

Engineering Procedure

Signalling (Manual J)

CRN SP 004

FAILURES

Version 1.4

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Document control

Revision	Date of Approval	Summary of change
V 2.0	Jan 2004	No SC 00 52 00 04 SI Failures
V1.0	July 2011	Conversion to CRN Signalling Standard CRN SP 004
V1.1	July 2011	Addition New Section 1.8 Axle Counters
V1.2	July 2017	Update to reflect current CRN processes and personnel structure
V1.3	Jan 2017	Review and update
V1.4	October 2018	Review

Summary of changes from previous version

Section	Summary of change
1.5.2	Include MPis and MLIs as signal, add axle counters to train detection system, remove block and staff instruments and remove diagram indications in mechanical cabins
1.6.3	Remove Plug Connector and key (refers to EP points)
1.6.6.1.1	Change to 4 th level format – 1.6.6.1
1.6.6.2	Update Train Register Book to Network Control Centre register
1.1	Added Text Message
1.7	Section Removed (Half Pilot Staffs removed)

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1 General

Signalling maintainers responsible for signalling maintenance shall clearly understand that the object of maintenance is to prevent failures by identifying the conditional failures rather than to wait until the failures become functional.

In the case of accident, emergency or disruptive failure of signalling apparatus, signalling maintainers shall attend with all due urgency in order to deal promptly with the apparatus and rectify any failure and assist, when possible, to minimise train delays caused by the failure (each failure is either a potential or actual source of traffic delay).

Every signalling failure should be reported, recorded and analysed so that appropriate measures can be taken to reduce such failures to a minimum.

1.1 Reporting and Recording Failures

All failures requiring the attention of a signalling employee shall be fully investigated and, full details must be filled in immediately on a 'Failure Recording Sheet' by the signalling employee who attended the failure. The Failure Recording Sheets shall be coded as per standing instructions contained in the 'Maximo Manual', for statistical purposes. These forms are to be kept bound in a book and the entry signed by the signalling employee and retained by them.

Details of the defective component and the nature of the defect shall also be entered into the Country Regional Network (CRN) Maintenance Management Information System.

All details from the 'Failure Recording Sheet' shall be reported to the maintenance supervisor or signals engineer as soon as possible after the fault has been rectified. The Regional Office will then complete a failure recording sheet from the information supplied or enter it directly into the computerised system.

Any irregularity or alleged irregularity shall be reported to the Signal Engineer immediately by telephone, should the signalling employee be unable to contact the Signal Engineer, the CRN Operations Centre Mayfield shall be informed by telephone and requested to contact and advise a Signal Engineer. Attendance to and reporting of irregularities/wrong side failures shall be in accordance with Paragraph 1.5 following

Signalling employees on country districts, who have been required to attend failures outside normal working hours shall, before ceasing duty, send an e-mail text message to their maintenance supervisor or signals engineer advising the particulars of the failure or failures, unless other satisfactory arrangements are made.

For any failure or damage to signalling and/or safeworking communications equipment, caused by a party other than CRN or its subcontractors, a 'Damage to Signalling and Safeworking Equipment by Other Parties' Form SF J104/A shall be instigated by the signalling employee in charge of the repair work, and then forwarded to the Signal Engineer.

1.2 Failure Reporting

1.2.1 Detailed Report

Where a fully Detailed Report is requested, it shall include details of train delays and other consequences of the failure/incident.

Additional information is also important for certain types of signalling failure reports as follows:

- Were the points wound over by hand and by whom. - including the time that the crank handle was removed from the 'Emergency Switch Mechanism Lock' (ESML) or EOL removed.
- Special working introduced and cancelled.

- Name of Network Control Officer if it is alleged that equipment has been incorrectly manipulated.
- Name of gang, if it is alleged that a specific project or upgrading or other Discipline operations are responsible for a failure.
- The time and details of Civil, 4Tel advised the result of their own investigation/s (if available).
- For multiple failures, a specific list of all items failed, when each item was damaged and a general comment on if this was as a consequence of say a derailment or power failure etc.
- Whether further investigation is to be carried out.
- Any unusual circumstances.
- The alleged cause for no cause found.
- The kilometrage of any Civil defect.
- The nature of temporary repairs and the requirements for permanent repair.
- The exact location (relative to a suitable structure) of joints made in multicore cables or in single conductor cables in GLT or buried routes, and the type of cable joint installed.
- Comments shall be kept concise, while providing full detail of the failure and circumstances. Abbreviations other than well known ones such as FPL, JS, ESML. etc shall be avoided.
- A Detailed Report shall also be completed whenever directed by the Signal Maintenance Engineer.

The Signal Maintenance Engineer shall carefully scrutinise the Detailed Report and add any relevant details or comments as required and initiate any corrective or preventative actions required.

1.2.2 No Cause Found Failure Forms

In the case of a failure for which the cause is not found immediately the failure must be fully investigated. A 'No Cause Found Failure Report' form shall be completed on each occasion unless otherwise instructed by the Signal Maintenance Engineer.

The relevant parts of the "No Cause Found Failure Report" Form SF J103 shall be completed by the signalling employee attending the failure and the follow up Investigator shall complete the 'Follow up Investigation' section of the form.

After signature by the Investigator, the "No Cause Found Failure Report" Form shall be forwarded to and filed in the Signal Maintenance Engineer's office.

1.3 Failures due to Other Disciplines

If signalling maintainers find a defect or failure in signalling apparatus, the cause of which is due to another Discipline, they shall call the attention of the Discipline representative concerned to the defect or failure. The cause of such failures shall be clearly described.

When signalling maintainers become aware of Civil defects affecting the operation or reliability of signalling equipment procedures for co-ordinating signal and civil work shall be followed to ensure the matter receives appropriate attention.

1.4 Safeworking Procedures

On arrival at a location to attend to a failure the signalling maintainer in charge shall obtain details about the failure from the Network Control Officer and for any updated information about the failure.

Before any points, signals, facing point locks, bars or any safeworking equipment in connection therewith is disconnected, the signalling maintainer in charge shall ensure the observance of Network Rules and Procedures CNWT 312 and CNPR 704

When the failure has been rectified and the necessary tests carried out, the signalling maintainer in charge shall advise the Network Control Officer and check that an appropriate entry is made in the Network Control Centre register.

1.5 Signalling Irregularities and Wrong Side Failures

1.5.1 General

A signalling failure is termed an irregularity when vital signalling equipment items or circuits do not fail-safe or do not function correctly in accordance with their design specifications to provide the intended protection.

1.5.2 Wrong Side Failure

A signalling irregularity is termed a wrong side failure where a signal shows a less restrictive indication for a train than conditions should allow, or a set of points are released under traffic conditions when they should be locked, or where automatic level crossing protection fails to operate for a train, that is, irregularities which could directly endanger the safe running of trains in the particular circumstances pertaining.

It should be noted that irregularities may be 'protected' or 'unprotected' within the system design e.g. a failure of a signal to return to stop may be proved in the track stick circuit, block or some other control and therefore the 'wrong side' failure may be protected

All reports of signalling irregularities and wrong side failures must be advised to the signal engineer by telephone as soon as possible.

Local signalling maintainers who become aware of reports of signalling irregularities or wrong side failures shall obtain as much relevant information as they immediately can and relay this information to the signal engineer. If the signal engineer is not immediately contactable messages shall be left. A Signal Engineer shall conduct the investigation. Signalling maintainers who could possibly be required to assist the investigation are to proceed to the site as soon as possible.

All irregularities, whether they result in an unsafe system failure or not, shall be promptly investigated by a Signal Engineer.

In investigating an irregularity the Signal Engineer shall give due consideration to the circumstances regarding the need for an independent investigating Signal Engineer.

In cases of serious consequence or implication the investigation should be supervised by a suitably experienced, independent Signal Engineer nominated by the Principal Signal Engineer. A suitable, independent officer from another discipline or organisation should also be sought to witness the on-site investigation.

When signalling maintainers report irregularities, they are to request instructions from the Signal Engineer and proceed as instructed.

It is the responsibility of the Signal Engineer investigating the irregularity to determine that the signalling is safe to restore to normal operational use.

The Signal Engineer must be satisfied that the report is properly investigated and that the signalling is safe to restore to operational use before advising approval for its restoration.

In the first instance the equipment and system shall not be disturbed, but shall be protected in accordance with the safeworking procedures by arranging that the signals in rear remain at 'stop' and by booking the affected signal(s) out of use on Network IBA (Infrastructure Booking Authority form) CNRF 003.

The failure conditions shall be examined and noted by signalling maintainers in attendance in an attempt to determine the cause of the irregularity but without disturbing the fault or associated evidence. In other than simple cases (defined below) the signalling maintainers conducting these preliminary examinations are to be accompanied by a suitable independent witness before they access signalling equipment. In serious cases the signalling maintainers must be accompanied by a suitable independent witness from another discipline before they proceed to the site of the suspect equipment.

The Signal Engineer shall be advised of all examinations carried out by signalling maintainers in attendance and shall give instructions on any further action to be taken. The Principal Signal Engineer shall be notified by the Signal Maintenance Engineer or the Signal Maintenance Manager.

Care must be taken when accessing signalling equipment if movement, or vibrations from movement, could release mechanically stuck devices or vary electrical leakage paths or otherwise remove evidence of the cause of an irregularity.

In simple cases where there has been no injury or damage, no collision, derailment or near miss, and no extraordinary circumstances, and where the cause is non-contentious and obvious to the signalling maintainers conducting the preliminary examination, then it may not be necessary the investigating Signal Engineer to attend on site in order to determine that the signalling is or has been made safe and can be restored into use.

For example, if there is a report of irregular signal lights and the signalling maintainer finds the signal lamp case door open and this fully explains the reported irregularity then, after noting the door and lock condition and any evidence explaining why the door was open, and after ensuring there are no other factors involved, the signalling maintainer reports this to the Signal Engineer who, when satisfied with the investigation and assured that the door is properly secured closed, arranges for the signalling to be restored to use.

In serious or complex cases, or where the irregularity is a wrong side failure, a signal engineer is to attend and conduct the investigation on site.

In cases where no cause is obvious for a reported irregularity and evidence available does not allow a conclusion that there was no irregularity, a signal engineer is to personally investigate the allegation.

Before concluding an irregularity report was mistaken, the details and actual circumstances surrounding the report should be fully understood, preferably by questioning the person who made the report.

It is necessary to treat irregularity reports as factual until it can be concluded otherwise on the weight of the evidence and, while others may begin to look for that evidence, a signal engineer must be notified and be responsible for the investigation.

A copy of the investigating Signal Engineer's comprehensive report on the incident shall be forwarded to the Principal Signal Engineer.

A preliminary report shall be made by the morning of the first working day following the incident and should contain details of the incident and the investigation together with any rectification measures either completed or proposed (including further investigations if appropriate).

In the case of signalling irregularities it is the duty of the Signal Engineer to provide comment in the Report. The Signal Engineer may suggest modifications to designs, installation methods, etc.

A separate file for each signalling irregularity or wrong side failure shall be kept by the Maintenance Supervisor and Signal engineer. These files shall not be closed until all investigations and inquiries have been completed and fully reported and all recommendations, corrective and preventative actions have been satisfactorily implemented.

Where a recurrence of the reported defect cannot be ruled out and could result in serious consequences, then the investigating Signal Engineer, before the signalling is restored into use, shall also refer the circumstances to the Principal Engineer Signals or his/her designated representative and proceed as directed by him/her.

- Examples of signalling irregularities and wrong side failures include:
- Detectors - If signals can be cleared incorrectly i.e. with facing points not closed or not locked.
- Points - If a derailment occurs at points over which a signal was cleared (does not apply to a defective vehicle or permanent way)
- Signals or MPI or MLI - If a less restrictive aspect (indication to the driver) is exhibited than is correct for the conditions set up.
- Track Circuit - If a track circuit fails to detect the presence of a vehicle/vehicles.
- Axle Counter – If an axle counter fails to detect the presence of a vehicle/vehicles.
- Mechanical or Electrical Interlocking - If a release can be incorrectly obtained from the locked position.
- Electric Locks - If a lock is incorrectly free.
- Dual Control - if the restoration of any one control fails to return the signal to the stop position/aspect.

1.5.3 Irregularity Investigation and Train Operations

The procedure for dealing with signalling irregularities is generally as follows:

- Establish that the reported situation could constitute an irregularity
- Book out the signal route concerned which displays or is alleged to have displayed a false proceed indication, or which could display a false proceed indication given the reported circumstances.
- Do not disturb anything that could destroy evidence and prevent determination of the true cause by the proper authorities unless directed to by the proper authorities. (This may mean that the signal route concerned is not physically disconnected but is booked out on paper only).
- Provide protection by booking out and disconnecting any signal routes that allow trains to approach a signal which is displaying or which could display a false proceed indication given the reported circumstances.

OR

- If it is clearly evident that the cause of the irregularity is not within the signal operating circuit or its controlling relay/module, and thereby the signal route can be disconnected and reliably maintained at stop without disturbing the cause, then book out the item of equipment to which the cause can be isolated (eg, track circuit, points, release switch, level crossing warning equipment) and provide protection by booking out and disconnecting the signal route(s) that lead trains into situations where they could be endangered eg, the signal route over the defective track circuit or set of points.

OR

- If the true cause of the irregularity is positively determined by the properly appointed investigating signal engineer but cannot be rectified without delay, and if under the prescribed procedures traffic operations using the signals can be safely allowed by disconnecting and securing the defective equipment in a safe state, then the signals providing protection may be restored to use once the defective equipment has been disconnected and secured in accordance with the prescribed procedures.

- While testing is being carried out book out and disconnect any signalling equipment which is subject to interference by the testing work and could endanger the passage of trains.
- Find and rectify the cause.
- Test and certify the signalling system as safe and operational.
- Book back into use.

If the signalling is likely to be out of use for some time and critical trains services are going to be seriously disrupted, investigating Signal Engineers should consult with senior, experienced Signal Engineers on whether there other permissible means of protection that will ensure a safe situation but minimise the disruption.

1.6 Failures - Action to be Taken

1.6.1 General

It is the duty of signalling maintainers responsible for maintenance of signalling equipment to attend failures promptly and restore the system to good working order, as soon as possible, to permit the resumption of traffic working under normal signalled conditions.

The rectification of failures shall be carried out in such a manner that the failure will not reoccur.

During a failure the best possible arrangements, consistent with safety and in accordance with the Safeworking Procedures, shall be made to minimise delay to traffic.

Under no circumstances shall signalling maintainers cause a signal to display a less restrictive signal indication to a driver or cause a signal to clear by means of manipulation or interference with circuits or bridging of relay contacts, or other similar actions, except as specifically laid down in these procedures.

When required maintenance signalling employees shall attend to failures on sections other than their own. They shall leave details of the failure, its cause and repairs carried out, for the maintenance signalling employees who normally maintain the equipment.

When temporary repairs have been made to correct a failure condition they shall be listed on the Failure Report Form and the Signal Engineer informed (see failure reporting).

1.6.2 Signal or MLI – Failure

Defective signals or MLIs which have failed 'right side' shall be made to remain at stop until the apparatus has been restored to correct working order.

In the case of a signal showing a less restrictive signal indication than conditions should allow, the signal next in rear must be disconnected and protected by appropriate safeworking procedures until the 'wrong side' failure is investigated by a Signal Engineer. (See failure reporting).

In the case of a MLI showing a less restrictive signal indication that conditions should allow, the Network Control Officer shall issue a CAN warning to rail traffic approaching that MLI and protected by appropriate safeworking procedures until the 'wrong side' failure is investigated by a Signal Engineer (See failure reporting).

1.6.3 Failure of Power Operated Points

When power operated points have failed no attempt shall be made to unlock or move the points other than by normal operation from the lever (or operating console/panel/keyboard) unless:-

The points are disconnected and booked out of use.

OR

Emergency facilities, interlocked with the signalling, are specifically provided to enable failed power worked points to be operated by hand eg. ESML (Emergency switch machine lock and Annett Key with attached crank handle) or EOL (Emergency Operation Lock).

In all cases the signaller is to be requested to place affected controlled signals at stop before the emergency facilities are taken and closely approaching trains are to come to a stand before the points are manually operated.

In all cases of hand operation of power worked points during failure or emergency the controlling lever in the signal box should be placed to correspond to the position to which the points are operated by hand.

Power operated points shall not be moved out of correspondence with the interlocking unless they are disconnected electrically and the signals reading over the affected points are disconnected and securely maintained at stop. Distant Signals or the equivalent of the Distant Signals, shall also be arranged to be maintained at Caution.

Before traffic moves are permitted over power operated facing points which have failed, the requirements of Network Rule CNSG 608 shall be observed.

After the emergency operating facilities have been returned to their cabinet:

The facing points do not have to be clipped and locked as long as the detector light on the signaller's indicator diagram shows that the points have been correctly set.

OR

The facing points must be secured in the correct position by point clip and SL lock when the detector light on the signaller's indicator diagram shows that the points have not been correctly set.

In the case of power worked trailing points, the authorised employee must operate (wind) the trailing end of the points first; the handsignalers, etc are to ensure that all points on the intended route are in the correct position for the train to proceed.

Under these conditions signalling maintainers shall request that trailing points be clipped for handsignalled moves to avoid damage to point machines due to run throughs.

1.6.4 Failure of Point Detection due to Damage

When a failure of electrical point detection is caused by damage or other reason requiring replacement of a significant part of the points detection mechanism and, if it is necessary to avoid significant disruption to traffic until it can be rectified, it will be permissible on authority being given to take emergency action to bridge the affected detection contacts to allow the normal clearance of signals leading over the diamond crossings or over the trailing end(s) of the defective points in question.

The emergency action shall be as prescribed in CRN SP 009, "Disconnection of Points for Work on the Points: Points Detection not in Working Order (Exceptional Case)" and in CRN SP 002 "Bridging or False Feeding of Signalling Circuits".

1.6.5 Failure of Level Crossing Protection Interlocked Gates or Boom Barriers.

In the event of a failure of interlocked boom barriers, or when carrying out repairs to this equipment which may interfere with the interlocking, traffic must be conducted over the level crossing in accordance with Network rule and Procedure CNGE 218 and CNPR 715.

The fixed signals protecting the interlocked level crossing shall be disconnected and the associated Distant Signals or equivalent shall be arranged to be securely maintained at caution, and traffic conducted past the protecting signals in accordance with the applicable Network Rules and Procedures.

Handsignallers shall be provided in accordance with Network Procedure CNPR 715 in event of failure or when work is being carried out which affects the normal operation of the level crossing.

1.6.6 Failure of Track Circuits

1.6.6.1 Track Failures General

In the event of the failure of a track circuit no attempt shall be made to clear any of the signals controlled by such track circuit by manipulating the track circuit relay, bridging across the track circuit relay contact terminals, etc.

The signals controlled by the track circuit shall remain at stop until the track circuit is again in working order, and the traffic shall be conducted past them in accordance with Network Rule CNSG 608 for passing the signal at stop.

Track and indication locking controlled by a track circuit, which has failed, may be released by the signalling maintainer only as prescribed in procedure CRN SP 006

1.6.6.2 Tracks Failing to Shunt

When rails in sections of a track circuit are in such a condition that vehicles cannot be relied upon to shunt the track relay, the signalling maintainer shall disconnect and book out of order all signals, points or level crossing protection affected by the track concerned until satisfied that a vehicle will properly shunt the track relay.

When the defective track controls the lock on any point lever, the points concerned shall be clipped and locked until such time as an effective shunt has been obtained.

The signalling maintainer, when booking the equipment concerned out of order, shall fill in Network form NRF 003, see that an entry is made in the Network Control Centre Register and signed and exhibit a list of the defective track or tracks in the Network Control Centre until they are again in order. In all cases, where doubt regarding the proper shunting of a track circuit exists, signalling maintainers must immediately inform their Maintenance Supervisor, by telephone, advising the circumstances and action taken.

1.6.6.3 Broken Rails

Signalling maintainers who become aware of a broken rail that is a danger to rail traffic are to arrange for the immediate protecting signal/s to be placed at 'Stop' and disconnected, for a handsignaller to be provided (RVD areas excepted) and for the attendance of the Civil representative.

Where the broken rail and track circuit failure is causing significant delays due to points being inoperable, or more than one signal or home/starting or starting signals (in the RVD area) are being held at 'Stop', the signalling maintainer after receiving assurance from the civil engineering employee and confirmation from the signaller that temporary repairs have been made and the line is fit for traffic, may place a temporary bond around the break and restore the disconnected signal/s.

Relay Interlockings - Failure of Signal Reverse or Points Normal or Points Reverse Relays or Failure of Route Reverse Lock Relays (RLR) or Release Switch Normal and Reverse Lock Relays (NLR & RLR). Not to be Lifted or Released.

In standard relay interlockings if a failure occurs to the interlocking circuits resulting in a failure of a "Reverse" relay in the case of a signal lever, or a "Reverse" or "Normal" relay in the case of a point lever, or release switch lever, traffic shall be conducted in accordance with Network Rule CNSG 608 until the defect is rectified.

In route control interlockings should a failure occur of a route reverse lock relays (RLR or RUR) or release switch or point NLR or RLR, traffic shall be conducted in accordance with Network Rule CNSG 608 until the defect is rectified.

On no account shall any of these relays be lifted, or unplugged and replaced by a relay in the "up" position.

1.7 Failure of Axles Counters

Axle counters perform the same function as a conventional track circuit by detecting the presence and absence of a train by counting axles in and out of a defined section of track. The Axle Counter interface into the Signalling System is the same as a conventional track circuit.

In the event of the failure of an axle counter section no attempt shall be made to clear any of the signals controlled by axle counter sections by manipulating any relay indicating the state of an axle counter section

The signals controlled by the axle counter section shall remain at stop until the axle counter section is again in working order, and the traffic shall be conducted past them in accordance with Network Rule CNSG 608 for passing the signal at stop.

Track and indication locking controlled by an axle counter section that has failed, may be released by the signalling maintainer only as prescribed in procedure CRN SP 006 and CRN SP 050

Axle Counters located at certain level Crossing installations are fitted with Axle Counter Re-Set box fitted to the outside of the level crossing location building and can be reset by trained maintainer or operator these procedures are described in CRN SP 050

2 Signalling Forms

Country Regional Network

Signalling Form SF J103 Rev.1

NO CAUSE FOUND FAILURE REPORT

INITIAL INVESTIGATION

FOLLOW UP INVESTIGATION

SECTION: _____ LOCATION: _____

EQUIPMENT: _____

DATE OF FAILURES: _____ TIME FAILED: _____

OK ON ARRIVAL CAME OK WHILE TESTING

INTERMITTENT OK AFTER TRAIN

OK AFTER POINTS WOUND OTHER (DETAILS BELOW)

SYMPTOMS OF REPORTED FAILURE: _____

DETAILS OF EQUIPMENT EXAMINED: _____

TEST CONDUCTED & RESULTS: _____

NOTE POSSIBLE CAUSES & ANY OTHER FACTS THAT MAY BE RELEVANT:

Provide Copy of Track History Card if Failure was that of a Track Circuit:

ELECTRICIANS SIGNATURE _____ DATE: ___ / ___ / ___

INVESTIGATORS SIGNATURE _____ DATE: ___ / ___ / ___

(use reverse side if not enough room for information)

TO: MAINTENANCE SUPERVISOR _____