

**Instructions for an  
Intercomparison of the  
Surface Insulation  
Resistance (SIR)  
Technique**

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Approved on behalf of Managing Director, NPL, by Dr C Lea,  
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# **Instructions for an Intercomparison of the Surface Insulation Resistance (SIR) Technique**

by

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## **ABSTRACT**

As part of the NPL programme to develop the SIR test we are proposing to carry out an interlaboratory comparison. The test procedure is given in this report, and the results will form part of the validation on the SIR technique.

## 1 INTRODUCTION

The SIR test is enjoying increased popularity as a tool to establish circuit reliability in terms of cleanliness. The test however is complex and requires careful control of a number of variables. The work at NPL<sup>(1,2)</sup> has highlighted the issues in selecting the correct temperature and humidity for the testing with different flux chemistries. To verify these measurements and demonstrate that the SIR technique is robust an intercomparison has been planned, the instructions for which are contained within this report. Issues that have been considered in planning the intercomparison include the flux chemistry, the PCB finish, the flux loading, test temperature and humidity, the test voltage, and the test duration. These issues and other handling issues are detailed below.

## 2 SUPPLIED EQUIPMENT

The participants in the intercomparison will be supplied with a printed circuit board (PCB), as shown in Figure 1.

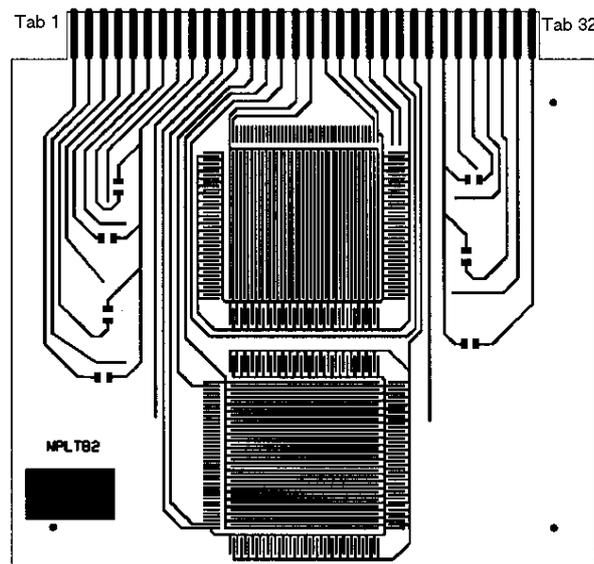


Figure 1: Test Board For SIR Measurement.

The PCB contains two SIR patterns that have been fluxed and are ready for SIR testing. The connections from the SIR patterns come out on the tabs listed in Table 1.

Table 1: Tab connections to PCB

	SIR 1 Signal	SIR 2 Signal	Bias volts)	(50 Earth (screen)
Tabs	16	14	11, 19	10, 12, 13, 15, 17, 18, 20, 21, 23

The boards will have been pre-cleaned in an Ionograph to ensure their cleanliness. The boards will be fluxed with 100 $\mu$ l of a polyethylene glycol (PEG) flux onto each SIR pattern.

The PEG flux, was made up with 1.6g/litre in IPA with PEG 400. The boards will be preheated to 60°C and the flux carefully dispensed onto the boards to keep the flux within the SIR pattern.

Please do not handle the boards with bare hands and either use the supplied connector or carefully solder onto the tabs on the board if you prefer. If soldering please protect the board with aluminium foil during soldering and use a low residue flux cored solder wire.

Three fluxed PCBs have been supplied and one clean board as a control. The fluxed boards are marked with a "F" and the clean board with a "C" on the back side.

### **3 PROCEDURE**

Carefully mount the four PCBs vertically in the chamber and connect the wiring loom from the boards to the outside measuring chamber.

A single test voltage of 50V should be used throughout the entire experiment. If you have an automatic monitoring system, start the monitoring at room temperature, and use a 20 minute cycle time. If using a manual system, Table 2 is provided for recording the data. To complete Table 2 the SIR values must be recorded at room temperature, then again at temperature, again when the required humidity is attained just at the start of the test, 1 hour later and then 24 and 48 hours after the test. Reduce the humidity and then the temperature and take a final reading a room temperature.

The test conditions should be 85°C and 85%RH. The temperature should be ramped up first followed by the humidity. The humidity should be brought up slow enough to avoid condensation on the board. This may be best achieved by bringing the humidity up to 80%RH, with a small hold and then a further increase to 85%RH. The temperature and humidity of the chamber should be checked with calibrated instruments.

### **4 RECORDING RESULTS**

For continuously monitored data please provide a spreadsheet of the resistance values for the 8 SIR patterns along with the time values. If using a manual method please a similar format to that shown in Table 2.

Table 2: Report of Manual SIR Readings

	Clean Boards		Fluxed Boards					
	SIR1	SIR2	SIR3	SIR4	SIR5	SIR6	SIR7	SIR8
Room Temp								
At Temp								
At Temp & Humidity								
1 hour after temp & humidity achieved								
24 hour after temp & humidity achieved								
48 hour after temp & humidity achieved								
Room Temp								

## ACKNOWLEDGEMENTS

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## REFERENCES

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- (2) L.Zou and C.P.Hunt., NPL Report CMMT(A)120, 1998