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Summary

In April 2012 ERA carried out a series of tests for British Power International as part of a contract BPI had with the Electricity and Water Authority in the Kingdom of Bahrain relating to the evaluation of manufacturers of LV cables.

Following the issue of the complete ERA reports National Cable Industry, NCI, asked ERA to provide further details of the OIT test that was carried out.

This report gives the full results of oxidative induction time, OIT, tests carried out on XLPE two samples of cable from NCI.

The results of the OIT tests have shown that the XLPE insulation tested has good thermooxidative stability properties.

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Contents

Figures List

Page No.

1. Introduction

In April 2012 ERA carried out a series of tests for British Power International as part of a contract BPI had with the Electricity and Water Authority in the Kingdom of Bahrain relating to the evaluation of manufacturers of LV cables.

Following the issue of the complete ERA reports National Cable Industry, NCI, asked ERA to provide further details of the OIT test that was carried out.

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2. Test samples and method

The cable samples were a 240 mm², 4-core, XLPE insulated, armoured, PVC sheathed cable and a 25 mm², 4-core, XLPE insulated armoured, PVC sheathed cable. The tests were carried out on samples of insulation from all cores of both cables.

The OIT test is not called up in the cable standards for XLPE insulation. However the OIT test is an internationally recognized means of characterising the thermooxidative stability of polyolefins such as polyethylene. The test method is described in various standards such as ASTM D3895 and ISO 11357-6. From past experience ERA considers this a useful test to give an indication to the likely longer term performance of the XLPE insulation. All polymeric cable insulation ages over time. One factor that affects the ageing performance is the rate of oxidative degradation of the polymer. XLPE insulation material contains additives that are intended to reduce the rate of oxidative ageing of the polymer. The OIT test gives an indication of the effectiveness of these additives. For this test ERA follows the general procedure described in ISO 11357-6 with the sample heated to 180 °C. In this procedure a differential scanning calorimeter, DSC, is used to conduct the tests. To carry out the test a sample of the insulation is heated in a nitrogen atmosphere. When the temperature has stabilised the atmosphere is switched to oxygen and the sample is maintained at a constant temperature. The test is continued for a time of at least 30 minutes or until the sample shows evidence of oxidative degradation. The on-set of degradation is indicated by an exothermal reaction that is the trace from the DSC drops rapidly. The time, after switching to an oxygen atmosphere, taken for the sample to show signs of degradation is the oxidation induction time. For the test conditions used by ERA a time of less than 10 minutes is considered as 'poor', 10 to 20 minutes as 'marginal' and greater than 25 minutes 'good'.

3. Results

In all of the tests the trace from the DSC remained horizontal for the full period after introduction of oxygen. All of the OIT tests gave times of greater than 30 minutes. This falls into the category 'good'. The OIT traces for each sample are given in Figures 1 to 8.

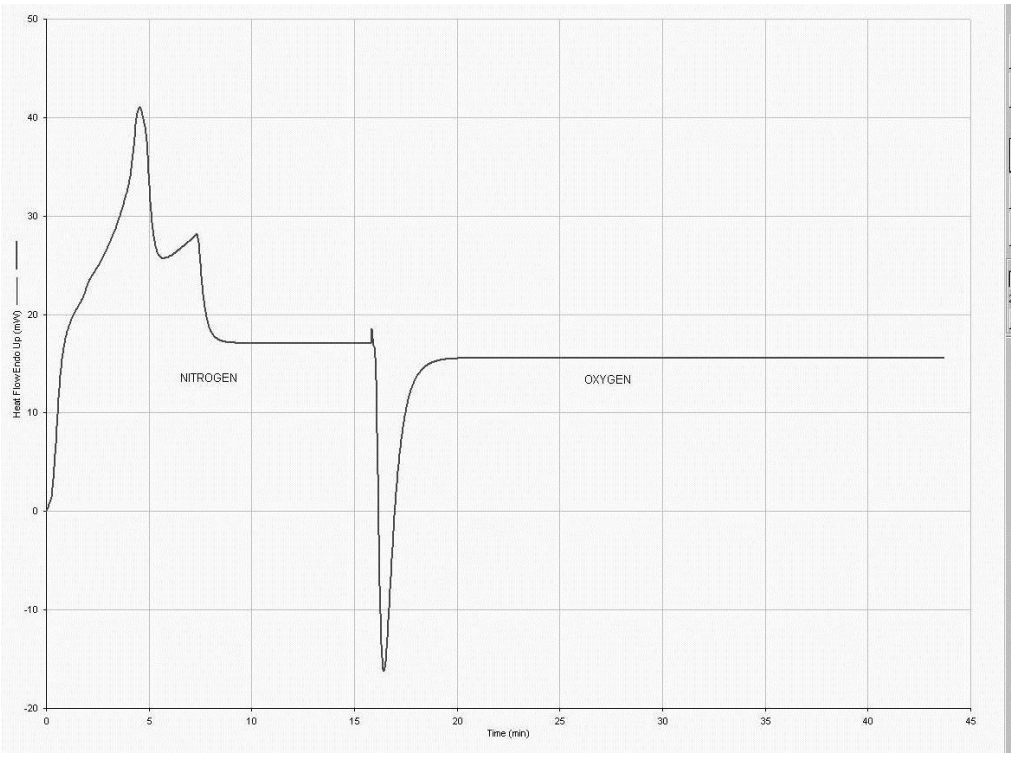

Figure 1 OIT trace – 25mm² - red core

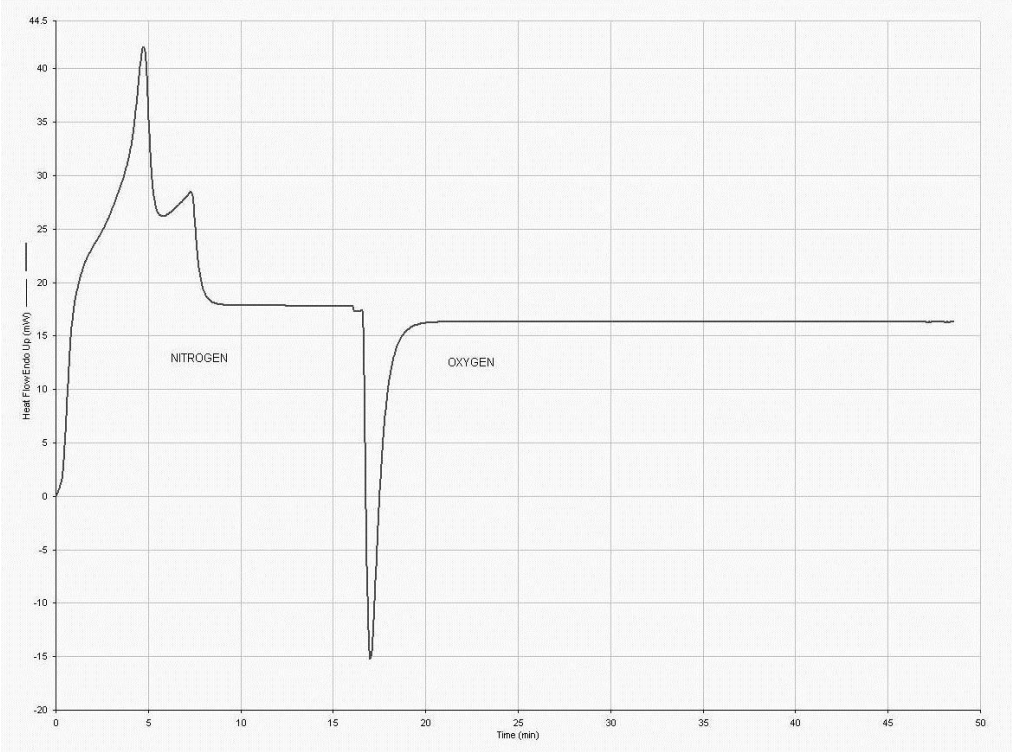

Figure 2 OIT trace – 25mm² - blue core

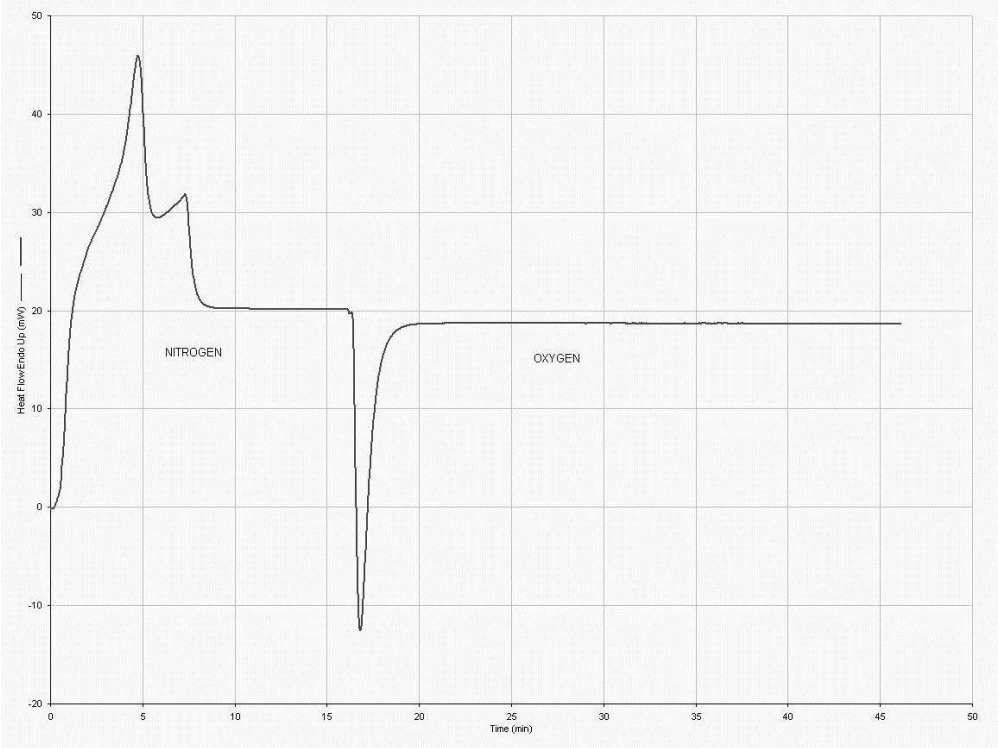

Figure 3 OIT trace – 25mm² - yellow core

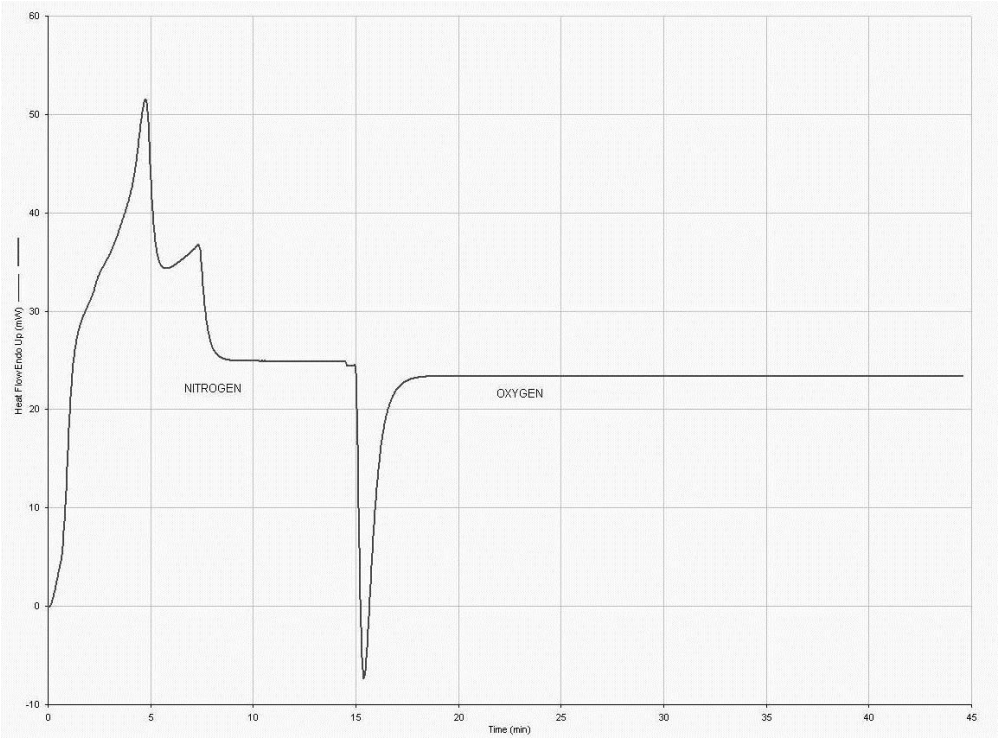

Figure 4 OIT trace – 25mm² - black core

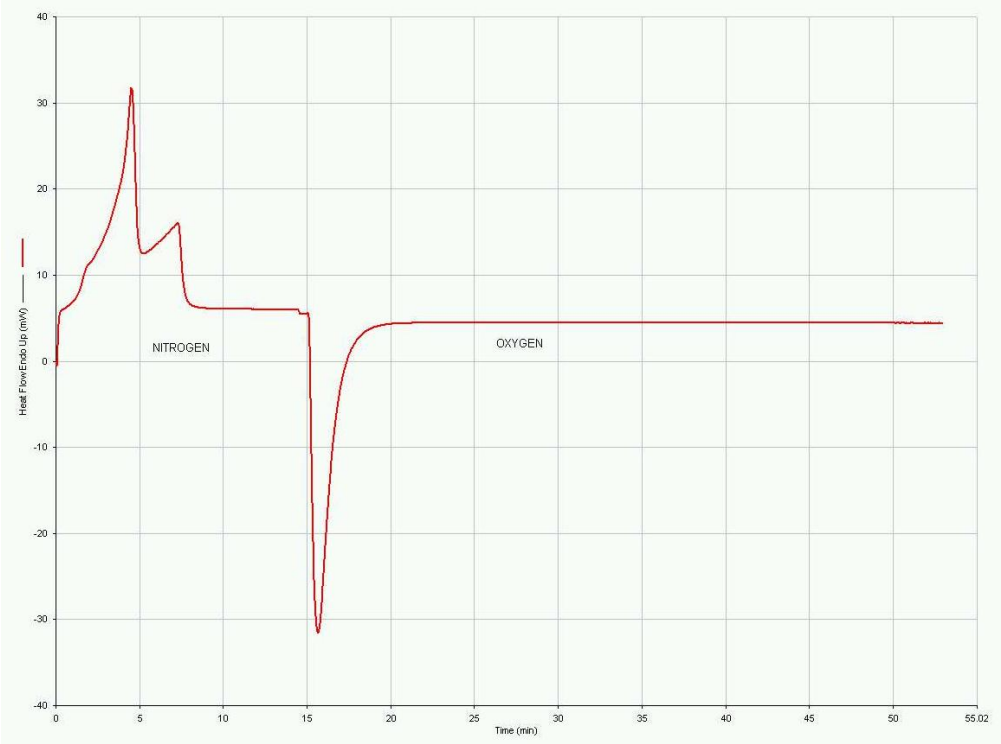

Figure 5 OIT trace – 240mm² - red core

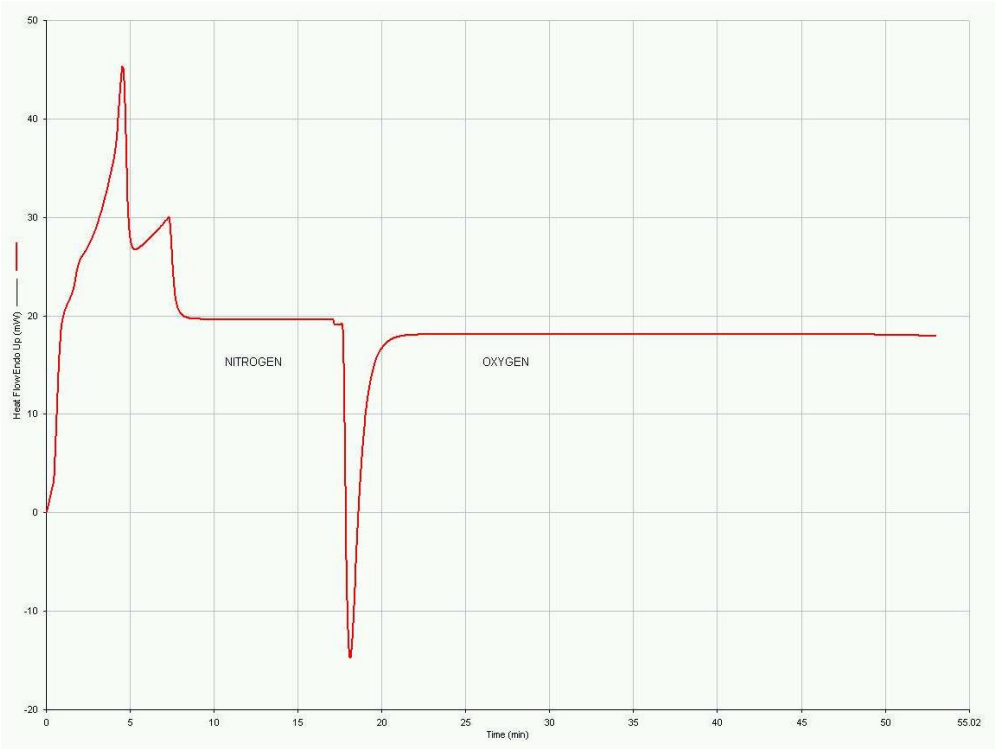

Figure 6 OIT trace – 240mm² - blue core

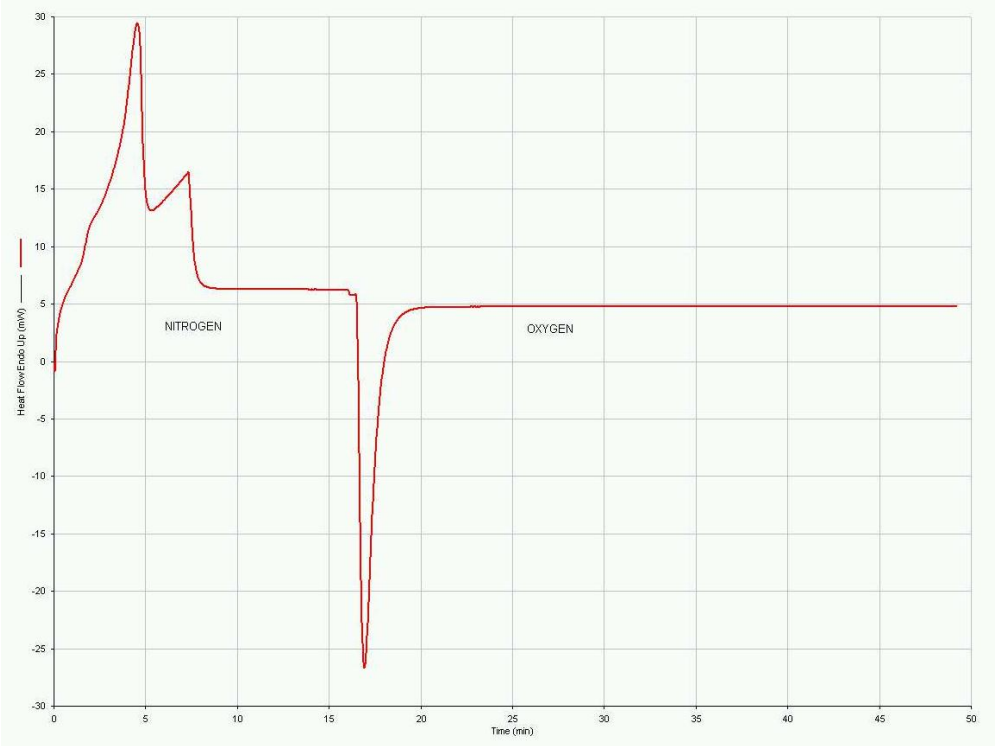

Figure 7 OIT trace – 240mm² - yellow core

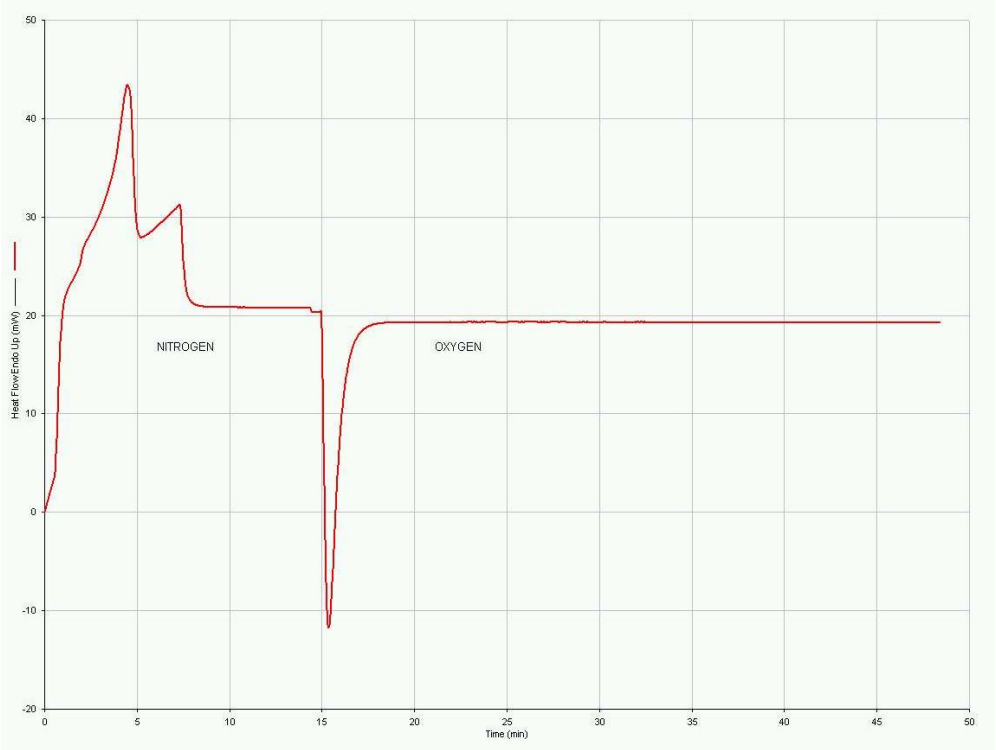

Figure 8 OIT trace – 240mm² - black core

4. Conclusions

The results of the OIT tests have shown that the XLPE insulation tested has good thermooxidative stability properties.

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