

Category 1 Standard

S1199 Signalling and Signalling Control – Operation and Maintenance



**Please read the Written Notices
attached to this standard**

Issue No.: A4

Issue date: February 2014
Review date: February 2019

MAYOR OF LONDON

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1 Purpose

- 1.1 The purpose of this Standard is to state the requirements concerning process, technical, and environmental issues which must be applied to the operations phase and its associated maintenance regime in the life cycle of signalling systems.

2 Scope

- 2.1 This Standard contains the requirement for a maintenance regime to manage the signalling system assets on the LU operational railway.
- 2.2 The parts of this standard which refer to the changing of equipment are concerned only with like for like replacement unless the text indicates otherwise.
- 2.3 This standard covers the requirements for incident management and emergency works.
- 2.4 For clauses 3.2.2.5.1 and 3.2.2.7.3:
- a) Suppliers may offer an alternative providing that the option is in accordance with Good Industry Practice, BS and ENs and that risks are always managed ALARP.
 - b) Suppliers shall declare the option and provide evidence of meeting both the criteria described above and their own standards where applicable.

3 Requirements

3.1 Maintenance Process Requirements

3.1.1 Maintenance Regime Establishment

3.1.1.1 General Requirements

- 3.1.1.1.1 Suppliers shall devise a maintenance regime which ensures that all the assets which comprise the signalling system are maintained in a safe and effective operating state throughout the life of each asset.

Note 1: Assets include any non-operational equipment that is present on the railway and could have an effect on its safe operation.

Note 2: Factors which should be considered in instigating a maintenance regime include:

- a) system safety functions;
- b) required safety integrity levels;
- c) required operational availability;
- d) degree of fault tolerance in the system design;
- e) location and accessibility of the system components;
- f) range, predictability and probability of failure modes;
- g) extent of built in test facilities or remote monitoring of asset condition;
- h) typical and maximum times to diagnose and remedy particular failure modes;
- j) the degree of likely service disruption and impact of particular sub system failures;
- k) availability and response of available maintenance staff;



m)	availability of spares;
n)	maximum allowable duration of any one period of service down time.

3.1.1.1.2 The regime documentation shall define the frequency (or alternative criteria) for maintenance and the tasks to be carried out.

3.1.1.1.3 Maintenance activities, including the derivation and upkeep of the documented regime and its implementation, shall be controlled by a management system which shall be subject to programmed review and audit by the Supplier.

3.1.1.1.4 Suppliers shall develop methods of verification to monitor the effectiveness of the maintenance regime.

3.1.1.1.5 The scope and effectiveness of the maintenance regime shall be verified by the Supplier:

- a) At regular intervals;
- b) Following significant incidents;
- c) In advance of planned changes to the regime.

3.1.1.1.6 Any changes required to the maintenance regime, whether identified by the verification process, or for any other reason, shall be managed in accordance with the requirements of Standards 1-538, Assurance, and 5-539, Verification of Assurance.

3.1.1.1.7 Signalling, signalling control, and depot systems and sub-systems shall be analysed to identify degradation modes with the potential to reduce system safety, and defences against them shall be specified within the maintenance regime.

3.1.1.1.8 Where testing is the specified defence to monitor the onset or development of degradation then a programme of planned testing shall be established and carried out.

3.1.1.2 Reporting

3.1.1.2.1 Processes shall be established to enable the maintainer to report potential deficiencies in the regime and for these to be formally addressed.

3.1.1.2.2 An asset register shall be maintained for all equipment and shall include the mandatory elements of Standard 1-041, Provision of Asset Information, and the additional elements required by this standard:

- a) Asset identity;
 - i) Type;
 - ii) Identification number;
 - iii) Line;
 - iv) Location (i.e. road and the distance in the direction of traffic from the station in the rear) and BRS code;
 - v) Detailed description;
 - vi) Serial number.
- b) Asset history (where applicable);
 - i) Incident records;
 - ii) Preventive and corrective maintenance history;
 - iii) Failure root causes (including workshop repair findings);
 - iv) Annual certified test records;
 - v) Authority to Work Certificate records.



- vi) Defined critical parameters that are to be measured and recorded (such as insulation of safety multicore cables or track circuit set-up);

- vii) Records of signals passed at danger due to technical reasons.

3.1.1.2.3 Failure of any item that affects the operational railway shall be reported to a fault reporting centre for appropriate action.

3.1.1.2.4 The Supplier shall document all faults as part of the asset history. Faults that cannot be addressed immediately shall be documented for remedial work.

3.1.1.2.5 Suppliers shall provide information on assets to the Professional Head of Signalling on request.

Note: Information required may include signalling equipment in use at specific locations, generic failure rates, and site-specific information.

3.1.1.2.6 Relevant information relating to actual or potential wrong-side equipment failures shall be disseminated to other railway authorities and to the equipment supplier(s).

3.1.1.3 Management of Testing

3.1.1.3.1 The critical processes of testing, require a consistent approach because of their direct impact on safety assurance, and shall be co-ordinated by the supplier in order to:

- a) Facilitate the monitoring or management of such activities across the network; and
- b) Minimise the risks where different groups interface or work together.

3.1.1.3.2 In determining the levels of supervision, quality checks and audit, account shall be taken by the Supplier of:

- a) the complexity of the work and the extent to which it is unusual or unique;
- b) the competency of the testing personnel in relation to the work being performed;
- c) the likelihood of errors being made;
- d) the consequences of such errors.

3.1.1.3.3 Suppliers shall ensure that testers are permitted sufficient time to plan and conduct testing thoroughly, and are not subject to undue interference or pressure by other persons in management, supervisory or other capacities, either to finish before their testing activities are completed, or to accept situations where the defined acceptance criteria are not met.

Note: There should be an appropriate reporting line for testers to assist in meeting the requirement to avoid undue pressure during testing.

3.1.1.4 Maintenance Procedures For Environmental Changes

3.1.1.4.1 The maintenance regime shall address the safety implications of credible changes in environmental conditions.

Note: The safety implications for the following may be included:

- a) track circuit shunting performance after rainfall;
- b) managing the impact of leaf fall on safe braking distances and train detection;
- c) the effects of snow and ice.



3.1.1.5 Routine Change Requirements For Specific Equipment

- 3.1.1.5.1 Equipment with potentially unsafe failure modes due to progressive degradation that cannot be satisfactorily addressed by maintenance of the equipment at its installed position shall be subject to routine change at intervals to be determined by the Supplier.

Note: This requirement applies to line replaceable units such as relays, trainstops etc.

3.1.1.6 Certified Tests

- 3.1.1.6.1 The supplier shall identify equipment that requires a certified test to provide a formal record that it is safe for continued use.
- 3.1.1.6.2 Pass and fail criteria shall be defined for each certified test.
- 3.1.1.6.3 Certified tests shall be conducted on track circuits, rail circuits, points and trainstops at intervals of not more than 12 months.
- 3.1.1.7 Equipment Overhaul
- 3.1.1.8 Where equipment is overhauled, this shall be carried out in accordance with Standard S1202, Signal Equipment Overhaul.

Note: If overhaul of signalling equipment and components is not carried out correctly the risk that they may fail to protect adequately against hazards of collision or derailment is introduced.

3.1.2 Competency of staff

- 3.1.2.1 Maintainers shall be competent when working on the relevant asset type, in the particular operating context (application and environment), in accordance with the Standard S1203, Competence of personnel working on signal and control systems.
- 3.1.2.2 When a new system or new equipment is implemented, all appropriate personnel (including maintainers) shall be trained on new or unfamiliar equipment.
- 3.1.2.3 The Maintainers shall have training in the handling of all equipment and fault finding from the history and symptoms of a failure of equipment in a signalling system.

3.1.3 Safe methods of working

3.1.3.1 Safety of Staff

- 3.1.3.1.1 All potential hazards shall be identified. Safe systems of work shall be devised and shall contain procedures to protect the Maintainers and LU Operators against the potential identified hazards when carrying out maintenance activities.

Note 1: Hazards considered should include those from terminals with lethal voltages, moving trains, hazardous substances, and pressure systems. Hazards of working close to the track when maintaining signalling equipment should be considered.

Note 2: The following hazards arising from fault conditions should be considered:

- a) any part of a track circuit or rail circuit may be raised to the voltage of the track conductor rails;
- b) where the continuous rail is used for traction return current, the running rails may have a continuous voltage of approximately fifty volts even when the traction supply in the area is switched off.



Note 3: The hazards arising from the possible presence of ethylene glycol in the air distribution system should be considered. As this is a pollutant, precautions against spillage should be taken.

Note 4: Account should be taken of statutory requirements and those in the LU Rule Book.

Note 5: The following hazards associated with 25kV areas should be considered:

- a) the requirement for safe clearance between the maintainers' tools, ladders and live overhead conductors;
- b) the possibility for bonding conductors ('red bonds'), running rails, air main and other infrastructure to be energised by acting as a return path for traction voltages;
- c) that the electrical bridging of isolation gaps may cause wrong side failures or cable fires;
- d) that under fault conditions hazardous potential differences may occur between conductive surfaces.

3.1.3.1.2 Suppliers shall ensure that any equipment or materials used for cleaning do not introduce risk to the maintainer or cause degradation of components of the signalling system.

3.1.3.1.3 Control and monitoring of the Maintainers' working hours on safety critical systems shall be in accordance with 1-548, Safety Critical Work.

3.1.4 Task Authorisation & Certification

3.1.4.1 Individual tasks involving a disturbance to the function of an asset shall be sanctioned in advance and certified on completion through the issue of an Authority to Work Certificate (AWC) in accordance with the AWC process in Standard S1201, Signalling and Signalling Control - Approvals.

3.1.5 Traceability Of Assets

3.1.5.1 Details of the traceability requirements are given in standard S1198, Signalling and Signalling Control - Installation, Testing, Commissioning, and Handover.

3.1.5.2 Suppliers shall establish a means to record the traceability of all signalling assets, except where it can be shown that their performance is not critical to safety or that to do so is not reasonably practicable.

3.1.6 Maintenance Spares and Support

3.1.6.1 Arrangements shall be made to ensure that an adequate level of spare parts and product support is maintained for the complete life of the system.

Note: It may be necessary to develop contingency plans to address the continued availability of the required spares and product support.

3.1.7 Asset Inspection Requirements

3.1.7.1 The Supplier shall undertake planned inspections of the safety signalling systems and signalling control systems to assess the current integrity and fitness for purpose of assets and to make a judgement on their future integrity.

3.1.7.2 The supplier shall address the findings from each inspection and shall initiate appropriate action where necessary to ensure the continued integrity of the signalling system and that the assets remain fit for purpose.

Note 1: inspections should consider accessibility and labelling of assets.



Note 2: when inspections are being undertaken, inspectors should consider the effect on the LU railway of any changes (environmental, physical etc.) which have been or are being made in the area adjacent to the railway.

- 3.1.7.3 Reports of inspections undertaken shall be retained by the supplier for the life of the asset, so as to formally record findings and observations made during these inspections.
- 3.1.7.4 No deterioration in the existing capability for the correct and timely interpretation of the information conveyed by lineside signals, signs and indicators shall be permitted.
- 3.1.7.5 Every opportunity shall be taken to achieve improvements in sighting and readability of lineside signals, where reasonably practicable.
- 3.1.7.6 Changes in the natural and built environment, environmental conditions, changes to rolling stock, reports of operational experience, and other factors which are not capable of being codified in an engineering standard, shall be kept under review regarding the sighting and readability of lineside signals at any particular location.

3.1.8 Equipment Security Requirements

- 3.1.8.1 In order to maintain the safe and reliable operation of the railway, Signalling Equipment Rooms (SERs) and trackside equipment cases shall be secured against access by unauthorised personnel in accordance with good industry practice.

Note 1: Entry to the SER's shall be authorised to licensed personnel and permitted key holders in accordance with the LU Rule Book. Unauthorised people should not be permitted to enter these rooms unless accompanied by authorised personnel.

Note 2: The access control regime (regarding keys and locks) shall be in accordance with the requirements of the Premises Engineer.

- 3.1.8.2 The following requirements apply to all methods for controlling access to SERs and trackside equipment cases:
 - a) Suppliers shall maintain a management system for controlling the means of access to SERs and trackside equipment cases.
 - b) Authorised personnel entering an SER shall notify the person whose name and contact details shall be displayed, by the Supplier, in a prominent position within each SER.
 - c) Authorised personnel status shall only be given to persons who have an appropriate and proper need to enter and work in SERs.
 - d) Authorised personnel shall be allowed unhindered access and entry to SERs for inspection and other legitimate purposes.
 - e) Records detailing names of persons entering SERs and the nature of the works performed in SERs shall be maintained.
 - f) SERs shall be fitted with entry alarm systems, where reasonably practicable. The action to be taken when there is an alarm activation shall be agreed between the Professional Head of Signalling and the Supplier at the time of supply of the alarm system.
 - g) The Supplier shall retain control of any system which limits access to an SER for the life of that system.
- 3.1.8.3 The following requirements shall apply to mechanical key suiting systems:
 - a) the procurement, storage, issue, use and return of keys that allow access to SERs and trackside equipment cases shall be subject to rigorously enforced management control.



- b) suppliers shall define keyholder competence criteria and only issue keys to persons meeting this criteria.
- c) suppliers shall maintain records of Key Holders and, where they are issued with keys on a personal basis, the type and serial number of keys held.
- d) suppliers shall ensure that keys are issued only to persons who have an appropriate and proper need to access SERs and trackside equipment cases.
- e) suppliers shall ensure that competent London Underground and British Transport Police personnel are issued with keys as required.
- f) personal issue keys shall not be transferable and their use by an unauthorised person shall be treated as a serious breach of discipline by both the authorised and unauthorised persons.
- g) no new key suiting arrangements shall be implemented at any site until such arrangements (including key types, identification codes and serial numbers) have been formally discussed and agreed between the Supplier(s) and the Professional Head of Signalling.
- h) audits shall be performed on Key Holders to ensure the correct usage and allocation of keys. The Key Holder shall present on demand their personal identification, issued by their employer, together with the relevant key(s).

3.2 Testing During the Operation and Maintenance Life Cycle Phase

3.2.1 Overview

- 3.2.1.1 Arrangements shall be established to permit detailed technical investigations of confirmed or suspected misoperation of signalling systems or components, both in-situ and off site. In-situ investigations shall be planned and carried out by licensed personnel.

Note: In clause 3.2.1.1 the term "carried out" covers the situation where an AWC-holding licensed person is supervising a non-licensed specialist and where the AWC holder maintains responsibility for the safe re-entry of the system into service.

- 3.2.1.2 Maintenance testing shall be carried out to achieve one or more of the following objectives:

- a) to verify the physical correspondence between a system and its authorised design, including that the authorised version of a component or data set has been installed;
- b) to verify the logical operation of a system in accordance with its authorised design;
- c) to verify the correct adjustment of a component or sub-system;
- d) to verify the critical characteristics or parameters of a component or sub-system.

Note: Objective d) may be undertaken for the following situations:

- a) following a reported unsafe failure of the signalling system, in order to determine the validity of the report (e.g. testing the insulation resistance between independent contacts of a relay when a false feed between circuits is suspected); or
- b) where safety integrity of the signalling is critically dependent on component parameters or characteristics whose initial achievement or stability over the life of the installation cannot reasonably be assured other than by testing (e.g. testing the insulation of vital multicore cables where this is critical to the safety of the signalling).

3.2.2 Maintenance Testing

3.2.2.1 Scope

- 3.2.2.1.1 'Maintenance Testing' shall be applied in connection with any task which interrupts or interferes with the commissioned signalling system and which:



- a) on completion returns the signalling to exactly the same design configuration as before (commonly referred to as 'like-for-like'); and
- b) is of limited extent and complexity.

Note 1:	This scope would typically include like-for-like replacement of individual components (including 'routine change'), preventative maintenance and corrective maintenance.
Note 2:	The 'design configuration' includes the version or modification state of the equipment. However, where an authorised statement of interchangeability has been issued by the Design Authority then substitution of different versions or modification states in accordance with the statement is deemed to be 'like-for-like', provided any specified conditions or restrictions are complied with.
Note 3:	Tasks which 'interrupt or interfere with the commissioned signalling system' require to be authorised and recorded through the issue and use of an AWC, in accordance with the AWC procedure (see section 3.1.4.1).

3.2.2.1.2 Maintenance testing shall not be applied when the work:

- a) is extensive and simultaneous, or of particular complexity, (despite being 'like for-like'); or
- b) involves any degree of validation (as opposed to verification).

In these cases, the applicable techniques and requirements of Works Testing shall be applied, as defined in standard S1198, Signalling and Signalling Control - Installation, Testing, Commissioning and Handover. The Supplier shall provide guidance on when this clause applies.

Note 1:	Verification is a check that the system under test complies with the design.
Note 2:	Validation is a check that the principles used have been correctly implemented in the design to make a system fit for purpose.

3.2.2.1.3 If a discrepancy is found between the 'as built' site records and the physical installation it shall not be presumed that the records represent a valid design. As a consequence:

- a) should doubts arise as to the safety integrity of the design as shown in the site records or of the installed signalling itself, appropriate steps shall be taken to safeguard the operation of the site and the matter shall be escalated;
- b) before any planned work where the safety assurance relies on the accuracy of the 'as built' records, the correlation between the installed wiring and the as built records shall be confirmed.

3.2.2.2 Management control

3.2.2.2.1 Whenever a maintenance testing task is to be carried out, the Supplier shall ensure that:

- a) one person is in charge of the testing (the Tester), and is authorised and accountable for the particular task concerned by the issue of an AWC, in accordance with the AWC procedure (see section 3.1.4.1);
- b) maintenance testing is undertaken only by or under the direct supervision of the person described in a) above;
- c) the Tester is responsible for selecting the relevant test specifications.

3.2.2.3 Maintenance Testing Independence

3.2.2.3.1 Suppliers shall be responsible for ensuring task analysis is carried out to identify maintenance operations that require independence of testing or other safeguards to assure the integrity of the signalling system.



3.2.2.3.2 The degree of independence between the person or persons carrying out the task for which testing is required, and the person undertaking the testing for that task, shall be sufficient to ensure that the integrity requirements of section 3.2.2.3.1 will not be compromised.

3.2.2.3.3 Where tasks and test specifications are common across more than one Supplier, a common independence requirement shall be agreed between the Suppliers concerned.

3.2.2.4 Risk Identification And Mitigation

3.2.2.4.1 Risks arising from or associated with Maintenance Testing that could impair the safety integrity of the system shall be assessed and mitigated prior to undertaking the task.

3.2.2.4.2 The assessment and mitigation of such hazards shall be sufficiently rigorous to ensure that all credible risks to the safe operation of the signalling arising from or associated with the maintenance task and its testing are either eliminated or controlled to a level that is ALARP.

3.2.2.4.3 The assessment of risks and mitigation measures shall be reviewed and updated periodically and following relevant incidents.

Note:	Hazards may arise from or be associated with:
a)	inadequate protection of the operational railway during testing;
b)	the presence of redundant, uncommissioned or decommissioned equipment on site (particularly if these are not shown in the site records);
c)	the poor condition of existing equipment (e.g. degraded wire insulation);
d)	non-standard equipment (e.g. trainstops having non-standard contact arrangements);
e)	the masking of certain controls by other controls leaving part untested (e.g. track circuit controls being masked by timer down-proving);
f)	replacement of 'memory' components (e.g. gravity bias or magnetically latched relays), or polarity-critical components (e.g. polarised relays);
g)	transfer of critical-identity data modules (such as site-specific or version-specific EPROMs) to replacement sub-systems, or replacement of the data modules themselves;
h)	replacement of configurable components (e.g. switch-encoded processor cards, or adjustable timers);
j)	replacement of components by physically interchangeable items which may not be operationally equivalent;
k)	hazards associated with temporary connections, such as test equipment;
m)	out-of-date records, or discrepancies between site records and the physical installation, for example: i) relay contacts with wiring to armature and front terminals reversed; or ii) outside terminal boxes at older sites, which may not be shown on wiring plans.
n)	a testing environment that increases fatigue or impedes tester effectiveness (e.g. high noise levels or poor lighting).



3.2.2.5 Testing following maintenance and like-for-like renewals

3.2.2.5.1 For work of a planned nature, such as preventative maintenance, routine change or track replacement, the extent of the testing shall be documented in a test plan prior to implementation. This plan shall include or refer to the relevant test specifications, see 3.2.2.7.

Note: Where the work involves extensive and simultaneous re-commissioning, or is of unusual complexity, the requirements of clause 3.2.2.1.2 apply.

3.2.2.5.2 Arrangements for the control of deviations from the test plan shall be specified and changes shall be documented.

3.2.2.5.3 Test plans shall be subject to independent review and acceptance by an accountable engineer before use.

3.2.2.6 Testing Following Faults And Failures

3.2.2.6.1 Where testing work is required for the identification or rectification of faults or failures, the test specifications that were employed shall be recorded on the AWC.

3.2.2.6.2 For testing in connection with faults and failures, a formal test plan is only required when:

- a) carrying out planned 'follow-up' investigations of undiagnosed failures; or
- b) investigating a reported suspected unsafe condition or other serious incident, see 3.3.3.

3.2.2.7 Test Specifications

3.2.2.7.1 All maintenance testing shall be carried out in accordance with suitable test specifications.

3.2.2.7.2 Test specifications shall ensure a consistent approach to maintenance testing. Where systems and test requirements are common across more than one Supplier, a common test specification and common independence requirement (see section 3.2.2.3) shall be agreed between the Suppliers concerned. It shall be permissible to use generic or standard test specifications, provided they are applied within the scope of their validity.

3.2.2.7.3 Maintenance test specifications shall contain:

- a) the objectives of the test;
- b) the testing steps necessary to ensure the correct operation of equipment following preventative or renewal maintenance tasks;
- c) the testing steps necessary to ensure the correct operation of the equipment that has been disturbed or replaced and of the sub-system of which it forms a part;
- d) the expected results and acceptance criteria;
- e) the required methods for recording and certifying the test results (sufficient to indicate what testing was undertaken, and to demonstrate the satisfactory completion of the testing and any associated adjustments);
- f) credible threats to the effectiveness of the test, and required defences.

3.2.2.7.4 Test specifications shall be prepared by accountable engineers, and those relating to safety systems shall be independently reviewed by a second accountable engineer.

3.2.2.7.5 Test specifications shall be made available for use prior to the entry into service of any new equipment or system.



Note: Where the hazard assessments and mitigation plans required by section 3.2.2.4 relate directly to a particular test specification, they may form an integral part of the test specification itself.

3.2.2.8 Recording and certification

3.2.2.8.1 The results and certification of maintenance testing shall be recorded and retained.

3.2.2.8.2 The test records and the persons conducting them shall be monitored, having regard to the requirements of supervision & audit (section 3.1.1.3), in order to identify and correct deficiencies in process or compliance and to effect a continuous improvement strategy.

3.2.2.9 Implementation of Maintenance Testing

3.2.2.9.1 Testing shall be carried out in accordance with:

- a) the test specifications relevant to the work; and
- b) the test plan, where one is provided in accordance with section 3.2.2.5 or 3.2.2.6.

3.2.2.9.2 The nature and extent of the testing (as defined in the test specifications, and in the test plan when required), and the rigour of the testing process, shall be such as to:

- a) meet all of the testing objectives required (by the relevant parts of section 3.2.1.2);
- b) satisfy the fundamental requirements of ALARP and, in doing so;
- c) address the risks both of technical deficiencies within the system under test and of systematic failure within the testing process itself.

Note: Examples of technical deficiencies might include: an installation error (e.g. incorrect wiring or adjustment of equipment); or sub-standard components (e.g. a high resistance relay contact).

3.2.2.10 Error Reporting And Rectification

3.2.2.10.1 Suppliers shall specify appropriate arrangements for reporting any discrepancies between the site records and the installed signalling that may come to light during maintenance testing.

3.2.2.10.2 Errors found during testing shall be dealt with as required in S1197, Signalling and Signalling Control - Design and Implementation, and S1198, Signalling and Signalling Control - Installation, Testing, Commissioning and Handover.

3.2.2.10.3 The system shall be re-tested following correction. The re-verification shall be sufficient to cover the extent of the rectification required.

3.2.2.10.4 If an error is considered serious enough to warrant it, the error shall be treated as an incident and the escalation procedures for Incident Management, in section 3.3 of this standard, shall be initiated.

3.2.2.11 Re-entry Into Service

3.2.2.11.1 Re-entry into service shall be permitted only when:

- a) the correct responses to route commands from the Operators' point of control have been observed;
- b) any simulation or other temporary facilities have been completely removed from the commissioned system, unless they are intended to be retained as part of an authorised monitoring arrangement;
- c) the system has been restored to its normal (quiescent) state, and;



- d) the AWC has been signed off, supported as appropriate by other required evidence of proper completion mandated by the testing specifications, in accordance with section 3.2.2.7.3 (e).

3.3 Incident Management

3.3.1 Overview

3.3.1.1 Organisation

3.3.1.1.1 A Supplier responsible for the line maintenance regime shall implement an incident management organisation which shall provide the following:

- a) defined points of contact for initial reporting and ongoing technical liaison;
- b) a secure arrangement for recording and tracking of signal assets changed either during or after an incident;
- c) twenty-four hour cover by competent signalling technicians and a technical supervisor and contact with a competent and experienced signal manager;
- d) a means of escalation for additional knowledge or a higher level of authority;
- e) standby arrangements for additional competent technicians and supervisors;
- f) controlled copy access to 'as built' drawings at signalling equipment rooms and offices.

Incidents shall be reported and managed in accordance with this standard and, where applicable, the LU Rule Book.

3.3.1.1.2 Positions of responsibility together with primary duties relating to incident management shall be discharged as defined within the LU Rule Book.

3.3.1.1.3 The Supplier shall provide to the Professional Head of Signalling the names and contact details of persons who are rostered to fulfil specific and agreed roles as part of the escalation process. In addition, an up-to-date list shall also be provided to the NOC.

3.3.1.1.4 The Supplier shall hold and make available to LU the contact details of all persons or entities who are a Design Authority and for which systems or equipment they hold this designation.

3.3.1.2 Response to incidents

3.3.1.2.1 The supplier shall notify the Duty Senior Signal Engineer, as soon as practicable, of all reported unsafe failures or conditions of the signalling system.

Note: Contact details for the Duty Senior Signal Engineer are available via the NOC.

3.3.1.2.2 The management of incidents, where damage has been caused to infrastructure, for instance by fire or train derailment, shall be handled in consultation with the accountable engineer nominated by the Supplier to be on duty for this purpose.

3.3.1.2.3 Confirmed instances of unprotected wrong side failures shall be reported to the ORR by the Professional Head of Signalling.

Note: Initial unconfirmed reports of such failures will normally be made to the ORR by the NOC.

3.3.1.2.4 Details of all such incidents shall be recorded in the Professional Head of Signalling's register of safety critical signalling incidents.

3.3.1.2.5 Each supplier shall establish procedures for tasks involving disturbance to working assets and partial or temporary repairs. The procedures shall ensure that these activities are controlled and formally recorded.



3.3.1.2.6 The suppliers' procedures shall specify:

- a) limits or restrictions on how, when or by whom such activities may be authorised or performed. Formal hazard analysis techniques shall be used to assist in identifying the need for such limits;
- b) the response to any allegation that the signalling has failed in an unsafe way.

3.3.1.2.7 The suppliers' procedures shall also address the following three key requirements:

- a) urgently making the railway safe;
- b) preserving the evidence of what occurred;
- c) properly controlling the arrangements for the recommencement of train movements.

3.3.1.3 Preservation of evidence

3.3.1.3.1 Evidence of an incident shall be preserved so as to ensure that the facts can be established with maximum certainty for possible use at any subsequent inquiry by:

- a) immediate observation and noting of key visible information as the position of trains and the state of affected equipment such as indications, signal aspects, trainstops, points, relays, levers. Photographs shall be taken of any evidence;
- b) avoiding disturbance of the affected equipment and circuits, so that transient states (such as electrically latched circuits, jammed relays or intermittent false feeds) are preserved until they can be subjected to expert examination;
- c) controlled measurement of potentially volatile parameters, such as input or output voltages of key items of equipment;
- d) carefully preserving for expert examination any relevant item of equipment or material that may have already been changed following the incident, or which is changed during the subsequent investigation. Equipment shall not be removed without the authority of the accountable engineer nominated by the Supplier to be on duty for this purpose on site. Equipment removed shall be handled and transported with great care to ensure that the equipment arrives in a satisfactory condition at a designated place defined by the accountable engineer nominated by the Supplier to be on duty for this purpose;
- e) securing relevant recorded data, such as video recordings, voice communication recordings, control system computer data logs and vehicle 'black box' recordings before they are overwritten;
- f) urgent collation of written statements from key witnesses;
- g) conducting effective documented interviews with key witnesses (who shall be directed to hold themselves available until interviewed, unless there are unavoidable reasons for releasing them in which case contact details shall be taken) by appropriate operating and technical experts as soon as possible after the events (taking care to establish and maintain the independence of each witness's evidence where possible);
- h) properly controlling the arrangements for the recommencement of train movements which may be either:
 - i) before a full technical investigation has been carried out or its conclusions reached (where early recommencement of service is considered essential on operational grounds, and where appropriate technical or procedural safeguards, or both, can be agreed upon between a designated Maintainer and an LU Operator for the protection of train movements until the signalling is returned to full normal operation); or
 - ii) after a full technical investigation has concluded that the reasons for the incident are understood and have been corrected, or are sufficiently closely