

New Zealand Army SQ&EA Report.

Coolant PulseFlush FL100 Test Results.

Over the week of 22nd to 26th November 2004, SQ&EA conducted investigative engine cooling system **Pulse Flushing** of the New Zealand Army's fleet equipment using the FL100 PulseFlush Machine supplied by Professional Coolant Services Ltd.

The aim of the testing was to ascertain:

1. The current state of some new key equipment.
2. The current state of some "well used" equipment in service.
3. Any benefit of flushing to either of the above.

NZ Army vehicle, **M 113 APC (powered by a 6v53 Detroit diesel)**, was power flushed to demonstrate the FL100 PulseFlush Machine's ability to do this type of engine in this type of vehicle and to thoroughly internally clean the engine. It was achieved with ease.

Next we moved to servicing Army Generators. These provided a useful opportunity to test before flushing and after flushing temperature differences, as they can be loaded in a controlled and easily measured way.

The mode of testing was to run up each generator till warm, run on 80% load until at full continuous operating temperature, measure "before" temperatures at fixed locations on the engine block, cylinder head and exhaust manifold. Then allow engine to run down and cool, remove thermostat and PulseFlush, replace thermostat (with original one) replace coolant, run up again under 80% load until fully up to temperature and measure the "after" temperatures in the same location as before. (Temperatures were measured externally with Infrared Digital equipment.)

| RESULTS: | Before | After | Temperature Reduction |
|----------|--------|-------|-----------------------|
|----------|--------|-------|-----------------------|

15KVA

| | | | |
|------------------------------|-----|-----|----------|
| Block Temperature | 77 | 70 | 7 (10%) |
| Head Temperature | 81 | 70 | 11 (14%) |
| Exhaust Manifold Temperature | 318 | 310 | 8 (3%) |

30 KVA

| | | | |
|------------------------------|-----|-----|----------|
| Block Temperature | 96 | 86 | 10 (10%) |
| Head Temperature | 92 | 83 | 9 (10%) |
| Exhaust Manifold Temperature | 300 | 278 | 22 (7%) |

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As was discovered, the simple act of a cooling system FL100 PulseFlush, (the only required service parts being a new thermostat gasket and the addition of new coolant), gave a substantial reduction in the running temperature. This is due to cooling system contamination having high thermal coefficients (that is, it does not conduct heat readily) thus raising the internal running temperature until the amount of heat produced equals the amount being dissipated by the cooling system. This is a concern as raising the ambient temperature can push engines into an overheat situation that cannot be readily rectified on site. Radiator replacement does not remove contamination within the head and block.

We then moved onto the third phase of the trials, the flushing of the newly delivered **LAV 111 powerpacs (CAT 350 hp)**, these have been manufactured and stored in Canada prior to delivery to New Zealand.

This was quite an eye-opener to all involved. A large amount of rust, scale and sand was extracted from the sample power pack which prompted the project engineer (WO 1 K. Gardiner) to request that we flush the other five packs in storage where we found similar amounts of sand, rust and scale in every one.

This is of concern as this type of contamination in cooling systems can cause localised overheating, hots-pots and component failure, thus grounding an expensive asset.

To summarize the FL100 PulseFlush Machine, it is a most useful item of maintenance equipment with a broad spectrum of use. I have not located an item of Army equipment that we have not been able to power flush with the FL100 Machine and with wide-ranging benefits to Army equipment as a whole.

It has been demonstrated that the FL100 Machine can be used in:

1. Preventative maintenance at the start of the equipments service life.
2. Restorative maintenance for equipment that hasn't had the required amount of maintenance over its service life.
3. Routine maintenance service during the equipments life of service.

The time requirement, approximately one to two hours the FL100 PulseFlush process takes, the ease of operation and no chemicals used, means there is no down-side to introducing into service this item of engine maintenance equipment.

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Note: The New Zealand Army mechanical service workshops are equipped with FL100 PulseFlush machines, servicing all motorised equipment every two years, on a routine Preventative Maintenance schedule.

Arte et Marte

