

Parker Hydraulics and IQAN Control Modernize the Cog Railway

The owners and engineers at the Mount Washington Cog Railway made a decision several years ago to introduce their first major redesign of the railway engines that pull its passenger cars to the summit of the 6,288 foot mountain in the White Mountains of New Hampshire. Since 1869 the historical steam engines of the railway have burned through over one ton of soft-grade bituminous coal per round trip to the summit. At the prevailing rate of about \$225 per ton (and rising annually) there was a lot of appeal in the concept of a bio-diesel alternative that would reduce the cost to about \$60 per trip, a fuel savings of 74 percent.

Beyond the fuel costs, just the annual \$100,000 expense for "boiler inspections" had become an economic burden without any obvious solution. Only the elimination of the boiler could stop that expense. Further, with a diesel engine, instead of a boiler, the train could operate with one person in the cab, instead of two, which cut personnel costs in half. And, economics aside, the proposed change reduced the emissions issue, reduced the chance of fires starting along the tracks, and would encourage more riders that otherwise objected to the smoke and dust from the existing engines.

Innovative Hydraulic Solutions With the switch from a boiler making steam,

to a diesel engine driving a Power Take Off pump, a new age was born. The engineers at the Cog Railway designed a new system from the engine, to the braking, to the overall system control. Working closely with the Cog Railway engineers, The Hope Group team introduced several Parker system solutions, including a hydraulic power train drive and hydraulic controls for the braking system.

Two Parker Denison hydrostatic pumps provide electronically controlled variable pressure and flow to two Parker fixed displacement, axial piston hydraulic drive motors. They are coupled to two planetary gear boxes that drive the locomotive's two Cog gears. The decision to go hydraulic was based on the fundamental advantages of hydraulics when it comes to power density.

Even in descent, there is an important requirement for power, ensuring the train comes down the mountain at a slow, safe speed, and under complete control. (No coasting down!) A Parker Denison fixed vane hydraulic pump runs unloaded during the trip up the mountain, but is used as a brake during the descent. A Parker proportional relief valve controls the pressure of the pump, which induces a load on the power train and applies brakes for the locomotive and the passenger coach during the descent.

(continued on back)



The fleet of new Cog Railway locomotives are powered by a hydrostatic drive system, all controlled by an electronic joystick.



Sales Engineer Ron Ruel, rides the newest Cog Railway locomotive during a shakedown ride, to observe how the control system monitored vital engine data.



Tourists now have a choice of a traditional steam powered ascent or the revolutionary bio-diesel powered locomotive now coming on line.

(continued from front)



Electronic System Control

A Parker IQAN-MDL electronic control system provides integrated system management for the locomotive's diesel engine, hydrostatic drive system, braking system, and cooling systems. The control system functions as a master controller, providing a display for the operating engineer, and providing a data gateway. Through the careful selection of an electronically governed diesel engine, the engineering team was able to integrate the Parker IQAN control system with the engine and other power train components. The control system gathers vital engine data from the engine's CANbus protocol and monitors parameters such as engine speed, oil pressure and cooling water jacket temperature. All of the data is transferred directly via a simple connection through two wires where it can be monitored, analyzed and displayed. The multiple screens display vehicle speed, angle of

inclination, train location, vibration, and hydraulic filter status.

Monitoring Hydraulic Fluids

A clean engine is a happy engine. To ensure the safe operation of the engine, it's vital to measure and monitor the hydraulic fluids in the system. The IQAN-MDL constantly reads pressure transducers that monitor pressure levels of hydraulic functions. The system can detect possible leaks and can take appropriate action. To ensure clean hydraulic fluid, the engineers installed a Parker iCount particle counter system to measure dirt particles in the fluid from the drain of the two hydrostatic transmissions. If the particle count becomes too high, the MDL alerts the locomotive operator and slows the train before critical damage to the transmission occurs. Visitors to Mount Washington now have a choice of a traditional steam powered ascent or the revolutionary

bio-diesel powered locomotive's now coming on line. Several of the new engines are operating successfully now and more are on the way. The Cog Railway was a true innovation in 1869 and it continues that reputation as an innovator today.

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