

Results of Effective Advanced Internal Boiler Water Treatment

Porta Treatment is related to the French system TIA. Table 1, which follows, gives a snapshot of the success achieved with that system on locomotives operating from the SNCF depot at Nice. It is important to remember that PT is a more thorough treatment than TIA and the BR Alfloc system referred to below and thus results in even lower levels of maintenance.

Engine N ^o .	Accumulated km under the TIA	Maintenance work	Man hours
141R1156	985,000	Replace a broken stay; replace a fissured large tube	10.9
	1,985,000	Replace 118 small tubes; replace 21 large tubes	Approx 300
141R1158	1,001,362	Replace a fissured small tube; replace two cracked	29.4
	2,015,000	Replace 79 small tubes; replace 22 large tubes; various welds on the tubes.	Approx 280
141R1159	985,231	Replace a cracked large tube; replace 7 stays because of eroded heads; repair of some cracks in the siphon.	Approx 20
	2,016,000	Replace 89 small tubes; replace 33 large tubes; tube welding on 39 small and 28 large tubes.	Approx 240
TOTALS:	8,987,593 (5,584,631 miles)		880.3 (approx)

Table 1: (above) The results of TIA applied to SNCF 141R types running from Nice depot.

From the above table it can be deduced the man hours per 1000km of running was just 0.1. For man hours per 1000 miles of running the figure is 0.16. Put either way the figures really speak for themselves.

Other pertinent statistics relating to TIA include:

- a) SNCF reduced boiler maintenance costs by 90%;
- b) One major workshop was closed , through lack of work, as a consequence of TIA use;
- c) Washouts on average only every 56 days, but in some cases 5 months was possible;
- d) Stay and tube leakage virtually unheard of;
- e) Almost zero incidence of stay breakage;

- f) “Considerable” coal savings, but no actual figures given;
- g) 35% increase of useful work from the average locomotive;
- h) One suburban Paris shed’s records showed the average time spent on boiler repairs per engine (between major overhauls) was reduced from 1350 hours to 210 hours;
- i) Up to 600,000 miles were achieved between major boiler repairs.

The use of the ICI/Alfloc system, which is not dissimilar to TIA, on parts of British Railways also achieved good results. In one of the worst of areas for water quality in the country (Annesley) full retubing was undertaken after just twelve months and maintenance was described as more or less constant prior to the treatment regime starting. The results were impressive. Routine maintenance was virtually eradicated and the very short life expectancy of (copper) inner fireboxes was increased to the norm for elsewhere.

Figures on the success of the treatment regime at FCAF should be available on the completion of test reports covering the work carried out on FCAF N^o2 and 3. However at the time of writing (2005):

- a) FCAF N^o2 has not had to have any boiler maintenance *whatsoever* since 2001, when the current boiler was fitted. This includes the periods of maintenance, such as over the winter of 2003, when a large amount of mechanical work was undertaken;
- b) FCAF N^o3, the boiler of which suffered very badly during the 1995-1999 period of running with no boiler treatment or correct maintenance procedures, has been trouble free since 2000;
- c) Since October 2000 neither FCAF N^o2 or N^o3 have not lost a day in service or failed due to boiler problems;
- d) Washouts at a minimum of 6 monthly intervals with 209 days *in steam* the current maximum achieved. However this washout only occurred as it was scheduled, not because it was required;
- e) Blowdown have been reduced to no more than a couple every six months. In each case ¼ of the water showing in the gauge glass was extracted via the blowdown valve. All blowdowns are undertaken on shed. Blowdowns when running are prohibited;
- f) All water tanks are scale free through the action of the treatment, not manual cleaning;
- g) All water tanks are virtually corrosion free, remaining corrosion dates from before the treatment was implemented. There is no new corrosion.

Detailed analysis of the successes in Argentina, on FCGB, when the treatment was applied following the development on FCGB N^o1802, are not available at this time. However evidence, from several sources, indicates the treatment performed as expected and in fact enabled FCGB to continue to use steam traction for longer than it would have been able to do with the treatment regime in use prior to PT. It can be stated that:

- a) Washouts occurred at a minimum of 6 monthly intervals;
- b) Bi-annual retubing suspended as it was no longer necessary;
- c) Boiler maintenance, of a day to day nature, “disappeared from the map”;

- d) Boiler condition ceased to be the reason for locos requiring central workshop attention;
- e) Spare boilers were disposed of;
- f) No blowdowns were scheduled (thanks to the use of continuous blowdown);
- g) Full rated evaporation from the boilers (especially important on routes with more or less continuous 1 in 40 gradients for several hundred kilometres, such as route C14 from Salta to Socompa) was always available. Recorded steaming rates were 100 to 140 kg/m².

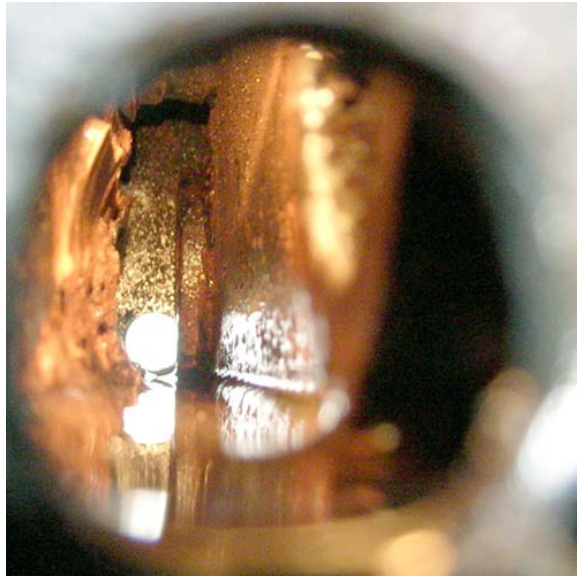
In South Africa, on both the 3'6" and 2' gauge locos, the results were compromised by inflexible operating procedures. Washouts were fixed at 25 days in steam (9). This meant the full boiler chemistry was never able to develop. However within the restrictions it was operating PT was very successful with results being as good as they could be within the environment. Extremely clean, scale and mud free, boilers resulted coupled to minimal maintenance requirements.

Account must also be taken of the savings to be made from not having to blowdown regularly in terms of water (especially where it is paid for by volume consumed) and fuel used to boil the water which is then blown out of the boiler without having done any revenue earning work. It is also one less job to worry about.

Locomotives using PT will have higher availability. The boiler conditions will mean stopping for a washout every thirty or so days can be eliminated, where regulations allow, leading to far fewer days being lost to routine maintenance. This also has the advantage of freeing scarce staff for more productive tasks. Even where washouts are required by regulation they do become little more than a formality and if hot washouts are conducted, as is recommended, time out of service can be kept to the absolute minimum.



Scale washed out of FCAF N^o.3. The scale shown was all removed by chemical action. No mechanical action was required. © M.Bane



A view at foundation ring level of KLR 0-6-4st 'Badger' at its first washout following the introduction of PT. Note how, whilst some old scale is still present, many sections are totally clear of scale. Some corrosion is visible which predates the PT application. Over time this corrosion will be stopped and a layer of magnetite will form over the surface. © I.Screeton



An internal view of FCAF N^o 2's boiler in October 2004. The grey colour indicates a covering of magnetite with no sign of corrosion or scaling. This boiler has been treated from its very first steaming¹. The red dots visible are paint splashes from the then recent repainting of the boiler cladding. © M.Bane

¹ This boiler was ready for use approximately 2½ months before the locomotive was ready to run. During the intervening period the boiler was full of treated water thus giving the system a very useful head start. This procedure is recommended for all boilers.



This photo shows the water side of a washout plugs removed from Kirklees Light Railway 0-6-4st 'Badger' after approximately the first 40 days in steam on Porta Treatment. Note how this steel plug has already acquired a protective coating of magnetite. This plug will see no more corrosion on the water side. The same is true for any other water side component with a covering of magnetite. © I. Screeton

It should also be noted, and the author feels this point cannot be emphasised strongly enough, that lineside treatment plants, such as reverse osmosis equipment, are ineffective in locomotive use and thus a total waste of money. Porta makes the point that TIA enabled boiler shops in France to be closed for lack of work. However an expensive and extensive installation of lineside treatment plants in Argentina (many years prior to the development of PT) on the Buenos Aires Great Southern Railway (later the Ferrocarril Nacional General Roca) had no such effect. Heavy boiler maintenance basically continued as it always had done despite the investment (32). This fact has been acknowledged for many years as was shown in 1949:

“It was demonstrated that the result aimed at, could not be obtained by the previous demineralisation of the water, either by the processes of the lime-soda type or by zeolites, for either the anti-scaling action was not sufficient, or corrossions appeared. It has been demonstrated in every instance that it is necessary to add various products to the boiler water.”