Ravenglass and Eskdale Railway Preservation Society  
Diesel - Hydraulic Locomotive  
‘Douglas Ferreira’

Operating Manual
The Douglas Ferreira is a twin cab diesel-hydraulic 15” gauge locomotive which was built in 2005 by TMA Engineering and works on the Ravenglass & Eskdale Railway in Cumbria, England. Its wheel configuration is B-B and it is named after the former General Manager of the railway from 1961 until 1994, Douglas Ferreira.

It is owned and was designed by a working group from the Ravenglass & Eskdale Railway Preservation Society and now works passenger trains almost every day that they are scheduled, specifically the off-peak trains during the summer months and the vast majority of service trains throughout the winter.

In 2006 it worked 9230 miles on the railway and in 2007 it travelled 8958 miles between Ravenglass and Dalegarth.

The locomotive carries the Indian Red livery of the Furness Railway, which worked on the Cumbrian Coast Line until 1922, with the White and Red lining of the T & J Harrison Shipping Line (Ferreira’s first employer), colloquially known as “Two of Fat and One of Lean”, at the top of the body on the engine house and cab sides. The Indian Red is identical to that used on River Mite, the steam locomotive owned by the R&ER Preservation Society. It uses a Westinghouse air brake system which is combined to provide a singular train brake and locomotive brake operation, however the locomotive also has a separate parking brake. It is noted for also using very bright aircraft landing lights as headlights at either end.

A development of the similar Lady Wakefield locomotive, built by the railway in 1980 and the John Southland and Captain Howey locomotives built by TMA Engineering for the Romney, Hythe & Dymchurch Railway, the locomotive upholds a high miles-per-casualty ratio, making it an invaluable asset to the railway.

In September 2008 the locomotive made its first visit to another 15” gauge line, in this case, the Bure Valley Railway’s Super Power event. The locomotive suffered a catastrophic power unit failure in April 2013 and was dispatched to TMA Engineering for a replacement to be fitted. At the time, the railway was already struggling for operational motive power, due to the major fire in the engineering workshops and unavailability of steam locomotives. 1929-vintage Perkins stepped up as the only available diesel locomotive available for passenger service, as Lady Wakefield was also receiving a new power unit in Birmingham, while Shelagh of Eskdale has been out of service for several years. As of May 2013, the locomotive is at TMA’s workshops in Birmingham.

The locomotive is powered by a Perkins PXL04.4RJI 4.4l 4 cylinder turbo engine Type 2177/2200 which can develop 125 hp (94kW). This drives a hydraulic pump/motor, using a Linde Transmission system, with the motor output driving both bogies via a cardan shaft and worm gear arrangement to each bogie.

The locomotive weighs in at 7 tonnes, is 6.2m long and 2m high.
Looking at the cab control arrangements, it will be apparent that they are basically the same - but handed. The intention is that the locomotive is not turned round at each end of the line, but runs the same way round with the driver changing cabs. For this to work, the controls are arranged on the same side of the cab as the doors in the carriages. The only other difference of note, is that the heater controls are located in the Dalegarth cab. As the heater must be turned off and allowed to cool before turning off the locomotive electrics, it should be turned off by Miteside on the final run of the day. This may mean stopping the train to do this.
Ravenglass cab

Dalegarth cab

Dalegarth cab control desk
- basically identical to ravenglass cab, apart from the controls being sited on the opposite side of the cab.
Locomotive layout
Drivers side of the engine bay
Non-drivers side of the engine bay

- Radiator
- Air Compressor Air filter
- Engine instrument panel
- Hydraulic oil tank
- Hydraulic coolers
- Axle box grease nipples
- Brake blocks
- Dalegarth end
- Ravenglass end
Control of the Locomotive

The locomotive is controlled by means of a throttle lever and a brake valve. Only one cab can be energised to control the locomotive at any one time. This is achieved by means of a fortress interlock which mechanically frees the brake application valve and electrically energises the controls for that cab. Only one key is available for use to operate this interlock. De-energising a cab will immediately de-energise the hydraulic solenoid valves which connect the pump to the drive motor, bringing the locomotive to an immediate halt, should drive be engaged when the cab is de-energised.

When a cab is energised, the direction of travel – or none – can be selected. Once a selection is made, the train brakes can be released and the parking brake released. If the throttle lever is then advanced, once the engine revolutions have exceeded 1200rpm, the transmission brake will be released and power will be applied from the hydraulic pump to the motor, and thence to the bogies via the cardan shafts under the locomotive. Increasing the throttle opening will increase the power transmitted to the bogies. Closing the throttle will decrease the power to the bogies. The nature of the hydraulic transmission, is such that there is no ‘freewheel’ capability. If the wheels start to overrun the hydraulic motor output, then the hydraulic system will effectively act as a brake and slow the locomotive. Should this overrun be ‘excessive’, cavitation will occur in the motor and will become apparent to the driver in the form of vibration and surging from the locomotive. If this is detected, the throttle should be opened until this effect stops. Locomotive and train brakes should be used to reduce or control speed, at times running against an open throttle. If the engine revolutions drop below 1200rpm, then the transmission brake will come into full effect and bring the locomotive to a rapid halt. This can throw passengers forward, and the driver should be aware of this possibility. On greasy rail, one additional effect, is that the locomotive wheels may start to slide, should the throttle be used to control train speed. Again, the throttle should be opened and train brakes used to control speed.

At all times, when the train is in motion, the throttle lever must be held open. The lever is spring loaded to automatically close if it is released – at the direction of the Railway Regulator. If it is inadvertently released, the transmission brake will come into full effect. For this reason, care must be taken when using the radio, to ensure that the throttle is never released.

The locomotive brakes are single clasp brakes on each wheel, operated pneumatically with the train brakes. The brake blocks are on the outer side of each wheel and are linked to oppose each other, so on each side of the bogie, they will pull towards each other to apply. The brakes are applied and released pneumatically using the Westinghouse continuous automatic brake system. The engine mounted air compressor charges the main reservoir in the engine bay. The output from that is directed via the cab brake valves to a reservoir on each side of the locomotive. Each supplies air to the brakes on one bogie as directed by the triple valve controlled by the cab brake valve. The valve is locked in the lap position, in which state no air is supplied to, or released from the train pipe & underframe brake reservoirs. When it is released, the valve can be moved to the ‘release’ or ‘apply’ positions – with the extent of movement allowing graduated air response. In the ‘release’ position – away from the driver – air is supplied into the train pipe/breaker reservoirs allowing the brakes to be released. In the ‘apply’ position, the train pipe pressure is lowered, and when it drops below 40psi, the brake reservoir pressure will reduce, causing the brakes to be applied. The braking effort applied will be related to how far below 40psi, the train pipe pressure has fallen. A limited braking effect to control speed on a downhill section can be achieved by slightly lowering the pressure and then lapping the valve, to lock the train pipe at that pressure – subject to leakage. The train pipe normally runs at 50psi, where the brakes are all fully released.

The parking brake is a clamp brake around one of the Cardan shafts from the hydraulic motor to the bogies. This is released by air pressure, and applied by spring pressure. It will not release until the train pipe pressure exceeds 40psi.

In emergency, the air in the train pipe and brake reservoirs can be dumped using the dump valve on the cab desk. This can be operated irrespective of the cab being energised or not.
Routine driver checks

Daily:
- Oil level
- Coolant level - either dip with finger - tip should just touch fluid, or remove cap, shine torch in opening and compare level with marks on side of container
- Hydraulic oil level
- General check
- Note running hours

Two daily:
- Blow down air reservoirs to expel accumulated water

Weekly:
- Check bogies for signs of oil leakage where cardan shaft enters bogie
- Check brake wear. Stop with brakes fully released. Blocks should not be pressed against the wheel rims, and not be more than finger width away from the rim.
- Grease axle boxes - for nipple locations see pages 5 & 6

Hydraulic tank, pneumatic lubricator and water trap
- Hydraulic level gauge

Engine coolant tank above radiator
- Level mark

Non-drivers side of engine:
- Radiator
- Compressor
- Oil level dipstick

Radiator, Compressor, Oil level dipstick

Engine hours meter

Main air reservoir drain valve

Underframe air tank drain valve

Cab heater unit
Engine bay cooling

It is necessary to ensure that the whole engine bay is cooled, as well as providing the normal oil and water cooling systems. Due to the locomotive having a sealed engine bay floor and small louvres in the doors, air flow round the engine bay is limited, and in hot weather, the temperature in the engine bay can become excessive. This can result in overheating of electronics and the fuel system and can result in the fuel pump fuses failing and starving the engine of fuel.

In hot weather, especially if it is sunny, the engine bay doors should be opened when the locomotive is parked at Dalegarth. It may be worth removing a pair or more of the lift-off engine bay doors to allow more air in. For preference, select the doors on the non-passenger side, at the engine end.

If the locomotive is parked with doors open, it is advisable to place a notice on the control desk as a reminder of this, to minimise the risk of inadvertently moving the loco in this condition.

Draining the hydraulic sump

The engine bay is fitted with a solid base to prevent rail muck from being thrown up into the engine bay and minimise contamination of the ground by oil etc. dripping or leaking from the engine bay. This means that should a hydraulic hose rupture, it will fill the engine bay with fluid. In this event, some will drain into a sump in the centre of the engine bay and trigger an alarm – displayed as ‘Hydraulic fault’ in the cab. As there are other initiators for this alarm, the sump should be drained first to eliminate this as a cause. Having confirmed with Control, open the drain cock on the side of the sump and close when all fluid has drained out.

NOTE: careless use of a hose when washing the locomotive body can also flood the engine bay and trigger this alarm, as can washing out the engine bay itself.

Towing the locomotive

Should the need arise to tow the locomotive dead, it will be necessary to re-configure the hydraulic system and potentially to manually release the brakes.

Re-configuring the hydraulic system:

In the centre of the engine bay, open the towing valve by turning the lever so that it is inline with the pipework. This allows oil to bypass the pump when the motor is being turned by the action of towing the locomotive. It should be noted that the pipework associated with this valve is much smaller than the main oil pipework. This means that much smaller quantities of oil can flow, and if the locomotive is towed at more than 5mph, this can result in cavitation in the hydraulic system which can cause major damage. For this reason, DO NOT tow the locomotive at more than 5mph. When towing has stopped, the towing valve should be returned to its normal closed position, with the handle ‘across’ the pipework.

Releasing the brakes:

If air is available from the towing locomotive, and battery power is available onboard Douglas:

When air has been supplied from the towing locomotive, energise a cab, release the parking brake as normal and release the locomotive brakes as normal. Be aware, that the low oil pressure siren will sound as the engine is not running.

If air is not available from the towing locomotive, or battery power is not available onboard Douglas:

Isolate the train pipe air supply to the underframe air reservoirs and open the drain valves to blow off and release the brakes. Using the adjustable spanner, unscrew the parking brake adjusting nut – turning it anticlockwise. This will free off the brake. The fitters MUST be made aware that this has been done. See page 7 for location.