



LNWR G2 0-8-0 Heavy Goods Engine

By Meshtools



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History

The LNWR (London and North Western Railway) G2s were the last in the line of LNWR 0-8-0s whose lineage dates back to 1892. The G2s were a series of 60 new build engines being built from 1921 to 1922 under C.J. Bowen Cooke at Crewe works and were in essence an improved version of the earlier G1. They featured a redesigned and strengthened direct acting joy valve gear, strengthened frames, large axles and axle boxes and a higher boiler pressure of 175psi over the G1's 160psi.

The G1s themselves were an amalgamation of rebuilt and upgraded earlier classes along with a handful of new built engines (and so comprised of members of the A, B, C, C2X, D, E, F and G classes). Over time most of the G1s would be rebuilt into the class known as the G2A which raised the boiler pressure to 175psi, strengthened the motion and often replaced the indirect acting joy valve gear with direct acting gear.

Combined the G2, G1 and G2A class were comprised of around 502 members making it the 6th largest class of locomotives to operate in the UK and 4th of the LMS classes (only being beaten by Black fives, 4Fs and 8Fs). This means that the LNWR 0-8-0s became something of a quasi-standard heavy freight engine class of the LMS, something that the higher ups in the LMS would only begrudgingly admit, although a lot of rebuilding and improvements to the classes were unusually done under William Stanier of all people! The G2s could practically be found on all types of trains on the LMS and under BR, from heavy mineral, coal and goods trains, fast vacuum fitted express goods, pickup goods, banking, piloting, shunting, snow plough duties, stopping passenger trains, excursions, raitour specials and even express passenger trains, they did the lot. Their smaller size, lighter weight and relatively high efficiency kept them useful right up until the end of steam and they often did jobs which larger engines like the 8Fs and 9Fs couldn't do or would have been extremely inefficient to use.

The class earned itself several nicknames, the most common of which was the Super D. This originated from the G Class engines which were in essence a Superheated D class, over time this was shortened to Super D and often just D, this name then carried forward onto the G1s, G2s and G2As despite then not being much like a D anymore! Other nicknames were somewhat less polite, another common one being Stupid D, and others like Mourners, Choo Choos and Fat nancies, quite how these names came about is left to your imagination.

Over time various upgrades were applied to the G2s such as Belpaire fireboxes, Wakefield fountain lubricators, Stanier pattern chimneys, tender cabs and rear steam sanding being amongst them. This had the result that no two G2s were ever quite the same! The Class lasted right up to the end of steam with the last two being withdrawn at the end of 1964. One engine number 49395

has been preserved as part of the national collection and currently resides as a static exhibit at the National Railway museum at Shildon.

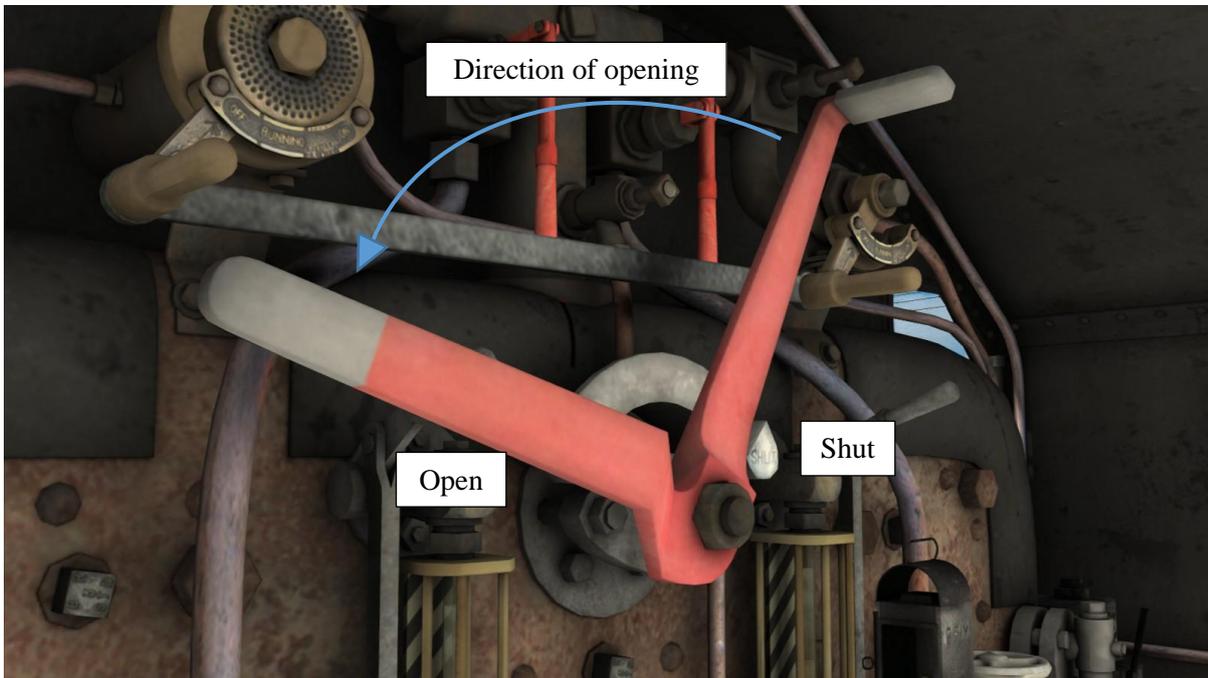
The class did see one further development, the LMS 7F 0-8-0 often termed the G3 or ran with the nickname Austin 7 and was a direct development of the G2s which saw several improvements like increased boiler pressure and long travel Walschaerts valve gear. They were designed to ultimately replace the LNWR 0-8-0s and the class gained a reputation for being excellent engines... when they worked. Unfortunately, Derby had their hand in the class's development and essentially ruined it with inadequate axle boxes from the Midland 4F. The net result was the class had over 50% higher running costs and less than half the availability of the LNWR engines. This combined with the lack of vacuum brakes spelled an early end for the class and by 1959 all had been withdrawn. The irony being the class they were designed to replace ended up outliving them!

Technical data

- Power Classification: 7F
- Configuration: 0-8-0
- Total Built: 60
- Length: 55'. 4 "
- Width: 8'.3"
- Height: 13'. 2.5"
- Weight: 66 tons + 40.25 ton tender
- Coal Capacity: 6 tons
- Water Capacity: 3000 gallons
- Tractive Effort: 28043 lbf
- Estimated Power Output: 940 hp
- Fire tube heating surface: 1538 sq ft
- Superheater Heating Surface 464 sq ft
- Firebox heating surface: 149 sq ft
- Total Heating Surface: 2151 sq ft
- Grate area: 23.6 sq ft
- Cylinder Size: 20.5' x 24'
- Driver Diameter: 4'. 5.5"
- Boiler Pressure: 175 psi
- Valve Gear: Joy

Controls

Regulator

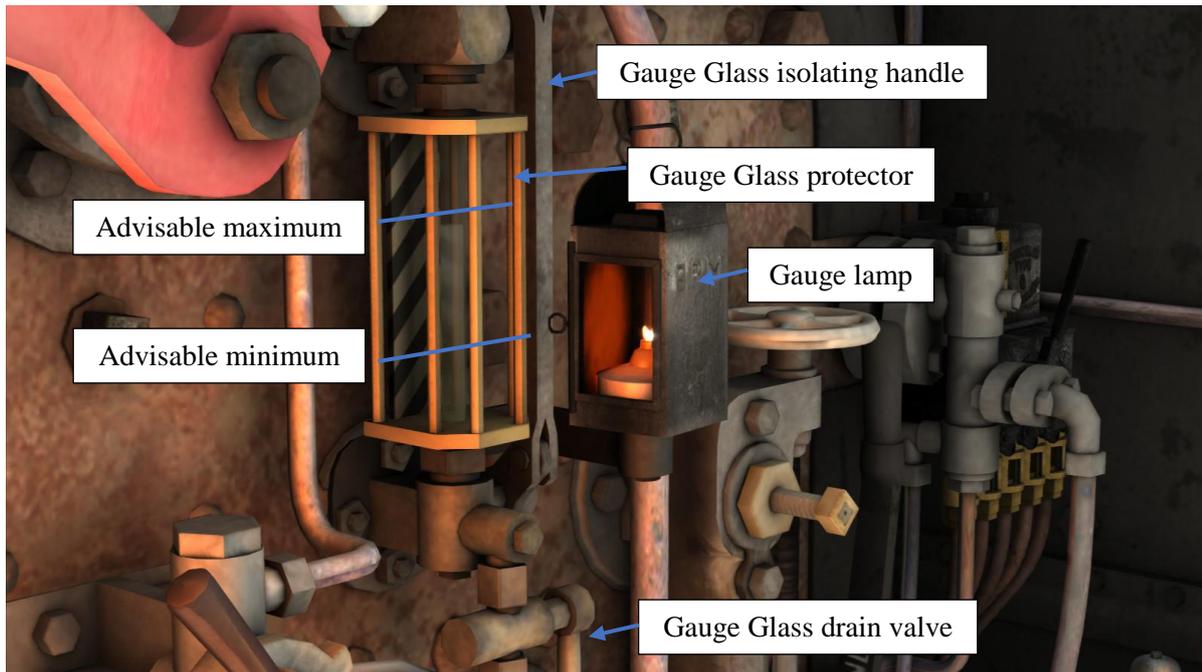


The regulator controls the flow of steam from the boiler to the steam chest and cylinder. The wider the regulator is opened the greater the flow of steam which will result in an increase in steam chest pressure and hence into the cylinders. The regulator on the G2 is a Ramsbottom double beat type regulator. This type is noted as being very free moving (so much so that it can sometimes close itself!). A characteristic of this type of regulator valve is that it has no distinct pilot and main valves, the other major characteristic is that it opens backwards to the convention.

Unlike most left hand drive locos whereby the regulator is opened clockwise, the G2 regulator opens anticlockwise. This is further reflected in the keys used to operate the regulator. Unlike most engines which use 'A' to open and 'D' to close, the G2 uses the opposite i.e. 'D' to open and 'A' to close. This has been done to replicate the confusion which occurs if driver happens to be used to more conventional locomotives and subconsciously operates the regulator the wrong way out of habit. If, however you cannot get on with the backwards regulator there is an option to reverse the key combination back to the more conventional layout with the 'Ctrl+D' key combination.

It should be noted due to the large volume of the steam chest, regulator piping and superheater that the engine can keep going for a reasonable amount of time after the regulator is shut. There is also a delay between opening the regulator and the engine setting off.

Gauge Glass Level, Carry Over and Hydraulic Steaming



The G2 has another unusual and quite dangerous trait with the regulator which is to do with carry over, more commonly referred to as priming. If the water level is too high and the regulator is open, water can be drawn through the regulator and into the steam chest and cylinders. This is true of all engines, however the G2 is very prone to carry over and will start carrying over if the water level is near the top of the gauge glass.

Furthermore, the G2 simulates the rise in water level caused by the drawing of steam through the regulator. The wider the regulator, the more the water level is drawn up. This causes two potential problems. First off, the water level increases if the regulator is opened meaning it is possible for the level to increase above the level at which priming can occur. Secondly, it gives a misreading if the regulator is open, giving the impression you have more water than you do.

There are other factors which will also affect the gauge glass water level. If the boiler is on an upward slope, water will surge towards the rear increasing the level shown in the gauge glass and giving the impression of having more water than you actually have. If the boiler is on a downward slope, water will surge towards the front of the boiler meaning the level in the gauge glass will drop and may also potentially reveal the boiler's crown sheet and fusible plugs.

Going around a corner will cause water to surge slightly to the outer side from the inner side, leading to the level in the gauge glass on the outer side reading higher than that on the inner. Harsh braking or acceleration will cause the water to surge forwards or backwards depending on the direction of acceleration or braking. The natural motion of the locomotive will induce oscillations in the boiler level, the faster you are going the more noticeable the bob in the gauge glass will be, the level should be taken as the midpoint of these oscillations.

Unlike on some engines we have decided not to simulate damage which can potentially occur from priming, we have however simulated something potentially more dangerous. When water is carried over through the regulator, before it reaches the cylinders it must pass through the superheater. As the water passes through the superheater it is turned to steam which in turn will generate pressure within the superheater itself. This means that the superheat suddenly becomes a

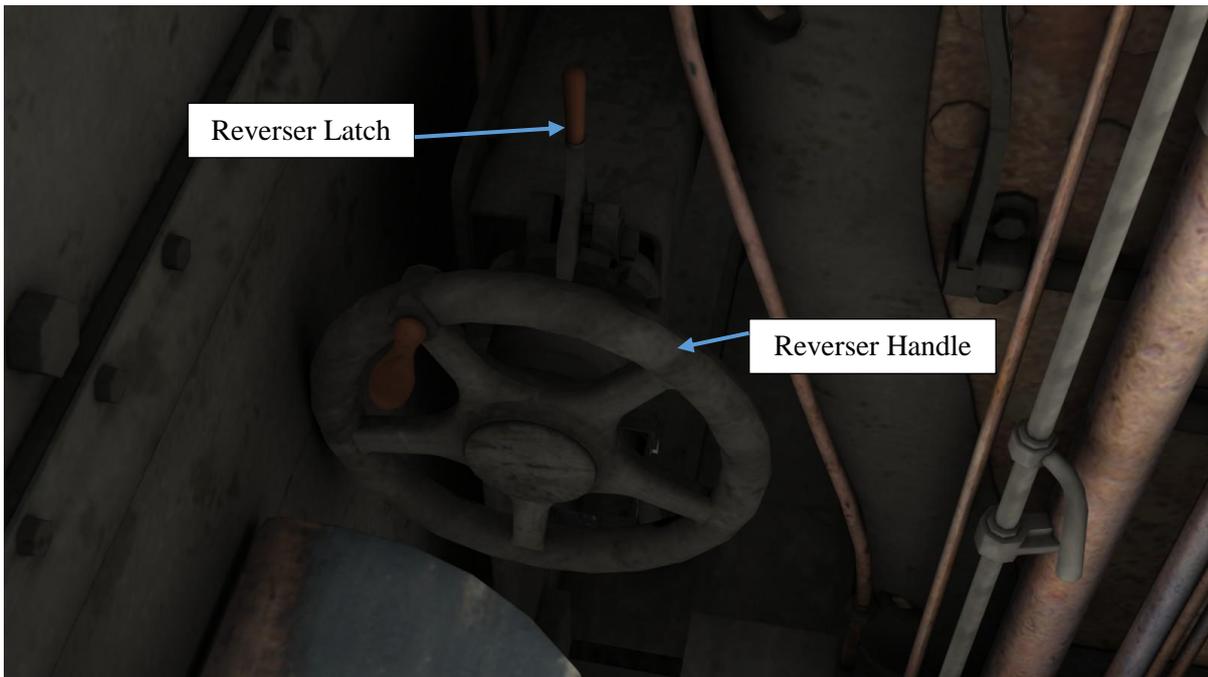
mini boiler in and of itself but one that you have no control of. The steam generated means that even if you shut the regulator there will continue to be steam flowing to the cylinders. If too much water is carried over, the pressure generated can force the regulator valve wide open and you will be unable to shut the now fully open regulator (which will probably draw even more water up!) until the pressure within the superheater has dropped enough to shut the regulator. When the engine is running in such a fashion, it is said to be running on hydraulic steam. Should priming be suspected the cylinder cocks should immediately be opened and if need be, the cut off should be reduced. If you totally lose control, you may have to resort to mid gearing the cut off or reversing to slow down. The cylinder cocks should be open all the time in such circumstances.

The locomotive's vacuum ejector can also be affected by water level, unlike the regulator which is centrally mounted in the boiler and so is less affected by gradient changes, the ejector draws its steam from the rear. This means if you come to an upward gradient and the water level is high, the ejector may start to prime once you hit the gradient, in which case you will lose all draw from the ejector which will result in the brakes applying.

All of this is avoidable if you keep the water level within sensible bounds. We advise that the water level be kept to between 1/3 of a glass and 2/3s of a glass. It should also be noted that you should not use the water level on any of the HUDs. The G2 has an offset water level meaning that 1.15 is the top of the gauge glass, 0.15 is the bottom and 0 is the level at which the crown sheets are revealed. The HUD does not show the effects of regulator draw and as such should not be trusted as accurate.

The gauge glass itself has several controls. The drain valve is used to drain water from the class and blow through steam to assist in cleaning it. This can be used to assist in checking the level if you struggle to see where it currently is. The isolating valves are used to shut off the steam and water supply to the gauge glass. The gauge glass protector can be rotated by clicking on it then dragging to the left and right. Finally, the gauge glass lamp can be lit with '**Ctrl+H**' and can also be moved to the other side by grabbing and dragging to the gauge glass you wish to illuminate.

Reverser

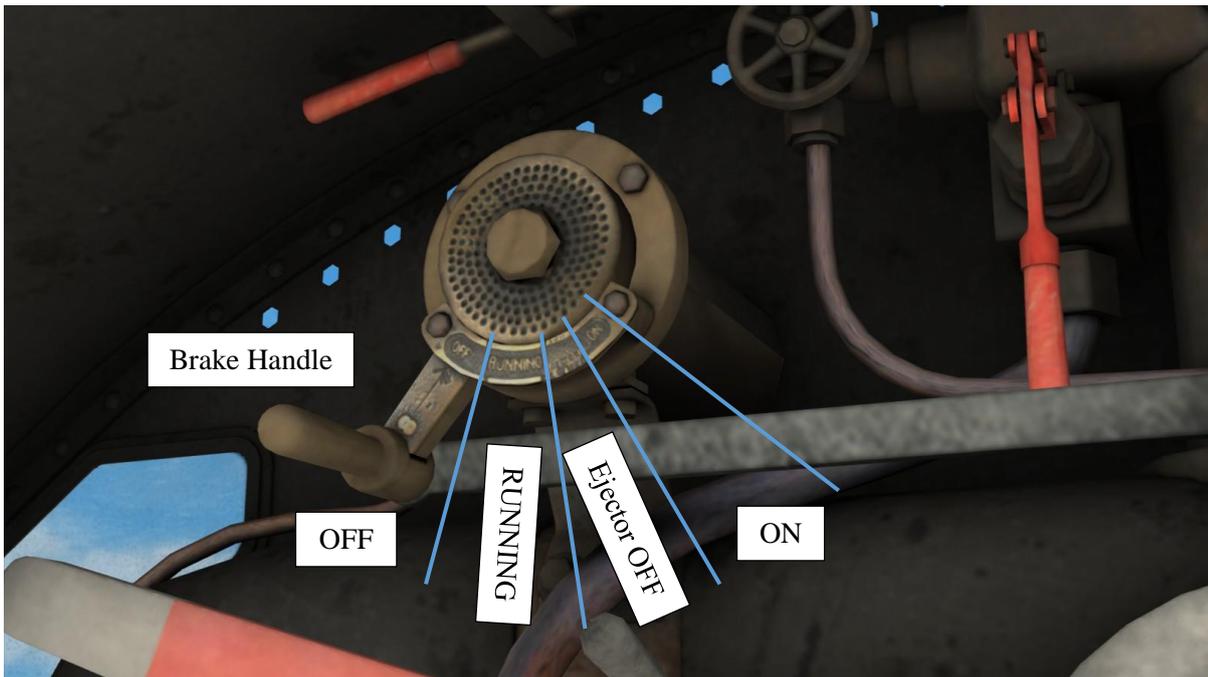


The G2's reverser is another quirk because like the regulator it is back to front. Most engines have the reverser turn clockwise to increase cut off in the forward direction. On the G2 the reverser is turned anticlockwise to go into full forward. Like the regulator the keys are reversed so it is 'S' to increase cut off and 'W' to decrease. Like the regulator the keys can be reversed using 'Ctrl+D'. The reverser also has a latch to lock the reverser in position and prevent it wandering off the desired cut off. This can be released by holding the 'E' key. The latch itself will only lock in certain positions.

The other thing you may note is the lack of cut off indication. There is a vague indication on the side of the reverser but this is practically impossible to see. You should therefore try to remember how many turns from mid gear or full gear you are currently at. The table below should allow you to estimate the cut off based on this:

Turns from Midgear	Cutoff (%)
0.0	8
0.5	14
1.0	23
1.5	34
2.0	46
2.5	56
3.0	65
3.5	71
4.0	76
4.5	80

Vacuum Brakes and Brake Valve



The G2 is fitted with vacuum brakes. It has 3 brake cylinders, one under the cab, one on the tender and one in front of the firebox. There is a large vacuum reservoir cylinder fitted under the tender as well.

The brake valve has 4 main positions. 'OFF', 'RUNNING', 'Ejector OFF' and 'ON'.

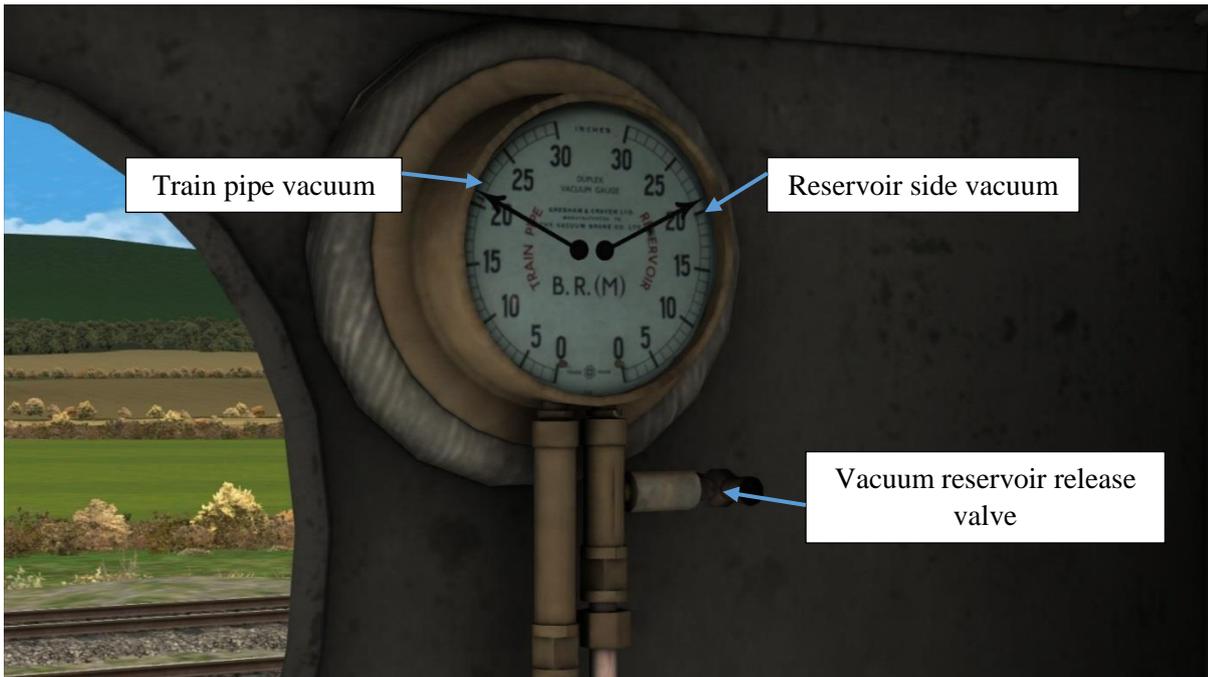
OFF - In the 'Off' position the brakes will come off; the air disc is shut so no air is let into the train pipe and the ejector is operating so air will be drawn from the train pipe creating a vacuum.

RUNNING – In the 'Running' position the air disc is still shut but the ejector is partially closed, reducing the draw on the train pipe meaning vacuum is created slower. On long trains, you may not be able to maintain a full vacuum in this position and will need to keep the handle in off. Originally the G2s had vacuum pumps to assist in maintaining the train pipe vacuum (LNWR livery only) and so on these engines once the brake is off and you are under way you can keep the brake handle in running to save steam.

Ejector OFF – Moving the brake handle from running towards this position will gradually open the air disc and shut off the ejector. This can be used to maintain a partial vacuum (say keeping the vacuum at around 10" Hg). Moving the handle into this position will shut the ejector and the brake will come on fully. The ejector will also cease to operate and use steam.

ON – Moving the handle further to the right will further open the air disc meaning the air flow into the train pipe will increase and the brake will apply quicker. Moving the handle right across will operate the ejector again, however this time it will start drawing the reservoir side vacuum to maximise the brake force.

The brake handle can be moved towards ON with the ']' key or towards OFF with the '[' key.



When applying the vacuum brake you will notice the decreasing vacuum slow as it passes 18" Hg, the vacuum reservoir side will also be observed to fall slowly. This is because as air is let into the train pipe the pressure increases in the train pipe and so it does on the lower side of the brake cylinders, the pressure on the top side (reservoir) remains constant for the moment. The force acting on the brake cylinder itself and rigging is the difference between these two pressures. As the difference reaches about 2-3" Hg the force is enough to overcome the weight and friction within the rigging.

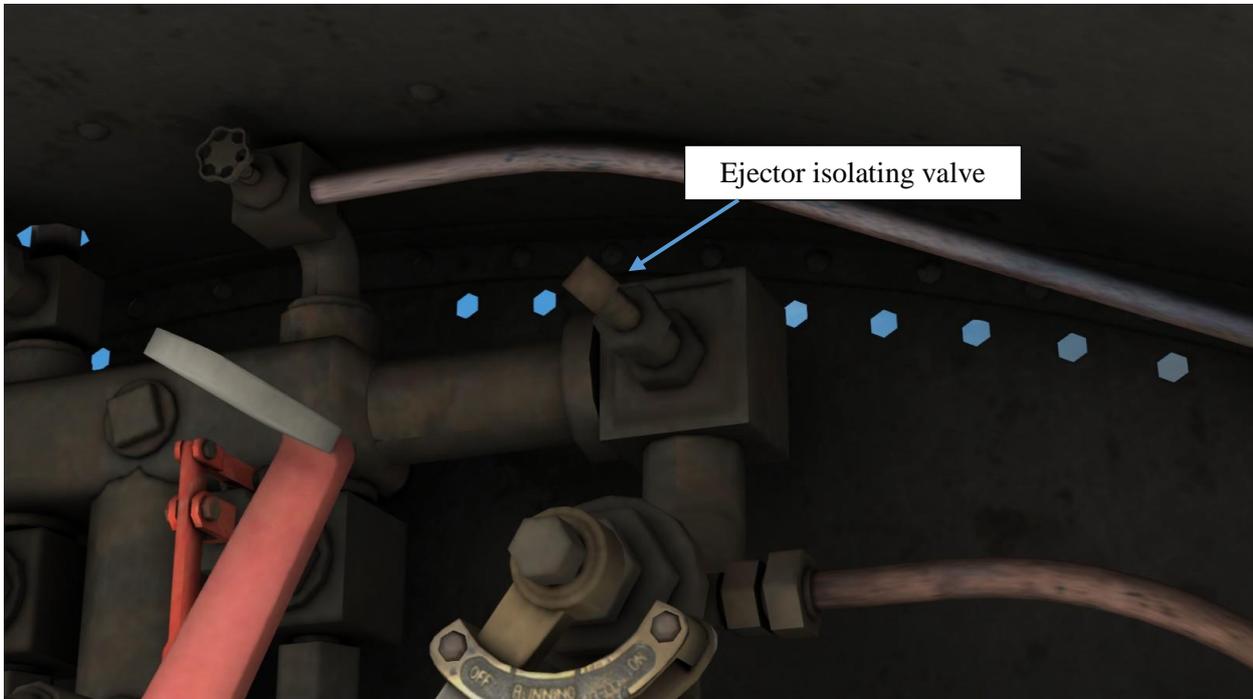
The brake cylinder will now begin to rise, however as it does, the volume on the bottom side (train pipe) increases, while the volume of the top side (decreases). This results in decreasing pressure on the bottom side (increasing vacuum) and increasing pressure on the top side (decreasing vacuum). This will continue to occur until the rigging cannot move any further i.e. when the brake blocks come hard up against the wheels. The rate of decrease of the train pipe vacuum will now increase and the vacuum brake will now start slowing the train/locomotive. This is called setting the brake. Remember that the brake will not be applied until this phase occurs. The setting can be sped up by moving the brake valve closer to ON, or if in an emergency, fully across to ON so air is being drawn from the reservoir speeding up the process.

The force at which the brake is applied is proportional to the difference between the train pipe vacuum and the reservoir side vacuum. A difference of 10" Hg indicates the brake is applied at half force. A difference of 21" Hg indicates the brake is applied with full force. This means it is entirely possible to have no brake force if both the train pipe vacuum and reservoir side are at 0" Hg.

This can be used to your advantage if you are short of steam and are on an unfitted train, and do not need to use the brake. By opening the reservoir drain valve ('J' key) the reservoir side vacuum will start to drop. Shutting the ejector ('P' key) and naturally letting train pipe vacuum drop with the reservoir side vacuum is an option. If you are careful you can move the handle towards ejector off and slowly let the train pipe vacuum fall (with the ejector still running) but not so fast as to let the brake come on. The reservoir will take approximately a minute to drain fully to 0" Hg so you need to match the fall in train pipe vacuum with the fall in reservoir vacuum. Once both vacuums

are at 0" Hg the ejector can be reopened if it has been shut and the brake handle placed on ejector OFF, the reservoir drain valve can also now be closed.

It should also be noted that the reservoir needle will register a false value with the drain valve open, this is due to the proximity of the vacuum release valve to the gauge. You will need to listen to the volume of the hiss to judge the level or periodically close the valve to check.

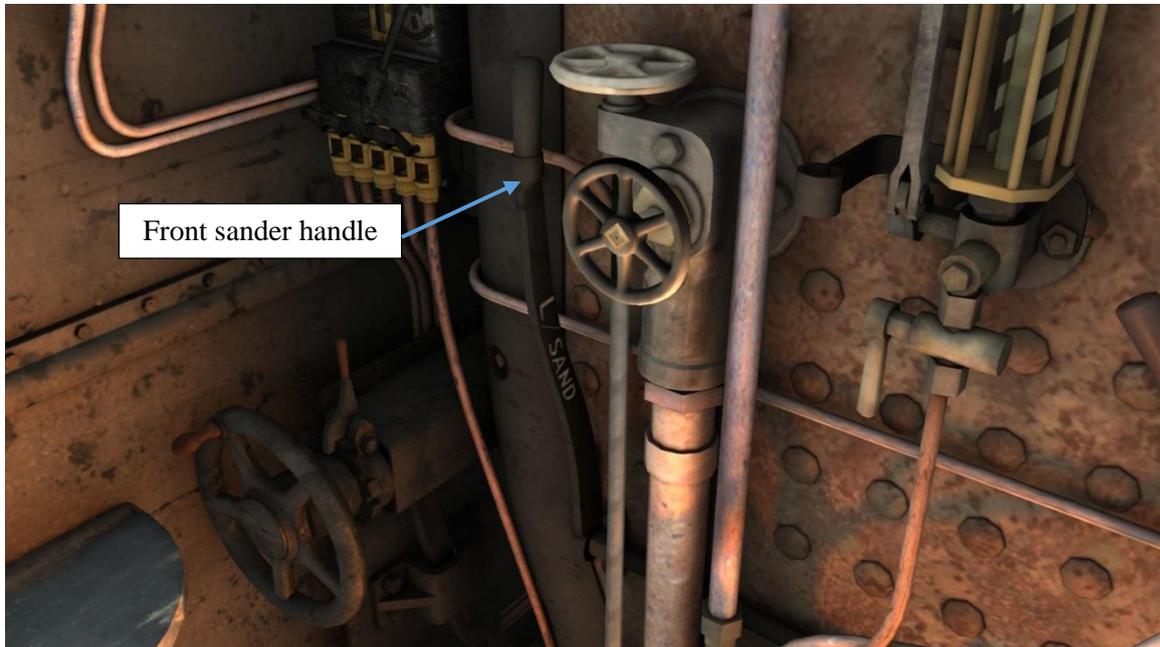


When you need to slow down again once the brake is out, reopen the ejector and if there is no urgent need to slow down moved the handle to off and then slowly apply the brake again. Alternatively, the handle can be moved straight across to ON where the reservoir side vacuum will be created and the brake should come on quickly.

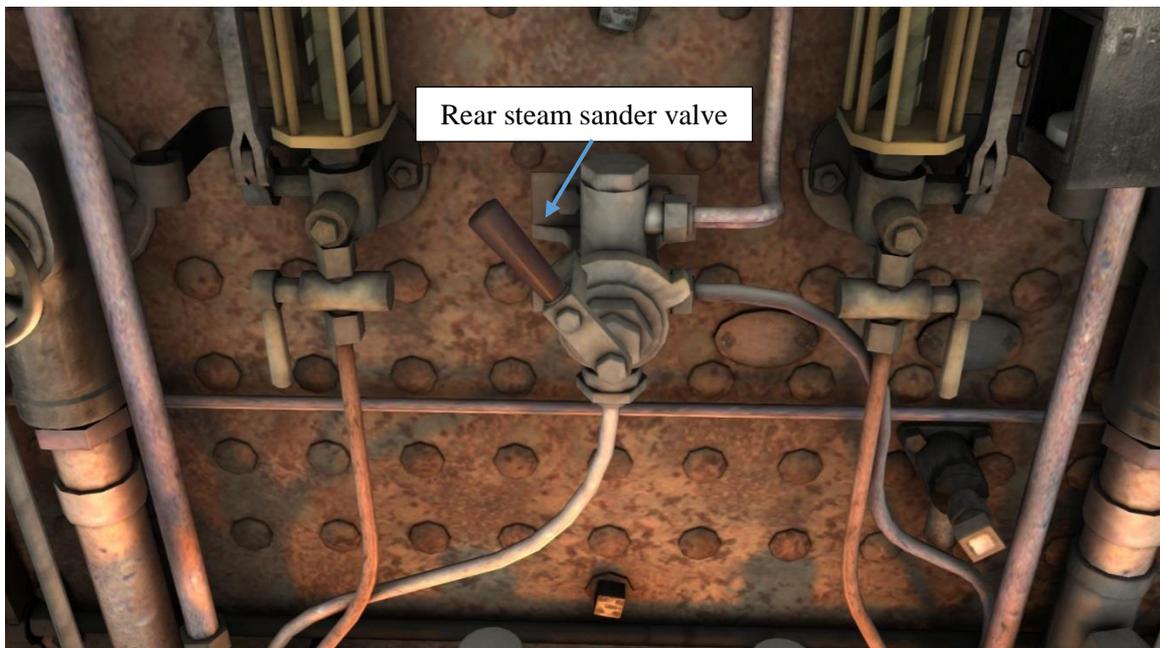
If a brake van is fitted to the train, the vacuum brake can also be applied through the guard's brake valve with the ‘,’ key.

Sanding Gear

This is one of the more complex parts of the G2 as it varies between engines. The front sanders are consistent in that they are always gravity operated. These can be opened and closed with the 'X' key or pulling the handle towards you:



The rear sanders however vary between engine: some engines are fitted with steam rear sanders (usually those with tender cabs). These can be operated with the 'Z' key or moving the handle to the right-hand position:



They can alternatively be operated by gravity like the front sanders which are operated with the 'Ctrl+Z' key or moving the handle towards the centre of the cab:



Gravity sanders are characterised by the fact they are much trickier to use than steam sanders. They have a tendency of dropping too much sand as the flow from the box is relatively uncontrolled. To get around this the handle should be moved from open to closed in a rhythmic fashion at 1-2s intervals. Gravity sanders are also more affected by the slip stream generated as the locomotive moves along and so more sand will need to be dropped as speed increases (leave the handle open for longer). You must be careful not to drop too much sand as this will make adhesion worse! You will also waste a lot of sand and the box will rapidly empty if the handle is left open too much.

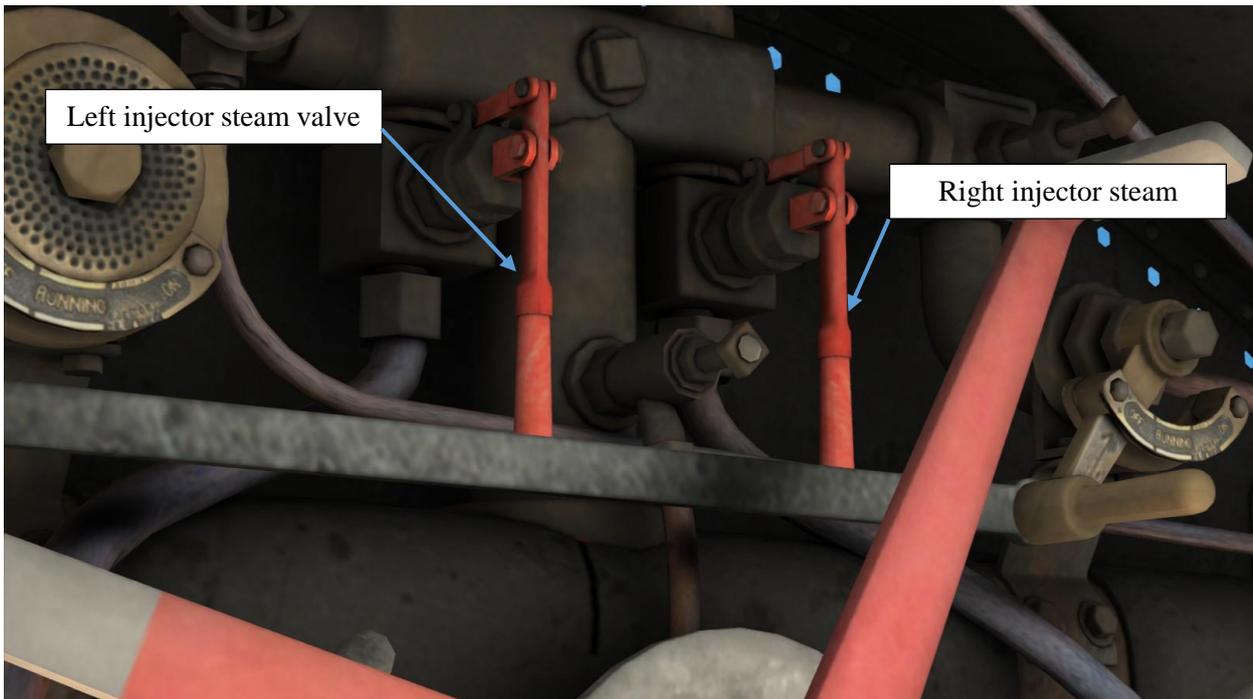
Steam sanders are much easier to use, they have only two states: on or off and they aren't affected by speed as much. As such you can just leave the sander open constantly if you need to. Be aware that there is only a finite amount of sand available to use (about 45 minutes' worth).

Injectors

The G2 is fitted with two Webb type self-acting injectors. The left injector is an 11mm injector (approximately 27000 lb/hr feed rate) and the right injector is a 9mm injector (approximately 19500 lb/hr feed rate). The injector itself is mounted below the footplate and cannot be seen in the cab. The same goes for the overflow which drops right below the injector into the four foot.

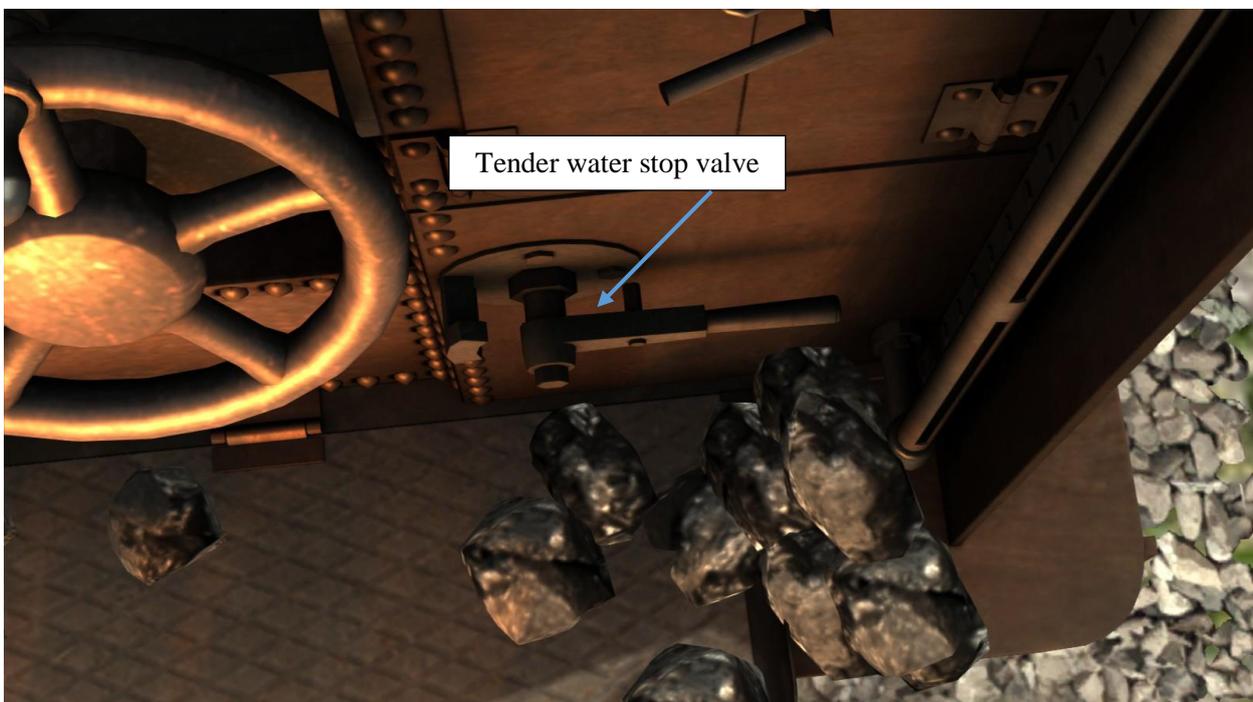
There are 3 principle controls which you need to worry about (there are others but their purpose is not needed in game).

Steam Valve



The steam valve is used to admit steam from the boiler into the injector cones, simply pulling the handle out will let steam into the injector. The key to operate the left steam valve is the 'I' key and the key for the right steam valve is the 'O' key.

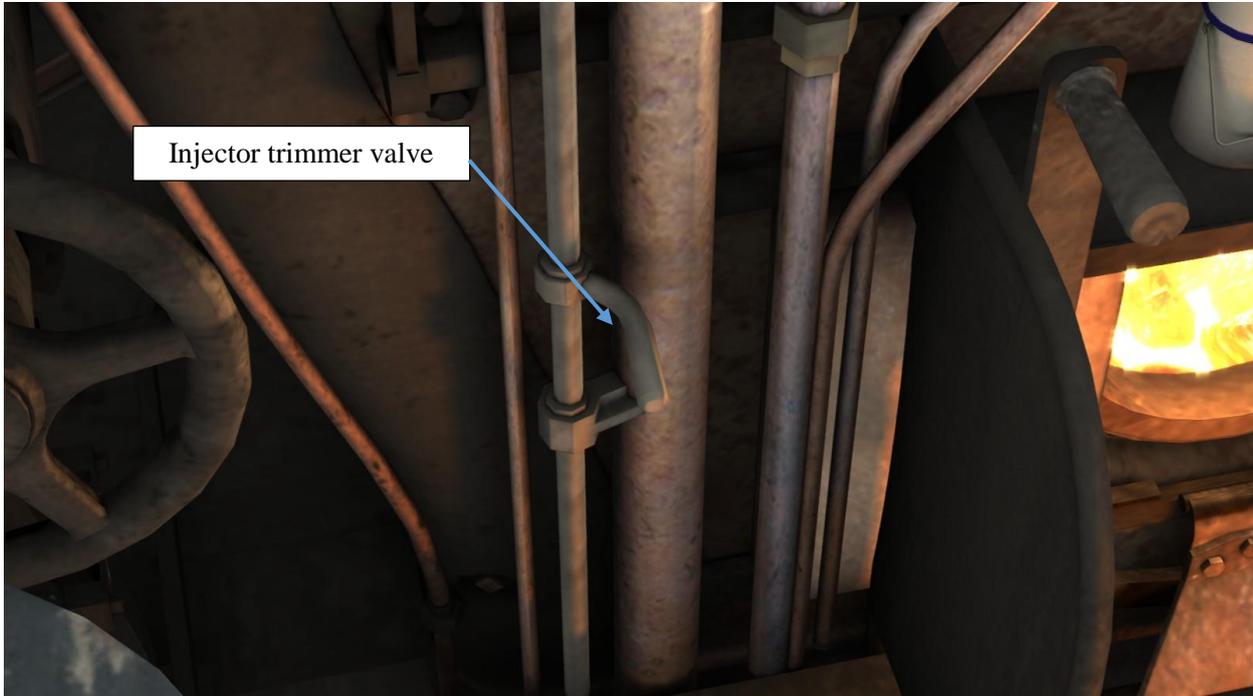
Tender Water Valve



Before the steam valve is opened water must be let from the tender to the injector. To do this the tender stop valves for the respective injector must be opened. These are located beneath the lockers on either side of the tender. To open, the handle must be rotated towards the centre of the cab (anticlockwise in this case). These are the valves you should use to stop or start the flow of water

to the injector and not the water trimmer valves. The '**K**' key is to open and close the left injector water stop valve and the '**L**' key is the right injector stop valve.

Trimmer Valves



These valves are used to control the flow of water from the tender to the injector cones. These can generally be kept in the same position all the time except when necessary to adjust for falling pressure or decreasing tender water level. Moving the handle towards the centre shuts the flow to the injector while moving them to the outside side of the loco opens the valve fully. They start in a position which should allow the injector to pickup. The left valve can be opened with the '**Ctrl+K**' key or shut with '**Ctrl+Shift+K**' while the right valve can be opened with the '**Ctrl+L**' key or shut with '**Ctrl+Shift+L**'.

Injector Starting Procedure

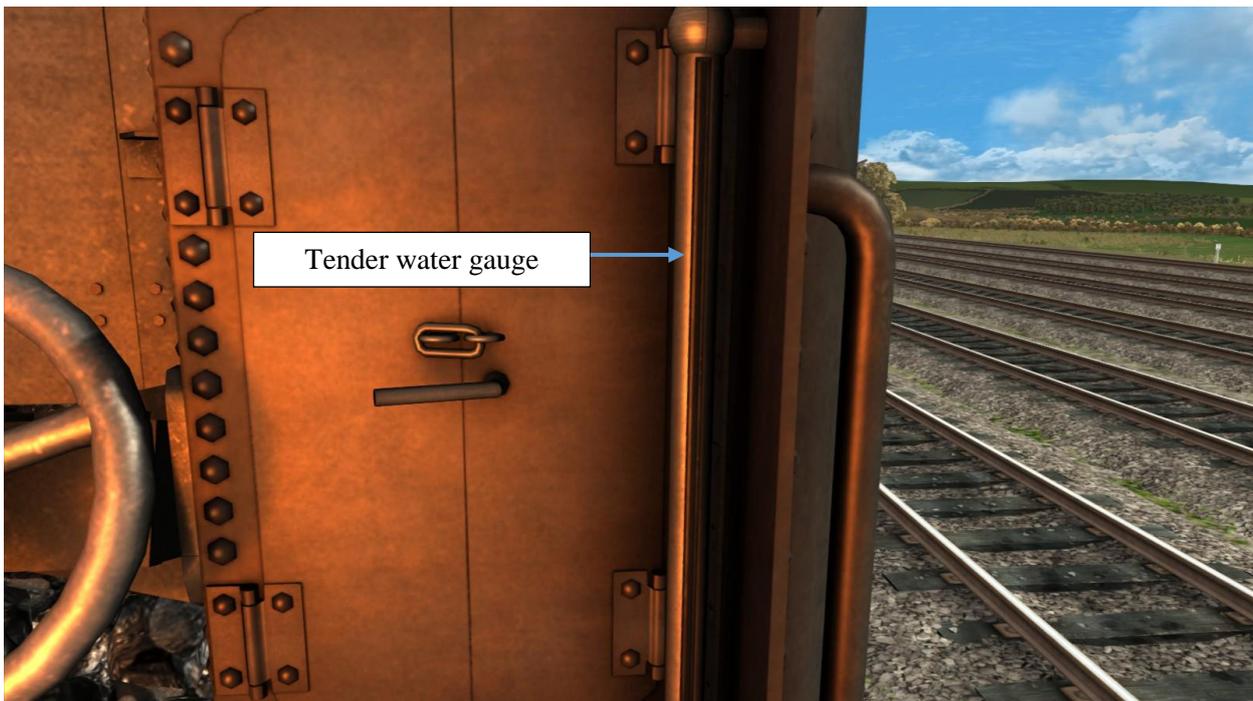
Open the tender water valve for the injector you wish to use, check the trimmer valve is about half open then pull the injector steam valve to start the injector. If a loud steam rushing sound is observed, shut the steam valve, adjust the water trimmer position and try again (If steam and water are observed at the overflow, shut the valve, if just steam is observed, open it). If the injector starts and you are stationary (well you can check at any time in game but it would be impossible in reality) check under the cab and check for any water from the overflow. If there is any water coming from the overflow, shut the trimmer valve a tiny bit until it stops.

Injector Stopping Procedure

Shut the steam valve then shut the tender water valve.

Notes

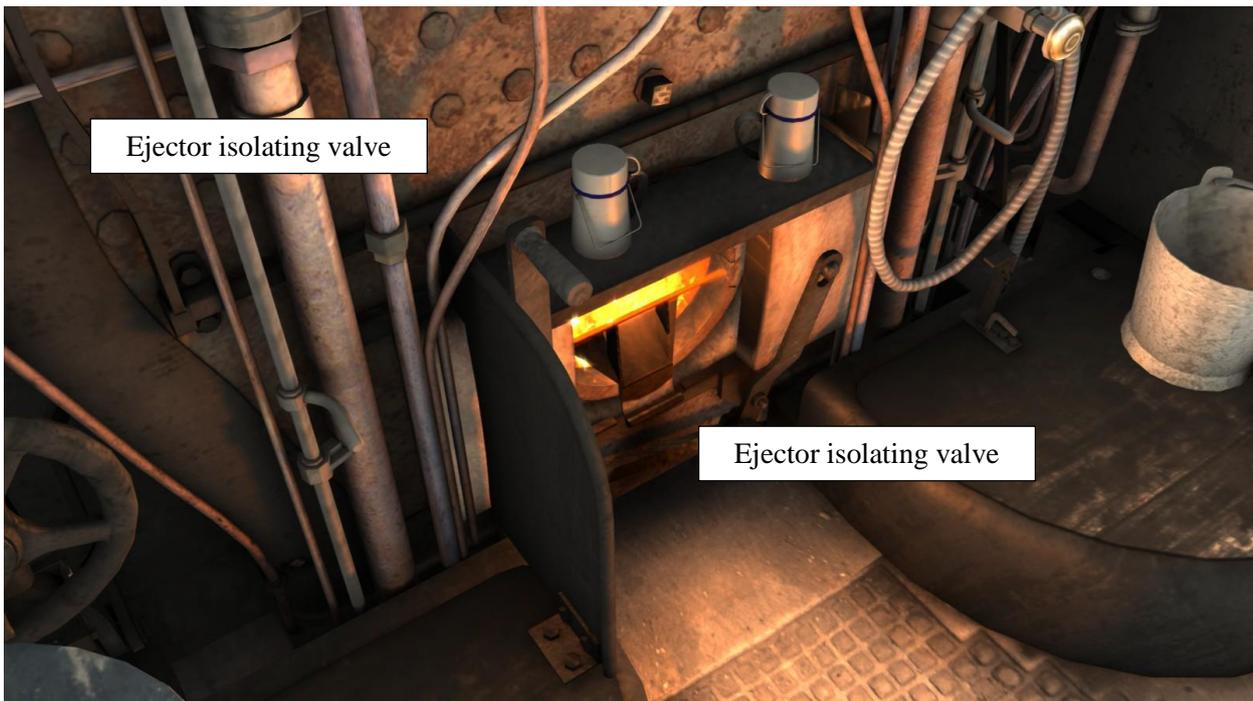
- As boiler pressure falls the capacity of the injector will decrease, as a result you will need to shut the water trimmer a small amount to compensate for the decreasing ability of the injector to feed the boiler.
- As the level of water in the tender drops the flowrate of water from the tender will fall. As such as the level drops you will need to gradually open the water valve to compensate for this fall.
- If the tender water level drops too much the injectors may not be able to start as the flow is too limited. This particularly affects the left hand injector as it is a larger size.
- Due to the larger size the left hand injector should be used sparingly as the large delivery rate will have a significant effect on the steaming of the boiler. The right hand injector has a much reduced effect on the boiler and so should be left running continuously as the injector feeds at nearly the exact same rate as is used generating steam in the boiler. The boiler water level can therefore be kept basically constant with continuous use of the right injector while operating at near or at full output.
- The locomotive has a tender water gauge mounted to the right side of the right locker.



Firedoors, Fire, Dampers and Blower Valve

This is quite a complex mechanism on the G2 and requires quite a lot of skill to steam the locomotive to its full potential. The good news is there is a scripted automatic fireman if you struggle with this. In fact, it is advised that he is used while you are operating at full output to allow you to concentrate on driving. **DO NOT** use the default game fireman, he **MUST** be disabled in the options to use the G2 properly. To activate the G2's fireman press the '**Ctrl+R**' key to activate/disable him. Please note he **WILL NOT** operate the injectors, these are still under your jurisdiction.

Firing



If you have used our Return to Maerdy Austerity you will likely be familiar with the firing procedure on the G2. The fire doors are opened with the '**F**' key and shut with the '**Shift+F**' keys. To load up a shovel full of coal quickly press the '**R**' key. If the fire doors are open the coal will be added to the fire as a lump of around 10lb if the firing flap is down or 5lb if the firing flap is up. The key needs to be held down if you want consecutive lumps to be added. The firing flap can be raised or lowered with '**Ctrl+F**'.

On engines fitted with sliding fire doors (all current liveries except the LNWR livery) the fire door is fitted with a firing flap. The locomotive can still be fired with the flap up, indeed while firing the fire door should always be kept up to minimise the cooling effect on the fire and potential cold air damage on the tube plate. The fire doors can be shut with the flap still in position.

The ideal fire mass on the G2 is 450lb. The engine is very sensitive to even a slight difference in fire mass and should be kept in a range of 450-465lb. Too much fire is very bad for the engine due to the narrow firebars which become easily blocked if the fire is too thick. There are three things which can assist you in firing the G2. Firstly, the fire itself:



Figure 1. Firebox has a red/orange glow to it. And the coals can be fairly visible



Figure 2. Light is much brighter and firebox has taken on a yellow look. Individual coals are harder to see.



Figure 3. Fire is now an incandescent mass and the firebox has attained a creamy white colour.



Figure 4. Both the fire and the firebox are incandescent white and it is practically impossible to distinguish where the fire bed is.

Figure 1 illustrates the fire condition at rest with the blower shut, figure 2 illustrates either light working of the engine or idle with the blower open. Figure 3 indicates the engine is working hard. Figure 4 indicates the locomotive is working very hard indeed and that the fire is between the ideal bounds of 450lb and 465lb. If the fire is like that of figure 3 while working very hard then the fire is not within the ideal bounds or the dampers are incorrectly set.

While it is very hard to determine the outline of the fire bed while working hard, when not working so hard you can use the position of the coals to estimate the fire mass.



In the above picture, the fire is at the ideal fire mass, the coals should just cover the row of stay heads. As the fire mass drops the stay heads become much more visible and below around 360lb fire mass the firebars can begin to be seen.

While working hard, the fire doors should be kept in a position like that shown below (partially open) with the firing flap in the up position.



While in this condition the smoke can also be used to estimate the condition of the fire:



Greater than 520lb



Greater than 495lb and less than 520lb



Greater than 469lb and less than 495lb



Greater than 447lb and less than 469lb



Greater than 424lb and less than 447lb



Less than 424lb

These are only guides and will vary upon damper position, firing flap position, fire door position, how hard the engine is working and blower position. They should act as guides to assist and you should find your own fire door opening/smoke colour pattern which you are comfortable with.

When working hard the intense draw on the fire can lift coals from the bed resulting in sparks, these can be used as a guide as to when you need to notch the reverser back. When the locomotive is lightly sparking, it indicates you may need to wind the reverser back a bit but it isn't urgent.



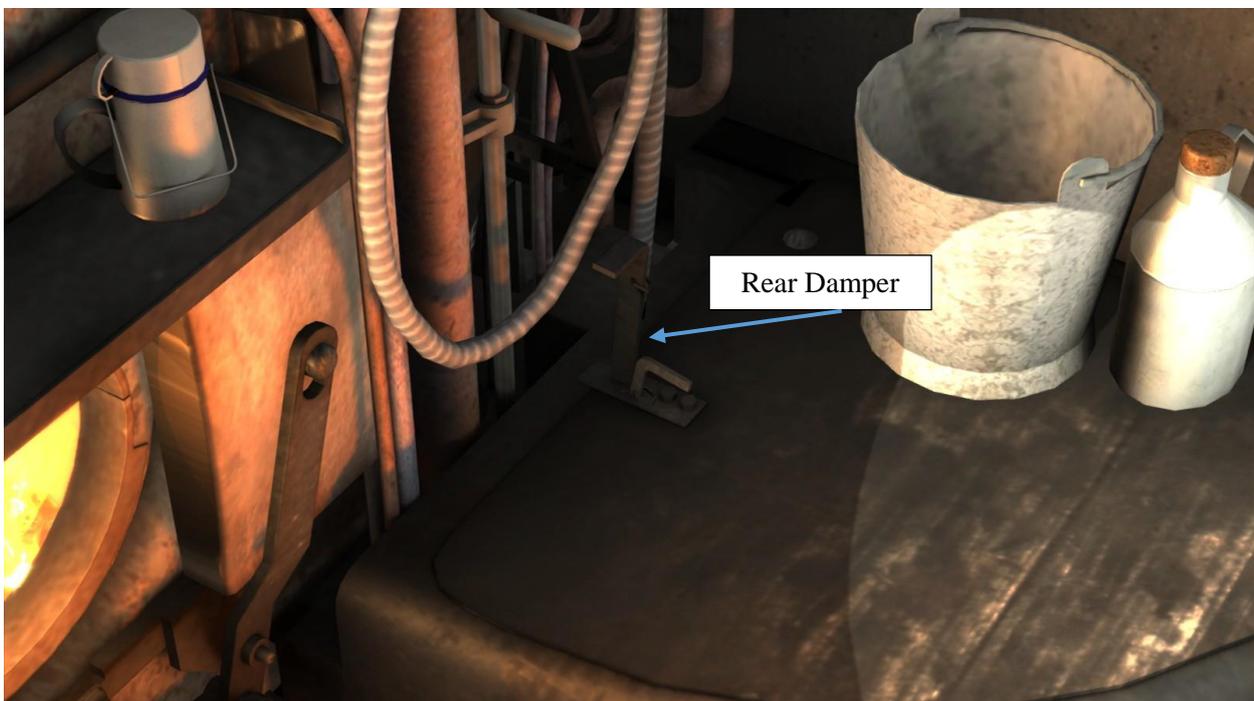
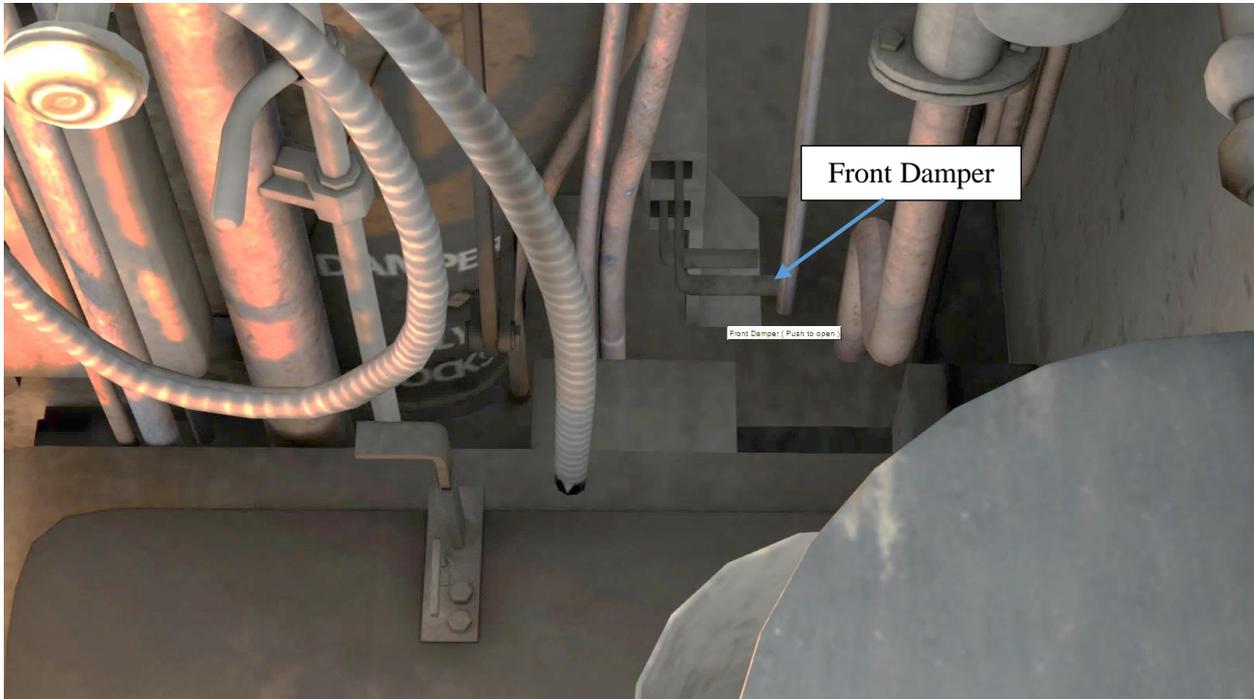
If the engine is intensely sparking like below it indicates that the engine is at or over the exhaust limit and the reverser should be wound back or the regulator eased otherwise your boiler pressure will rapidly drop.



Dampers

Dampers control the flow of primary air to the fire through the ashpan, they can be used to limit the rate of combustion of the fire. The G2 is fitted with two dampers, a rear damper and a front

damper. The front damper is pushed away to open and can also be opened with 'Ctrl+M' or shut with 'Ctrl+Shift+M'. The rear damper is lifted to open or can also be opened with the 'M' key, and shut with the 'Shift+M'. Each damper has 5 notches (0 - fully shut, 0.25, 0.5, 0.75 and 1 - fully open).



On the G2 the dampers need to be manipulated with firemass to get the optimal performance from them. The rear damper is the most influential of the dampers and so closing it will drastically alter the performance of the engine. On this engine if the dampers are open too much or too little, steaming performance will be affected. The table below gives you some indication as to the required damper opening for optimal performance.

Fire mass (lb)	Front Damper position	Rear Damper position
450	0.5	1
380	0	1
320	0	0.5
100	0	0.25
0	0	0

Blower

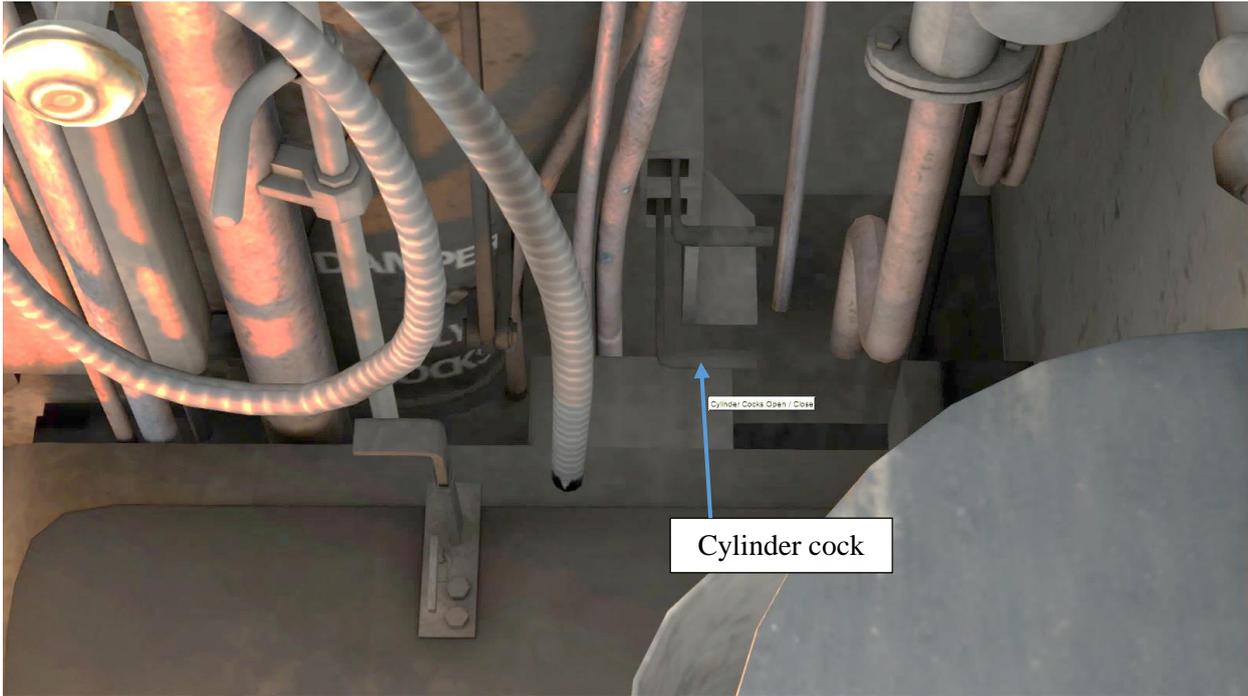
The blower creates an artificial draw on the fire and can be used to assist in generating steam with the regulator shut. The blower can be opened with the 'N' key and shut with the 'Shift+N' key.



Other Controls

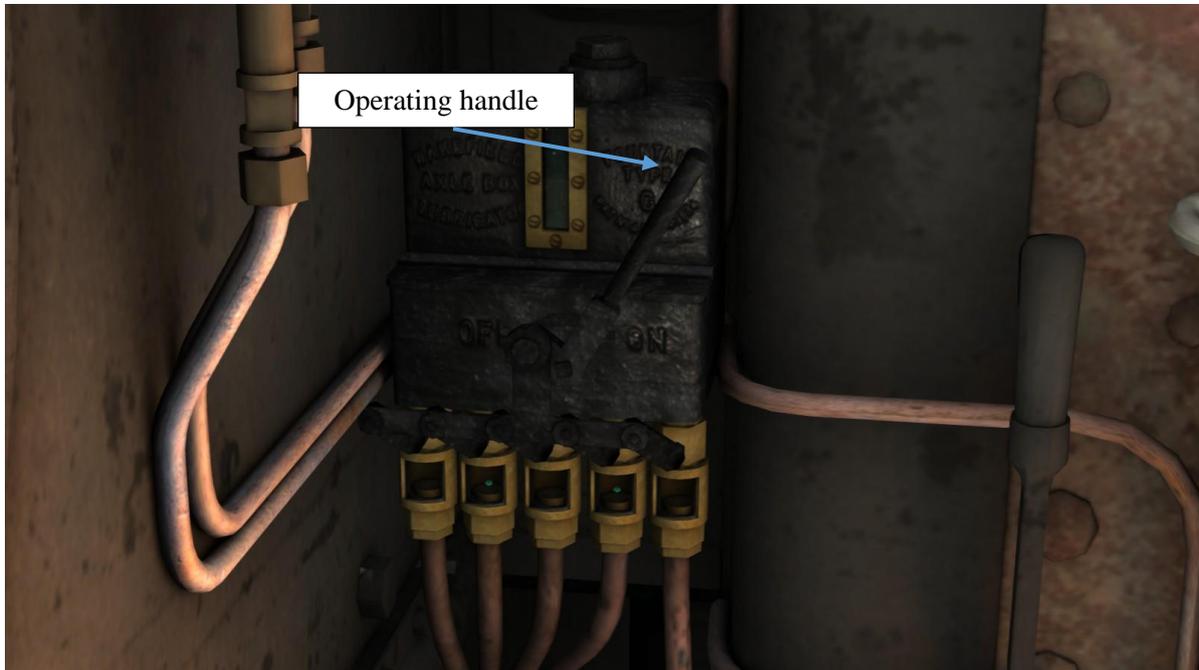
Cylinder Cocks

The cylinder cocks are used to clear water from the cylinders, they should be opened when you come to a stand and left open until around 4-5 revolutions of the wheels have gone by if you have stood for a prolonged period. If the locomotive primes, you should also open the cylinder cocks. They are operated with the 'C' key.



Wakefield Lubricators

These are fitted to certain members of the G2 class. They are designed to save oil giving the driver the ability to stop oil flowing to the axle boxes when the locomotive is stationary which would be otherwise wasted. Engines not fitted have additional oilboxes mounted around the engine.

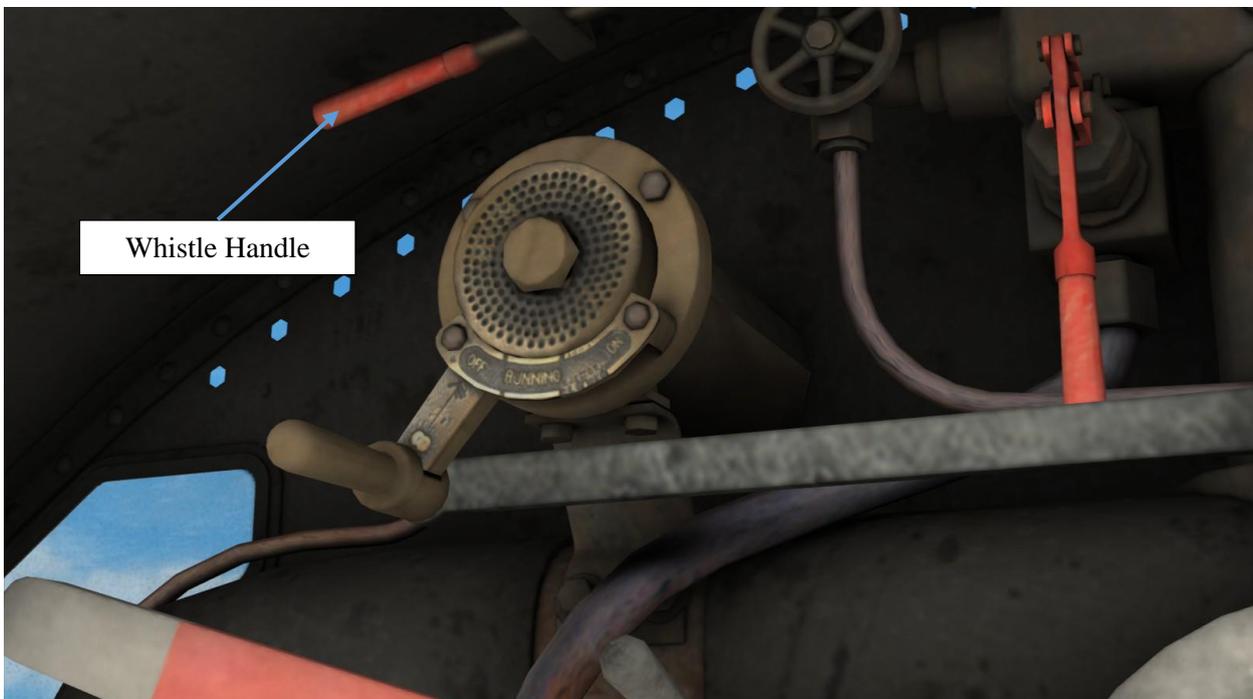


Hand Brake



The hand brake is used to manually apply the brakes on the tender, it can be used to assist in gradually buffering up an unfitted train. However, it is not a very powerful brake and so the vacuum brake will need to be used to assist in stopping long trains. It can be applied using the ‘/’ key and released with ‘**Shift** + /’.

Whistle



Very little needs explaining about this one other than the keys to operate the whistle:

Short Whistle – ‘**B**’

Long whistle – ‘**V**’ (note: different selection of whistle samples above 20mph)

Medium whistle – ‘**Ctrl+V**’ (note: different selection of whistle samples above 20mph)

Main whistle – ‘**Space**’

Alternative main whistle – ‘**Shift Space**’ – (make sure to release space first when shutting)

2nd Alternative main whistle ‘**Ctrl Shift Space**’ – (make sure to release space first when shutting)

Lamps

Lamps on the locomotive can be placed with the ‘**Ctrl 1-4**’ keys, lamps on the tender can be placed with the ‘**Ctrl 5-8**’ keys. Red filters can be fitted to those lamps using the ‘**Ctrl+Shift+respective lamp number**’.

Advice

The G2 is an engine which requires patience to master, the engine is not very fast, the brakes take a while to come off, the controls are awkward, the injectors can be fiddly, firing it is a black art. Do not expect to hop in this loco and be the master of it from the word go. Keep practicing with it and learning its little foibles, once mastered the engine is a very powerful, hard working engine which can be highly efficient if fired correctly. This loco and manual assumes you have at least some appreciation of the operation of steam engines.

That being said there are a couple of hints that will help you along your way:

- The G2 features an advanced adhesion model which takes account of several factors including ambient humidity, temperature, water on the track and season. The engine can be particularly tricky to drive in low adhesion conditions and care must be taken not to let the engine go into an excessive slip.
- If while under braking the wheels lock up, immediate release the brake as quickly as possible and try again. If the wheels lock up, your stopping distance will increase tenfold so a stop which should take 100m will take about 1000m with the wheels locked up.
- When using gravity sanders make sure to rock the sander handle open and closed in a rhythmic fashion. This prevents too much sand from being dropped which stops your boxes being emptied in record time and also stops the adhesion getting worse!
- The mouse can be used to slowly and steadily move the reverser. A slight movement of the mouse while selected will result in the reverser slowly moving, a larger movement will make the reverser turn faster.
- If you suddenly find your brakes coming on check for two things, is the pressure above 120psi? If not you need to increase the pressure as the ejector is not running as efficiently as it should be. If you are above this pressure, check the isolating valve hasn't accidentally been closed. If this fails you have most likely primed the ejector and you should shut off the injector if it is on.
- The ideal fire mass on this engine is 450lb, try to keep the fire mass in the range of 450-465lb.
- Water level should be kept between 1/3 and 2/3 of the level in the gauge glass, as indicated by the cab gauge glass and not the HUD value.
- Longer trains take longer for the brakes to apply, they also take longer for the brakes to release. Make sure to plan for this especially if the train you are pulling is composed of wagons without direct admission valves.

- Don't forget the reverser and regulator keys are back to front, nothing good can come of this as indicated by the number of shed walls that G2's managed to end up going through!
- It is advised that you use the G2's built in fireman ('**Ctrl+R**') at all times except when coasting or wanting to run at a lower boiler output.
- Do not use the games automatic fireman on the G2
- You can reverse the keys of the regulator and reverser with the '**Ctrl+D**' key.
- While under way keep the firing flap up and have the fire doors partially open to allow enough secondary air into the fire.
- If coasting and using the injector(s) you will probably need to open the blower.
- You can get a little additional braking force by winding the reverser closer to mid gear and taking advantage of compression braking.
- Brake blocks get hot when applied, sparks from the brake blocks indicate they have gotten very hot. When brake blocks get hot they fade and the brake force will decrease. Make sure not to let the brakes get so hot they fade completely.
- The faster you go the faster the brake blocks will heat up and the more the brakes will fade.
- The locomotive is fitted with cast iron brake blocks, these brake blocks have the characteristic whereby the faster you go the lower the amount of brake force the blocks apply, by 60mph the brakes are a 1/3 as effective as they are at 5mph.
- All this leads onto say while running an unfitted goods train do not go excessively fast, you will struggle or may be completely unable to slow and stop the train. Keep your speed below 25mph if you know what's good for you. On very heavy trains on steep gradients you may even have to consider going slower.

SCENARIOS

- [J94] Deliveries** Making deliveries to various stations up to Stanhope. Picking up and dropping off wagons at sidings, it should be a quiet day, take your time and make sure you keep a note of your pickup and drop off points.
- [G2] Diversion** Take charge of a Darlington bound goods train, but watch out, trouble is on the Horizon.
- [G2] 03:50
Darlington to
Middleton
Teesdale Goods** Take charge of the 03.50 goods from Darlington To Middleton Teesdale. You will only have one extra stop tonight at Barnard Castle where you will drop the rear portion of your train.
- [G2] G2 on tour** The Super D is on a rail tour! Take the special ticket holders on a special trip they'll never forget!

Credits

Major contributors:

Michael Whiteley: 3D modelling, texturing, animation, route building, scenarios, research.

Edward Fisk: Sounds, simulation/physics, scripting, quality control, research and scenarios.

Dovetail games: support, publishing and testing.

Additional contributors:

Simon Hall: Advice and support over the years it has taken for the loco to be completed.

Chris Barnes: Testing, advice and discussions and extra particle effects.

James Green: Additional vacuum brake sounds.

Kieron Rigby: Providing some excellent recordings of the Austerity.

Testers:

Dovetail games Beta/QA testers

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The East Lancashire Railway

<http://www.eastlancsrailway.org.uk/>

And the staff of the National Railway Museum and National Railway Museum Shildon who restored 49395 to operational condition and inspired us to make this addon.

<http://www.nrm.org.uk/>

<http://www.nrm.org.uk/PlanaVisit/VisitShildon>

Thanks also goes to the custodians of 49395 who helped restore her to running order.

The LNWR society's books and those written by Edward Talbot must also get a special mention because without them, this project would not have been possible.

Developed By <https://www.facebook.com/Meshtools/>

Reskinning/Sound Policy

Our (Meshtools) reskin policy for this addon is as follows:

We generally allow reskins of our work to be done. Permission needs to be sought before doing said reskin, to do this contact us at Meshtools by sending a message on our facebook page <https://www.facebook.com/Meshtools/>

We would also like for you to inform us how your reskin is going and if any improvements can be made to make reskinning easier. Approval should also be sought before uploading it to any site as a quality control check.

The reskins must not include the shape files, child object files, script files, Sound files or animation files, but it can include the loco bins if needed.

No modifications at all must be done to the sounds, any sound modifications must be done from scratch and not based on the included sound files (Sound files includes: .xml and .bin files). Sound modifications if done must not use or include any audio files such as .wav or .dav files included with the addon. Permission must be sought before doing any sound modifications.