

**Detailed Requirements Document (DRD)
Rail Engineering Advanced Technician Level 4
Telecoms Knowledge & Skills Content**

Purpose

The purpose of this Detailed Requirements Document (DRD) is to provide employers, colleges and training providers and those developing qualifications with an additional level of detail behind the Standard. The DRD should be used to support the delivery of the Railway Engineering Advanced Technician Apprenticeship

This document sets out the Knowledge and Skills required for anyone following the Telecoms pathway. These requirements are in addition to the Rail Engineering Advanced Technician core knowledge and skills.

Once complete this document this document will form part of the Employer Occupational Brief (EOB).

Development process and sources

The detail within this document has been developed from Rail Engineering Technician DRDS to which additional requirements were added or items that were deemed no longer necessary were removed.

Table of Contents

Detailed Requirements Document (DRD).....	1
The Standard: Telecoms Specialism	3
IRSE Licenses	Error! Bookmark not defined.
1. Safe and Professional working practices.....	5
2. The scientific, technical, engineering, mathematical and design principles.....	6
3 How to work effectively to design and develop engineering solutions and innovation and innovation.....	7
4. How to deliver engineering solutions effectively	9
5. How the Railway works as a system and their role within it.....	9
6. The importance of 3rd party and internal business requirements and operational interfaces.....	10
7. How the Railway works commercially	10
8. How the Railway is evolving	10
Skills.....	11
9. Keep themselves and others safe by adhering to safe working practices	11
10. Produce a work plan based on safe systems of work.....	11
11. Undertake and direct a high standard of technical work.	12
12. Solve problems.....	16
13. Make informed and considered decisions and complex critical judgements	18
14. Supervise and manage resources.....	19
15. Work collaboratively maintaining effective relationships with colleagues, clients, suppliers and the public	20
16. Communicate effectively	20
11. IRSE Licenses	20

The Standard: Telecoms Specialism

Core Knowledge. Within a Railway context all Rail Engineering Advanced Technicians need an in-depth knowledge and understanding of:

1. Safe and Professional working practices including legislation, regulation, industry procedures, safety requirements, risk management and environmental impact together with an understanding of human factors and techniques to address these.

2. The scientific, technical, engineering, mathematical and design principles (some of them complex) that are required in undertaking and directing maintenance, renewal and construction of and across The Railway.

3. How to work effectively to design and develop engineering solutions and innovation including understanding of failure modes and their causes; advanced problem solving, diagnostic systems and development of preventative maintenance; asset management and whole life asset costs.

4. How to deliver engineering solutions effectively including project management principles and systems to manage, time, resource, asset and quality management and assurance systems; business improvement and innovation systems, processes and techniques.

5. How the Railway works as a system and their role within it. The critical interfaces across the Railway system and how those interfaces are managed.

6. The importance of 3rd party and internal business requirements and operational interfaces. The need for and understanding of client confidentiality and compliance with corporate policies including ethics, equality and diversity and sustainability.

7. How the Railway works commercially including contractual principles and financial systems, forecasts and budgets, and performance implications and performance management techniques.

8. How the Railway is evolving. Awareness and understanding of new technological developments across the Railway and how these will impact the future operation of The Railway.

The above to include the Telecoms specific Knowledge requirements of the Standard:

Telecoms Advanced Technicians will have the following specific knowledge regarding different techniques and methods used to construct, install, maintain and renew The Railway and to avoid Railway asset, equipment, process and systems failures:

A thorough understanding of telecommunications principles and associated operating procedures for railway communication and infection systems and systems interfaces

Understand the physical systems interfaces between Telecoms assets and systems and other aspects of The Railway and the operating requirements, implications and constraints of these including the application of safety integrity

Understand and be able to undertake rudimentary telecoms system design

Core Skills. Within a Railway context all Rail Engineering Advanced Technicians need to be able to:

9. Keep themselves and others safe by leading and demonstrating safe working practices. Understand, reinforce and comply with statutory regulations and organisational safety requirements, including competence and safe access to work locations.

10. Produce a work plan based on safe systems of work that is informed by technical drawings, schematics and programmes of work needed for the development of rail engineering activity. Prepare contingency arrangements to manage change and risk as appropriate.

11. Undertake and direct a high standard of technical work. Take responsibility for the efficient and effective delivery of technical work activities and projects. Undertake and supervise the operation of equipment & systems. Complete integrity & compliance checks on own work and that of others and ensure appropriate testing is undertaken. Transfer responsibility of assets once work has been completed. Be responsible and accountable for their own work and that of others.

12. Solve problems: Design and develop a structured and/or innovative approach to problem solving and diagnosis. Apply appropriate methods and business improvement techniques. Predict and prevent failures through the analysis of data and the ability to provide feedback on these.

13. Make informed and considered decisions and complex critical judgements as appropriate.

14. Supervise and manage resources including the efficient utilisation of individuals, teams, tools, materials and equipment. Monitor and manage individual and team performance and development.

15. Work collaboratively maintaining effective relationships with colleagues, clients, suppliers and the public. Support the development of others through coaching and mentoring.

16. Communicate effectively across all management levels. Use oral, written, electronic and IT based methods and systems for the accurate communication, technical reporting & recording of information and management reporting.

The above to include the Telecoms specific Skills requirements of the Standard:

Telecoms Advanced Technicians will have the following specific skills regarding different techniques and methods used to construct, install, maintain and renew The Railway and to avoid Railway asset, equipment, process and systems failures

Installation , maintenance, report and testing of telecoms and transmission complex systems, equipment and components including fibre optic s and copper materials

Ability to understand and analyse data packages and find and prevent systems failures

Knowledge

1. Safe and Professional working practices

1. Safe and Professional working practices including legislation, regulation, industry procedures, safety requirements, risk management and environmental impact together with an understanding of human factors and techniques to address these.

Standards and Procedures

- Infrastructure guidelines and standard operating procedures
- Equipment manufacturer's documents
- BS, ISO and/or BS EN standards
- Appropriate Operating Organisations Handbook and procedures
- Other industry specific telecom standards/specifications
- Your organisations' procedures for the transfer of responsibility of telecoms assets

The procedures and precautions to be adopted to eliminate electrostatic discharge (ESD) hazards when working with and handling electronic devices

Hazards associated with carrying out telecom installation and test activities (such as stored voltages, radio frequency radiation, electrical supplies, electrical/electronic interfaces, using damaged or badly maintained tools and equipment, not following laid-down procedures), and how to minimise these and reduce any risks

The classification of different voltage levels and the authority requirements for working on them

The procedures and precautions to be adopted to eliminate electrostatic discharge (ESD) hazards when working with and handling electronic devices

Your organisation's procedures for the transfer of responsibility of telecoms assets

Site Access

Identify the access requirements related to the following types of site equipment/installation locations:

- Trackside
- Internal (such as signal box, equipment room)
- Areas to which the public have access
- Confined spaces
- Elevated structures

2. The scientific, technical, engineering, mathematical and design principles.

<p>2. The scientific, technical, engineering, mathematical and design principles (some of them complex) that are required in undertaking and directing maintenance, renewal and construction of and across The Railway.</p>
<ul style="list-style-type: none"> • How to interpret the conventions, symbols, terminology and abbreviations used in site, equipment and systems schematics / diagrams, engineering drawings and specifications including an understanding of telecoms and data (e.g. Ethernet) terminology • Understanding of telecoms and data terminology • Understanding of data communication systems and terminology and the interface with Network Rail data management centre
<ul style="list-style-type: none"> • Understanding of signalling terminology to enable conversation with signal fault finders and operators
<p>The Level 3 Rail Engineering Technician knowledge qualification for the Telecoms pathway is made up of the following two units:</p> <ol style="list-style-type: none"> 1. Telecommunications Technologies and 2. Telecommunications Principles. <p>The content below includes the Level 3 qualification content PLUS additional content to cover Level 4</p> <p>For further guidance re the Level 3 qualification please see the knowledge qualification structure at annex A.</p>
<p>Telecommunication Technologies</p>
<p>Understand the relationship between telecommunication circuits and transmission lines and their effect on a digital signal</p> <ul style="list-style-type: none"> • Describe the properties of a circuit with reactive and resistive components • Describe the characteristics of a transmission line with reference to an equivalent circuit model • Describe the properties of a digital signal and the impairments that could affect it • Understand the role of the above in analysis, how you would use this and the impact on validation of measurements
<p>Understand the principles and characteristics of frequency modulation and multiplexing</p> <ul style="list-style-type: none"> • Describe analogue and digital modulation techniques and the properties of a modulated signal • Describe the principles and benefits of analogue to digital conversion (PDH) • Describe the principles and benefits of frequency modulation, time division multiplexing (TDM) and optical frequency division multiplexing
<p>Be able to carry out tests on telecommunications electrical and optical circuits</p> <ul style="list-style-type: none"> • Make measurements on telecommunication electrical and optical circuits
<p>Understand the applications of electromagnetic theory as applied to telecommunications</p> <ul style="list-style-type: none"> • Detailed understanding of the frequency bands within the electromagnetic spectrum appropriate to optical and radio systems • Detailed understanding of the frequency bands within the electromagnetic spectrum appropriate to optical and radio systems • Explain how transformers and other telecommunication devices make use of the principles of electromagnetism.

Telecommunications Principles
<p>Know the main elements of data communications system</p> <ul style="list-style-type: none"> • Identify and explain types of communication devices and how they can be configured to create a data network to fulfill a particular need • Explain the principles of signal theory
<p>Understand the communication principles of computer networks</p> <ul style="list-style-type: none"> • Identify and describe the roles of network components and how they are interconnected • Describe the features of networks and the communication services they offer • Describe communication protocols used and explain why they are important
<p>Understand transmission protocols and models</p> <ul style="list-style-type: none"> • Describe different methods of electronic communication and transmission media used.
<p>Understand internet communications</p> <ul style="list-style-type: none"> • Describe the nature of internet communication and the associated system requirements.
<p>Understanding of data communication systems e.g. Ethernet including terminology and how to interface with "central network management centre" (i.e. control centre)</p>
<p>Understand telecoms and data interfaces and implications of action across the system& interfaces e.g. customer information and signalling</p>
<p>SCADA</p> <ul style="list-style-type: none"> • The principles of how communication-electronic or associated systems function and interact e.g. SCADA • The purpose and uses of SCADA
Assets and Equipment
<p>The different types of cabling including their application and compliance (such as multi-core cables, steel wire armored (SWA), data cables, screened cables, fiber cables) their fittings and their application.</p>
<p>The different types of electrical component (such as plugs, sockets, switches, lighting and fittings, junction boxes, relays, protection devices)</p>
<p>The different types of mounting, connecting and cable supporting systems used by the telecoms equipment</p>
<p>How to isolate pieces of equipment being used or worked on</p>
<p>Knowledge of standby generators and how to restore service in a controlled manner</p>

3 How to work effectively to design and develop engineering solutions and innovation and innovation

3. How to work effectively to design and develop engineering solutions and innovation including understanding of failure modes and their causes; advanced problem solving, diagnostic systems and development of preventative maintenance; asset management and whole life asset costs.

Design
Understand and be able to undertake rudimentary telecoms system design including: <ul style="list-style-type: none"> • Basic design principles and standards • Systems interfaces • The safety elements of parts removal • The concept of and procedures relating to "lified" items • Ability to write and approved test plans and drawings • Ability to make recommendations to the providers for changes to design plans
The effects of pressure and flow on the performance of the system
The principles of how Heating Ventilation Air Conditioning (HVAC) units/modules function The need for and calculations related to the removal of dangerous gases
Whole life assets costs
The application of the seven key measures of competitiveness. Determine and calculate the following: <ul style="list-style-type: none"> • Not right first time • Delivery schedule achievement • Parts per operator hour (PPOH) • Overall equipment effectiveness (OEE) • Value added per person (VAPP) • Stock turns • Cost breakdown in term of labour, material and overhead • Floor space utilisation (FSU)
Failure Modes and their Causes
The activities which may compromise system functionality and integrity, including disturbing other equipment and systems without authority
How defects and variations can affect the safety and performance of telecoms system
How to secure the system for testing purposes
How to secure the system prior to fault finding activities taking place
The range and type of operational constraints and authorisation procedures for carrying out telecoms and data activities on the operational railway
The types of damage or disturbance that could occur to operational equipment and the railway system when undertaking a maintenance activity
The types of operational constraints that could occur when carrying out telecoms maintenance / adjustment activities
The correct mode of operation of the asset following replacement activities
The correct mode of operation and configuration of telecoms asset being installed / maintained

How to check to ensure compliance with the original specification following installation, maintenance and or renewal
The relevant methods, techniques and procedures for the adjustment of telecoms data components and equipment
How and when telecoms activities cannot be achieved
The methods and techniques for data diagnostic analysis relevant to the equipment and system

4. How to deliver engineering solutions effectively

4. How to deliver engineering solutions effectively including project management principles and systems to manage, time, resource, asset and quality management and assurance systems; business improvement and innovation systems, processes and techniques.
Activity Planning
How to source and interpret relevant technical information, standards, diagrams, instructions, specifications and schedules for: <ul style="list-style-type: none"> • Installation of telecoms equipment • Telecom engineering activities • Other related information for the testing/checking of telecoms equipment
How to achieve and the importance of effective working relationships when organising local telecoms engineering activities
How to locate and identify the equipment, components and cables to be worked on
Organise local telecoms engineering activities for one of the following types of telecom equipment: <ul style="list-style-type: none"> • Transmission systems inc. synchronous digital hierarchy (SDH) • Bearer circuits i.e copper or fibre • Telecoms bearers carrying signalling circuits • SCADA – inc. telecoms, electrical control, SCADA systems • Operational telephones • Switches and systems (such as telephone exchanges & concentrators) • Railway operational information systems inc. customer information system and information from signaling equipment • PAVA (Public Address Voice Announcement) and CCTV • Operational CCTV such as One Person Operation (OPO) and Driver Only Operation (DOO) • GSM-R • Other industry specific telecom equipment • Station radio

5. How the Railway works as a system and their role within it

How the Railway works as a system and their role within it. The critical interfaces across the Railway system and how those interfaces are managed.
See Trailblazer document – no TELECOMS specific content

6. The importance of 3rd party and internal business requirements and operational interfaces

The importance of 3rd party and internal business requirements and operational interfaces. The need for and understanding of client confidentiality and compliance with corporate policies including ethics, equality and diversity and sustainability.

See Trailblazer document – no TELECOMS specific content

7. How the Railway works commercially

How the Railway works commercially including contractual principles and financial systems, forecasts and budgets, and performance implications and performance management techniques.

See Trailblazer document – no TELECOMS specific content

8. How the Railway is evolving

How the Railway is evolving. Awareness and understanding of new technological developments across the Railway and how these will impact the future operation of The Railway.

See Trailblazer document – no TELECOMS specific content

Skills

9. Keep themselves and others safe by adhering to safe working practices

Keep themselves and others safe by leading and demonstrating safe working practices. Understand, reinforce and comply with statutory regulations and organisational safety requirements, including competence and safe access to work locations.

See Trailblazer document – no Telecoms specific content

10. Produce a work plan based on safe systems of work

Produce a work plan based on safe systems of work that is informed by technical drawings, schematics and programmes of work needed for the development of rail engineering activity. Prepare contingency arrangements to manage change and risk as appropriate.

Identify any special requirements and incorporate them in the plan, for example, identifying when independent testing of the telecoms and data¹ equipment is required and/or whether failure investigation of the telecoms and data equipment is required

Establish the required installation, testing or maintenance technical information for the following types of telecom equipment:

- Transmission systems inc. synchronous digital hierarchy (SDH)
- Bearer circuits i.e copper or fibre
- Telecoms bearers carrying signalling circuits
- SCADA – inc. telecoms, electrical control, SCADA systems
- Operational telephones
- Switches and systems (such as telephone exchanges & concentrators)
- Railway operational information systems inc. customer information system and information from signaling equipment
- PAVA (Public Address Voice Announcement) and CCTV
- Operational CCTV such as One Person Operation (OPO) and Driver Only Operation (DOO)
- GSM-R
- Other industry specific telecom equipment

Station radio

Obtain, extract and analyse information from the following sources as applicable to the equipment being tested:

- Design drawings
 - Test plans
 - Records of previously completed testing
 - Installation plans
 - Test specifications
 - Industry procedures
 - Manufactures handbooks
 - Equipment specific requirements
- The appropriate operators test procedures/handbook

¹ Data – the transfer of digital information transferred over electronic systems

11. Undertake and direct a high standard of technical work.

11. Undertake and direct a high standard of technical work. Take responsibility for the efficient and effective delivery of technical work activities and projects. Undertake and supervise the operation of equipment & systems. Complete integrity & compliance checks on own work and that of others and ensure appropriate testing is undertaken. Transfer responsibility of assets once work has been completed. Be responsible and accountable for their own work and that of others.

Installation

Obtain and extract information from the following sources as applicable to the equipment being installed:

- Design drawings
- Installation plans
- Handbooks
- Installation standards
- Equipment specific requirements
- Manufactures instructions
- Schedules
- Procedures

Ensure that installation activities comply with one of the following:

- Infrastructure guidelines and standard operating procedures
- Equipment manufacturer's documents
- BS, ISO and/or BS EN standards
- Other industry specific telecom standards/specifications

Install the following types of telecom equipment:

- Transmission systems inc. synchronous digital hierarchy (SDH)
- Bearer circuits i.e copper or fibre
- Telecoms bearers carrying signalling circuits
- SCADA – inc. telecoms, electrical control, SCADA systems
- Operational telephones
- Switches and systems (such as telephone exchanges & concentrators)
- Railway operational information systems inc. customer information system and information from signaling equipment
- PAVA (Public Address Voice Announcement) and CCTV
- Operational CCTV such as One Person Operation (OPO) and Driver Only Operation (DOO)
- GSM-R
- Other industry specific telecom equipment
- Station radio

The relevant methods and techniques covering the installation of telecoms equipment and how to interpret them

Make the following types of connections during the installation:

- Crimping
- Mechanical
- Soldering
- IDC
- Optical
- Other specific type of termination/connection

Identify and correctly label wires and cables in accordance with installation requirements

Run, secure and terminate wires and cables correctly

Maintenance

Lead & instruct planned maintenance/ adjustments/removal/replacement on the following types of telecom equipment on an operational and a non-operational system:

- Transmission systems inc. synchronous digital hierarchy (SDH)
- Bearer circuits i.e copper or fibre
- Telecoms bearers carrying signalling circuits
- SCADA – inc. telecoms, electrical control, SCADA systems
- Operational telephones
- Switches and systems (such as telephone exchanges & concentrators)
- Railway operational information systems inc. customer information system and information from signaling equipment
- PAVA (Public Address Voice Announcement) and CCTV
- Operational CCTV such as One Person Operation (OPO) and Driver Only Operation (DOO)
- GSM-R
- Other industry specific telecom equipment
- Station radio

Ensure that the maintenance activities comply with the following:

- Infrastructure guidelines and standard operating procedures
- Equipment manufacturer's documents
- BS, ISO and/or BS EN standards
- Appropriate operators handbook

Other industry specific telecom standards/specifications

Lead the following tests/maintenance activities as applicable to the type of telecom equipment being maintained/tested:

- Bandwidth
- Power
- Interference
- Attenuation
- Frequency
- Image quality
- Alignment
- Day/night settings
- OTDR
- Psophometric
- Insertion loss measurement
- Data error rate
- Voltage
- Current
- Resistance
- Continuity

Other industry specific telecoms tests

Lead the following maintenance activities as applicable to the equipment being maintained:

- Visual and aural checks
- Electrical measurements and adjustments
- Mechanical measurements and adjustments
- Routine servicing
- Cleaning
- Lubricating
- Other specific telecom maintenance activity

Integrity & Compliance

The importance of integrity checks, including how and when they should be carried out

The types of defects or variations that could occur in telecoms systems

What constitutes a significant defect or variation in telecoms systems
Identify and deal promptly with information, which is inadequate, contradictory and/or ambiguous
The activities which may compromise system functionality and integrity including the operational constraints to carrying out testing activities
The correct and incorrect mode of operation of the system to be tested, including acceptable operational variances
Testing
How to develop a test plan, what it should contain and what authorisation procedures apply (signed off by Principal Engineer)
The testing process relating to the telecoms and data equipment (maintenance testing/failure investigation)
<p>Ensure that testing activities comply with the following:</p> <ul style="list-style-type: none"> • Infrastructure guidelines and standard operating procedures • Equipment manufacturer's documents • BS, ISO and/or BS EN standards • Appropriate Operating Organisations Handbook and procedures • Other industry specific telecom standards/specifications
<p>Plan and conduct compliance testing of the following types of maintained telecom equipment and systems interfaces:</p> <ul style="list-style-type: none"> • Transmission systems inc. synchronous digital hierarchy (SDH) • Bearer circuits i.e copper or fibre • Telecoms bearers carrying signalling circuits • SCADA – inc. telecoms, electrical control, SCADA systems • Operational telephones • Switches and systems (such as telephone exchanges & concentrators) • Railway operational information systems inc. customer information system and information from signaling equipment • PAVA (Public Address Voice Announcement) and CCTV • Operational CCTV such as One Person Operation (OPO) and Driver Only Operation (DOO) • GSM-R • Other industry specific telecom equipment • Station radio
<p>Use the following types of tools and equipment as applicable to the equipment being tested:</p> <ul style="list-style-type: none"> • Calibrated hand tools • Un-calibrated hand tools • Calibrated test leads/loads • Computerised test equipment • Test recording equipment • Other specific telecom test equipment
<p>Complete the relevant maintenance/test records, to include one of the following, and pass it to the appropriate people:</p> <ul style="list-style-type: none"> • Job card • Appropriate Operator Handbook • Maintenance log and action report • Company reporting procedures • Other industry specific maintenance records

Including what methods and test were used to prove and ensure that the equipment / system is fully serviceable and back in operatoon
Confirm compliance with the design details, specifications, industry standards, wiring diagrams and plans in accordance with testing instructions
<p>Plan and conduct maintenance testing for the following types of telecom equipment:</p> <ul style="list-style-type: none"> • Transmission systems inc. synchronous digital hierarchy (SDH) • Bearer circuits i.e copper or fibre • Telecoms bearers carrying signalling circuits • SCADA – inc. telecoms, electrical control, SCADA systems • Operational telephones • Switches and systems (such as telephone exchanges & concentrators) • Railway operational information systems inc. customer information system and information from signaling equipment • PAVA (Public Address Voice Announcement) and CCTV • Operational CCTV such as One Person Operation (OPO) and Driver Only Operation (DOO) • GSM-R • Other industry specific telecom equipment <p>Station radio</p>
Confirm that the work (immediate and/or predefined) is suitable for testing
<p>Conduct the following tests as applicable to the type of telecom equipment being tested:</p> <ul style="list-style-type: none"> • Power • Interference • Attenuation • Frequency • Image quality • Alignment • Day/night settings • OTDR • Psophometric • Insertion loss measurement • Data error rate – non-digital and digital systems • Voltage • Current • Resistance • Continuity <p>Other industry specific telecoms tests</p>
How to identify, evaluate and respond to influencing factors whilst carrying out the tests/checks, including environmental factors, site conditions and working on an operational railway
<p>Complete the relevant test/compliance records, to include one of the following, and pass it to the appropriate people:</p> <ul style="list-style-type: none"> • Job card • Appropriate Operator Handbook • Test log and action report • Company reporting procedures <p>Other industry specific test/compliance records</p>
Transfer Responsibility

<p>Apply your organisation's procedures for the transfer of responsibility of telecoms assets ensuring that transfer of responsibility transfer complies with the following:</p> <ul style="list-style-type: none"> • Infrastructure guidelines and standard operating procedures • Equipment manufacturer's documents • BS, ISO and/or BS EN standards • Other industry specific telecom standards/specifications
<p>Transfer responsibility for the following types of telecom equipment:</p> <ul style="list-style-type: none"> • Transmission systems inc. synchronous digital hierarchy (SDH) • Bearer circuits i.e copper or fibre • Telecoms bearers carrying signalling circuits • SCADA – inc. telecoms, electrical control, SCADA systems • Operational telephones • Switches and systems (such as telephone exchanges & concentrators) • Railway operational information systems inc. customer information system and information from signaling equipment • PAVA (Public Address Voice Announcement) and CCTV • Operational CCTV such as One Person Operation (OPO) and Driver Only Operation (DOO) • GSM-R • Other industry specific telecom equipment • Station radio
<p>Complete the relevant transfer records, to include one of the following, and pass it to the appropriate people:</p> <ul style="list-style-type: none"> • Job card • Appropriate Operator Handbook • Maintenance log and action report • Company reporting procedures • Other industry specific maintenance records

12. Solve problems

<p>Solve problems: Design and develop a structured and/or innovative approach to problem solving and diagnosis. Apply appropriate methods and business improvement techniques. Predict and prevent failures through the analysis of data and the ability to provide feedback on these.</p>
<p>The importance of integrity checks, including how and when they should be carried out</p>
<p>The activities which may compromise system functionality and integrity including the operational constraints to carrying out diagnostic activities</p>
<p>Confirm that the adjusted components/equipment meet the required operating specification</p>
<p>Investigate and determine the most likely causes of the faults, including as appropriate, selecting and following the appropriate fault investigation guide</p>
<p>Review and analyse all relevant information on the symptoms and problems associated with the equipment including fault history to accurately establish the location and nature of the fault</p>

<p>Using of advanced test equipment undertake report analysis and lead fault finding based on analysis /symptoms</p> <p>Lead fault finding based on analysis / symptoms independently and in conjunction with the control center at network / system level including the integration of more and 1 piece of equipment and the equipment interfaces</p>
<p>Understand telecoms and systems interfaces and implication of actions across the system e.g. customer information and signaling systems</p>
<p>Ensure appropriate action is taken to prevent the system functionality or integrity being compromised before starting any intrusive activities and that protection and disconnection arrangements are implemented to ensure operational safety</p>
<p>Carry out diagnostic techniques in a manner that minimises the interference with other systems and equipment and is within the limits of your own authority</p>
<p>The relevant methods and techniques covering maintenance and/or fault finding of telecoms system equipment and how to interpret them</p>
<p>Use a range of logical diagnostic techniques appropriate to the equipment or system and analyse and verify a combination of tests including:</p> <ul style="list-style-type: none"> • Half-split technique • Input/output technique • Injection and sampling • Six point technique • Emergent sequence • Unit substitution • Function/performance testing • Equipment self-diagnostics
<p>Diagnose faults on the following types of telecom equipment:</p> <ul style="list-style-type: none"> • Transmission systems inc. synchronous digital hierarchy (SDH) • Bearer circuits i.e copper or fibre • Telecoms bearers carrying signalling circuits • SCADA – inc. telecoms, electrical control, SCADA systems • Operational telephones • Switches and systems (such as telephone exchanges & concentrators) • Railway operational information systems inc. customer information system and information from signaling equipment • PAVA (Public Address Voice Announcement) and CCTV • Operational CCTV such as One Person Operation (OPO) and Driver Only Operation (DOO) • GSM-R • Other industry specific telecom equipment • Station radio
<p>Identify the methods and tests to be used to ensure the equipment and system is fit for purpose</p>
<p>Complete and sign off the relevant diagnostic/maintenance/replacement records including the following, and pass it to the appropriate people:</p> <ul style="list-style-type: none"> • Job card • Appropriate operators handbook • Fault log and action report • Company reporting procedures • Other industry specific test records
<p>Ensure that the fault diagnosis activities comply with the following:</p>

<ul style="list-style-type: none"> • Infrastructure guidelines and standard operating procedures • Equipment manufacturer's documents • BS, ISO and/or BS EN standards • Appropriate Operator Handbook • Authorised test plan • Investigation guide • Industry specific telecom standards/specifications
<p>Collect fault diagnosis evidence from the following sources:</p> <ul style="list-style-type: none"> • The person or operator who reported the fault • Equipment self-diagnosis • Test instrument measurements • Recording devices • Sensory input (such as sight, sound, smell, touch) • Equipment records • Circuit meters • Equipment outputs
<p>Develop and deliver a diagnostic plan by making use of remote facilities including the use of remote tools and 3rd party actions e.g. requests to the control centre. Analyse and record outputs.</p>
<p>Able to understand and analyse data packages to identify failure causes and potential root causes.</p> <p>Use a test environment to recreate faults and analyse results. Make recommendations for systems renewal / configuration changes to improve network reliability</p>
<p>Contribute to the technical leadership of telecoms fault finding and analysis of engineering activities for one of the following types of telecom equipment:</p> <ul style="list-style-type: none"> • Transmission systems inc. synchronous digital hierarchy (SDH) • Bearer circuits i.e copper or fibre • Telecoms bearers carrying signalling circuits • SCADA – inc. telecoms, electrical control, SCADA systems • Operational telephones • Switches and systems (such as telephone exchanges & concentrators) • Railway operational information systems inc. customer information system and information from signaling equipment • PAVA (Public Address Voice Announcement) and CCTV • Operational CCTV such as One Person Operation (OPO) and Driver Only Operation (DOO) • GSM-R • Other industry specific telecom equipment • Station radio

13. Make informed and considered decisions and complex critical judgements

<p>Make informed and considered decisions and complex critical judgements as appropriate</p>
<p>See Trailblazer document – no Telecoms specific content</p>

14. Supervise and manage resources

Supervise and manage resources including the efficient utilisation of individuals, teams, tools, materials and equipment. Monitor and manage individual and team performance and development.

How to identify the various types of connectors, termination as and interfaces used and the correct tools and equipment to make the disconnection and connections correctly

The relevant methods, techniques and procedures to replace components and ensure they are fit for purpose

Use the following types of approved/calibrated tools and equipment as applicable to the components and/or equipment being installed, maintained or replaced:

- Power tools
- Hand tools
- Wire and cable strippers/cutters
- Installation Displacement Connections (IDC) tools
- Termination tools
- Wrenches
- Soldering irons
- Manual handling equipment

Make the following types of connections/ terminations during the installation, maintenance or replacement:

- Crimping
- Mechanical – radio frequency and copper
- Soldering
- Installation Displacement Connections (IDC)
- Optical
- Other specific type of termination/connection

Connect the following types of connections / terminations during the installation, maintenance or replacement of the components as applicable to the type of equipment:

- Mechanical
- Soldered
- IDC
- Optical
- Other specific type of termination/connection

Disconnect the following types of connections / terminations during the removal of the equipment as applicable to the type of equipment:

- Mechanical
- Soldered
- Electronic
- IDC
- Optical
- Other specific type of termination/connection

Allocate and monitor and manage resources for the following telecom engineering activities:

- Installation
- Maintenance
- Fault finding
- Testing
- Other industry specific telecoms activity

Allocate and monitor the following resources as applicable to the telecom engineering activities:

- Documentation (current and appropriate)
- Tools, plant and test equipment (calibrated and serviceable)
- Materials, replacement equipment and consumables
- Communications equipment
- Personnel (total required and competence)
- Access arrangements

15. Work collaboratively maintaining effective relationships with colleagues, clients, suppliers and the public

Work collaboratively maintaining effective relationships with colleagues, clients, suppliers and the public. Support the development of others through coaching and mentoring.

See Trailblazer document – no Telecoms specific content

16. Communicate effectively

Communicate effectively across all management levels. Use oral, written, electronic and IT based methods and systems for the accurate communication, technical reporting & recording of information and management reporting.

See Trailblazer document – no Telecoms specific content

11. IRSE Licenses

For matters relating to IRSE licenses please refer to current guidance issued by the Professional Institute.