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Level 3

Signalling Equipment Workshop Engineering Notice (SIGWEN021) Signalling Relays

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Issue record

Issue	Date	Comments
1	August 2004	New Issue
2	December 2004	Additional servicing requirements added
3	January 2008	New requirement for capacitors to be changed in slow-to-release relays. New requirement for fitting stainless steel retaining wires when servicing magnetic-stick relays
4	December 2010	Revised requirements for changing QNNS1 coils. Clarified the requirements to change old style operating carrier arms on all P-Series relays. Updated section 6.18 to provide details of new miniature cradle relay.
5	June 2011	Updated section 6.12.8 to provide details of what separators not to use. Inclusion of new section 6.5.4 Loose Rivet Heads in Z Style Relays to Specification BR936

Compliance

This Network Rail standard is mandatory and shall be complied with by Network Rail and its contractors if applicable from 04/06/2011.

When this standard is implemented, it is permissible for all projects that have formally completed GRIP Stage 3 (Option Selection) to continue to comply with the Issue of any relevant Network Rail Standards current when GRIP Stage 3 was completed and not to comply with requirements contained herein, unless stipulated otherwise in the scope of this standard.

Reference documentation

NR/GN/SIG/19020	<i>SIGTAN 020 Signalling Relays</i>
NR/L2/SIG/11129	<i>Life Management of Signalling Relays, Searchlight and Banner Signals</i>
NR/GN/SIG/19265	<i>SIGWEN 014 Labelling of Signalling Equipment</i>
NR/L2/SIG/11107	Silver Migration

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1 Purpose

This standard has been prepared to advise manufacturers, repair and service agents about problems affecting railway signalling relays used on Network Rail's Signalling Infrastructure.

The methods and processes used to satisfy the requirements of this standard should be detailed within the manufacturers and/or service agents documented procedures, as applicable.

2 Scope

This standard applies to the manufacture, repair and *servicing* of electro-mechanical relays that form part of the infrastructure based railway signalling control system which are used in safety critical or safety related applications. Additional information will be added as necessary following identification and risk assessment of any new problems.

For service agents undertaking repair and *servicing* the proposed actions are stated.

For manufacturers the information needs to be considered and any enhancements made to equipment to prevent the problems detailed in this document shall be subject to the appropriate approval regime prior to implementing any change to the equipment.

It does not address the general personnel and system safety measures necessary for working with signalling equipment

3 Definitions

Functional Test	The test carried out to demonstrate that the equipment fulfils its purpose.
Servicing (also service, serviced)	The process whereby the subject equipment (e.g. a relay) is restored to its original specification as to performance and future service life by any necessary component replacement and adjustment with subsequent testing and certification.
Test to Specification	A test to make certain that the equipment meets all of the intended operating parameters

4 Abbreviations

SIGTAN	Signalling Equipment Technical Advice Notice
SIGWEN	Signalling Equipment Workshop Engineering Notice

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5 General Information

5.1 Handling, Storage and Visual Checks

All relays must be handled carefully. Accidentally dropping or knocking a relay can dislodge components, such as adjustment cards, whilst leaving the relay apparently undamaged.

Relays should be provided with adequate packing to prevent damage to components in transit.

When relays are received for *servicing* the following conditions should be resolved at the appropriate point in the *servicing* regime:

- Flaking plating on relay internal framework and components.
- Ill fitting or warped / yellowing, damaged / cracked or loose covers.
- Damaged or broken adjustment cards.
- Presence of foreign bodies inside relay.
- Presence of Silver Sulphide contamination.
- Severe contamination, water.
- Heat damage.
- Case distortion.
- Physical damage.
- Unused holes in case.
- Damaged or poor condition internal wiring or wiring on the Remax top where fitted (taking care to use non-sulphur variety of insulation material on replacement).
- Damaged, incorrect or any re-configured pin code (relates to any pins, seals and any coded holes in the relay base). *Note: A re-configured pin code means one where a replacement relay base has had to be used to service the relay and which originally had a different pin code to the one specified for the relay under-going servicing and is required to be changed.*

Prototype relays or relays of suspect origin should be destroyed with the permission of the owner / maintainer.

Relays can be stored for up to 3 years before action is required prior to inserting them into operational use. Where relays have been stored for over 3 years and up to 10 years, a *functional test* should be performed. Relays stored for 10 years or over require a full *test to specification* or to be sent for *servicing*.

5.2 Labelling and Modification State Control

All relays shall be fitted with service agent seals after *servicing* work is completed and labelled to current requirements, see NR/GN/SIG/19265 which details the necessary labelling and modification state management requirements.

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5.3 Security of Wire terminations

A number of investigations have found coil connections have become detached due to dry soldered joints. Both the wire and the tag had solder applied, but it appeared that the solder had not flowed between the two. Additionally a mechanical connection by wrapping the wire round the tag had not been made. Special checks shall be made to make certain that wire connections are secure. If necessary they should be re-terminated.

5.4 Riveted Contacts

Some relays were originally manufactured with the contact element only riveted to the contact spring. In order to reduce contact resistance manufacturing techniques were amended to additionally solder the contacts. A recent investigation has found a relay with a loose contact element which had only been riveted. When relays are received for servicing contact elements that are only riveted shall be checked for riveting adequacy and soldered.

5.5 Molten Solder Caused by Overheating

When current passes through a contact, heat is generated. Where the current is high enough, the heat can melt the solder that secures the contact to the spring. Very occasionally, this has run down and formed a bridge to the next contact. See Figure 1.

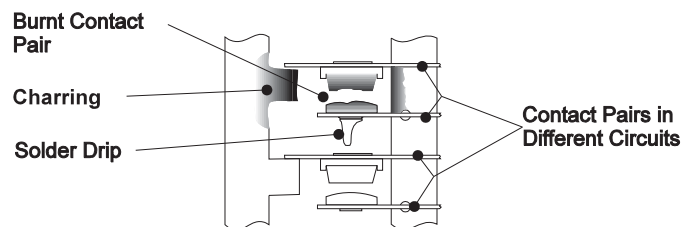


Figure 1

Any such damage found should be repaired by replacement of components.

5.6 Silver Sulphide Contamination

Silver Sulphide crystals can grow on the contacts. These look like black iron filings on a magnet and are electrically conductive, see Figure 2. If they build up sufficiently, they could bridge contact pairs together. The cause of the problem is a chemical reaction between sulphur vapour (given off from the rubber insulation of coil connecting wires, or rubber pads between coil and relay frame, due to operating heat) and silver contacts.

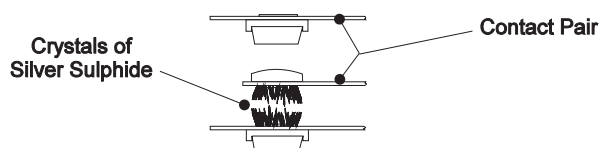


Figure 2

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Silver Sulphide has been observed in Westinghouse Q style (BR930) relays made between 1966 and 1970. Later relays used different (sulphur-free) insulation. Once any sulphur present in the rubber has dissipated the problem should not occur again. Relays made during this period require the offending wire / pads to be replaced with sulphur free components when *servicing* takes place. All traces of contamination shall be removed. Silver Sulphide contamination has also been found in SGE full size plug-in relays and shelf type relays. Any relays found exhibiting this condition shall have all traces of contamination removed and rubber components replaced with sulphur-free components where available.

5.7 Unused Holes in Case

Until 1980, it had been the practice to label the relay case with its function (e.g. 123HR).

The danger of doing this was that if a relay was swapped the labels could sometimes be moved with it. The practice now is to fix the label to the rack.

Any spare holes found in relay covers should be filled with an appropriate substance so as to make certain that insects and dirt can not enter the relay. The method used to fill the holes shall not interfere with the operation of the relay.

GEC, AEI-GS, AEI-GRS, GRS and SGE relays are known types which may have spare holes present in the relay cover.

5.8 Cracked Covers

Some relays made by Tyers, Zone Controls (later known as STS Signals Ltd) and AEI-GS, were manufactured without adequate internal support for the handle. Consequently, sustained or prolonged pressure on the handle by the retaining clip has caused their covers to crack.

The cracks start near the base of the handle and usually spread across the top and down the sides of the cover. One cover was found almost split in half.

The cracking occurs owing to the sudden shock caused when a tight fitting relay retaining clip is 'snapped' into position in the handle's clip recess. The continuing pressure from the clip then causes the cracks to spread. See Figure 3.

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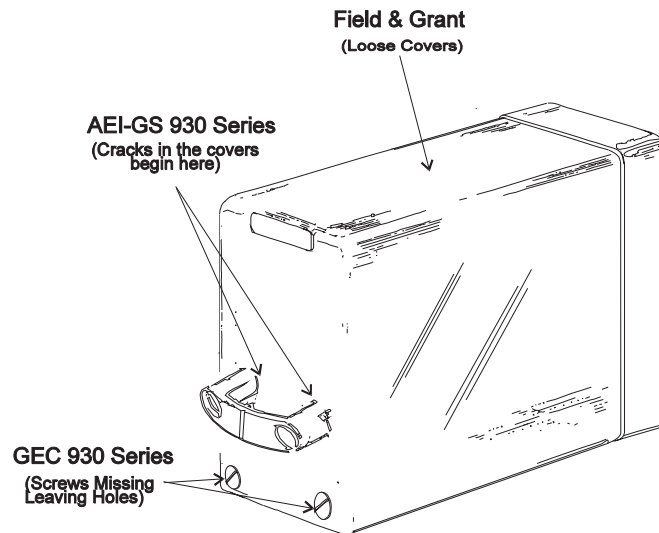


Figure 3

It is also possible for the plastic casing to crack as a result of chemical reaction with orthophthalate plasticiser released from the PVC sheathing of the coil connection wires following hot conditions. This contamination has been found in BR935 relays and is visible as a misty, oil-like coating inside the relay case. It can also result in high resistance contacts and may irritate sensitive skin. Any damaged or contaminated covers shall be replaced.

5.9 Warped Covers

Some relay covers have been found to be distorted by high temperature. This effect is most likely to be seen on covers enclosing twin relays where both relays can be energised simultaneously for prolonged periods. The heat produced if the bus-bar voltage is higher than the nominal can exceed the design levels.

Westinghouse P series relays were manufactured with cellulose acetate covers. These are particularly prone to distort inwards, accompanied by yellowing discolouration and a distinctive vinegar smell.

The side windows in some SGE Full-size plug-in relay covers have also been found to be similarly affected.

Any distorted or discoloured cases or side windows shall be replaced with appropriate components which are not susceptible to the problem.

5.10 Loose Covers

Field & Grant (later known as STS Signals Ltd) relays have been found with damaged or displaced adjustment cards (also known as 'combs' or 'bankers'). They have been bent out of position or broken. The cause has been traced to loose covers which can move sufficiently, relative to the base, to push on the adjustment card. The damage is caused by the cards being trapped between the cover top and the heavy coil and core assembly.