Temperature Testing Ultra-mini Coil

1. Overview

The CWT Ultra-mini coils have been designed for use over a wide operating temperature range from -40 to 125^{o}C. This document provides details for the test schedule used to validate the operating temperature range and to determine the temperature coefficient of the Ultra-mini coil.

2. Test Set-up

The equipment used throughout the duration of the temperature testing is shown in Figure 1.

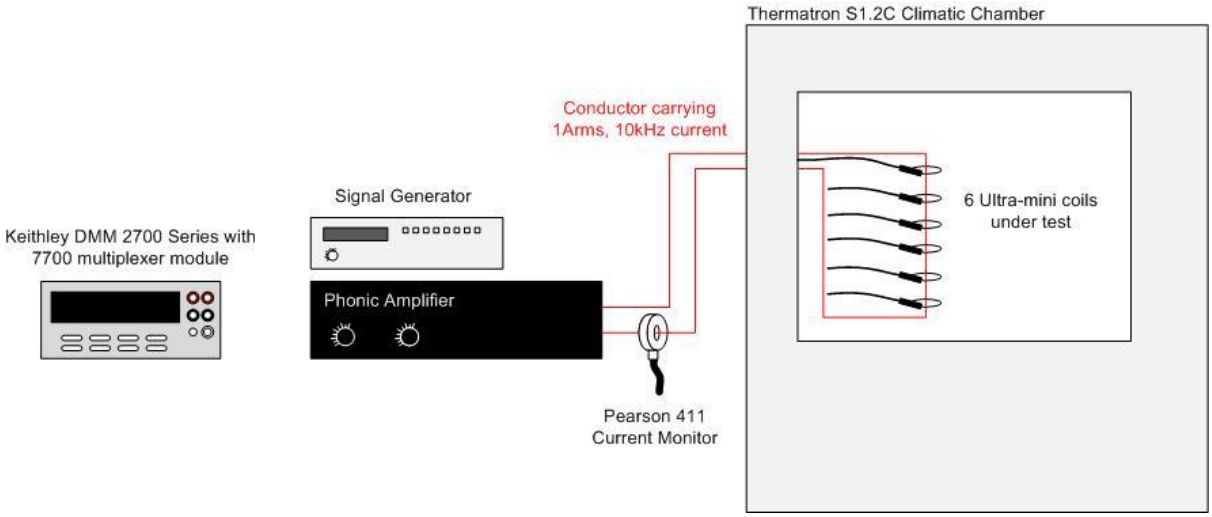

Figure 1. Test equipment

A signal generator and phonic amplifier are used to generate a 1Arms, 10kHz sinusoidal current. A Pearson 411 current monitor is used to set the amplitude and frequency of the excitation current and is used as a reference measurement throughout the testing. The same current is also monitored by the Ultra-mini coils within the climatic chamber.

A maximum of six Ultra-mini coils are positioned in the environmental chamber during each test. Three thermistors are placed between the coils to provide a reliable measurement of the ambient temperature. The position of the Ultra-mini coils, the excitation current loop and the thermistors within the climatic chamber are shown in Figure 2..

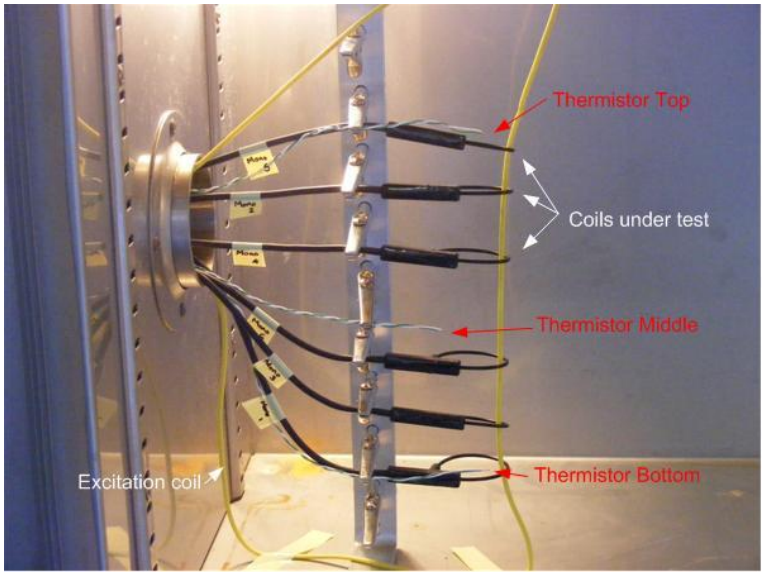

Figure 2. Position of excitation coil, coils under test and thermistors

Each Ultra-mini coil is connected to an active integrator (positioned outside the environmental chamber) to give a sensitivity of approximately 600mV/A at 10kHz.

The output of the Pearson current monitor, the three thermistors and the output of all six integrators are recorded at 30 second intervals using the DMM and multiplexer module shown in Figure 1.

The thermal profile of the temperature chamber is shown in Figure 3. The profile allows for a 30 minute settling period at 125, 20 and -40^{o}C and a ramp of 2^{o}C/minute for each transient. The program consists of 15 complete cycles from 125 to -40^{o}C. The duration of each complete test of six coils is just under 75 hours.

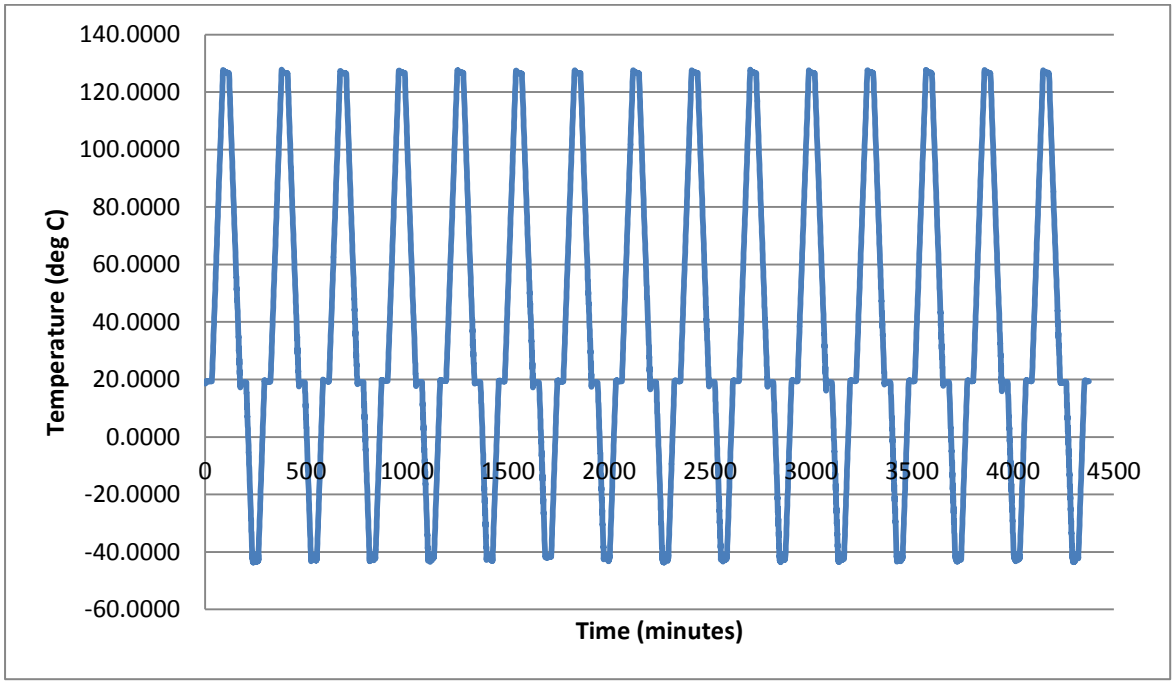

Figure 3. Thermal profile of the temperature chamber

3. Results

Figure 4. plots the change in sensitivity over each of the 15 cycles for a total of 18 coils. A trendline shows the typical temperature coefficient of each coil. The results are normalised to the coil sensitivity recorded at 20°C

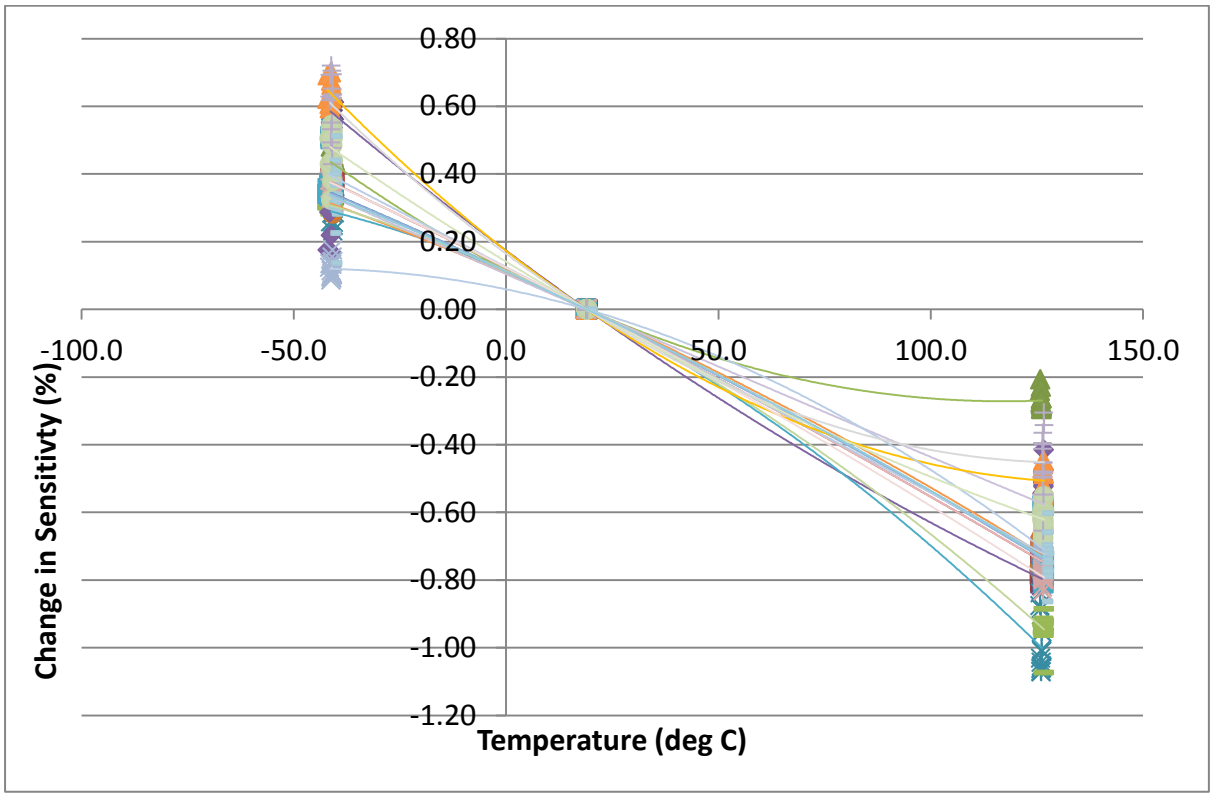

Figure 4. Results of 18 coils each tested for 15 cycles

4. Conclusion

Over the duration of the temperature testing 18 coils have been subjected to a total of 330 temperature cycles (-40 to 125°C) and 1700 hours of testing without failure.

It is known from this, and previous testing, that a change in the operating temperature will cause an expansion and contraction of the plastic material within the coil. The expansion occurs along the central axis of the coil winding and results in a change in the coil sensitivity which is inversely proportional the change in temperature.

From the results in section 3 it is possible to obtain the following typical and maximum temperature coefficients for the Ultra-mini coil over the operating temperature range -40 to 125°C:

Typical	67	ppm/°C
Maximum	100	ppm/°C

Assuming the maximum temperature coefficient for the coil; the maximum variation in sensitivity over the full operating temperature range is only 1.65% of reading.