

Handheld CML Saturation Measurement

Introduction

For rehabilitation of cast iron (CICL) pipes with cement mortar liners (CML), installing polyurethane or polyurea spray liners will increase the longevity of the pipe life. However, when installing a spray liner blistering may occur. Blistering of the spray liner can be caused by a dry CML, when the spray is applied at a higher temperature than the CML, where air in the CML expands and tries to escape through the spray liner. To reduce spray liner blistering, the CML should be saturated, but touch dry (reducing air trapped in the CML). Currently there are no standard methods of measuring the saturation of a CML. Research by Monash University using a handheld RMS multimeter on CML samples for saturation were examined. The following document gives an indication of measuring saturation in a cement mortar liner (CML) for a cast iron cement lined (CICL) pipe.

Method

Using a handheld RMS multimeter (Figure 1), set the reading tab to resistance/ohms (Ω). The dial should be set to Mega ohms. Make sure the multimeter is good quality such that the resistance readings do not fluctuate highly. Check the reading of the multimeter by touching the red and black test probe together. The reading should be close to 0 Ω .

Check if the cast iron is in good condition (no large graphite patches) by touching the red and black test probe to the cast iron about 10 mm apart. The reading should be close to 0 Ω . If the reading is in k Ω or M Ω the graphite will have to be sanded, brushed or grit-blasted off.

The red and black test probes can also be placed in water about 10 mm apart. The reading should be close to 100 k Ω . If the reading is in M Ω the water is not similar to tap water. If the reading is in Ω the water can be used.

Place one probe (red) on the dry concrete sample and the second probe (black) on the cast iron (non-graphitised section) directly opposite the other red probe. The reading should be infinite resistance ("OL"), see Figure 1, which means the resistance is greater than

the meter can measure (Fluke manual). Once the CICL sample has been placed in water, try the measurement again. This time there should be a reading if there is a closed circuit (some part of the liner is saturated).



Figure 1. Image of Fluke handheld resistance multimeter and dry CML sample

Take at least three readings around the axis of the pipe sample. If the liner is saturated all values should be less than 0.8 M Ω (Figure 2). Note: Further testing is required for exact numbers to compare with saturation. Any reading above 1M Ω indicates the sample is not yet saturated.

Secondary readings can also be taken on the surface of the cement liner. Take readings with the two test probes about 10 mm apart. If the reading is <0.7M Ω move one of the probes further away (say 25 mm) and take a reading. The reading should still be <0.8M Ω . Keep moving the test probes further from each other. If the readings stay close to or below the maximum value, this indicates that the CML is close to saturated. This should be now be the time that the pipe sample is spray lined.

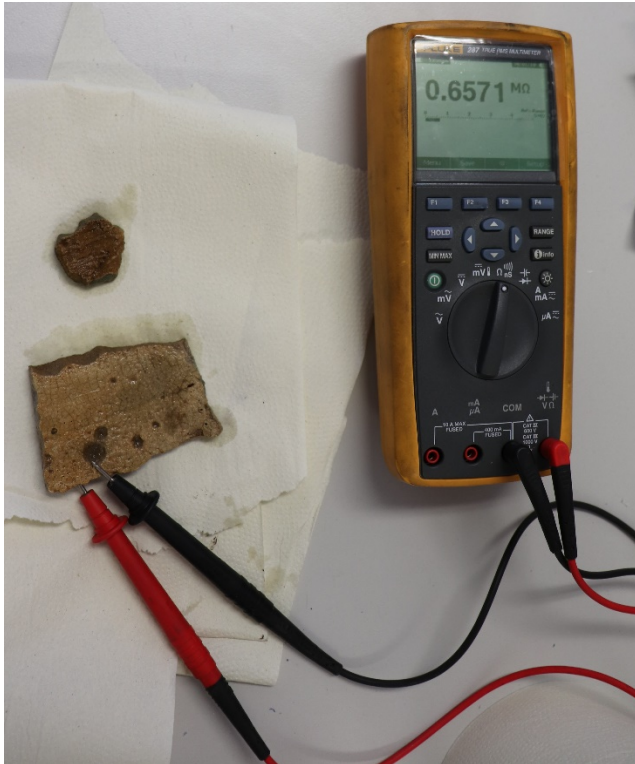


Figure 2. Image of Fluke handheld resistance multimeter and saturated CML sample

Please note that the CML can easily dry out if not saturated under water. If lining has been delayed, the CML should be tested again for saturation.



Figure 3. Image of Fluke handheld resistance multimeter and saturated CLCL pipe

Things that can affect the liner saturation

CML composition – smaller particles in the CML can reduce the permeability leading to slower saturation times.

In situ vs. factory lined – the CML installation method can influence the saturation times.

Cement leaching – Cement leaching can lead to faster permeability.

Age of CML – an older CML could experience higher level of leaching.

References

Fluke multimeter manual

