

Steam Locomotive Driving – Expert mode and Manual Fireman – UK Locos in TS 2013

In order to get the best results you should read and digest the appropriate manual for each locomotive.

Preamble and Settings

- It is best to turn off the F4 HUD display, and use the the F5 display (Press F5 twice)
- The two key measurements we are looking for when driving a steam locomotive are steam usage and steam generation. (Note if this balanced it shows as green in the F4 HUD) and more steam is generated than used F5 HUD. The other important two are the boiler pressure and steam chest pressure which are discussed in the guide.
- *Note" If you use the F4 HUD it may affect certain aspects of controlling various features of driving some of the locomotives.*
- Enter the cab and ensure that you can see all of the instruments with or without a cab light.
- Instead of the keystrokes I have listed below the locomotive could also be driven using the X-Box controller or by clicking, etc the actual controls in the cab.

I have added some extra notes courtesy of David Hodder, which should be useful to all simmers wrt steam locos.

Note: Some of these tips will apply to US Steam locos too.

This guide is intended for the beginner simmer who wishes to graduate from the auto-fireman to operating the steam locomotive manually and hopefully more realistically.

The guide is only a general guide and does not cover the advance steam locos like the Jinty or the 9F, but could still give the basic idea of driving these advanced locos.

A driver's guide to the JT steam locos and other specialised steam locos will follow shortly.

If there are any errors please let me know so that they can be fixed.

Peter Hayes
August 2013

Stepwise instructions to run a loco that is stationary on a neutral to slight uphill gradient and increase speed to running.

Action	Key Stroke /HUD	Supplemental
Check Train Brake is on	"'" (Apostrophe)	"F4 HUD or F5 HUD "
Open Cylinder Cocks	"C"	
Check Fire Box, Boiler pressure and water levels	F5 HUD	F4 HUD
Stoke and top up water as needed	Sequence "F"+"R" & "L"+"O"	Stoke and water $\approx 5/10\%$ of starting scenario level. Using Live injector as no exhaust steam until moving. Open water " L " before steam " O " Stoke to $\approx 80/85\%$ fire mass and inject water to $\approx 85\%$ level
Open the Dampers	"M"	
Turn on the blower	"N"	
Release Handbrake	"/"	Not always modelled
Open small Ejector	"J"	Allows brake to be released and brake pressure to rise. May also need to use the Large Ejector " U "
Release the Train brake fully	";"	Usually shows 21/25" Hg in F4 HUD or Release in F5 HUD
Open the Reverser Fully	"↑W"	$\approx 75/100\%$
Open the Regulator	"↑A"	$\approx 15 - 60\%$ Loco dependent Increase slowly
Close Cylinder Cocks	"C"	after 4-5 revolutions of the wheels Closed on " F5 HUD "
At ≈ 10 mph , Set Brakes to Running Close Blower	"," " Shift+N "	$\approx 5-12\%$ running Closed on " F5 HUD "
At ≈ 15 mph decrease the reverser increase the regulator	"↓S" "↑A"	$\approx 35-40\%$ F4 HUD or " F5 HUD monitor boiler pressure, " F5 HUD "
every ≈ 10 mph you gain Repeat the decrease the reverser increase the regulator	"↓S" "↑A"	monitor boiler pressure, " F5 HUD
As you move faster reduce the reverser "↓S" to $\approx 10/25\%$ increase the regulator "↑A" slowly up to 100%	"↓S" "↑A"	Keep the boiler pressure as close to the optimum/ maximum (Green on the F4 HUD or as per loco spec on " F5 HUD ")
Keep the dampers open (White Smoke close damper.)	"M" " Shift+M "	Only close/reduce them " Shift+M ". if you wish to limit steam production to avoid blow-off i.e. during light loads.

Starting on a Hill:

Action	Key Stroke / HUD	Supplemental
When stopped Open Blower	"N"	Damper may be closed
Stoke and inject water	Sequence "F"+"R" & "L"+"O"	Stoke up to ≈80/85% , fire mass and inject water to ≈85/90% level.
Open Cylinder Cocks	"C"	
Check Fire Box, Boiler pressure and water levels	F5 HUD	F4 HUD
Stoke and top up water as needed	Sequence "F"+"R" & "L"+"O"	
Open the Dampers	"M"	
Turn on the blower	"N"	
Turn on Loco Brake Optional	"J"	
Re-Check Fire Box, Boiler pressure and water levels	F5 HUD	F4 HUD
Close Fire Door and stop water. Keep closed	Sequence "Shift+R"+"Shift+F" & "Shift+O"+"Shift+L"	Stop stoking at around 85% fire mass and stop water at 85% level.
Release the Train brake fully	","	≈ 21/25" Hg in F4 HUD Release in F5 HUD
Close Small Ejector	"Shift+J"	
Open the Reverser Fully	"↑W"	75/100%
Open the Regulator	"↑A"	15 – 60% Loco dependent Increase slowly
Activate Sand	"X"	
Release Loco Brake if on	"["	Train Moves
Close Cylinder Cocks	"C"	after 4/5 revs of the wheels Closed on "F5 HUD"
If Slipping occurs close regulator then reopen slowly.	"↓D" then "↑A"	Close completely and immediately reopen slowly.
If moving forward		
Turn off Sand	"X" or "Shift+X"	Re-apply if needed
Reduce Reverser	"↓S"	Slowly to ≈40%
Increase Regulator	"↑A"	Avoid wheel slip and increase speed
Check Fire Box, Boiler pressure and water levels	F5 HUD	F4 HUD
Maintain Steady Speed	10 mph might be OK for some hills.	Balancing steam pressure, generation, usage etc. and wheel slip is avoided
As you move faster and faster: reduce the reverser "↓S" increase the regulator "↑A"	"↓S" "↑A"	Keep the boiler pressure as close to the optimum. (Green on the F4 HUD or "F5 HUD") as you can for maximum efficiency.
Reduce/Turn-off Blower	"Shift+N"	as appropriate

Things to keep an eye on when running

- Keep the fire mass percentage (F4 HUD or "**F5 HUD**") at around what it was at the start of a particular scenario (in the order of +/-10% of start), or use various tables to maintain an optimum fire mass for a particular engine.
- Stoke regularly and intermittently (Open Fire Box "**F**" and shovel Coal "**R**") when travelling – best on the level and
Stop shovelling coal "**Shift+R**" and close the firebox ("**Shift+F**") for hills and tunnels.
Stoke to keep the fire level within +/-10% of the starting value
- Similarly inject water (either "**K**" & "**I**" or "**L**" & "**O**") into the boiler as needed and usually inject on the flat and not on hills.
- Use the Exhaust Injectors "**K**" & "**I**" when exhaust steam is available i.e. when moving.
- Keep an eye on water levels as it easy to run out of water when firing manually (F4 HUD or "**F5 HUD**").
The exhaust injector "**K**" uses less water than the live "**L**" injector does but in TS2013, you can use either.
Inject water (either "**K**" & "**I**" or "**L**" & "**O**") as needed – best when travelling on the level coasting or when stopped in a station signal, etc.
Start Injecting water when the level falls 5/10% below the scenario start and inject up to around **≈85%** level. When climbing a steep gradient the level can be allowed to drop to **≈60%** or even less but when the slope decreases inject immediately.
- Steam Chest Pressure ("**F5 HUD**") (reflects Cylinder Pressure) should be as high as possible to reduce pressure fluctuations and is a measure of the power available. Within 85 – 100% Boiler Pressure.
The steam chest pressure is useful in helping the driver to avoid wheel-slip at start-up, by warning if the regulator "**↑A**" is open too far.
- The regulator "**↑A**" needs to be opened progressively on many locos if you open it too fast you may end up with "too much steam" if the cut off is above **≈45%** and the loco will start to slow down or you get "wheel spin".
- There must be a balance between speed and efficiency so it is usually best to keep the regulator "**↑A**" high, e.g. on the flat, with a reasonable load many locos will run pretty well at 60 - 80%, but others may need the maximum 100%.
- The faster you go then the reverser "**↓S**" usually will need to be further reduced to achieve top speed, but monitor the steam generation and steam usage continually (F4 HUD or "**F5 HUD**").
- Maintain the boiler pressure at in the green, (F4 HUD) or at indicated for a particular loco ("**F5 HUD**") by using the injectors and/or firing and balancing the regulator "**↑A**" or "**↓D**" with the reverser "**↑W**" or "**↓S**".
- Start firing (Open Fire Box "**F**" and shovel Coal "**R**") when the fire mass is **≈5/10%** less than the scenario start and keep shovelling up to **≈80/85%**, or optimum for a particular loco.
These figures can be lower in light load situations or downhill running.
- Do not fire/stoke when standing at a platform.
- The damper "**M**" in TS2013 can make a difference in maintaining steam pressure so open the damper "**M**" to about 50% to increase steam generation/pressure but monitor excessive continual steam exhaust (blow-off)

(inefficient).

Close the damper "**Shift+M**" approaching and standing at a platform.

- Keep steam generation roughly the same as steam usage ("**F5 HUD**").
- Manage the pressure in the boiler at levels indicated in the loco manual or achieve a "green" pressure indication in the F4 HUD. Keep similar but slightly lower levels for the steam chest pressure.
- Approaching Tunnels open the blower "**N**" and close the firebox door "**Shift+F**".
- When coasting always open the blower "**N**" before opening the fire door "**F**" and stoking "**R**".
- When coasting into a platform turn off the blower "**Shift+N**".
- When stopped always turn the blower on "**N**" before you open the fire door "**F**" and stoking "**R**". Do not use the blower when standing at a platform,
- When stopped for any reason (signal, but not railway station, etc.) always turn the blower on "**N**" to keep the fire mass hot and ready to go!
- When stopped for any period of time always open the cylinder cocks "**C**" to drain out condensate, turn off "**C**" after 2-3 revolutions of the wheels.
- When coasting and/or slowing down keep the reverser "**↑W**" or "**↓S**" in the middle and ensure that the regulator "**↑A**" is open very slightly 1 or 2% to "cushion/lubricate" the pistons.

Stopping

- Most UK brakes when **RELEASED** operate at either 21 or 25 (inches of mercury).
- A steam train takes a long time to stop e.g. at 60 mph it will need approximately $\frac{3}{4}$ - 1 mile to come to a halt, depending on load, weather, gradient etc.
- The best way to use the brakes is to experiment for each loco as they are all different.

Action	Key Stroke /HUD	Supplemental
Open the small ejector	"J"	F5 HUD
Apply the brakes so that	"Apply"	appears in the F4/F5 HUD
Trim brakes initially to	10-15"Hg	10 - 15 inches of mercury F4/F5 HUD
Reduce brakes to	"Self Lap" ≈12 – 25%	F4/F5 HUD
Finally as train slows reduce to	"Running" ≈ 5 – 12%	F4/F5 HUD
Stopping too fast move brake to:	Release 0%	F4/F5 HUD
Trim brakes to say	16-18"Hg	F4/F5 HUD
Reduce brakes to	"Self Lap" ≈12 – 25%	F4/F5 HUD
Finally as train slows reduce to	"Running" ≈ 5 – 12%	F4/F5 HUD
Stopping too slowly move brake to	Release 0%	F4/F5 HUD Slower braking
Trim brakes to say	6-8"Hg	F4/F5 HUD
Repeat above		Faster Braking
Coast into a railway station and turn off the damper and blower.	"Shift +M" & "Shift + N"	Do not stoke when standing at a platform – dirty passengers.
When stopped	"C"	Open Cylinder Cocks

- It is all trial and error to get it right.
- If you need to continue, moving i.e. you braked a little too "hard" then just set the reverser appropriately for the speed you are travelling and open the regulator slowly so that you pick up again smoothly.
- Move the brake lever to "OFF" when speed gets to within 5 - 6mph of required speed. The train will continue to slow (until gauge gets to max (21/25.0" Hg) smoothly and progressively.
- Do not just apply the brakes and then let the train slow down use the technique described here its much smoother.

Stopping at a Station – level approach

- Best to approach by coasting ie not under power – regulator 1%, Reverser (cut-off) 50% brakes on 'running' at a speed between 15 – 30 mph depending on platform length ie 15 mph short platforms, 30 mph long platforms
- Do not fire the loco on approach or use the injectors.
- Do not open the cylinder cocks until halted, unless you need to release steam chest pressure.
- Use/Trim/Apply the brakes as above.

Action	Key Stroke /HUD	Supplemental
Coast into platform	1%, Regulator (A/D) Reverser W/S 50% Brakes on 'running'	Approach speed between 15 – 30 mph depending on platform length ie 15 mph short platforms, 30 mph long platforms
Ensure small ejector Open	" J "	F5/F4 HUD
Stop Stoking	Shift+R	F5/F4 HUD
Close Fire Door	Shift+F	F5/F4 HUD
Do not Inject Water	Shift+O+Shift+L or Shift+K+Shift+I	F5/F4 HUD
Close the blower and damper	Shift + N/ Shift + M	Could blow ash over passengers
Apply the brakes so that	" Apply "	appears in the F4/F5 HUD
Trim brakes initially to	As above and to suit platform length	F4/F5 HUD
When stopped	" C "	Open Cylinder Cocks

Other Notes:

Water Injectors Levels and Sights

If there are glass sights in the cab –use them and the following may help:

- Run with about 85%) glass full,
- Do not run with less than 1/8 (12.5%) glass of water.
- When stopped inject water to around (85%) glass.
- These figures give room in the boiler to expand with exhausting (wasting) too much steam and actually saves steam when injecting cold water.
- Use Live injectors when stationery and Exhaust Injectors when moving.
- The percentage figures relate to the **F5 HUD**.

The Live Steam Injectors and the Exhaust Steam Injectors

Basically, these are used to get water into the boiler from the tender to generate steam to drive the loco.

- The **Live injector** (to turn on/increase "**L**" and "**O**") is a simple device that uses live steam from the boiler to mix with and heat the water from the tender and pressurise the mix.
In TS2013 turn on the water regulator "**L**" and slowly open the steam Injector "**O**" filling the boiler to the optimum level.
This mix of condensate steam and heated water can then overcome the internal pressure of the boiler and generate more steam to drive the loco. To reduce or turn off use "**Shift+O**" then "**Shift+ L**" key combination. Don't forget to turn off the water Shift K or L as the tank will drain dry very quickly.
- This may lower your boiler pressure and will usually only used when there is no exhaust steam.
- The **Exhaust Steam Injector** (to turn on/increase "**K**" and "**I**") combines low-pressure steam from the cylinder exhaust combined with high-pressure live steam to drive, pressurize and heat the water from the tender into the boiler against its internal pressure. Superheated steam is also part of the process to stop saturated steam from going where it should not i.e. the cylinder exhaust.
In TS2013 turn on the water regulator "**K**" and slowly open the steam Injector "**I**" filling the boiler to the optimum level.
To reduce or turn off use "**Shift+I**" then "**Shift+K**" key combination.
- Both are modelled in some locos in TS2013 and logically you would use the Exhaust Steam Injectors) when exhaust steam is available (i.e. on the move as this has less effect on steam pressure.

Note: In the RSC driver manual the keystrokes for the injectors are incorrect and they have been emailed about it.

Dampers

- The dampers "**M**" regulate airflow to the fire.
- Open the dampers and the fire gets more air and draught and heats up
- Close the dampers and the fire will starve and cool down.
- Hence, the Boiler Pressure will drop if the dampers are closed for any length of time.
- If you see "white" smoke out of the chimney then that is the time to reduce/close the dampers ("**Shift+M**").
- If two dampers were modelled, you would probably run with the rear dampers only open and open the front dampers only for harder working of the fire. i.e. hill climbs, heavy loads, etc.
- Close the dampers on approach to a railway station and keep closed until moving off.
- A change of the damper setting takes a few minutes to effect the fire temperature. Wait before changing again to avoid "chasing" the dampers.

The Ejectors

- These are used to control vacuum brakes and normally there are two i.e. a 'large ejector' and a 'small ejector'.
- The small injector "**J**" is left open to keep the brakes at optimum performance even if there are leaks.
To reduce/close the small injector ie use "**Shift+J**".
- On some locos you need to keep pressing "**J**" to release the brake pressure 100%.
- The large ejector "**U**" [on some not all locos] is effectively the brake release and it is closed off once the brakes are released ("**Shift+U**" closes the large ejector).
- Both may be modelled as handles/wheels in the Cab.
- Both can be modelled in TS2013

The Blower

- The Blower "**N**" provides a draught for the fire when no exhaust is available.
- The blower is used to maintain a draught on the fire i.e. to keep it "hot".
- When operated, live steam from the boiler escapes into the chimney (if there is no exhaust steam from the cylinders) thus providing suitable draught.
- Always operate the blower if black smoke is coming out of the chimney.
- The draught from the blower also prevents the possibility of a reversal of the flow out of the firebox preventing blowback of fire into the cab.
It is also operated in tunnels to prevent build-up of smoke etc. in the cab.
- It is modelled in TS2013 and works well in some locos.
- To turn off the blower use "**Shift+N**".
- Close the blower on approach to a railway station and keep closed until moving off.

The Cylinder Cocks

- The use of steam in locomotives causes much condensation, which condenses as water in pipes, valves and cylinders.
- Water reduces the efficiency of the steam, and could damage cylinders when steam is admitted into the cylinders on top of the condensed water.
- To eliminate the water damage, cylinders are fitted with small cylinder cocks (valves) so that the water can be expelled using steam pressure.
- Always open the cylinder cocks "**C**" when stopped eg after braking to a halt.
- The cylinder cocks "**C**" should be left open when a locomotive is standing.
- They should remain open as the locomotive is started so that, when steam is admitted into the cylinders the water is blown out.
- Once the locomotive is moving and the cylinders are warmed up, the cocks can be closed "**C**" and full pressure is available.
- Rule of Thumb Turn of after 3 to 4 revolutions of wheels or below 5mph.

The Reverser or "Cut-off"

- The position of the reverser determines the proportion of the stroke during which steam is admitted into the cylinder. For example, a 50% cut-off admits steam for half the stroke of the piston, and so on and 75/100% cut-off means you get a full stroke of the Piston to get you moving.
- Simply, the reverser "**↑W**" & "**↓S**" determines if the locomotive goes forward or backwards and acts as the "gears" of the steam locomotive.
- In TS 2013 with the reverser set in the direction of travel, when steam is introduced into the cylinder it forces the piston to move in the right direction so that you go in the direction that you have set.
- In TS2013, it has three principle positions, Full Forward Gear, Mid Gear and Full Reverse Gear.
Full forward would be akin to low gear
(Low forward gear say 10 - 25%, akin to top gear) on a road vehicle.
Mid Gear 0% is equivalent to 'neutral', and
the same would apply when using reverse settings.
- How you operate, the reverser will be different for each loco that you drive and you may need to read the manual to find the best settings. There are no universal settings other than start high e.g. 50/75/100% and reduce it progressively to (usually >10%) as you gain speed either forward or in reverse.
- Usually reduce the reverser to 0% when standing in a station or at a signal.

The Regulator (Throttle)

- The Regulator "**↑A**" & "**↓D**" admits or reduces steam to the cylinders, which then via a series of pistons, cams, slides, con rods, etc. drives the loco in the direction of travel.
- Some locomotives generate superheated steam for greater fuel efficiency.
- The regulator is usually controlled from the cab by a lever and this is the case in TS2013.
- It has to be used correctly to ensure smooth running of the loco.
- It is modelled in TS2013

Tractive effort

Had to include this as it shows how locos move:

- The force exerted at the edge of the driving wheel of a locomotive expressed in pounds.
- Calculated as: $TE = (d^2 * n * s * (0.85 * p)) / 2 * D$,
- Where d = piston diameter (ins.), n = number of cylinders, p = boiler pressure (lb.), s = piston stroke (ins.), D = driving wheel diameter (ins) and P is 85% of boiler pressure (psi).

Steam Controls

Keystroke	Result
"J"/"Shift+J"	Small ejector open/close (Expert)
"U"/"Shift+U"	Large ejector open/close (Expert)
"C"	Cylinder cocks open/close(Expert)
"E"	Allows Reverser to change on some locos
"F"/"Shift-F"	Fire Box Open/Close
"R"/"Shift-R"	Shovelling coal - Increase/Reduce rate
"I"/"Shift+I"	Exhaust steam injector Turn on/off
"K"/"Shift-K"	Exhaust injector Increase/Reduce flow Water Regulator
"O"/"Shift+O"	Live steam injector Turn on/off
"L"/"Shift+L"	Live (water) injector Increase/Reduce flow (Water Tender feed valve)
"N"/"Shift+N"	Blower Increase/Reduce
"M"/"Shift+M"	Damper Increase/reduce
"H"/"Shift+H"	Lamps – Toggle lamp modes when available
Ctrl+1,2,3,4	Seat Head Codes (Varies loco to loco)
"↑A"/"↓D"	Regulator. This allows steam to pass from the boiler to the cylinders, which turns the wheels and moves the locomotive. Manipulate the regulator by clicking and dragging the control to change the amount of steam passed. ("↑A" to increase/"↓D" to decrease)
"↑W"/"↓S"	Reverser. This can be switched between Full Forward and Full Reverse and must be used before setting off. Use a high reverser setting to give maximum power. This uses a lot of steam, so slowly reduce the reverser setting as you speed up. ("↑W" to wind the reverser forwards and the "↓S" key to wind it out/backwards).

F5 HUD

F5 shows the following indications

Speed - in MPH/KPH

Regulator – its position in %. The more open the more steam goes to the steam chest.

Reverser – its position in % forward or reverse from neutral. This is the 'gearbox' of the engine – it adjusts the amount of time steam is allowed to the pistons. It needs to be adjusted whilst driving to get the correct engine performance.

Train brake - % and if they are in Apply, Running, Release mode.

Loco Brake - % May need large ejector to release.

Boiler Pressure - PSI up to a maximum of 250 the nearer to 250 psi the better. Steam from here enters the Steam Chest.

Steam Chest pressure – In PSI – the higher the better. to drive the pistons and loco. Measures just below boiler pressure ie $\approx 85\%$.

Boiler water level – Needs to be kept high near the levels when the scenario started.

Fire Mass – Lbs. (Pounds) the higher the better and the hotter the fire is again stoke regularly

Steam generation rate – How much steam the boiler is creating.

Steam usage rate – how much the engine is using – needs to be below the Steam generation rate otherwise you will run out of steam.

Cylinder cocks - Open or closed – open to allow water out of the cylinders to stop damage.

Brake pipe pressure – The pressure in inches of the vacuum in the brake pipe – you need to have 21 inches of Hg when the engine is moving.

Small Ejector Open or Closed – Creates the vacuum for the brakes to work.

Tender water level - Gallons – Reduces as you drive top up if low.

Tender Coal level – Lbs. (Pounds) Reduces as you drive top up if low.

Blower - ON/OFF Creates draught for the fire ON when starting and usually off when running. Use in tunnels.

Dampers - ON/OFF Dampers are flaps, which regulate the flow of air through the ash pan to the fire. Usually leave on.

<p>"F4"</p>	<p>F4 HUD shows: Speed in MPH/KPH. Regulator open position in %. Reverser position in % forward or reverse. Train brake in % Brake Pressure inches of Mercury Train & Loco Icons Water Quantity On board in gallons Boiler Level % Coal on-board in tons Open/Close Fire Doors and Stoke icon Steam Pressure psi Green is Good, Red is Bad ie green when you're 'making' pressure, red when you're losing it. Line diagram Position of train, gradient, signals, distances etc. Plus icons for various functions not detailed here</p>
<p>F3</p>	<p>Regulator % 0 to 100 Reverser Position plus to minus Brake percentage Train icon Line diagram Position of train, gradient, signals, distances etc.</p>

Steam Loco Errors

Error	Consequence
Locomotive ran out of water	Your steam locomotive runs out of water.
Fusible plug has melted	Your steam locomotive run out of water and a safety mechanism allows pressure to leave the boiler so it does not explode. To avoid this, make sure the boiler water level never drops to zero.
Fatal blowback	Your steam locomotive enters a tunnel with the firebox doors open. To avoid this, close the firebox doors and turn the blower onto full when entering tunnels.
Firebox extinguished	You failed to stoke your fire with sufficient coal and it died.

Starting a Steam Train – General notes

1. Release your brakes.
Once they are fully released and the brake pipe pressure becomes constant (see the pressure display), apply the brakes slightly until they are in the Running position.
Leaving them in the Release position would waste steam.
2. Wind the reverser fully forwards.
3. Open the regulator to about 50% and the train starts to move.
4. When you reach about 10mph, wind the reverser back to about 45%.
5. As you pick up speed, continue to wind the reverser back until it is about 15-20%.

Driving Tips

- If you then need to go faster, increase the regulator until you reach your desired speed.
- When going uphill, you may need to wind the reverser forwards and/or open your regulator to keep speed up.
- When going downhill you can coast by closing the regulator completely and setting the reverser to about 45/50%.
- If you begin to lose boiler pressure, you are probably using more steam than you are generating so adjust the regulator and reverser or you will lose power.

Stopping the Train

1. Always give yourself plenty of room to stop – a typical steam-hauled train takes $\frac{3}{4}$ to 1 mile to stop from 60 mph.
2. Apply the train brake.
3. Leave the brake control in this position, and the brakes will come on slowly until they reach their maximum force.

Note: If you only want to make a partial brake application, after applying the brakes, release them until the control is in the 'Self LAP' and/or 'Running' position. This will hold the braking force at its current level.

Steam Engine data by David Hodder

Correcting wrong percentage for superheated engines and added minimum percentages for compound and wet steam engines.

Few things about reverser (cut-off):

- 75% is most power
- 25% is fastest
- 40% is minimum (and fastest) for compound engines
- 30% is minimum (and fastest) for wet steam engines (ie. non superheated)
- 20% is minimum (and fastest) for superheated engines
- below 25% (in real life) should not be used, as engine loses power and starts to work erratically.

Notes:

- Below any of the above minimum values (in real life) should not be used, as engine loses power and starts to work erratically
- Reverser at 7% means no power and breaks your engine.
- You should always try to keep regulator at 100% and speed/power is managed with regulator cut-off).
- In TS2013 on some locos a value of 50% is also good.
- In some situations you may have to use lower setting to keep steam usage down.

Driving Example in TS 2013 using the RSC 7F in Auto Fireman Mode

Start at Bath in the RSC 7F:

[There is quite a steep climb out of Bat, through a couple of tunnels, before the line levels off and goes downwards].

- 1) Maintain the pressure between 180-185 psi
- 2) When the speed limit changes to 30mph, set regulator at 100% and lower reverser gradually to 25%
- 3) When the pressure drops to 180 psi, set regulator at 80%
- 4) When the pressure raises to 185 psi, set regulator back to 100%
- 5) When the down hill section starts try to not over-speed :)

Using 25% reverser on a 1:50 uphill incline means that 7F has much more power than required for a short train. I'm using automatic fireman. I refuse to drive and fire at same time as this is impossible in real life.

Important Steam Features NOT modeled in TS2013

Notes By David Hodder

Contrary to MSTs that modeled the fire in detail with: fire temperature readout, color: dull red for cold, white for overheat, smoke color: from black during firing and lack of oxygen to white smoke with too much oxygen. TS2013 makes life (too) easy for the fireman: all he has to do is to keep the fire mass around the ideal. Either by using the published table on RWA or by staying near the % at the start of a scenario, generally 65%. It seems that there is a reduction in steam generation the further you move from the ideal mass but I haven't been able to validate that.

TS2013 does not model the effect of boiler length that affects water level when going up or down an incline and critically when going over a summit. With MSTs the boiler level could go from 100% to melted plugs in a couple of minutes if you didn't have all the injectors going full blast as the engine started to level off on the summit. TS2013 again makes life almost boring for the fireman as you can easily keep the boiler level safe.

When this sim first came out it was possible to interact directly with Adam Lucas and I was able to get some major changes through, however although I raised the above points several times at the beginning, I never got any answers apart from "thank you for your interesting remark"!!! So we can probably say that this problem will never be addressed.

Despite the fact that manual firing is almost too easy I do use it all the time. I tried the auto fireman at the start, was unimpressed, fired him, and have used manual ever since so I don't know if there has been any improvement over the years. (My fired auto fireman is probably shoveling coal down one of Lord Bickerstaff's mines, lol)

Some basic good driving rules (ex GWR)

Never fire when stationary in a station, it can cover the passengers in soot and that is not good for business. Therefore, the rule is to ensure that the fire is adequately stoked, with dampers closed and blower off as you coast into the station.

"Blowing off" more than a few seconds before leaving wastes steam (and money), it means you have to shovel more coal and it annoys passengers. Use dampers and/or blower to bring the boiler pressure to the "red line" just as you are about to leave. If the pressure rises too fast use the live steam injector to inject some cold water to lower the pressure. In order to have the scope to inject without overfilling boiler and risking "priming" (water in the steam pipes, immediately open cylinder cocks) ensure the boiler is not above 85% in the sim as you enter the station.

As GWR vacuum brakes are slow to release, especially with a long train (I find TS2013 quicker than reality and it doesn't seem to vary with train length) the process on entering station as follows. This way of braking also improves passenger comfort:- Initially brake a little more than necessary and slowly release the brakes as the train comes to a stop. This avoids a juddering stop but it is easier to say than do, especially if you have to stop just under a water crane for a fill!!! GWR practice was to hold the train with only the tender handbrake if the station was more or less on the level and completely release the train brake. That way when you got the go ahead you could crack open the regulator while the firemen released his tender hand brake and be on your way immediately.

A few points of steam theory

Over 50 years ago when I was studying, our thermodynamics classes still taught us all about steam engines (wonderful). One of the things that impressed me was the enormous torque generated by a steam engine as it begins to move. Spinning the wheels is very much easier than TS2013 leads you to believe.

The latest WLOS Black 5 models the "steam chest" effect for the first time so we may be seeing that in more of the locos in the future, so much the better.

From experience I can tell you that on a superheated loco, even when running light, to move you crack open the regulator for a couple of seconds then close it. Even with the cylinder cocks open the engine will move a significant distance and if you leave the regulator open a second too long the wheels will spin!!! The steam chest partially fills as you open the regulator and then this steam increases in temperature as it passes through the super- heater. You can in fact use the cylinder cocks to adjust the distance you move.

On the WLOS Black 5 you get this effect and it gives a much more realistic feel, you have to close the regulator early and even open the cylinder cocks to release the pressure!! While shunting you open the regulator a couple of seconds and close it, then if you run out of steam before getting to where you want to go you crack it open again.

I don't know how many "players" use the "advanced" version of the Black 5 with this feature but on the forums there were complaints that this engine was too difficult to drive. But that is what a steam engine is really like!!

Another point of theory, not really modeled on TS2013, is why the "cut off" must be completely open to start.

- On two cylinder engines the two pistons are not set exactly at 180° from one another;
- If this was not the case it could mean that once the engine has stopped the pistons could be at the extreme ends of their stroke
- Hence, when you try to start the engine, (ie now with the connecting rods being at the extreme ends of their travel), they could go backwards even with the regulator set to go forwards.
- Worse still, the engine could "freeze" as one side of the engine wants to go one way and the other the other way.
- By offsetting the pistons slightly you have a failsafe way of ensure a start in the right direction.
- For example if the cutoff is set at 25% then there would be a 75% chance that the pistons would be in a position where the inlet valves would be shut and it would be impossible to start.
- Thus opening the cutoff all the way ensures a start, but as soon as you have a little momentum it can be brought back very quickly.
- Personally after a couple of wheel rotations I close the cylinder cocks and bring the cut off well back 35% to 40% immediately.
- This saves steam and usually gives a better acceleration unless you have an extraordinarily heavy train.

Acknowledgements.

Many of these explanations are taken from <http://www.railway-technical.com/st-glos.shtml#E> an excellent site.

David Hodder has also posted some excellent info on various forums on how to drive a steam train.

Useful tables for fire mass and performance by Cordell Clarke

<http://railworksamerica.com/index.php/download-library/miscellaneous-files?view=document&id=47:steam-locomotives-specs-spreadsheet&catid=23:miscellaneous-files>

RSC Manuals

David Edestone

OVS

Wikipedia

Will Cook

Craig K Memphis

Marleyman for posting the guide on his website

Plus many others