

# Engineering Procedure

## Signalling (Manual J)

### CRN SP 010

# TESTING AND CERTIFYING EQUIPMENT DURING MAINTENANCE

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# 1 General - Assess The Risks, Take Adequate Precautions, Test On Completion

Having assured a safe, operational signalling installation by certification inspection and testing of New Works and Alterations, it is essential that this integrity is maintained and is not jeopardised by maintenance work that requires some necessary interference with vital parts of the signalling system.

When working on signalling equipment which involves disconnection, disarrangement, disassembly or adjustment, Signalling Maintainers must take adequate precautions during the work and carry out proper tests at the completion of the work, commensurate with the risk of incorrect reconnection, assembly or adjustment and a resultant irregularity. This includes risks associated with polarity reversal.

(Risk is a measure of the probability of the undesired event occurring multiplied by the severity of the consequences.)

Whenever a wire is disconnected from its terminal there may be a risk that it could be reconnected to the wrong terminal.

The risk increases with the circumstances, eg: are there other terminals close by; are the terminals and the wires labelled; are they correctly labelled; is more than one wire disconnected at the same time; is the period of disconnection brief or extended; will the person who re-connects the wire be a different person to the one who disconnected the wire; is the person involved unfit, tired or under pressure; is complacency likely; is lighting and access good or poor and awkward; could wrong reconnection lead to an irregularity or would it instantly be detected by a right side failure?

Similarly if an item of equipment is disconnected or disassembled, or replaced, is there a risk that it could be installed the wrong way around or upside down, and would such wrong assembly be detected by failure or could an irregularity result?

Similarly if broken wires are repaired there is a risk they could be cross connected and in certain cases this could cause an irregularity, if undetected.

Signalling Maintainers are to assess these risks when disconnecting wiring and when disconnecting or disassembling equipment and are to take adequate precautions to minimise the risk, eg: mark or label the wires and corresponding terminals; disconnect and reconnect one wire at a time where possible; mark matching sides of items of equipment before disassembly; improve lighting and access; remove distractions or causes of pressure; and concentrate the mind on the issues involved.

Most importantly, Signalling Maintainers are to follow up the precautions taken (to eliminate the probability of incorrect reconnection, assembly, repair or replacement) with a test of the reconnected circuit or item of equipment to ensure it is working correctly. Network rules and Procedures are to be followed wherever they apply.

Similarly when equipment is adjusted, Signalling Maintainers are to assess the risks, take adequate precautions to eliminate the probability of incorrect adjustment and then carry out tests to verify the correct operation of the adjusted equipment.

In all such cases, where work on vital signalling equipment involves disconnection, disarrangement, disassembly or adjustment then, unless there is negligible risk of signalling apparatus being altered and left malfunctioning as a potential irregularity, the principle shall be that,

- the equipment is worked on in accordance with the relevant Network rules and Procedures.
- adequate precautions are taken to eliminate the probability of incorrect reconnection, assembly, replacement or adjustment.
- the equipment is tested to function correctly after the work is completed
- the work is recorded and the document signed by the Signalling Maintainer which shall signify that it has been tested and functions correctly,
- where it is not practical to obtain prior authority, the details are to be promptly brought to the attention of the Signal Maintenance Engineer.

- the document is submitted to the Signal Maintenance Engineer, who actions it appropriately and retains the documented report on file.

Details shall be submitted on the following signed documents, which shall constitute certification.

- The Maintenance Record document
- Infrastructure Booking Authority form NRF 003, as applicable
- A Detailed Report, as applicable
- A specific Work Instruction, or Work Order, as applicable

The Signal Maintenance Engineer shall ensure that reporting and recording procedures are adequate and satisfy themselves that the work has been properly carried out.

Signalling Maintainers are to select and perform inspections and tests that will satisfy the certification requirements for the particular work.

A list of various types of inspections and tests used to verify correct physical and functional compliance is attached.

#### TYPICAL INSPECTIONS AND TESTS TO VERIFY PHYSICAL & FUNCTIONAL COMPLIANCE

The full list of procedures are found in CRN SC 011 the list below are the more common tests.

Apparatus Inspection:	Verify correct configuration, type, colour, labelling, inscriptions, positioning, clearances, rating, warding/pincoding/indexing, tightness, secureness, lock-up security, damage free, quality workmanship, no loose wires, extraneous items/material removed, temporary wiring/bridging removed, stagework removed.
Wire Count:	Verify correct number of conductors on terminals, also tightness and termination workmanship.
Null Count:	Verify no conductors on spare terminals.
Insulation Test:	Megger test insulation of conductor to earth, frame, cable screen/drain, cable spare conductors,
Bell Continuity Test:	Bell/meter test for conductor continuity between wire termination points.
Hand Trace:	Verify conductor runs directly (ie no intermediate connections) between two wire termination points by hand tracing.
Apparatus Function Test:	1. Test apparatus operates correctly from its local controls and power source and indicates its status correctly to local indications; 2. verify apparatus operates its contacts in correct correspondence and adjustment 3. verify mechanisms operate freely and within specified tolerances and in correct adjustment and that lights are correctly illuminated and focused/aligned.  <i>(1. local operation and correspondence test, 2. contact proving test, 3. adjustment test)</i>
Contact Proving Test:	Test apparatus opens and closes its contacts in correct correspondence and adjustment.
Circuit Function Test:	Test the circuit function energises and de-energises when its control devices change state and when fuses, links, are removed and replaced.
Circuit Strap & Function Test:	Test the circuit function is energised and de-energised by the specified contacts of its control devices when those individual contacts open and close; also when fuses, links are removed and replaced.

Function Test to Control Tables:	Test that functions interlock and/or control one another, in accordance with the control table.
Through Circuit Test:	Circuit function test the completed circuit over outgoing/incoming cable links and verify correct correspondence.
Through System Test:	Test correspondence from initial input to final output for controls and indications combined.
Track Circuit Shunt Test:	Test track relay is dropped away when the track circuit is shunted by a train (Train Shunt Check) or by a fixed shunt of the correct value at a given point along the track (Fixed Shunt Check) or by a fixed shunt at all extremities (Fixed Shunt Test).
Track Circuit Polarity Test:	Test for polarity reversal at block joints between adjoining track circuits, at all extremities.
Power Supply Polarity Test:	Test power supply polarity is correct and has not been reversed when transformers are changed or when wiring is interfered with.
Power Supply Isolation Test:	Test that power supply busbars are free of earths. Test that power supplies busbars are not interconnected.
Mechanical Locking Test	Test mechanical locking (to Locking Table, Locking Diagram, Working Sketch) of interlocking frames, release switch locks, electric locks, releasing keys, annett locks, pilotman's locks, half pilot staff locks, staff instruments, staff contact boxes, bolt locks, bracket locks, mechanical detectors/selectors, train bars, depression bars, facing point lockbars, emergency switch machine locks, etc

## 2 Alterations Not Affecting The Principle Of Circuits

When it is necessary, owing to insulation defects or to other cause, for a Signalling Maintainer to connect a new wire, effect repairs, or make temporary alterations which do not affect the principle of the circuits, the Signal Maintenance Engineer must be notified at the earliest possible moment. In addition, the Signalling Maintainer must test the circuit thoroughly each time such an alteration is made, provide a documented report and call the Signal Maintenance Engineer's attention to the alterations so that he/she can check them throughout.

In the event of any relocation or alteration in the adjustment being necessary on any working contact, special reference of such alteration should be recorded and be brought to the attention of the Signal Maintenance Engineer.

Resistances, excepting track resistances, which are provided in certain portions of the equipment, should not be altered without authority from the Signal Maintenance Engineer unless absolutely necessary to meet an emergency. In such cases the resistances must be replaced as soon as normal conditions are restored.

Resistances in track circuits may be altered as required, care being taken to see that the relays are not receiving more current than is necessary for their normal operation. A careful check must be made of the track circuit to ascertain the necessity for the alteration, and, if possible, the cause removed and the resistance restored. All cases of alterations to resistances must be reported promptly to the Signal Maintenance Engineer.

In an emergency a suitably accredited Signalling Maintainer may transfer a circuit from a defective contact or terminal to an equivalent spare contact or terminal or transfer a circuit from a defective cable core to a spare cable core provided the following procedure is also followed:

The circuit is tested to prove that the circuit has not been altered in any way.

The Signal Maintenance Engineer is notified promptly and in writing of permanent changes.

Any rearrangement in vital signalling circuits to the existing wiring between terminals, although there may be no change to the principle of the circuit, and even though the terminals may not be detailed in the existing circuit book, shall constitute a wiring alteration and, other than in emergency, require the prior approval of the Signal Maintenance Engineer.

Design drawings are required to be brought up to date with any permanent changes; the Signal Maintenance Engineer shall be advised and make suitable arrangements.

REFER ALSO TO CRN SP 011 LIKE FOR LIKE RENEWALS.

REFER ALSO TO CRN SP 012 REPAIR/REPLACEMENT OF SIGNALLING WIRES.

### **3 Alterations Affecting The Principle Of Circuits**

Alterations which affect the principle of the circuits shall be carried out only to an approved design alterations authorised by the Principal Signal Engineer.

A Signal Engineer shall be responsible for implementing and commissioning the alteration and hence shall be the "Commissioning Engineer". Testing and certification shall be carried out by the Commissioning Engineer or by a Signal Engineer who did not install any part of the alteration under test and who has been nominated and instructed by the Commissioning Engineer.

### **4 Relocating Or Moving Relay Racks**

Moving, relocating or temporarily supporting relay racks with operational relays in service should be avoided wherever possible. Whenever it is unavoidable precautions must be taken to ensure that there is no possibility of irregular operation, otherwise all associated circuits are to be disconnected and booked out of use.

Similarly, when any abnormal activity could tilt or turn upside down vital signalling equipment which relies on gravity return, the work must not be carried out while the equipment or affected circuits are in operational service.

### **5 Authority To Interfere With Signalling Working Circuits**

Suitably accredited signalling maintainers or signal engineers are authorised to interfere with vital signalling equipment and working circuits in the performance of their duties in accordance with standard practice. Personnel not accredited in signalling safeworking for their classification and who do not hold a current 'Statement of Competency' certificate for that classification are not to interfere with vital signalling working circuits or equipment.

Non-accredited persons for example signalling apprentices and non-accredited electrical mechanics and signal engineers, are not to connect, disconnect or reconnect wires to or from terminals on the installed signalling system equipment, nor do anything that affects or could affect the adjustment of that equipment, except as specifically instructed and under the direct and close supervision of the suitably accredited signalling maintainers or signal engineer who will take responsibility for the work performed under their instructions by the non accredited person.

Non-accredited signalling personnel are not to remove fuses, terminal pins or open links of existing operational signalling circuits, or where the equipment is being disconnected in association with

booking it out of use, except as specifically instructed and under the direct and close supervision of the suitably accredited signalling maintainers or signal engineer who will take responsibility for the work performed under their instructions by the non accredited employee.

The statement “direct and close supervision” shall mean where the non-accredited person is in reasonable proximity to the accredited supervising person, that is, can be clearly seen and is within normal hearing and speaking distance given the ambient noise level. This arrangement allows the accredited person to attend immediately should any undesirable situation occur.

**Example:** A signal electrician conducting track circuit testing or insulation testing of local equipment tail cables at a signal location, may use a non-accredited person to assist in the removal of fuses, terminal pins or open links in existing operational signalling circuits where it is necessary to complete the work providing;

- the person has the applicable trade or other essential competencies and,
- has been suitably instructed and understands their role in the work being performed and,
- Meets the above criteria for reasonable proximity.

The use of non-accredited signalling personnel to perform similar duties at remote locations where the criteria of ‘reasonable proximity’ cannot be met or where it is necessary to use telephones or radios to communicate is strictly forbidden

## 6 New works and alterations:

Where signalling equipment and/or circuits are disconnected and booked out of use and where the precautions in place together with the inspection and testing activities to be conducted will adequately ensure that only the intended connections, disconnections and adjustments will occur, then non-accredited persons, suitably experienced and properly instructed, may be used to progress the work on the disconnected signalling equipment and circuits under a level of supervision commensurate with the attendant risks.

The precautions in place, the inspections and tests to be conducted, and the level of supervision are also required to safeguard against

the possibility of inadvertent or mistaken interference with working signalling equipment and circuits in the vicinity that are not disconnected and booked out of use.

the possibility of wiring connections being made inadvertently or mistakenly to the wrong terminals (and then the correct connections being made with separate wiring) and the incorrect wiring being overlooked and left connected in a situation where it would not necessarily be detected in functional testing of the intended alterations. (When carrying out new work and alterations, any incorrect wiring run or wiring incorrectly terminated is to be removed as soon as it is discovered.)

The signalling maintainer in charge remains accountable for ensuring the non-accredited persons work within the required restrictions and remains accountable for the work of those persons.