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Signalling Equipment Technical Advice Notice (SIGTAN051) (formerly RT/E/C/19051)

This temporary front sheet facilitates change to the new Network Rail Standards referencing nomenclature.

The Ref above will be formally allocated to this standard when it is next changed in the meantime the contents, date and issue number of this Network Rail Standard are UNCHANGED and with immediate effect it should be referred to as "(new ref) formerly (old ref)".

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Railtrack Company Code of Practice

Signalling Equipment Technical Advice Notice (SIGTAN051)

GEC FDM
Reed Equipment

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ISSUE RECORD

ISSUE	DATE	COMMENTS
1	Dec 2002	Original Issue

IMPLEMENTATION

This code of practice highlights issues arising from operational experience, concerning the installation and maintenance of signalling equipment. Where appropriate, it gives current best practice for mitigating risk and is for implementation from Dec 2002. Alternative practices may be accepted where they can be demonstrated to be as good or better than the contents of this document.

COMPLIANCE

This Code of Practice is manadatory on Railtrack and compliance is required by March 2003.

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1 Purpose

The aim of this Code of Practice is to describe the nature of certain in-service problems that have arisen with GEC Reed equipment, the symptoms manifested, show how they can be avoided and where possible, what remedial action can be taken if these problems are experienced.

This document also describes best practice for jointing the transmission line cable used on Reed systems.

2 Scope

This Code of Practice applies to GEC Reed equipment used to remotely control signalling functions, e.g. points and signals and indicators.

The following topics are dealt with in this Code of Practice:

- the signs and symptoms of multiple channel signal oscillation (generally referred to as the "woodpecker effect");
- preventative and corrective measures that can be taken to reduce the risk of woodpecker effect occurring;
- the signs and symptoms of self-oscillation on receiver amplifiers;
- corrective action that should taken if self oscillation of a receiver amplifier is suspected;
- degraded power supply capacitors on Type R systems. The possible symptoms exhibited and what corrective action should taken;
- effective cable jointing techniques for jointing Reed FDM cables, used on control and indication circuits, particularly solid core 1/0.85mm conductors intended to avoid the need for slip-links.

This Code of Practice does not provide any guidance in relation to the general personnel or system safety measures necessary for working on the track with signalling equipment.

3 Abbreviations

DMM	Digital Multimeter
FDM	Frequency Division Multiplex
PCB	Polychlorinated Biphenyls

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4 The Woodpecker Effect

In order to understand what causes the woodpecker effect it is first of all necessary to re-cap the principles of operation for the GEC Reed system.

The GEC Reed system is an FDM system that enables the transmission of multiple control signals over a single pair cable where each frequency or channel is assigned to a particular signalling function. The Reed channels span a frequency range from, nominally, 400 to 900Hz and each channel has a bandwidth of approximately 1Hz.

Essentially a typical Reed system consists of a number transmitter units connected to a transmission line with receivers connected at intervening points along it to facilitate the remote control of signalling equipment. Each transmitter module consists of an amplifier and a filter which transmits a signal to a receiver, also consisting of an amplifier and a filter. Channel specific receiver filters tune the receivers to each frequency and ensure that invalid frequencies are rejected. The receiver amplifiers then amplify the signal which is then passed via an isolation transformer to the output via a diode. This applies half-wave rectification to the output which is then fed to a reed follower relay, normally energised when the function is called.

Interference immunity relies on the frequencies for each channel being non-coincident with harmonics of 50Hz and having a very narrow bandwidth. Therefore interference signals with frequencies significantly either side of a particular channel's centre frequency, (and for Reed systems this can be as little as 1Hz), are attenuated to a level that can be regarded as insignificant.

The narrow bandwidth of each channel is entirely attributable to the transmitter and receiver filters.

Although there are other components that provide further interference immunity the safety integrity of the Reed system relies on the front-end filters applied at the transmitters and the receivers attenuating any signal that is coincident or near coincident with any particular channel's frequency.

It has been found that when one or more intermittent disconnections occur in the line circuit to a receiver this can produce noise, the components of which can add to form a reed signal that can be passed by the reed filter and operate the reed follower relay. This is believed to be the result of poor quality connections being subjected to vibration originating from train movements. Where connections are less than ideal it is believed that vibration can cause the electrical signals appearing at those connection points to be switched at high speed, giving rise to an oscillatory waveform on the line circuit. This effect can manifest itself in the line circuit and the resulting signal produced has the ability to bypass the filter, normal interference safeguards are

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