

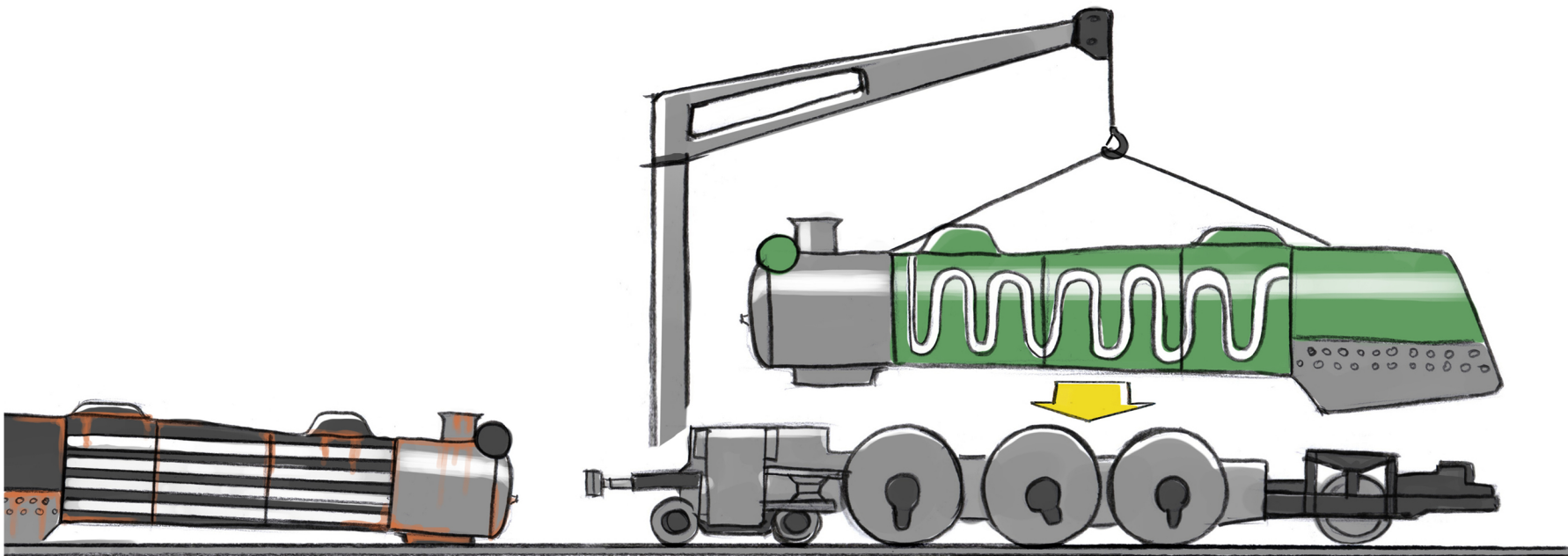
REPLACEMENT BOILERS

TO PRESERVE HERITAGE STEAM RAILWAYS



Sparks, smoke and inspections are increasing challenges for heritage rail

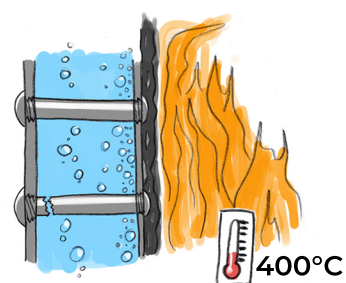
At **Mackwell Locomotive Company**, we are dedicated to **supporting the operation of steam locomotives** around the world, reboiling heritage locomotives with zero-carbon, spark- and smoke-free technology.



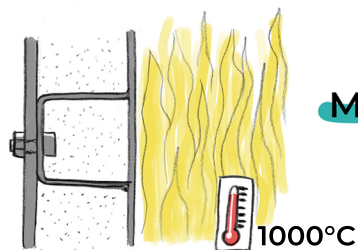
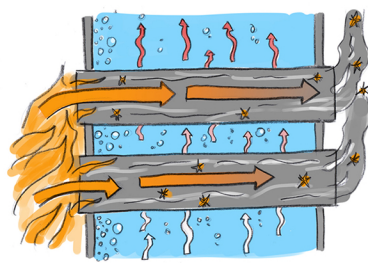
Replacement locomotive boilers are **identical in appearance**, ensuring external authenticity is retained.

30 minute lightup allows crews to arrive hours later or trains to depart earlier, and **easy steaming** ensures full steam pressure even with less experienced firemen.

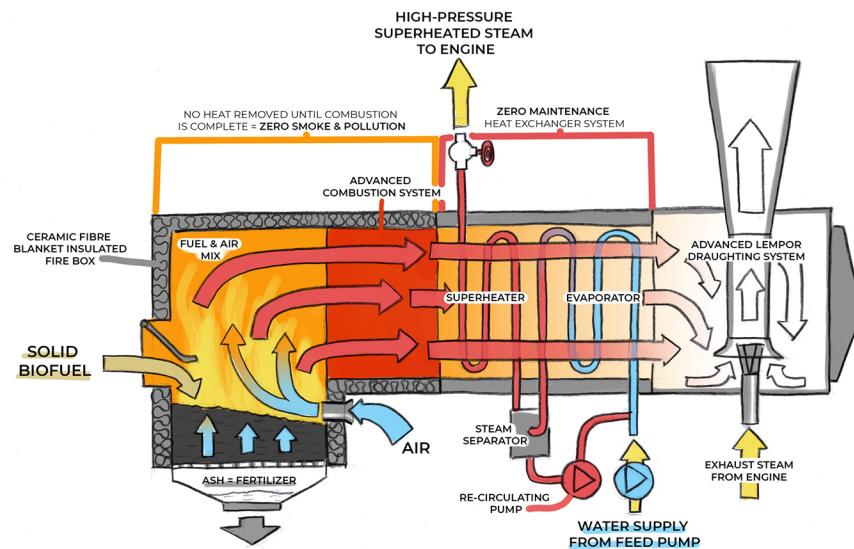
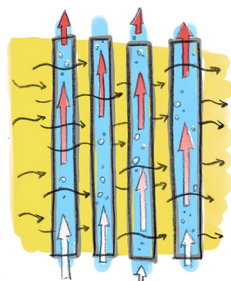
The Mackwell Boiler is **low maintenance**, with no stays to break or crownsheet to collapse. Our heat exchanger design eliminates washouts and cleaning in combination with Porta treatment, so fewer volunteer hours are required to operate. **Very pure steam** is generated without the use of antifoams, **reducing internal engine wear** and preventing damage.



OLD



MACKWELL

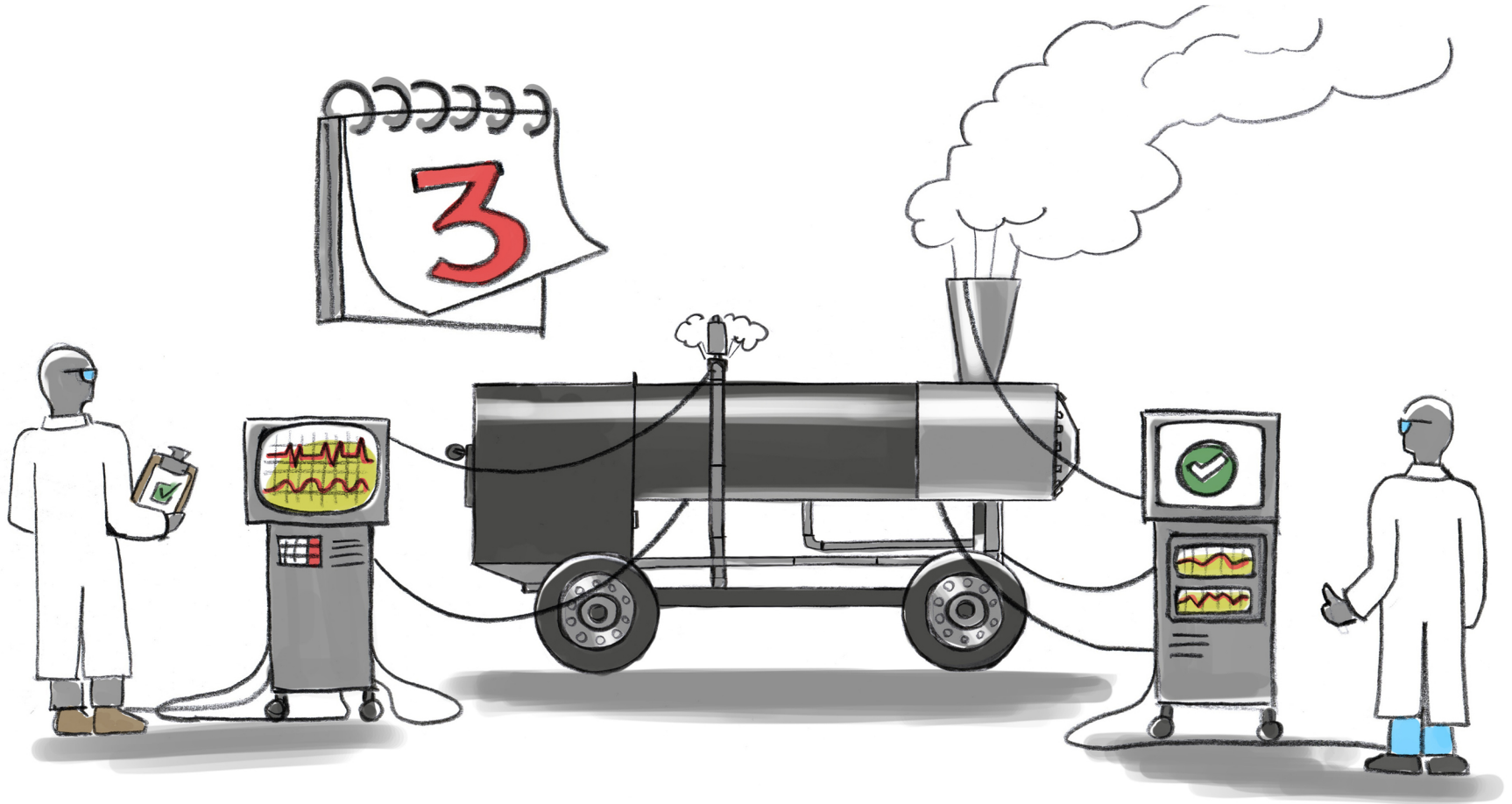


Two key principles underpin the Mackwell boiler technology:

1. No heat is removed until combustion is complete.
2. Fast-moving water is heated inside small robust tubes.

Mackwell Replacement Locomotive Boilers **cost the same to buy as a conventional boiler**, they run on locally sourced, cost-effective solid biofuel and with **zero explosion risk**, inspections are simpler and cheaper.

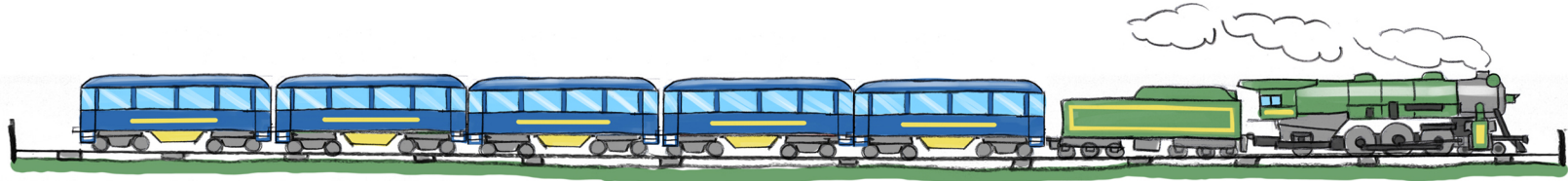
Mackwell boilers are **spark free**, eliminating the risk of line-side fires. With **zero smoke, soot and char** emissions, they also keep the neighbours happy. Learn more about how it works and meet some of the crew on YouTube.



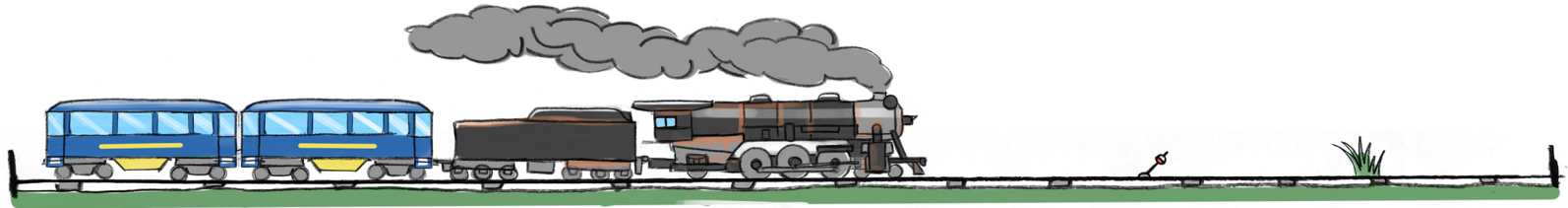
We've been **developing and refining the technology for seven years**. Our 400 hp prototype boiler has been subjected to **three years of testing**.



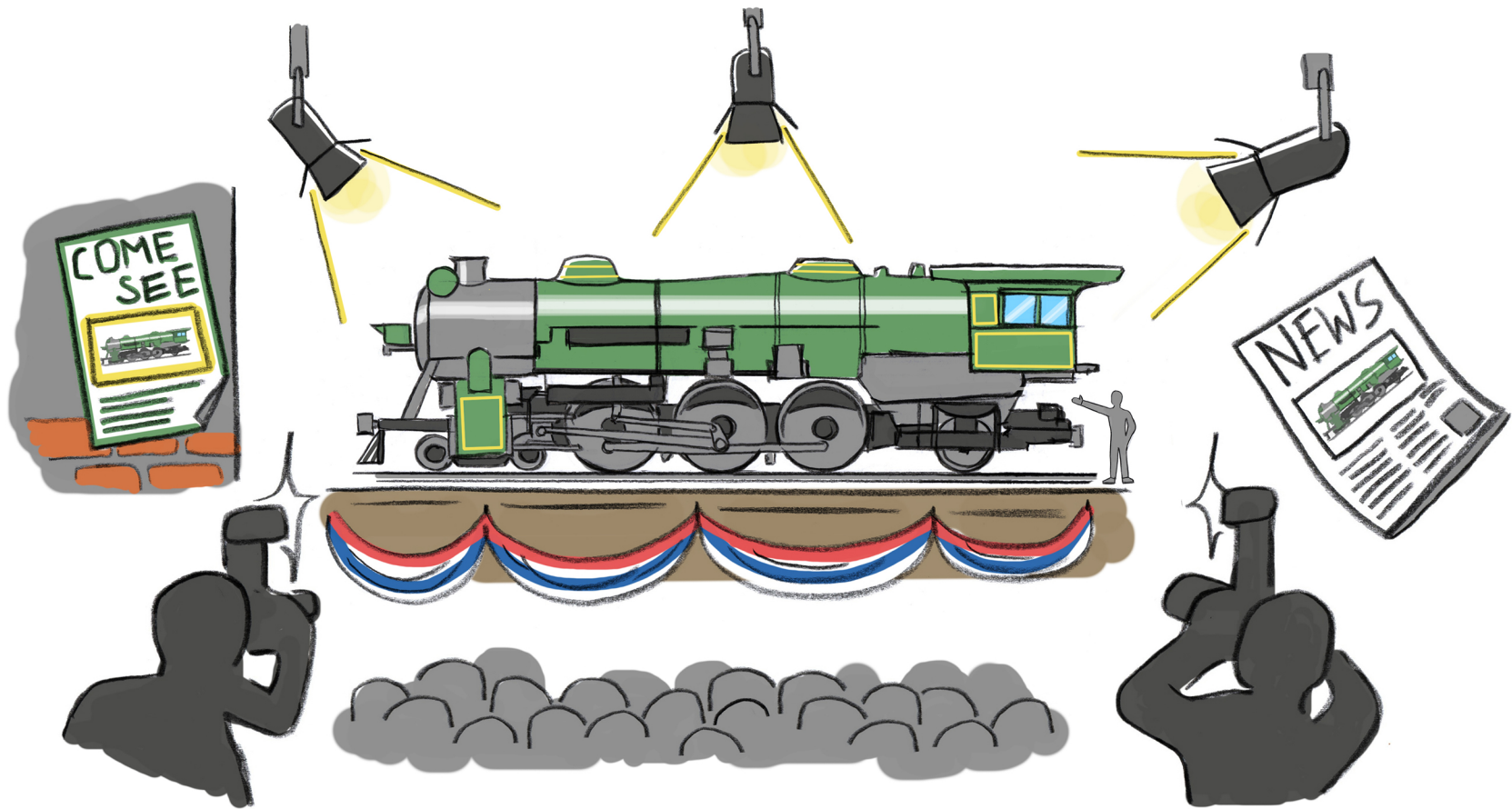
1\$



1\$



With the **boiler accounting for the lion's share of maintenance (91% of cost)**, Mackwell Replacement Boilers **improve viability** of heritage lines. Inspections reduce to a fraction of the cost, and may not be required at all. **Fuel costs reduce by 70%** and **overall running costs by 60%**. These savings have the potential to preserve heritage railways whose survival is threatened by lack of volunteers and funds.



Mackwell boilers create **safe, clean, zero-carbon** heritage locomotives that **look and feel exactly as they always did**. We'd love for you to be part of our story, and for us to be part of yours. Contact info@mackwelloco.com.

FAQ

How much will a Mackwell boiler cost?

Similar pricing to a replacement boiler of conventional design, price includes steam driven circulating pumps and some auxiliary components.

Can we use our existing auxiliary appliances? e.g. safety valves, fire-door, whistle, injectors, turbo-generator, etc.

Yes, most existing appliances work with the new boiler, provided they are in good working order and meet required certifications for safety, or we can supply new equipment.

1. The feed pump supplied with the boiler will provide easier control of the boiler water level compared with injectors.
2. A new throttle/regulator is supplied with the boiler where required.

Is the Mackwell boiler safer than a conventional boiler?

Yes, much safer due to the very small amount of water under pressure (about 3% of the water contained in a conventional boiler). The boiler's peer reviewed design contains and safely dissipates the energy of a pressure equipment failure, making the boiler almost as safe as a domestic refrigerator.

What fuel can we use? Will it be cheaper to run?

Any solid biofuel (preferably below 50% moisture content): cord firewood, wet or dry hog fuel, wood chip, pellet, biocoal, bagasse, rape cake. All boilers are hand fired with a mechanical firing option. High efficiency and cheaper fuel means fuel cost is reduced by 70%.

Can we burn coal?

No.

Does the boiler emit sparks?

Thanks to the design, Mackwell boilers do not spark. Steam trains during dry summer months are completely safe.

Do Mackwell boilers smoke?

No. The unique design of the boiler eliminates smoke emissions by burning solid biofuel in an insulated chamber at temperatures in excess of 900°C.

FAQ

Classic locomotives make “clouds of steam,” will this still be the case?

Yes. Emissions of steam from the chimney and cylinder cocks will be unchanged by converting to a Mackwell boiler.

Appearance, clothing, domes etc.

1. To the untrained eye the locomotive's appearance will be unchanged
2. Original cladding and clothing can be retained with little modification
3. False domes can be fitted with an identical appearance
4. Circulating pumps are discretely fitted but have a similar appearance to small Westinghouse air pumps. Feed pumps are similar.

Is the funnel (chimney) identical in appearance?

We can use the existing funnel and fit a liner. In some cases, for lower fuel consumption a slightly larger diameter funnel can be fitted of almost identical appearance.

Will cab layout, controls, fire door etc. be affected?

No, only extremely minor changes are noticeable.

Will there be any changes to external boiler plumbing?

Yes, some discrete changes will be required, for example to supply steam to the manifold in the cab. This will be worked out in consultation with the customer.

Is the weight the same?

Yes the weight of a custom built Mackwell boiler is identical to the locomotive's original boiler, however, due to the design the boiler can be supplied up to 50% lighter than the original boiler if it is desired to reduce axle loads or alter the locomotive's centre of gravity/weight distribution by adding ballast.

Will the locomotive's power remain the same?

The same or more.

How long does it take to raise steam?

As little as 20 minutes from striking the match depending on the amount of artificial draught available and the skill of the fire lighter.

FAQ

Will range be affected when using solid biofuel?

Compared to high quality bituminous coal, the volumetric energy of basic wood chip is about 20% by volume or 60% by weight. Densified solid biofuels such as pellets contain about 60% of the energy by volume compared to coal, and 75% of the energy by weight. In some cases tenders can be modified for additional range when using low cost solid biofuels such as hog fuel or wood chip.

Do we have to clean out the boiler?

Every 100 hrs, small quantities of ash may require removal in the smokebox (we call it an exhaustbox due to the absence of smoke). No tube cleaning is required and the combination of solid biofuel and boiler design eliminates fire cleaning (other than shaking the grate occasionally to remove any nails, stones etc.).

What boiler water treatment is required?

The boiler is designed to work with a simplified version of Porta treatment. This is made up of sodium carbonate and tannin and is supplied by us or can be prepared by the customer (full directions and support provided).

How often does the boiler need to be stripped for inspection?

Inspection is replaced by periodic hydrostatic testing to verify the integrity of the pressure system. Visual inspection of the pressure equipment contained within the smokebox (exhaustbox) should be undertaken every 100 hours. The boiler is designed so that it doesn't require stripping for annual inspection. Daily inspection of the locomotive and boiler systems is still important in accordance with good operating practice. Certification and mandatory inspections will depend on the specific laws that apply in any given jurisdiction, we will work with the operator to understand and navigate these.

Is boiler life the same?

A longer life can be expected due to the reduced stresses, simple design, ease of repairs and the use of Porta treatment to control corrosion and scaling. The pressure system is isolated from the boiler structure and can be repaired independently without replacing the whole boiler.

What is the typical delivery time for a custom replacement boiler?

Approx. six to eight months from order placement (depending on shipping)

Payment terms?

50% on order placement, 50% on completion of build prior to shipping.

Are the boilers steam tested prior to delivery?

Yes, all boilers are load tested to maximum evaporation (full power) prior to delivery.

HISTORY FIT FOR THE FUTURE...