Installation of Signalling and Operational Telecommunications Equipment

Synopsis
This document sets out the particular requirements for installation work involving the provision, alteration, like for like replacement and abolition of signalling and operational telecommunications systems and equipment used as part of Railtrack Controlled Infrastructure.

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Installation of Signalling and Operational Telecommunications Equipment

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Part A

Issue Record

This document will be updated when necessary by distribution of a complete replacement.

Revisions in the reissued document will be marked by a vertical black line in the right hand margin adjacent to the revision.

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<td>One</td>
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Responsibilities

Railway Group Standards are mandatory on all members of the Railway Group * and apply to all relevant activities that fall into the scope of each individual’s Railway Safety Case. If any of those activities are performed by a contractor, the contractor’s obligation in respect of Railway Group Standards is determined by the terms of the contract between the respective parties. Where a contractor is a duty holder of a Railway Safety Case then Railway Group Standards apply directly to the activities described in the Safety Case.

* The Railway Group comprises Railtrack and the duty holders of the Railway Safety Cases accepted by Railtrack.

Compliance

The provisions in this document are to be complied with from 7 October 2000 in respect of signalling systems and equipment, and from 7 April 2001 in respect of operational telecommunications systems and equipment.

Health and Safety Responsibilities

In issuing this document, Railtrack PLC makes no warranties, express or implied, that compliance with all or any documents published by the Safety & Standards Directorate is sufficient on its own to ensure safe systems of work or operation. Each user is reminded of its own responsibilities to ensure health and safety at work and its individual duties under health and safety legislation.

Supply

Controlled and uncontrolled copies of this document may be obtained from the Industry Safety Liaison Dept, Safety and Standards Directorate, Railtrack PLC, Railtrack House, DP01, Euston Square, London, NW1 2EE.
Part B

1 Purpose

The purpose of this document is to set out requirements for signalling and operational telecommunications installation work, in order to:

a) avoid jeopardising the safety of the operational railway whilst signalling and operational telecommunications installation work is taking place on Railtrack Controlled Infrastructure, and

b) avoid introducing defects or errors into signalling and operational telecommunications systems and equipment which could subsequently affect the safety of the operational railway while the equipment is in service.

2 Scope

The overall scope of Railway Group Standards is as specified in Appendix A of GA/RT6001.

This document contains requirements which are applicable to the duty holder of the following category of Railway Safety Case:

- Infrastructure Controller

Specifically the contents of this document apply to signalling and operational telecommunications (S&T) installation activities where the work:

- is taking place on equipment that forms part of Railtrack Controlled Infrastructure; or
- is taking place on equipment that is owned by Railtrack but has been leased to a telecommunications service provider; or
- is taking place at a non-railway location (eg, a factory) in accordance with application-specific designs, and the completed equipment could, when introduced into service, affect the safety of the operational railway.

Work within the scope of this document includes both new work and like for like replacement (as defined in section 3).

The scope does not include:

- general requirements for railway construction planning and management (see GI/RT7003);
- manufacture of “off-the-shelf” items such as signal heads, relays, electronic modules;
- installation of train-borne S&T equipment;
- specific requirements relevant to installation work set out in other Railway Group Standards (eg, the protection of trains in accordance with the Rule Book GO/RT3000; protection of buried services in accordance with GM/RT1103);
- occupational health and safety requirements relevant to personnel who install, test, maintain or operate the systems and equipment.

3 Definitions

Engineering Details

A suite of documents that provide the detailed information necessary for the construction/installation of the signalling system. It may also include application-specific software/data for the signalling system, where it is produced as a part of the design process. See clause 7.1.1 for a list of engineering details that are relevant to installation work.

Infrastructure Records

The definitive records of the signalling system which reflect the actual configuration of the installed equipment, wiring and software. Such records are
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created and retained in accordance with GI/RT7001, and may be physical drawings or electronically stored data.

Like for Like Replacement
The removal and restoration of an item of equipment in a previously working and commissioned system, where the work does not change the configuration or functionality of the system. Engineering details are not provided for the work, and instead the existing infrastructure records are used as the reference documents.

Typically, such work is carried out to repair/replace defective or life-expired equipment or wiring. The work may involve restoring the original item of equipment or replacing it with an operationally equivalent new item (an operationally equivalent item is one that is functionally identical to the item it replaces).

New Work
The installation of new or modified wiring, equipment and software, where the work changes the configuration or functionality of the system. The work is carried out in accordance with engineering details supplied for the purpose (see GK/RT0207). For the purposes of this document, the definition includes:

- the installation of totally new systems; and
- the alteration of existing systems; and
- the abolition (also known as “recovery”) of existing systems.

Operational Equipment/Circuits/Wiring
Equipment, circuits or wiring that are part of a working signalling or telecommunications system. Where a possession has been arranged to ensure the safety of trains and the public, then the equipment, circuits and wiring that are covered by the possession are regarded as “not operational” for the duration of the possession (ie, they are not within the scope of this definition).

Signalling and Operational Telecommunications Systems and Equipment
(Systems and Equipment)
Systems and equipment within the scope of this document which is used for:

- authorising and safeguarding the movement of trains (eg, Interlockings; train detection equipment; signals; point operating mechanisms; cables; cable routes; apparatus cases); and
- safety-related communications purposes in the direct operation of the railway (eg, signal post telephone systems; cab secure radio systems; signalling data communications systems), but excluding communications links and networks where the physical location of the equipment and the nature of the communications protocol is such that installation work involving the link/network could not jeopardise the safety of the railway; and
- providing protection and warnings for trackside personnel, where such systems and equipment form part of the whole signalling system.

The definition includes application-specific software and data, as well as equipment and wiring.

In the context of this document, the definition includes infrastructure-based systems and equipment only, not train-borne equipment.
4 Control of Installation Work

The requirements of this section apply to all installation work (like for like replacement and new work), whether taking place on Railtrack Controlled Infrastructure or not.

4.1 Competency Requirements

4.1.1 S&T installation work shall be planned only by personnel who possess sufficient knowledge of the following for the purposes of preparing the plans and method statements:

- the procedures, techniques and practices relevant to the work; and
- the equipment to be installed.

4.1.2 S&T installation work shall be performed only by personnel who:

- are competent to apply the procedures, techniques and practices relevant to the work; and
- possess sufficient knowledge of the equipment to be installed for the purposes of carrying out the work safely and to the appropriate standards.

4.2 Risk Identification and Mitigation

The particular risks associated with S&T installation work shall be identified, assessed and eliminated/mitigated before work commences. Particular attention shall be given to:

- activities where the safety of the operational systems and equipment could be jeopardised while the work is being performed; and
- the risk of introducing latent defects and errors that are not readily detectable during subsequent testing and commissioning activities.

4.3 Procedures

4.3.1 Insofar as they are relevant to safety, methods of work and standards of workmanship shall be:

- documented (e.g., in the form of safety plans, procedures, method statements or installation instructions); and
- approved by an authorised person. Approval shall be given by the Infrastructure Controller or by a person who has been authorised by the Infrastructure Controller to give such approval.

It is permissible for generic procedures/method statements to be used, provided that they are appropriate and sufficient in content for the particular installation work under consideration to be performed safely.

4.3.2 Where approved standard procedures/methods exist for S&T installation activities, they shall be applied except where a proposed alternative is:

- supported by an assessment of the risks, and those risks are controlled such that they are no worse than for the standard procedure/method; and
- documented and approved in accordance with the requirements of clause 4.3.1.

4.4 Supervision and Audit

Installation work shall be subject to appropriate levels of supervision, quality checks and audit, to ensure that the approved methods of work are applied, and
that the required standards of workmanship are achieved. Particular attention shall be given to the key areas of risk described in clause 4.2.

The arrangements for supervision, audit and quality checks shall be documented, and shall be subject to the approval of the Infrastructure Controller. The documentation shall include details of the particular audit and quality checks to be conducted.

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

- the complexity of the work and the extent to which it is unusual/unique; and
- the competency of the installation personnel in relation to the work being performed; and
- the likelihood of errors being made; and
- the consequences of such errors.

4.5 Testing

Systems, equipment and wiring (whether provided as new work or as like for like replacement) shall not be brought into service or connected to operational S&T systems/equipment or other infrastructure, if the safety of the operational railway could thereby be jeopardised, until testing has been successfully completed.

The requirements for testing are set out in GK/RT0209.

4.6 Adoption of Best Practice

The Infrastructure Controller shall endeavour to ensure that “best practice” is adopted in installation work, by means such as:

- systematic capture of emerging good practice from projects;
- use of hazard logs to record errors and defects arising from installation activities;
- periodic review of generic procedures/method statements and required standards of workmanship;
- documenting and promulgating of “best practice” and “lessons learned” information.

5 Installation Practices

The requirements of this section apply to all installation work (like for like replacement and new work), whether taking place on Railtrack Controlled Infrastructure or not.

5.1 Transport, Handling and Storage

Equipment shall be suitably protected to prevent damage during transport, handling and storage prior to, and during, installation work. Particular attention shall be given to the prevention of damage that is not readily identifiable during pre-installation checks.

Examples of hazards include: damage to electrostatically sensitive equipment; equipment exceeding shelf life; storage in an unsuitable environment.

5.2 Integrity of New Equipment

Equipment to be installed shall be checked to ensure it is of the correct type, free from defects and, where appropriate, correctly configured for its application.

5.3 Protection of Installed Equipment

Installed equipment and wiring shall be protected from exposure to reasonably foreseeable environmental and physical hazards that could cause mal-operation in service. Hazards to be considered include both those that arise prior to commissioning and those that arise during the operational life of the equipment.
Examples of hazards include: ingress of moisture; contact between wiring and abrasive/sharp edges; exposure of trackside cables to crushing or other damage; inadequate heating in lineside cabinets for relays.

5.4 **Tools and Measuring Devices**

Tools, meters and other measuring devices used for installation purposes shall be fit for purpose (which includes being calibrated, where necessary) and used in the correct manner, so as to avoid damage to the equipment being installed and hazards to operational systems and equipment.

Examples of hazards include: equipment wrongly adjusted arising from the use of an uncalibrated meter; inadvertent electrical contact between circuits arising from defective insulation on a tool; damage to wiring insulation or conductors during wire stripping; heat damage from soldering irons.

6 **Additional Installation Practices for Work on Railtrack Controlled Infrastructure**

The requirements of this section apply to all installation work (like for like replacement and new work) taking place on Railtrack Controlled Infrastructure.

6.1 **Integrity of Existing Infrastructure**

6.1.1 Installation work shall not interfere with the integrity, operation or use of existing S&T systems and equipment, except where measures have been implemented to ensure that safety is not jeopardised.

Examples of hazards include: obscuring signals; connection of electrical tools and equipment to signalling system or power supplies; use of mobile telephones near equipment which is susceptible to interference; insulation testing of live circuits; obstruction of moving parts; inadvertent release of locking during replacement of a relay; cutting operational cables; damage caused during recovery of redundant equipment or wiring; disruption of signaller’s control and display systems.

6.1.2 Installation work shall not interfere with the integrity, operation or use of other parts of the infrastructure, nor stations, except where measures have been implemented to ensure that safety is not jeopardised.

Examples of hazards include: obstruction of signal walkways during cable route construction; removal of bolts or other components from switches and crossings; the erection of structures near the track; disconnection of earth bonds from structures; excavations near or under the track; obstruction or excavation of platforms.

6.1.3 Where existing equipment or wiring is defective or in sub-standard condition, measures shall be applied to ensure that safety is not jeopardised by installation work which:

- is taking place on or near the equipment/wiring; or
- involves the re-use of the equipment/wiring.

Examples of hazards include: defective cable or wire insulation; earth faults; relays that need servicing before they can be re-used.

6.1.4 Measures shall be applied to prevent electrical contact between operational circuits and non-operational wiring. Specifically:
a) New wiring shall not be connected to, nor any other alterations made to, existing operational circuits until the new/altered wiring has been independently tested and proven to be safe.

b) The exposed ends of new wires that are not terminated, and of existing wires that are disconnected but not physically removed, shall be insulated in a secure manner to prevent inadvertent electrical contact with operational circuits.

c) Where installation work is taking place adjacent to operational circuits, appropriate precautions shall be taken to prevent inadvertent electrical contact between operational circuits that are electrically separate, and between operational circuits and non-operational wiring.

6.2 Disconnections
Where disconnections are required in accordance with Section E of the Rule Book GO/RT3000 in order to protect installation work, the disconnections shall be selected so that:

- they will not be affected by the work subsequently to be carried out; and
- they will be effective under all circumstances (e.g., a track circuit disconnection to hold a signal at danger might not be effective if the signal has a calling-on route associated with it); and
- they will not have to be reconnected for the purposes of testing prior to handback to the signaller; and
- in the event of partial handback to the signaller, they will remain effective for equipment that is not available for use.

Disconnections shall be clearly labelled to prevent inadvertent reconnection.

6.3 Identification of Equipment
6.3.1 New/replacement equipment and wiring shall be suitably labelled or otherwise identified as it is installed, for the purposes of:

- ensuring that the equipment and wiring can subsequently be electrically connected together in the correct manner; and
- identifying the phase of work to which the equipment and wiring applies (relevant where the work is being tested and commissioned in stages but the installation work is being carried out for several stages together); and
- facilitating testing activities.

Where the equipment identifiers are also to serve as the means of identification for maintenance purposes, their quality and durability shall be compatible with the life expectancy of the equipment.

6.3.2 Equipment which is not in service but which could mistakenly be thought to be in service or available for use shall be clearly signed or labelled to indicate that it is not in service. This applies to new equipment awaiting commissioning, equipment temporarily out of service and to redundant equipment awaiting removal.

Examples include: labels on telephones; signals hooded and marked with a cross.

6.4 Security
Equipment, plant and premises shall be secured against unauthorised access, use and misuse, to prevent safety being jeopardised during installation work and after the work has been completed.
Examples include: securing of points not in use; locking of unattended equipment rooms and lineside cabinets.
7 Additional Requirements for New Work

The requirements of this section apply to new work, whether it is taking place on Railtrack Controlled Infrastructure or not.

7.1 Application of Engineering Details

7.1.1 Systems, equipment and wiring shall be constructed, installed and set up in accordance with the requirements of the engineering details. Engineering details include, as appropriate:

a) details of new systems, equipment, software/data and wiring to be provided (including, the type/model/version number; modification state; configuration/coding information);

b) details of existing systems, equipment, software/data and wiring to be modified, removed or taken out of use but not removed;

c) details of interfaces between existing and new systems/equipment, and of interfaces with signallers and maintainers;

d) application-specific software and data that forms part of the signalling system;

e) details of test rigs and other temporary arrangements;

f) details of buildings, apparatus cases, fixtures, fittings, etc. relevant to the housing and environmental/physical protection of equipment;

g) details of earthing arrangements;

h) physical dimensions, equipment positions, alignments etc;

i) electrical ratings and values (eg, maximum voltages, cable ratings etc);

j) other installation details (eg, installation specifications and codes of practice; types of materials to be used; setting up procedures; manufacturers’ instructions; equipment specifications; standard drawings).

Where the design requirements are impracticable or unclear in intent, the problem shall be referred back to the supplier of the engineering details for resolution.

7.1.2 Where the engineering details do not give precise requirements for installation (eg, the exact position of equipment within an apparatus case, or the precise voltage setting for a power supply), it is permissible for installation personnel to make decisions about those details, provided that:

• any relevant setting up procedures are applied; and

• the decisions are made within the scope/limits permitted by the engineering details (eg, a voltage is selected to be within the minimum and maximum allowable values).

Where important for safety, precise positions, voltages and other parameters determined on site shall subsequently be recorded on the infrastructure records (see GK/RT0207 and GI/RT7001).

7.2 Records of Progress

Where work is being carried out on the railway, records shall be maintained of the extent of installation progress. The records shall contain sufficient detail that maintenance contractors and others who may need to know the current configuration of the system/equipment are not misled by apparent inconsistencies between the infrastructure records and the physical equipment and wiring on site.
Requirements relating to the updating of infrastructure records on completion of new work activities are specified in Railway Group Standards GK/RT0207 and GI/RT7001.

7.3 Interface with Testing Activities

Procedures shall be in place for:

- receiving engineering details, software and data (including any modifications) from designers in a controlled manner; and
- handing over completed installation work to testers; and
- implementing modifications to engineering details, software and data; and
- rectifying installation errors.

These procedures shall ensure that:

a) when installation work is handed over for testing, it has been completed in accordance with the most up-to-date version of the engineering details, and that the appropriate quality assurance certification has been completed (or equivalent evidence provided) to indicate that the required standards of workmanship have been achieved; and

b) where design modifications have to be implemented (or an installation error has to be corrected) after work has been handed over for testing, the re-work takes place under the authority of the testing personnel, to avoid misunderstanding over what has and has not been tested; and

c) re-work arising from design modification or installation errors is subject to re-testing.

8 Additional Requirements for Like for Like Replacement

The requirements of this section apply to like for like replacement work taking place on Railtrack Controlled Infrastructure.

8.1 Use of Infrastructure Records

8.1.1 Where the work involves:

- the disconnection and reconnection of equipment and wiring; or
- the replacement of any other item of equipment the details of which are shown on the infrastructure records,

then the infrastructure records shall be used for reference purposes when planning and carrying out the work, except where alternative arrangements are permitted by the procedures referred to in clause 8.1.3.

8.1.2 Where the infrastructure records are to be used in accordance with the requirements of clause 8.1.1, the existing equipment and wiring shall, except in the circumstances described below, be checked (correlated) against those records before installation work commences, in order to verify that they are accurate and can therefore be relied upon for the purposes of carrying out the work.

Correlation need not be carried out if:

- the existing infrastructure records are known to be accurate and complete; or
- the condition of the equipment or wiring is such that the correlation work would itself present a serious risk to the safety of the operational railway; or
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- the risks arising if correlation is not carried out are low, and the costs of correlation are assessed as being grossly disproportionate to any further benefit in risk reduction.

8.1.3 Procedures shall be in place to address situations where:

- correlation indicates that the infrastructure records do not agree with the existing equipment and wiring;
- correlation is not possible because the infrastructure records are not available, or because of the hazardous condition of the equipment/wiring, or because wiring/equipment is missing.

The procedures shall be sufficient to ensure beyond reasonable doubt that, where the like for like replacement work is permitted to proceed, it cannot jeopardise the safety of the operational railway.

8.1.4 Where the infrastructure records do not give precise requirements for installation (eg, the precise voltage setting of a power supply), it is permissible for installation personnel to make decisions about those details, provided that:

- any relevant setting up procedures are applied; and
- the decisions are made within the scope/limits permitted by the infrastructure records, the capability of the equipment involved, the associated equipment instructions, and any applicable standards (eg, a voltage is selected to be within the minimum and maximum allowable values).

8.2 Minor Changes
It is permissible for minor changes to be made to existing equipment and wiring in order to facilitate like for like replacement work, provided that the integrity and functionality of the system is not affected.

Records of such changes shall be provided on-site for the maintainers of the equipment, and where the changes are permanent, the infrastructure records shall be updated (see GI/RT7001).

Where like for like replacement involves the installation of an operationally equivalent item of equipment (see definition of "like for like replacement" in section 3), the equipment shall be of a type which is authorised for use in that application (see GI/RT7002).

Examples include: repositioning of an item of equipment within an apparatus case; re-routing of a circuit via another cable or cable core; replacement of an item of equipment by a non-identical but operationally equivalent item.

8.3 Identification of Equipment and Wiring to be Disconnected
Where like for like replacement is being carried out, existing equipment and wiring which is to be disconnected/removed but subsequently reinstated to use shall be labelled or otherwise made identifiable before disconnection/removal, so as to facilitate correct reinstatement.
References

GA/RT6001  Railway Group Standards Change Procedures
GI/RT7001  Management of Safety Related Records of Elements of the Infrastructure
GI/RT7002  Acceptance of Systems, Equipment and Materials for Use on Railtrack Controlled Infrastructure

* GI/RT7003  Management of Construction Work in the Railway Environment

GK/RT0207  Signalling Design Production

* GK/RT0209  Testing and Commissioning of Train Control and Operational Telecommunications Equipment (to supersede GK/RT0221)

GM/RT1103  Mechanical Protection and Marking of Buried Services
GO/RT3000  The Rule Book


* In draft at date of publication