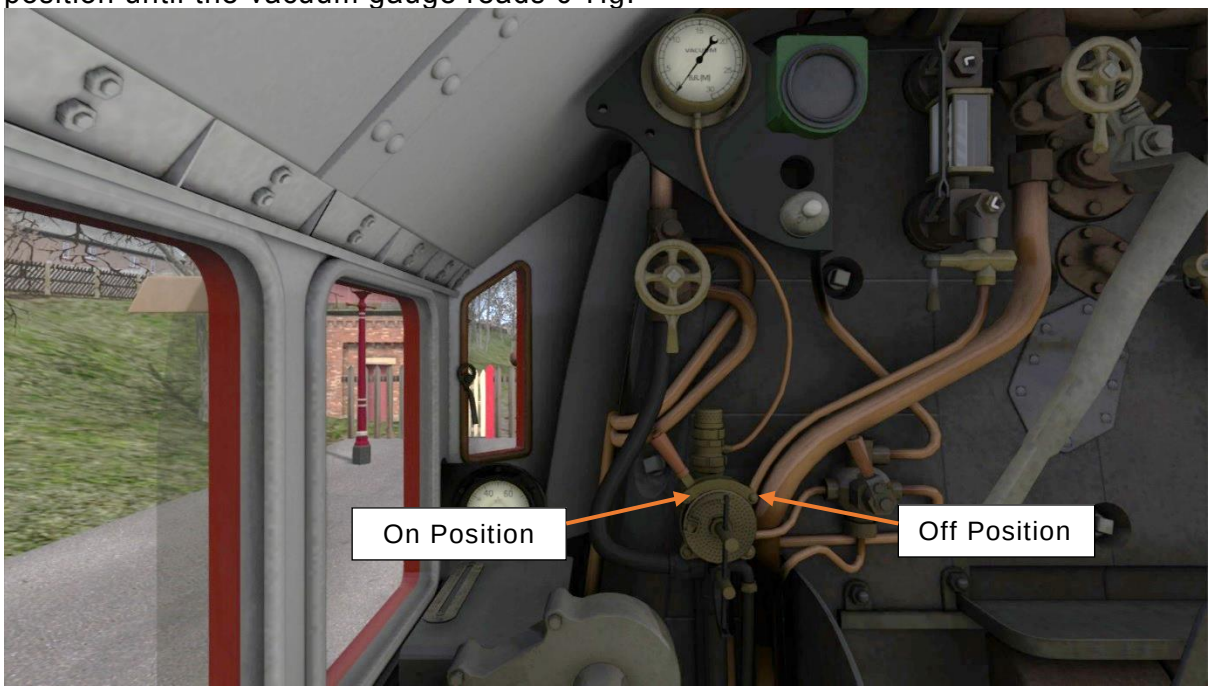
1) Starting Off

When you first enter the engine you will find the brake controls and gauges as below:

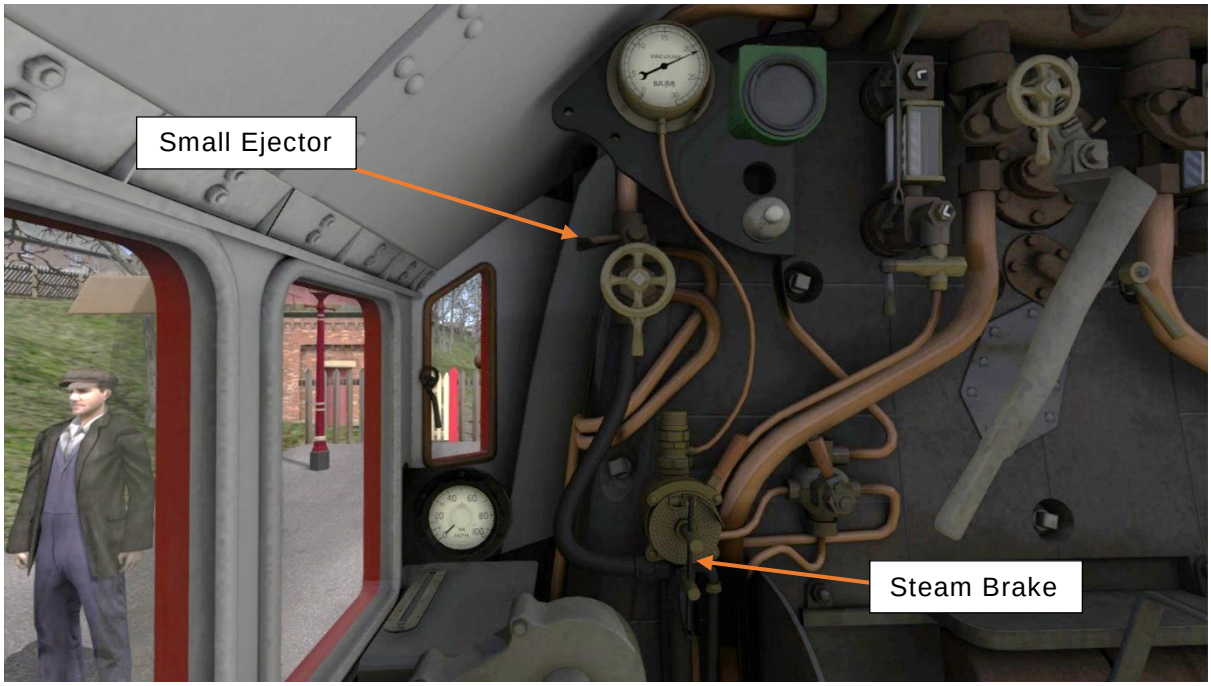


You will find the brake handle near the Off position, both ejectors shut and the vacuum partially destroyed.

First of all destroy the rest of the vacuum by moving the brake handle to the On position until the vacuum gauge reads 0”Hg.



To prepare for setting off return the brake handle of the Off position. To prevent unintentional movement keep the locomotive steam brake applied (see Part 8). With the brake handle in the Off position press **P** once. Next open the small ejector and the vacuum will now start to rise.



When the vacuum reaches 18”Hg the vacuum train brake is fully released.

Once the right away is given the steam brake can be released quickly by moving the handle slightly towards the On position and then returning it to Off. You should then hear the steam brake blow off and see the fulcrum lever move inwards. You are now ready to depart.

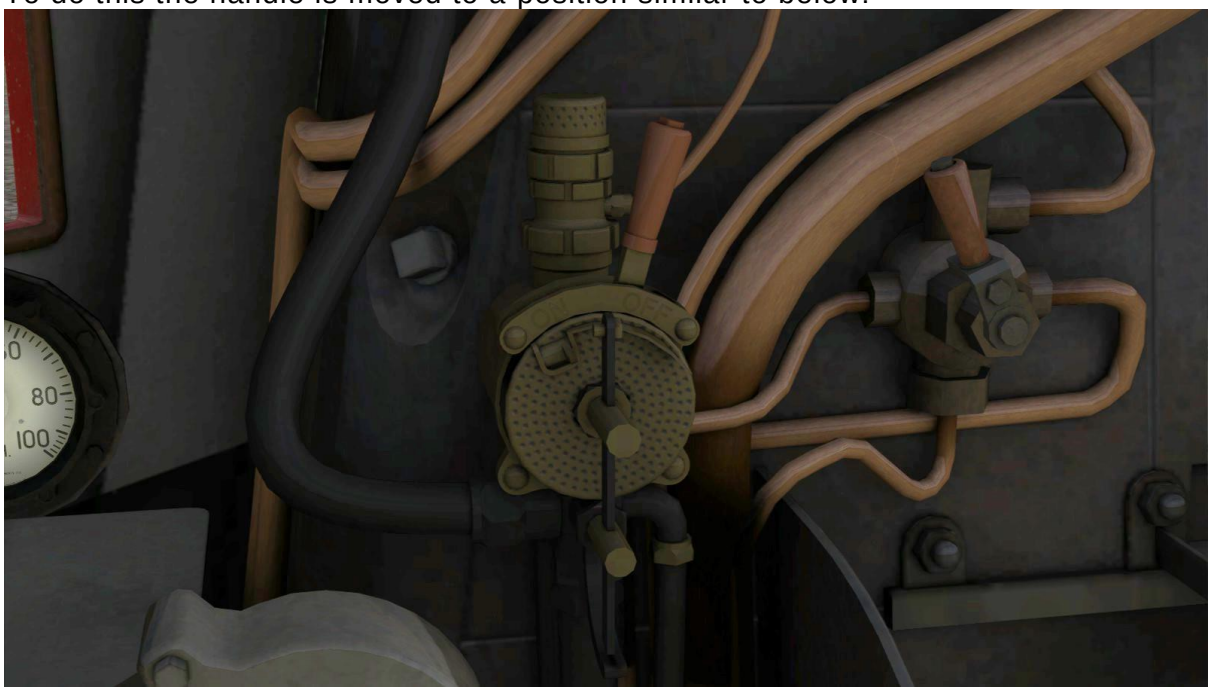
2) On the Road

Once on the move the small ejector should be left open to maintain the vacuum at 21”Hg against leakages. The brake handle should be left in the Off position.

3) Setting the Brake

When the time comes to slow down, maintain speed downhill or stop, the first thing to do is to set the brakes. This is done by performing a moderate application of the brake, bringing the vacuum down to about 15”Hg.

To do this the handle is moved to a position similar to below:



4) Maintaining a Set Vacuum

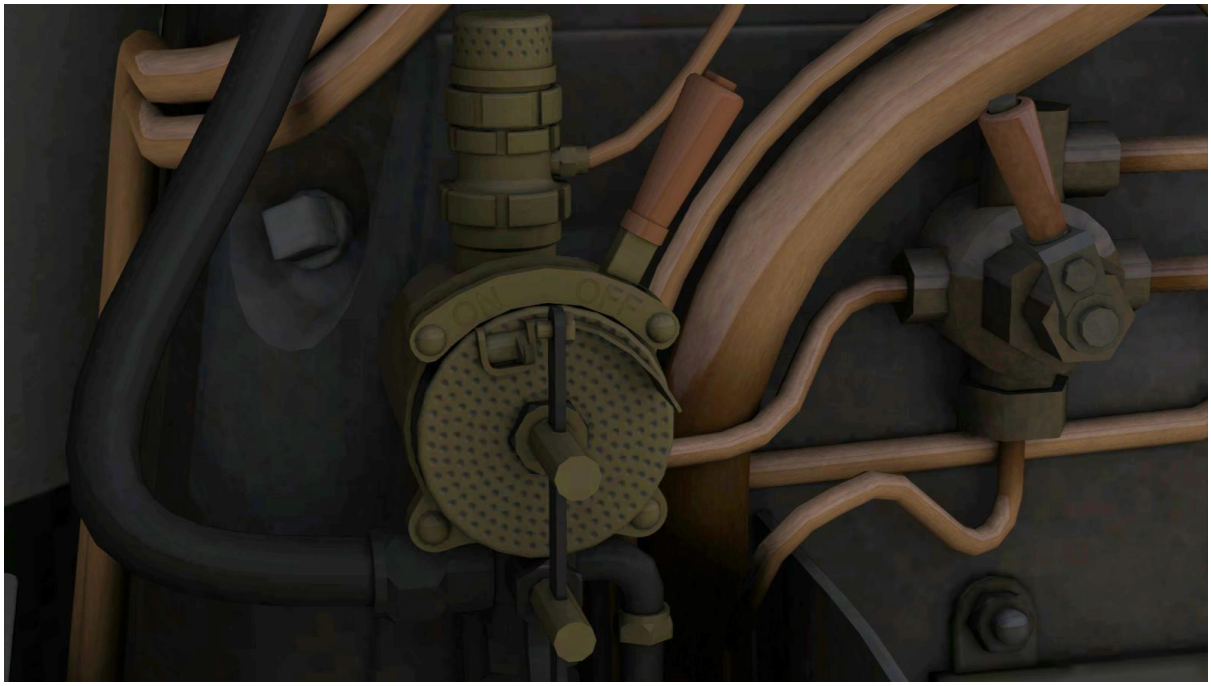
A vacuum of around 15”Hg should be sufficient to very gradually slow the train or hold speed down a long bank and therefore you may wish to hold this vacuum level.

Finding the correct brake handle position to achieve this is mostly trial and error and comes from experience. The way to find the desired point however is quite simple.

Once you have reached the desired vacuum, move the brake handle back towards the Off position and the rate at which the vacuum falls will stabilise and will eventually start increasing. Once this happens move the handle a fraction back towards On and the vacuum should stay relatively constant (minor changes aside).

The vacuum can then be fine-tuned by partially shutting the small ejector to decrease vacuum a little further, or by cracking open the large ejector to slightly increase the vacuum.

A position for maintaining about 14.5”Hg against a fully open small ejector is with the left side of the brake handle in line with the left side of the first F in OFF.



5) Slowing the Train

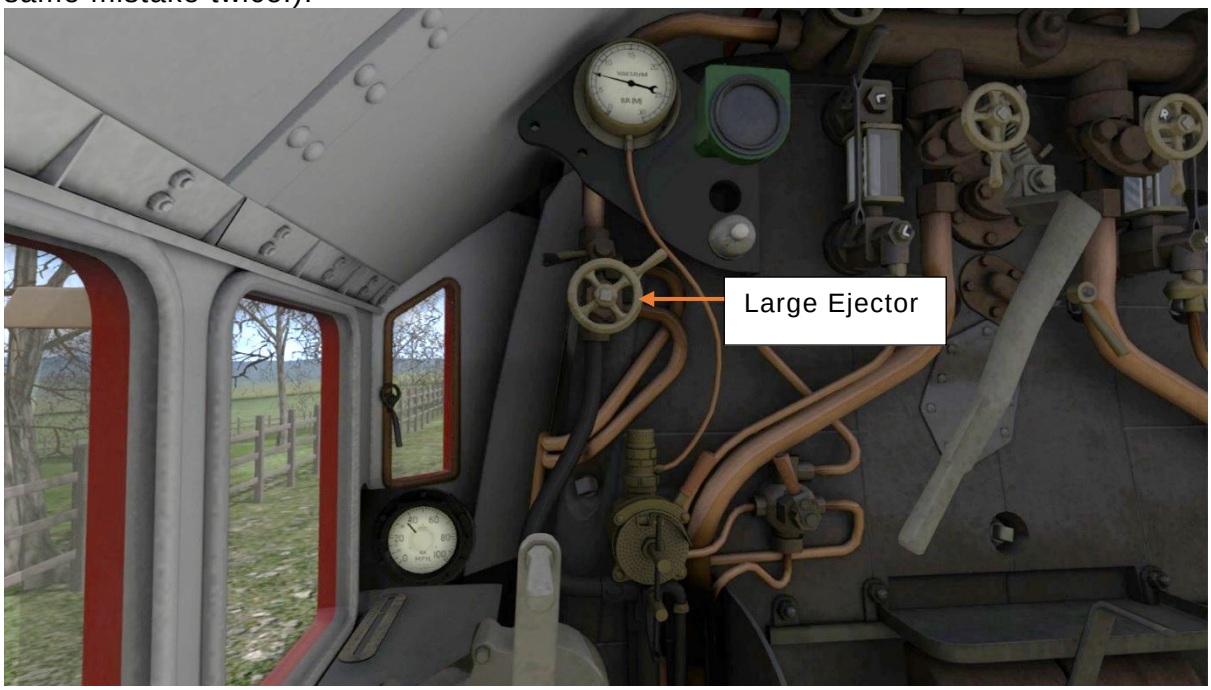
In all probability 15”Hg will not be enough to slow the train down quickly enough and an application of the locomotive steam brake would be necessary.
Therefore the vacuum should be reduced to the point where the steam brake applies - usually around 13-14”Hg (unless you are struggling for steam, in which case the vacuum may need to be destroyed further).

Move the handle back towards the On position and let the vacuum fall to around 11”Hg which should be sufficient for most stops (a heavy application could be considered around 5-8”Hg and an emergency application is 0”Hg). Once at the desired vacuum repeat the steps described in Part 4 above.

6) Over Braking
Should you accidently apply the brakes too quickly resulting in you slowing down too fast, don't panic!

Firstly release the vacuum brake as quickly as possible. To do this open the large ejector (**J** key). While the vacuum is being created - it will take quite a few seconds to release the train brakes - you can release the locomotive steam brake by pushing the fulcrum lever inwards with the **[** key and holding it.

Once you've reached the desired vacuum shut the large ejector and move the handle back towards the On position to hold the vacuum (being careful not to repeat the same mistake twice!).



7) The Station Stop
On approach to the station you should maintain a constant brake application; don't try to see-saw the brakes as it will only reduce their effectiveness.

If you find yourself coming up short return the handle to the Off position and allow the vacuum to recreate, and if necessary release the steam brake and open the small ejector.

If you are coming in too quickly apply the brake further. If there is a significant chance of overshooting put the handle fully over into the On position which will quickly cause the brakes to fully apply and leave the handle there until you are certain that you will stop in roughly the right place. Be aware you will probably slow down too quickly in which case you should see Part 6 above.

8) Standing at a Station

There are two possible scenarios the first of which is if the station is on a level gradient or near level. When standing at the station the train will not need to be held with the vacuum brake - the locomotive steam brake alone should suffice and will also allow a quick getaway.

To do this, return the brake handle to the Off position and vacuum should begin to rise. If the steam brake fulcrum is in the out position you can simply press the **P** key to hold it in position. However, if it is not fully out you will need to pull it out with the **]** key. Then, while still holding **]**, press the **P** key to hold the fulcrum lever in position.

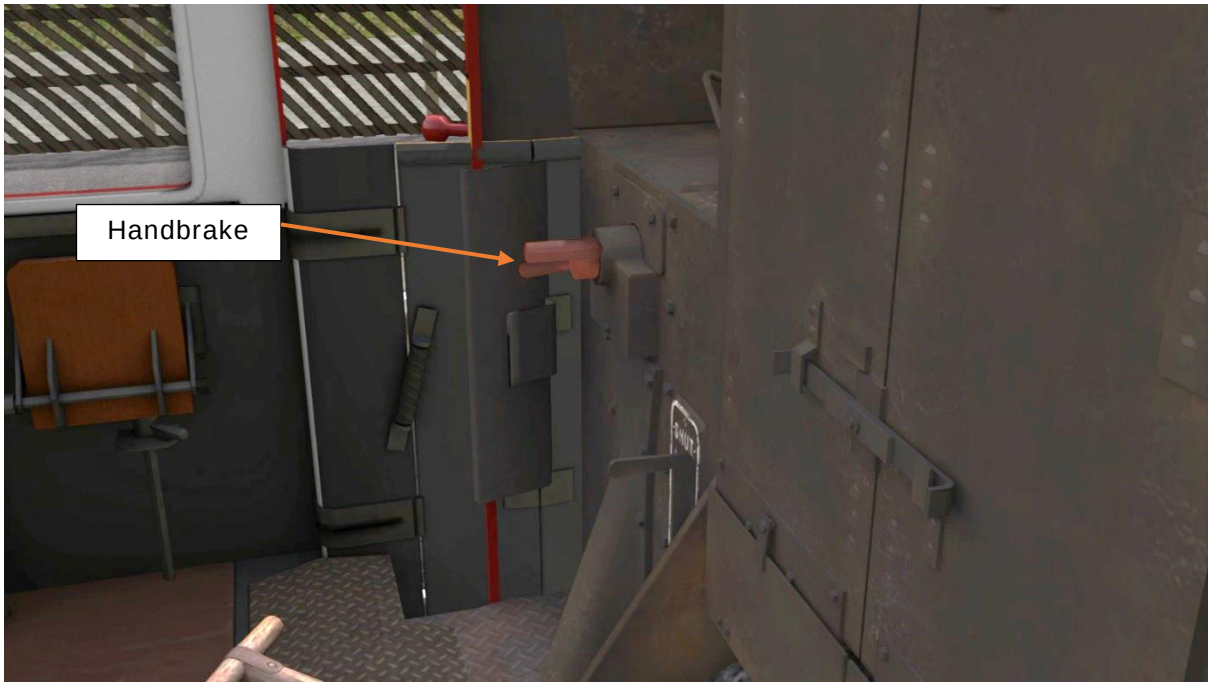
Once the right away is given repeat the final part of Part 1 above.

The second situation is if the station is on a steep gradient, such as at Settle. In these instances you will need to additionally use the vacuum brake to make sure the train doesn't move.

The vacuum should be set at around 12"Hg to allow the steam brake to be applied using the method described in Part 4 to hold it at this vacuum.

9) The End of the Day/Long Station Waits

When the locomotive is going to be standing idle for a long period of time it may be preferable to use the tender handbrake (located on the right-hand side of the tender) rather than the steam brake.



4.4 Additional Notes

The locomotive is fitted with cast iron brake blocks which gives the brakes the characteristics of being very fierce at low speeds, but exponentially weaker at high speeds (the brakes are 1/3 of the effectiveness at 50mph than at 5mph).

Be careful when running at high speeds as braking distances will be significantly longer than with more modern disc brakes. Similarly at low speeds the brakes are much fiercer and can lead to you stopping very sharply and suddenly. Due to this when you pull up you may want to release the steam brake to prevent a violent stop.

The maximum brake force provided by the steam brake is proportional to the boiler pressure so that as pressure falls the brakes will become weaker. At the same time the vacuum required to apply the steam brake will also fall so the vacuum brake will consequently need to be applied further.

Eventually it may even be impossible to apply the steam brake with the vacuum brake. If this is the case the brake handle will need placing in the On position whereby a cam will force the steam brake fulcrum out forcing it to apply.

Longer trains will cause longer application and release times. Take this into account when planning your braking distances. It is always better to err on the side of caution rather than overshoot a station or pass a signal at danger. Conversely very short trains will have shorter release and application times and care must be taken not to over brake or release the brakes too quickly.

When running light engine the rate at which the vacuum brake is applied and released is very fast. In addition the vacuum brake has no effect on the locomotive - only the steam brake does - so make sure to destroy vacuum below about 10”Hg to ensure a brake application. Do this in short bursts at low speeds; applying the brake

down to 10”Hg for a few seconds, letting the steam brake apply and then releasing again to prevent stopping suddenly in one go.

If the brake refuses to apply with the vacuum brake due to low pressure put the handle all the way across into the On positon (and if by some miracle that doesn’t work apply the hand brake and if necessary reverse the engine).

Should the locomotive pick up its feet (start to skid) you need to release the locomotive steam brakes as quickly as possible as the wheels will start to develop a flat spot and braking distances will be greatly increased. Manually release the steam brake with the **[** key and then open the sander valve in the appropriate direction.

Let the steam brake then apply again, and if the loco ‘picks up’ you will need to constantly release and apply the steam brake preventing the wheels from sliding.

In a situation requiring an emergency application first put the brake handle quickly into the On position, shut the regulator and open the sander, then begin winding the engine closer to mid gear to increase compression (not modelled). If necessary reverse the engine putting the cut off to about -20% and open the regulator partially, (cylinder cocks should also be opened in this case).

This is an **absolute** last resort and should not normally be done as it could potentially damage the engine. If the engine wheels pick up or slip backwards shut off steam immediately. If before reversing the engine the wheels slip, don’t bother reversing the engine as it will not slow down any quicker as you are already at the adhesion limit.

The small ejector on short trains does not need to be fully open to create a full vacuum, it is up to you to manipulate the ejector. A partially open ejector will result in an increased brake release time which may or may not be desirable.

On longer trains, even with the small ejector open, it may not be possible to fully release the brake up to 21”Hg. However, the vacuum brake will not actually apply until 18”Hg so you can run at anything between 18”Hg and 21”Hg with no issue. Do not let it concern you if you can’t draw a full 21”Hg vacuum.

5 Driver Assist

Driver Assist works by highlighting the control required to be adjusted and provides detailed instructions and real-time feedback as to how far it needs to be moved and the effect it has on the locomotive.

Once you've got the hang of it, the system is designed so it can be switched off. If you get stuck and feel the need for help again, simply turn it back on.

Activate / Deactivate Driver Assist by pressing **CTRL+A**

To pause the simulation when Driver Assist messages appear, press **CTRL+SHIFT+A**

6 Scenarios

For driving tutorials, please visit the Academy from the main TS2016 menu screen*

6.1 1. [DoH] Vintage Train: Part 1

Take 6229 between Carlisle and Appleby on the first leg of a railtour over the length of the route.

Duration: 35 Minutes
Difficulty: Medium

6.2 2. [DoH] Vintage Train: Part 2

Continue the railtour in 6229 between Appleby and Settle. You'll be battling up the climb to Ribblehead and then negotiating the tricky descent into Settle to finish.

Duration: 50 Minutes
Difficulty: Hard

6.3 3. [DoH] Vintage Train: The Return

On the return leg of the railtour you are following a local passenger service and have been held at Settle Junction. Now the road is clear how will you fare on the climb up to Ribblehead?

Duration: 35 Minutes
Difficulty: Very Hard

7 Acknowledgements

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Beta Testing Team