LONDON SOUTH BANK UNIVERSITY

Electronic Radiator Valve Battery Performance Testing

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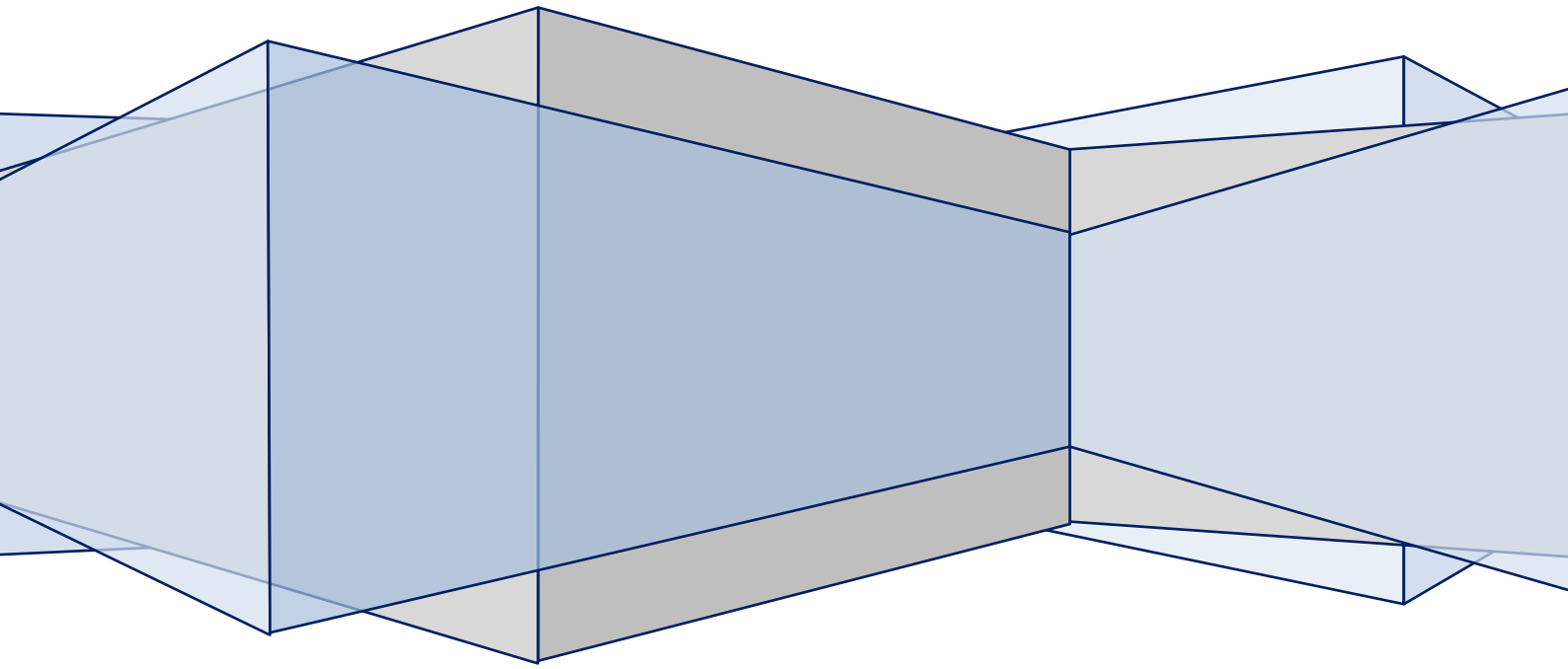
Test Conducted for – Chalmor Ltd
Test Conducted on – 6th December 2010



1.0 Objective

To test long term performances of parts and battery life expectancy of eTRV under normal expected load conditions.

2.0 Method

A test rig, software scheduler and data logger will be set up to control, monitor, and record the complete life duration of standard AA batteries used by eTRV. The rig will be set up to motor the eTRV valve continuous until the batteries are fully drained as to not have the power to drive the eTRV gears any longer resulting in eTRV failing in the open condition and displaying the “dead battery” LED feedback signal.

3.0 Rig Set Up

The test rig consisted of four eTRV’s mounted to four identical valve bodies (to provide 'real life' loads). The eTRV’s were controlled to fully stem open and close, using an active infra red software scheduler. The valves were arranged to activate a micro switch once per cycle and a counter would tally the number of full travel cycles. An example of a single mounted test station is shown on in fig 3.0.

Fig 3.0: Single test work station

3.1 Software - Supplied

Scheduler software automatically fully cycled the eTRV’s once every 5 mins (2.5 mins stem up and 2.5 mins stem down). A log of the “events” was automatically recorded providing the amount of “events” that the software had transmitted. This data was then compared with the switch counters (see below). This was used to determine correct operation and show whether an eTRV “ran slow” or missed a cycle e.g. due to increased time taken for the stem to down (possibly caused by added resistance of the lubricants or drained battery).

3.2 Temperature Control

PTC heaters were attached to the valve bodies to determine real life effect of heat on the plastics parts and lubricant used in assembly. Specified temperatures of the PTC heaters were set to the average radiator flow pipe temperatures seen in most domestic and commercial buildings (approx 60°C).

3.3 Switch Counters

Event counters were attached to a micro switch to increment once per cycle and a counter tallied the number of cycles. This would be used to compare the number of "events" recorded against the scheduler. This data was then compared with the scheduler software log

3.4 Batteries

All batteries were new AA Alkaline *Duracell Procell* as supplied with all eTRV's. Measurements of batteries were taken prior to installation.

3.5 Valve Bodies

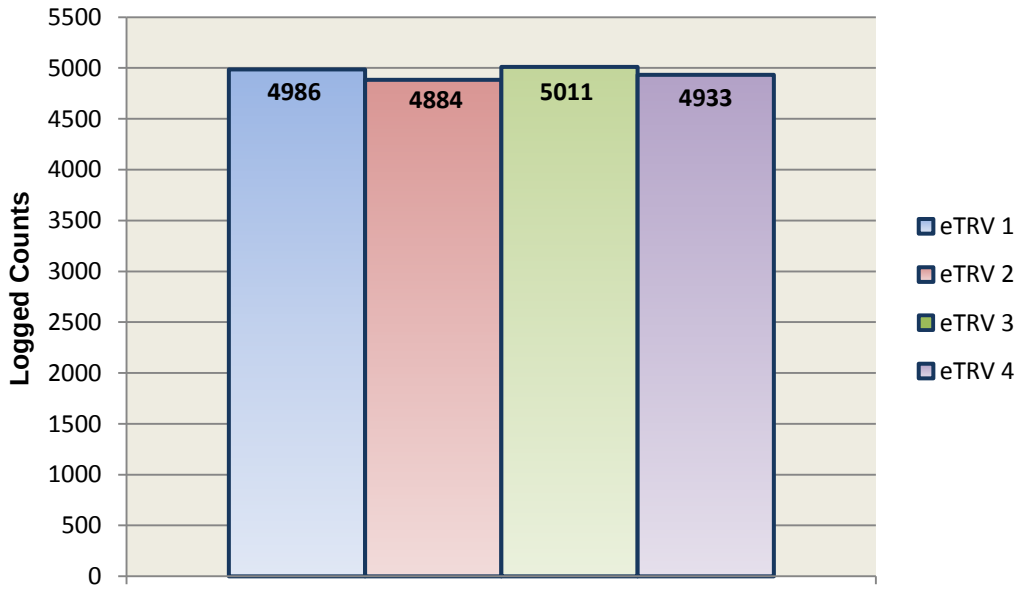
All valve bodies were Ø30mm and identical from the same manufacturer.

3.6 Logging Equipment

A mini T-Mac was used as an extra means to collect and view data in real time. The switch counters were hardwired to the T-Mac using volt free relays including logged temperatures sensors attached to the pipes.

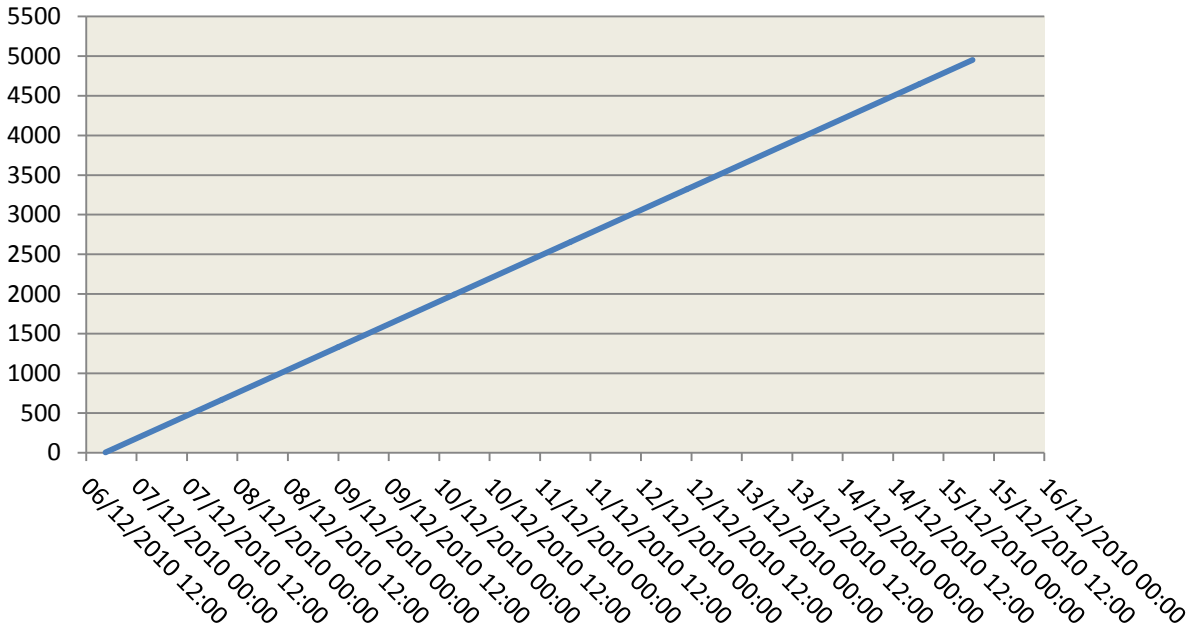
4.0 Results

Results for the four eTRVs run during the test are shown below in graph 4.0.



Graph 4.0: Complete travels made before power loss

The average result of 4953 is plotted below.



Graph 4.1: Logged False Count (Average Complete Travels)

4.1 Calculating expected battery life

The expected life of a single pair of batteries is calculated using the average complete travel achieved (4953) against a typical eTRV use of 3 program changes a day (6 complete up and down movements a day).

eTRV motoring during just the heating season (240 days per year)

4953 travels / 3 complete travels a day = 1651

1651 travels / 240 days = 6.9 years

Halving result allowing for battery drain over time = 6.9 / 2 = **3.5 years**

eTRV motoring year

4953 travels / 3 complete travels a day = 1651

1651 travels / 365 days (heating season) = 4.5 years

Allowing for battery drain = 4.5 / 2 = **2.25 years**