

A BRIEF NOTE ON THE PRACTICE OF PRE-COMBUSTION STAGE COAL WATERING AS APPLIED TO STEAM LOCOMOTIVES

The following brief technical note has been written by the present author when it was drawn to his attention that many present day railway administrations that are regular operators of coal fired steam locomotives do not wet the coal that is used as fuel prior to firing it, either mechanically or by hand, into the firebox and thus onto the firebed.

The pre-combustion stage of wetting, or more well known in railway terminology as “coal watering”, in the locomotives’ bunker or tender has a long tradition in footplate practice, over 150 years, and is carried out for a number of reasons. Unfortunately in present day practice this habit seems to have fallen by the wayside and it is not absolutely clear to the present writer why this has occurred. The person responsible for physically carrying out this duty on board the locomotive is the fireman, however (as with all footplate practices) the ultimate responsibility lies with the driver, hence if firemen are not applying the technique as part of their daily routine then it is most likely that the driver in charge has not been accustomed to such a practice during his firing days or does just not bother with its application.

For practical reasons, in order to maintain a minimum level of fine coal particles from being released into the immediate working area of the footplate, water is sprayed onto the coal that is stored in the locomotives bunker(s) or tender (also second/auxiliary tender if fitted). Fine particles that might be free to move around in the surrounding air generally create what amounts to a “dust charged” atmosphere and can be unpleasant in all aspects from breathing in these dust particles to having such jammed in ones eyes (the French practice of wearing footplate goggles is not to be forgotten, rarely seen in Britain as is the absence of footplate crews wearing gloves!). In South Africa the watering down of the coal in the tender or bunker is still a regular practice using the spray pipe (slacker pipe in British terminology) even though the footplate crews are generally ignorant of the other positive implications that this practice has upon the coal apart from just keeping footplate dust levels down and hence clean footplates and crew uniforms at the end of the day!

Apart from the practical reasons very briefly mentioned above, the pre-combustion watering stage of coal has a much more important aspect which is often misunderstood by locomotive design engineers, footplate inspectors, drivers, firemen and maintenance staff alike. Essentially the pre-combustion wetting stage of the coal “plugs” the porous sections of the coal lumps, whatever size the lump in question might be large Russian imported coal lumps such as the variety to be found in Britain at the moment or the relatively small 1/4” average coal lumps from Mine 5 (working face 71) and the new Mine 6 (under construction - working face 72) at Rio Turbio are equally affected. The plugging of the coal pores has a positive effect on the fuel being fired as it does away with the voids that are to be found within the coal lumps which in turn lead to a natural source of channeling within the fuel itself; the mechanical design of the grate sections themselves is carried out so as to avoid channeling between the fired particles on the firebed (Hulson type grate sections, pinhole type grate sections, V grinding anti clinker pinhole grate sections etc.) hence some form of mechanical control over the fuel itself being fired is of additional benefit to the design engineer in his work. The water also fills up the interstices between the particles themselves. Each particle in turn becomes a mini water – gas producer. Also a natural clogging action is produced that impedes the coal fines to be

entrained by turbulent gas currents in the firebox. This entrainment is not assisted by the mechanical stoker jets which is one very good reason for substituting the jets with a mechanical distributor such as the ELVIN stoker type. A greater degree of mechanical control over the fuel itself as well as the mechanical design of the firebox lead to complete and subsequent “clean” combustion (the golden rule of combustion – Time, Temperature, Turbulence should ALWAYS be applied!). As coal lumps are covered with what is akin to a greasy skin it is recommended to use some form of wetting agent when applying water to the pre-fired coal in order that the whole scheme is an effective one; note that these chemicals are very powerful (as for antifoams) and hence a very small quantity is required, in line injection should be used for such. A certain % of oil can be used as an alternative for this practice. At the design stage it is desirable to incorporate a semi automatic sprinkling/spray system to the bunker(s), tender or auxiliary tender. A supply system of this nature allows enough time for the water to work its way through the particle layers in the storage space, the nature of the layers themselves will be a result of the type of coal being used. For this reason, pre firing coal wetting should be carried out well in advance of the firing of coal itself.

Proportional feed of such combustion control water is desirable (for the same reasons as those used in conjunction with output proportionally controlled rocking grate systems such as the V grinding anti clinker grate sections) and the present writer is incorporating such a system into the design stages of the FC Rio Turbio - Puerto Natales “*Delta ASF 12X*” prototype locomotive.

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29th September 2006.