

Detailed Requirements Document (DRD) Pure Core Level 3

Overview

Employers in the Rail Engineering Sector have developed this Detailed Requirements Document (DRD); the document is designed to meet the detail required for the Railway Engineering Technician Standard.

This DRD describes the pure core content required for a Railway Engineering Technician to be competent; this document forms part of the Employer Occupational Brief (EOB).

Purpose

Employers, colleges and training providers should use this document to support the delivery of the Railway Engineering standard in the planning and delivery of the apprenticeship.

The detail within this document has been developed from the National Occupational Standards (NOS).

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1. High level overview of the Rail Engineering Technician Core Knowledge and Skills

Core Knowledge. Within a Rail context all Rail Engineering Technicians need to know about:

Safe and Professional working practices including legislation, regulation, industry procedures and safety requirements.

The scientific, technical, engineering, mathematical and design principles that are required to support the maintenance, renewal and construction of The Railway

How to work effectively and contribute to engineering solutions including understanding and applying problem solving techniques and diagnostics, project planning and management, time management and quality management and assurance systems.

The importance of 3rd party requirements and client confidentiality and the need to understand and adhere to corporate policies on ethics, equality and diversity

How the railway works commercially including contractual principles and implications

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

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

Plan a high standard of technical work: Gathering and interpreting information including drawings, plans and schedules needed for the development of rail engineering activity planning; detailed inspection and performance & condition analysis of assets; Plan work to be undertaken including the appropriate resources.

Deliver a high standard of technical work: Undertake engineering activities in relation to maintenance, construction / installation and or renewal of assets. Complete integrity & compliance checks on own work, instigate testing and identify where independent testing is required. Transfer responsibility of assets once work has been completed. Supervise their own work and that of others.

Solve problems: Identify problems and apply a structured approach and appropriate methods to problem solving and diagnosis.

Manage resources including the correct utilisation and storage of tools, materials and equipment, and the lifting and moving of materials, components and equipment.

Communicate effectively. Use oral, written, electronic and IT based methods and systems for the accurate communication, reporting & recording of technical and other information, using correct terms, standards, templates and certifications.

Core Knowledge

2. Safe and Professional Working Practices

Safe and Professional working practices including legislation, regulation, industry procedures and safety requirements.
Health, Safety and Environmental Legislation & Regulation
<p>The relevant health and safety legislation, regulations and safe working practices and procedures as appropriate to the activity and the responsibility placed on the apprentice. It must include:</p> <ul style="list-style-type: none"> Access restrictions for work Asbestos awareness Electromagnetic Compatibility Regulations (EMR) Emergency first aid Hazard Directory Hazards and risks for fibre and optic-microwave radio waves Health and Safety at Work Act Issues relating to COSHH Lifting Operations and Lifting Equipment Regulations (LOLER) Manual handling regulations Provision and Use of Work Equipment Regulations (PUWER) RIDDOR Rule Book – the appropriate parts for the apprenticeship pathway Safety sign regulations Working at heights Working in confined spaces Working On Or About 25kV AC Electrified lines The Controller of Infrastructure Regulations and procedures
The health and safety requirements of the area in which the activity is to take place, and the responsibility they place on you
The classification of different voltage levels and the authority requirements for working on them
The importance of wearing protective clothing and other appropriate safety equipment (PPE) when conducting work activities. Understand what is required and where i.e. differences
How to avoid personal injury and injury to others during the work
How the activity may affect the safe operation of the railway
Procedures
Your organisations procedures which apply to your work role
The roles of the relevant person(s) within your organisation related to your work role
The relevant reporting lines and procedures as approved by your organisation
The limits of your own authority and responsibility and those of others involved
The relevant first aid procedures that are approved by your organisation/client
The relevant evacuation procedures that are approved by your organisation/client

Core Knowledge

Safe and Professional working practices including legislation, regulation, industry procedures and safety requirements.
Procedures continued
The relevant reporting documentation and control procedures as approved by your organisation / client
The different types and methods of waste disposal procedures in your organisation/client, knowing whom to approach for authorisation including: How to identify items for re-use and/or waste items How to label and store removed component(s) for re-use, repair or disposal
Your organisations procedures for setting access controls and how to monitor these are in place
Protection
The types of resources and information available for protection requirements
The location, nature, extent and characteristics of the area to be protected
The information on protection requirements that need to be communicated and the appropriate methods of communication: <ul style="list-style-type: none">• Notice boards• H&S meetings• Briefings• Management tools
The potential impact of protection on safety and operations including other work parties and travelling customers/public
The relevant railway possession and protection arrangements for the work site and equipment to provide a safe system of work and how to check these have been implemented or withdrawn
Lifting & Moving
What information is required prior to moving materials, components and equipment
How to identify the different characteristics of the loads to be moved, including as appropriate: <ul style="list-style-type: none">• Weight distribution• Shape/size/length• Vulnerability to damage• Different types of lift• Adjacent Open Line (AOL) i.e. effect of swinging load fowling open line
How to establish the weight of loads

Core Knowledge

Safe and Professional working practices including legislation, regulation, industry procedures and safety requirements.
Site Access
The types of access controls that may be required for organisation & client
The protection and disconnection requirements or permit to work procedure that applies to the system (such as electrical isolation, locking off switchgear, placing of maintenance warning notices, proving the isolation has been achieved and secured) to ensure personal and operational safety when working on the railway infrastructure
How to reduce the risks of an electric shock (such as insulated tools, rubber matting and isolating transformers)
Process and Implications
The manufacturer's equipment operating and control procedures to be applied during the maintenance activity
The importance of carrying out repair activities in the specified sequence and agreed timescale
The implications of not following the procedures for the installation and / or maintenance activities
The importance of marking the component(s) orientation for re-assembly and how to undertake this
How incorrectly repaired components can affect the safety and performance of the infrastructure
The problems that can occur with the repair or modification operations, and how these can be overcome
The likely impact of your work on customers travelling and the operations of other departments and the impact of their work for you
The impact of any deviations from the planned activities
How to conduct any necessary checks to ensure that the completed repair or modification complies with all appropriate standards

Core Knowledge

3. The Scientific, technical, engineering, mathematical and design principles

The scientific, technical, engineering, mathematical and design principles that are required to support the maintenance, renewal and construction of The Railway

The Rail Engineering Technician knowledge qualification contains mandatory core and pathway core units. Listed below are the mandatory and pathway core units. For further guidance please see the knowledge qualification structure at annex A.

Advanced Mathematics for Rail Technicians

Understand mathematical equations:

- Use the Law of Indices - for positive integers
- Simplify indices
- Use the law of indices to find the logarithms of a number
- Use Logarithmic Plotting
- Apply equations of the first degree
- Apply second degree equations – quadratic

Understand trigonometric functions and equations:

- Use basic trigonometry functions $\sin\theta$, $\cos\theta$, $\tan\theta$
- Determine trigonometric identities using Pythagoras's theorem, use standard notation for a triangle
- Solve trigonometric equations using standard formulae to determine areas and volumes
- Produce and use trigonometric graphs
- Produce and use graphs of $R \cdot \sin \theta$
- Produce and use graphs of $\sin 2t$ and $\cos 2t$
Produce and use graphs of $y_1 = R \cdot \sin \omega t$ and $y_2 = R \cdot \sin(\omega t - \alpha)$ - Phase Angle
- Determine the 'inverse' trigonometric function 'x is equal to the angle whose sine is y' - $y = \sin x \rightarrow x = \sin^{-1} y$. Contrast with index notation $y = (\sin)^{-1} x$
- Determine angles of any magnitude
- Define the radian - radian measure of angles

Electrical and Electronic Principles

Be able to use circuit theory to determine voltage, current and resistance in direct current (DC) circuits:

- Use DC circuit theory to calculate current, voltage and resistance in DC network
- Use a multi-meter to carry out circuit measurements in a DC network

Understand the concepts of capacitance and determine capacitance values in DC circuits:

- Compare the forward and reverse characteristics of different types of semiconductor diode
- Describe the types and function of capacitors
- Determine the relationship between the voltage and current for a charging and discharging capacitor
- Calculate the charge, voltage and energy values in a DC network for capacitors in series and in parallel

Core Knowledge

The scientific, technical, engineering, mathematical and design principles that are required to support the maintenance, renewal and construction of The Railway

Electrical and Electronic Principles continued

Know the principles and properties of magnetism:

- Describe the characteristics of a magnetic field
- Describe the relationship between flux density (B) and field strength (H)
- Describe the principles and applications of electromagnetic induction

Be able to use single-phase alternating current (AC) theory:

- Use single phase AC circuit theory to determine the characteristics of a sinusoidal AC waveform
- Determine the inputs and outputs of a single phase AC circuit

Mechanical Engineering Principles and Applications

Be able to determine the effects of loading in static engineering systems:

- Calculate the magnitude, direction and position of the line of action of the resultant and equilibrant of a non-concurrent coplanar force system containing a minimum of four forces acting in different directions
- Calculate the support reactions of a simply supported beam carrying at least two concentrated loads and a uniformly distributed load
- Calculate the induced direct stress, strain and dimensional change in a component subjected to direct uniaxial loading and the shear stress and strain in a component subjected to shear loading

Be able to determine work, power and energy transfer in dynamic engineering systems:

- Solve problems that require the application of kinetic and dynamic principles to determine unknown system parameters
- Determine the retarding force on a freely falling body when it impacts upon a stationary object and is brought to rest without rebound, in a given distance

Be able to determine the parameters of fluid systems:

- Calculate the resultant thrust and overturning moment on a vertical rectangular retaining surface with one edge in the free surface of a liquid
- Determine the up-thrust on an immersed body
- Determine the thermal efficiency of a heat transfer process from given values of flow rate, temperature change and input power
- Use the continuity of volume and mass flow for an incompressible fluid to determine the design characteristics of a gradually tapering pipe

Be able to determine the effects of energy transfer in thermodynamic systems:

- Calculate the dimensional change when a solid material undergoes a change in temperature and the heat transfer that accompanies a change of temperature and phase
- Solve problems that require application of thermodynamic process equations for a perfect gas to determine the unknown parameters of the problems
- Determine the force induced in a rigidly held component that undergoes a change in temperature

4. How to work effectively and contribute to engineering solutions

How to work effectively and contribute to engineering solutions including understanding and applying problem solving techniques and diagnostics, project planning and management, time management and quality management and assurance systems.
Problem Solving
How to respond to influencing factors whilst carrying out tasks, including environmental factors
The range and type of problem solving methods and techniques
How to conduct and document a systematic plan, do, check, act (PDCA) approach to problem-solving and business improvement
Identify appropriate parts of the operation or process that will have visual controls
How to use "root cause" problem solving analysis using the 5 whys/how technique
Engineering Solutions
How to access and interpret the performance requirements of engineering assets
Your organisations/client methods and techniques for establishing the operational condition of the asset(s) relevant to your role
How to access and interpret the relevant equipment operating and test specifications as approved by your organisation
The relevant planning methods and techniques including as appropriate: <ul style="list-style-type: none"> • Computer-based programs • Diagrammatical plans • Resource estimating (quantities and cost)
How and when planned activities cannot be achieved
The types of resources available, including as appropriate: <ul style="list-style-type: none"> • Documentation - current and appropriate • Tools and equipment - calibrated and serviceable • Materials, assets and components • Communications equipment • Personnel -total and required competence
The types of information and document systems approved by your organisation including, as appropriate: <ul style="list-style-type: none"> • Work plans • Written company procedures • Method statements • Local policy statements • Safety briefing procedures • Skill databases
Your organisation's procedures for specifying requirements, such as, requesting and securing resources required for the maintenance activities

Core Knowledge

How to work effectively and contribute to engineering solutions including understanding and applying problem solving techniques and diagnostics, project planning and management, time management and quality management and assurance systems.

Engineering Solutions continued

How to prioritise work activities to achieve objectives whilst taking into account cost and efficiency

How to identify the components and/or equipment to be restored/assessed

When independent testing is required

How to identify, analyse and deal with influencing factors whilst carrying out the tests, including environmental factors

The installation activities which may compromise system functionality and integrity

The types of component defects that could occur

How to obtain and assess the required component(s) and ensure that they are fit for purpose, including assessing the compatibility of like-for-like components

How to check the engineering activity to ensure compliance with the original specification

How to establish whether there is a need for independent testing

Identify the activities to be carried out and determine their sequence

The relevant methods and techniques for prioritising and planning activities, including, time management and problem solving

Business Improvement

The quality control procedures to be followed during the replacement operations

The implications of not taking account of legislation, regulations, standards and guidelines when conducting business improvement activities

What is meant by business improvement, and how continuous improvement activities can benefit a company

How to evaluate improvement ideas in order to select those that are to be pursued

How improvements to the process are achieved by engaging the knowledge and experience of the people working on the process

Core Knowledge

How to work effectively and contribute to engineering solutions including understanding and applying problem solving techniques and diagnostics, project planning and management, time management and quality management and assurance systems.

Business Improvement continued

Create and/or update visual controls that promote the following:

- Producing shadow boards to standardise the storage and location of area equipment
- Colour coding of equipment
- Safety
- Performance measures
- Parts control system
- Zero defects
- Process control boards
- Skills matrices
- Process concerns or corrective actions
- Workplace organisation
- Work in progress locations and quantities (WIP)
- Problem resolution
- Standard operating procedures
- Autonomous maintenance worksheets

Understand quality assurance management, such as:

- Define the terms 'quality management' and 'quality assurance'
- Describe roles and stages of inspection activities
- Explain the key principles of the ISO 9000 series of standards
- Describe the elements of quality planning
- Describe the key principles of total quality management (TQM)

The importance of applying the appropriate behaviours in the workplace and the implications for both the apprentice and the business if these are not adhered to

Communication

Review system operations regularly and forward suggestions for improvement to the appropriate person(s)

Identify key performance indicators that will be displayed in the work area

Produce or update a Standard Operating Procedure (SOP) and visual controls for the operation or process

Record and present the records from business improvement activities to the appropriate people using:

- Verbal report using visual aids such as. flip-charts and white boards
- Written or typed report
- Computer based presentation
- Specific company documentation

Core Knowledge

5. The importance of 3rd party requirements and client confidentiality

The importance of 3 rd party requirements and client confidentiality and the need to understand and adhere to corporate policies on ethics, equality and diversity
3rd Party Requirements
How to develop and maintain working relationships in order to promote good teamwork
Customer/client importance
Ethics, equality and diversity
Understand commercial operations and corporate policies
Explain the importance of third party requirements and client confidentiality
Describe the employing organisations policies on ethics, diversity and equality
Describe the implications of not following policies on ethics, diversity and equality
Describe commercial operations and contractual principles between railway organisations
Identify positive and negative implications for railway organisations within their commercial operations

Core Knowledge

6. How the railway works commercially

How the railway works commercially including contractual principles and implications
Commercial Awareness
Understand what constitutes the rail infrastructure and how it integrates with other aspects of the rail engineering industry
Knowledge of budgets, tendering, schedules and payments
Principles of operating in a commercial environment and funding
Contingency planning
Key contractual principles and implications
The operational side of the rail industry
Importance of the customer - end to end journey experience
Sustainable operation
How the money flows
Rail regulation, franchising and control periods

Core Skills

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

<p>Keep themselves and others safe by adhering to safe working practices. Understand and comply with statutory regulations and organisational safety requirements, including safe access to work locations.</p>
<p>Statutory Regulations</p>
<p>Take prompt and appropriate action to minimise risk of personal and third party injury as a first priority and then damage to property and equipment</p>
<p>Follow shutdown and evacuation procedures promptly and correctly</p>
<p>Identify health and safety issues and safe working practices and procedures that must be followed, including as appropriate:</p> <ul style="list-style-type: none"> • Relevant local safety certificates • The implementation of relevant documentation • The implementation of a safe system of work • The use of relevant personal protective equipment
<p>Make sure that required safety arrangements are in place to protect other workers from activities likely to disrupt normal working Any considerations for working under OHLE or in the vicinity of DC lines</p>
<p>Make sure the required security arrangements are in place when working in the following areas:</p> <ul style="list-style-type: none"> • Isolated location • Distant location • Rural/urban issues • Tunnels/bridges • Lone worker
<p>Follow the health and safety legislation, regulations and safe working practices and procedures, from the following as applicable to the work location and activities:</p> <ul style="list-style-type: none"> • Your organisation's safety management system • Relevant sections of the Health and Safety at Work Act • COSHH • Authorised test plan • Track access restrictions • Track work instructions • Track possession • Task risk control sheets • Current rule book • Regulations for working under OHLE and in the vicinity of DC lines (where appropriate) • Equipment disconnections • Manual handling regulations • RIDDOR • Safety sign regulations • PPE
<p>How to evaluate the likely risk to yourself and others, and the effects the fault could have on the overall process</p>

Core Skills

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

Statutory Regulations continued

How to prepare and produce a risk analysis report, where appropriate

The importance of applying electrostatic discharge (ESD) procedures when working on sensitive equipment or devices

Ensure that the maintenance activities comply with the following within your organisation/client:

- Organisational guidelines and codes of practice
- Equipment manufacturer's operation range
- BS, ISO and/or BSEN standards
- Company standard operating procedures (SOP's)
- Documents such as technical procedures

Organisational Safety

Work safely at all times, complying with your organisation's procedures

Seek clarification promptly where conflict of information is identified

Deal safely with dangers that can be contained using appropriate equipment and materials, in accordance with your organisation's procedures

Your organisation's methods and techniques for conducting safety assessments, including as appropriate:

- Risk assessment
- Safe systems of work

Ensure that authorised practices are used where existing instructions are insufficient

Ensure that any course of remedial action is effective, safe, complies with instructions and is completed within the required timescales

Hazards

The types of hazards that could arise and how to identify them and their implications

Planning

The methods and techniques for supervising the work activities of the team

Work Area

The consequences of not preparing work areas correctly, including as appropriate:

- Safety to the public
- Safety to other employees
- Operational/performance implications

The methods, techniques and procedures for worksite repair as approved by your organisation including those that are both temporary and permanent

Core Skills

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

Understand and comply with statutory regulations and organisational safety requirements, including safe access to work locations.

Work Area continued

Reinstate the work areas to a safe condition in accordance with agreed requirements and schedules

Confirm the work area is secured on completion of the work

Call for expert help in the event of contingencies occurring, using warning systems as appropriate

Establish and maintain effective communication with the relevant person(s) prior to, during, and on completion of protection

Identify and analyse any necessary changes to safety requirements on arriving at site, and comply with operational requirements, including prompt reporting to the relevant person(s)

Ensure all actions are taken within the limits of your own authority and where doubt arises you seek advice from suitable reference documents or relevant person(s)

Identify and analyse any necessary changes to safety requirements on arriving at site and comply with operational requirements, including prompt reporting to the relevant person(s)

Core Skills

8. Plan a high standard of technical work

Plan a high standard of technical work: Gathering and interpreting information including drawings, plans, schedules needed for the development of rail engineering activity planning; Detailed inspection and performance & condition analysis of assets; Plan work to be undertaken including the appropriate resources.
Organisation Plan
Establish which methods are required and what resources are to be used, including as appropriate: <ul style="list-style-type: none"> • Documentation - current and appropriate • Tools, plant and test equipment -calibrated and serviceable • Materials, replacement equipment and consumables • Communications equipment • Personnel - total required and competence
Identify and analyse the types of information required for the activity and what planning needs to be completed before the work is undertaken
Identify any special requirements and incorporate them in the plan
Estimate timescales required
Prepare and record the plan
Complete required plan and associated documents accurately and process them correctly
Anticipate and show how changes to plans and/or allocated tasks will be accommodated, including providing details of the predicted impact on activities
Assess work methods and procedures for their suitability and technical feasibility
Resources
Your organisation's procedures and guidelines for obtaining resources
The types of resources to be used and how to check their availability
Identify, plan and record work methods and activities which make optimum use of resources
Agree and record individual roles and group responsibilities
Establish accurately resource requirements and their availability
The likely impact of your work on the operations of other departments and the impact of their work on you
How to source & follow relevant engineering diagrams and related specifications as approved by your organisation
How to analyse and evaluate information on protection
How to source and interpret information and document systems relevant to the engineering activity
How to source and follow your organisation's approved system procedures
How to interpret and analyse information received from equipment and measuring instruments, including as appropriate, performing calculations
How to obtain up-to-date information on engineering activities and the resources required
The methods and techniques for allocating resources

Core Skills

<p>Plan a high standard of technical work: Gathering and interpreting information including drawings, plans, schedules needed for the development of rail engineering activity planning; Detailed inspection and performance & condition analysis of assets; Plan work to be undertaken including the appropriate resources.</p>
<p>Resources continued</p> <p>Ensure that the following resources are considered during the planning as applicable to the equipment being tested:</p> <ul style="list-style-type: none"> • 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
<p>Confirm that all the required documentation is available and the information accurately identifies the work to be completed</p>
<p>Ensure that the following resources and documents are considered during the organising of the activities as applicable to the equipment:</p> <ul style="list-style-type: none"> • Site availability • Access arrangements • Operations and engineering notices • Plans, schedules and procedures • Diagrams, records and specifications • Personnel (roles and responsibilities)
<p>Allocate activities and responsibilities to relevant person(s) according to their competences, including providing the required instructions</p>
<p>Obtain confirmation that the personnel allocated for the testing activity are available and authorised to undertake the tasks</p>
<p>Gathering & Interpreting Information</p>
<p>Interpret the information available and establish the type and extent of the tests required</p>
<p>How to obtain and interpret drawings, charts, circuit and physical layouts, specifications, manufacturers' manuals, history, reports, symbols used and other documents needed for the engineering activities</p>
<p>Identify any unusual features, defects or discrepancies relating to the condition of the asset</p>
<p>The procedures for the control of a non-conforming component or asset and how to assess the safety implications</p>
<p>Determine the scope of the work to be carried out and the status of the previously tested equipment</p>
<p>How to determine and source the documentation requirements for the activities undertaken and how to confirm that these meet your organisation's procedures</p>

Core Skills

Plan a high standard of technical work: Gathering and interpreting information including drawings, plans, schedules needed for the development of rail engineering activity planning; Detailed inspection and performance & condition analysis of assets; Plan work to be undertaken including the appropriate resources.

Use of Information

Identify, extract and analyse the required information:

- Clearances
- Tolerances
- Limits
- Component specification
- Quantities and dimensions

How to source and follow information and document systems relating to the work area/site

Your organisation's methods and techniques for communicating a change to resource allocation

How to follow schedules and instructions relevant to your role

How to identify discrepancies in drawings, specifications and instructions, including, as appropriate version control

How to access and analyse wider sources of information specifically those from:

- Line manager
- Power suppliers
- Other infrastructure disciplines
- Manufacturers

How to source and interpret information and document systems as approved by your organisation, including as appropriate:

- Work plans
- Method statements
- Skill data bases

Identify where technical documentation, equipment, tools, materials, components and/or personnel are not available and deal with the deficiency in line with your organisation's procedures

Use a variety of diagnostic aids, including the following:

- Investigation guides
- Logic diagrams
- Fault analysis charts (such as fault trees)
- Flow charts or algorithms
- Manufacturers' manuals
- Probability charts/reports
- Troubleshooting guide
- Computer-aided test equipment
- Electronic aids

Core Skills

Plan a high standard of technical work: Gathering and interpreting information including drawings, plans, schedules needed for the development of rail engineering activity planning; Detailed inspection and performance & condition analysis of assets; Plan work to be undertaken including the appropriate resources.

Use of Information continued

How to identify, analyse, and deal with influencing factors whilst carrying out the organising of activities, including environmental factors

Record and present the plans to the appropriate people, using the following methods:

- Specific company documentation
- Pre-defined test plan
- New test plan

Work Area

Assess and analyse the work circumstances and their technical implications

The methods and requirements for work area preparation including as appropriate:

- Access requirements
- Storage requirements
- Levelling requirements

Ensure that the work environment is suitable for the work activities to be undertaken

Confirm that all the required documentation is available and accurately identifies the work to be undertaken

Identify the area of work and the components/equipment which is to be adjusted and/or maintained

Activity Planning

Identify, analyse and determine the sequence of the assessment/restoration activities to be undertaken

Ensure the necessary preparations are carried out to small plant, measuring equipment and tools in line with work requirements

Identify and confirm the assets to be installed

Source and follow the approved system procedures

The different types of specifications relevant to your role and how they are structured including as appropriate:

- Your organisation's procedures and policies
- Manufacturers' specifications and instructions
- Local instructions
- Client specifications
- Rail Strategy Standards Board and HSE guidance

Core Skills

Plan a high standard of technical work: Gathering and interpreting information including drawings, plans, schedules needed for the development of rail engineering activity planning; Detailed inspection and performance & condition analysis of assets; Plan work to be undertaken including the appropriate resources.

Activity Planning continued

Preparations to be undertaken prior to the repair or modification of the system

How to secure the system in preparation for the activity

The importance of making sure the component(s) orientation is correct before fitting and how to undertake this

Establish, and where appropriate, mark component(s) orientation for re-assembly

Methods of checking that components are fit for purpose, how to identify defects and wear characteristics, and the need to replace 'lived' items (such as filters, seals, washers and gaskets)

Core Skills

9. Deliver a high standard of technical work

<p>Deliver a high standard of technical work: Undertake engineering activities in relation to maintenance, construction / installation and or renewal of assets. Complete integrity & compliance checks on own work, instigate testing and identify where independent testing is required. Transfer responsibility of assets once work has been completed. Supervise their own work and that of others.</p>
<p>Installation</p>
<p>Construction methodology for the installation being undertaken</p>
<p>Ensure that all necessary connections to the equipment and components are complete</p>
<p>How to identify, evaluate and respond to activities that cannot be achieved</p>
<p>Produce accurate and complete records of all repair work carried out</p>
<p>Report any instances where the installation activities cannot be fully met or where there are identified defects outside the planned schedule</p>
<p>How to identify, analyse and deal with influencing factors whilst carrying out the installation tasks, including environmental factors, site conditions and working on operational railway equipment</p>
<p>Carry out the installation activities in the specified sequence and in an agreed timescale ensuring that the work does not interfere with any operational railway systems</p>
<p>Follow the required procedure for disconnection, when isolating the working area from other systems</p>
<p>Remove the required component(s) using approved procedures, tools and techniques and in a way that does not interfere with any operational railway systems</p>
<p>Make the required adjustments in the specified sequence and in an agreed timescale</p>
<p>The impact of any deviations from the allocated tasks</p>
<p>How to conduct any necessary checks to ensure the system integrity, functionality, accuracy and quality of the installation</p>
<p>Confirm that the equipment is ready for service by carrying out the following checks, as applicable to the equipment being handed over:</p> <ul style="list-style-type: none"> • The installation activity has been completed and the equipment functions to specification • All safety systems or features are functioning correctly • Any waste materials, safety barriers and warning signs have been removed (where appropriate) • Any auxiliary systems or equipment involved are connected and operable • Any environmental controls are operable (where appropriate) • Others involved in using the equipment are aware that the equipment is about to be operated/used

Core Skills

Deliver a high standard of technical work: Undertake engineering activities in relation to maintenance, construction / installation and or renewal of assets. Complete integrity & compliance checks on own work, instigate testing and identify where independent testing is required. Transfer responsibility of assets once work has been completed. Supervise their own work and that of others.

Maintenance

Prepare the component for repair

Report any instances where the maintenance activities cannot be fully met or where there are identified defects outside the planned schedule

Carry out the following during the maintenance activities:

- Plan and communicate the maintenance activities to cause minimal disruption to normal working
- Obtain and use the correct issue of company and/or manufacturers' drawings and maintenance documentation
- Adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations and procedures to realise a safe system of work
- Ensure the safe isolation of equipment (such as mechanical, electricity, air or fluids)
- Provide and maintain safe access and working arrangements for the maintenance area
- Warn others in the maintenance area if they are at risk of injury from the system being tested
- Carry out the maintenance activities using appropriate techniques and procedures
Reconnect and return the system to service on completion of the maintenance activities
- Dispose of waste items in safe and environmentally acceptable manner, and leave the work area in a safe condition

Follow planned maintenance activities based on the following types of maintenance schedule:

- Condition based maintenance
- Total preventative maintenance (TPM)
- Scheduled maintenance
- Preventative planned maintenance
- Predictive maintenance

The maintenance requirements for lifed, consumable and on condition components

How to follow maintenance schedules, procedures, instructions specifications, site and equipment diagrams

Ensure that interference with other systems is minimised, and equipment and systems other than those being maintained are not disturbed without authority

Carry out the maintenance activities in the specified sequence and in an agreed timescale

Core Skills

Deliver a high standard of technical work: Undertake engineering activities in relation to maintenance, construction / installation and or renewal of assets. Complete integrity & compliance checks on own work, instigate testing and identify where independent testing is required. Transfer responsibility of assets once work has been completed. Supervise their own work and that of others.

Maintenance continued

Carry out the system repair or modification using approved materials, methods and procedures

Complete the repair or modification within the agreed timescale

Complete relevant maintenance records accurately and pass them on to the appropriate person

How to identify, analyse and deal with influencing factors during the maintenance activities including environmental factors

Ensure the maintained equipment/system meets the following:

- All maintenance activities have been completed to the required schedule
- Equipment operates within acceptable limits for successful continuous operation to meet output specification
- Equipment remains compliant with appropriate regulations and safety requirements
- Any potential defects are identified and reported for future action

Carry out the following during the replacement activity:

- Obtain and use the correct issue of company publications and planning documentation
- Adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations and procedures to realise a safe system of work
- Check the calibration dates of tools and test equipment to be used
- Use approved removal/installation techniques and procedures at all times
- Use like for like component replacement to a standard specification
- Provide and maintain safe access and working arrangements to the work area
- Dispose of waste items in a safe and environmentally acceptable manner, and leave the work area in a safe condition

Carry out the handover of the following maintenance activities:

- Breakdown
- Scheduled servicing
- Preventative maintenance
- Modification to equipment

Observe sufficient operations of the components and equipment to confirm it is functioning correctly

Use authorised practices where existing instructions are insufficient

Confirm and agree what repairs or modifications are to be carried out to meet the specification

Core Skills

<p>Deliver a high standard of technical work: Undertake engineering activities in relation to maintenance, construction / installation and or renewal of assets. Complete integrity & compliance checks on own work, instigate testing and identify where independent testing is required. Transfer responsibility of assets once work has been completed. Supervise their own work and that of others.</p>
<p>Assembly</p>
<p>Report any instances where the maintenance/installation activities cannot be fully met or where there are identified defects outside the planned schedule</p>
<p>The sequence to be adopted for the dismantling and reassembling of the equipment, to both sub-assembly and individual component level</p>
<p>Replacement</p>
<p>Take adequate precautions to prevent damage to components, tools and equipment during replacement</p>
<p>Obtain all the required component(s) and ensure that they are in a suitable condition for replacement and fit for purpose</p>
<p>Complete the replacement integrity checks in accordance with appropriate standards and that the completed work is to specification</p>
<p>Integrity & Compliance</p>
<p>Prepare the worksite for repair, which may include as appropriate:</p> <ul style="list-style-type: none"> • Measuring components • Carrying out health and safety checks
<p>Confirm safe working systems are in place</p>
<p>Carry out assessment activities in a manner that minimises the interference with other systems and equipment, within the limits of your own authority</p>
<p>Identify where the operational condition of the asset(s) may affect the functional integrity and safety of the operational system</p>
<p>The types of defects and variations that could occur</p>
<p>Your organisation's methods and techniques for ensuring that repaired assets meet the specified operating conditions</p>
<p>Your organisation's requirements for the completion of work and testing activities prior to returning equipment to operational service</p>
<p>Company policy on repair/replacement of components during the maintenance activities</p>
<p>How to protect operational equipment from the adjustment activity</p>
<p>How to carry out currency/issue checks of the specifications you are working with</p>
<p>Compare the analysis against the product specification and identify any faults or variations from specification</p>
<p>The equipment operating and control procedures to be applied during the maintenance activity</p>

Core Skills

Deliver a high standard of technical work: Undertake engineering activities in relation to maintenance, construction / installation and or renewal of assets. Complete integrity & compliance checks on own work, instigate testing and identify where independent testing is required. Transfer responsibility of assets once work has been completed. Supervise their own work and that of others.

Integrity & Compliance continued

Review the results and carry out further tests if necessary

The documentation required, and the procedures to be followed at the conclusion of the test

Confirm that all testing/checking records are complete and accurately reflect the results of the testing/checking activities carried out

Protect, report and deal with any damage or disturbance to operational equipment in line with your organisation's procedures and how this could affect the safety of the operational railway

Your organisation's procedures for:

- Failure investigation
- Restoring the work area
- Recording the replacement activity
- The care and use of resources
- The control of faults and modifications
- The recording and control of modifications
- The use, care and control of equipment

Complete the relevant integrity checks in line with your organisation's procedures

Testing

Ensure that you have the necessary test data on which to conduct the assessment

The interfaces between the systems/equipment to be tested and other operational equipment, which may be affected

The various testing methods and procedures, and how to apply them to different operating conditions

Carry out tests and checks in a manner that minimises the interference with other systems and assets and is within the limits of your own authority

How to define the limits of testing to ensure operational equipment is not affected

Confirm that the tests/checks are appropriate to the equipment and are in line with testing procedures/instructions

Core Skills

Deliver a high standard of technical work: Undertake engineering activities in relation to maintenance, construction / installation and or renewal of assets. Complete integrity & compliance checks on own work, instigate testing and identify where independent testing is required. Transfer responsibility of assets once work has been completed. Supervise their own work and that of others.

Testing continued

Use the following types of tools and equipment as applicable to the equipment being tested to determine the fault location:

- Calibrated hand tools
- Un-calibrated hand tools
- Calibrated test leads/loads
- Computerised test equipment
- Test recording equipment
- Other specific telecom test equipment

Carry out tests/checks as required by the test plan in sufficient detail to establish the equipment status

Identify and analyse the tests/checks to be carried out, the sequence in which they are to be performed and the methods and equipment to be used

How to locate and identify the equipment to be tested or checked

Transfer Responsibility

Your organisation's procedures for transfer of responsibility of equipment and/or components

How to determine the condition of the equipment and/or components prior to transfer of responsibility

Confirm that the installation is complete, complies with the specification and all necessary tests and checks have been performed

Your organisation/clients procedures for restoring the work area

Confirm the work area is secured on completion of the work

The appropriate handover procedure, depending on the activity carried out (repair, modification, preventative maintenance, scheduled servicing)

The organisational documentation procedures to be used with regard to the handover

Core Skills

Deliver a high standard of technical work: Undertake engineering activities in relation to maintenance, construction / installation and or renewal of assets. Complete integrity & compliance checks on own work, instigate testing and identify where independent testing is required. Transfer responsibility of assets once work has been completed. Supervise their own work and that of others.

Transfer Responsibility continued

Carry out the following during the handover procedures:

- Operate/use the maintained equipment through a complete cycle in the presence of the appropriate person
- Confirm that the other person accepts that the equipment functions satisfactorily to specification
- Highlight to the appropriate person any modifications that would result in unusual features in the operating procedure
- Inform the appropriate person of any future activities that may be required
- Obtain agreement from the other person that they now accept responsibility for the equipment to be returned to service
- Complete any necessary handover documentation
- Confirm the other person knows how and who to contact for future requirements

Make sure that clear, accurate and complete records of the transfer of responsibility are made in line with your organisation's procedures

The checking process to be followed before handing over the equipment (such as are the safety and quality systems operable, does the equipment function to specification)

The need to confirm that the other person understands how to use/operate the equipment before handing the equipment over to them

Confirm that everyone involved accepts the asset is in a satisfactory condition prior to transfer of responsibility

The need to ensure that the person you are handing over the equipment to accepts that it is in a satisfactory condition

Make the transfer of responsibility and obtain agreement between everyone involved on the precise moment of transfer of responsibility

How to determine the condition of the asset prior to transfer of responsibility

The requirements for the completion of work and testing activities prior to returning equipment to service

The problems that can occur during handover/maintenance activity/ replacement operations, and how they can be overcome

Tools & Equipment

What constitutes an unacceptable equipment or component condition

Confirm that the relevant asset(s), equipment and/or component(s) are free from damage

Check the condition of the removed component(s) and record those that will require replacing

Core Skills

10. Solve problems

Solve problems: Identify problems and apply a structured approach and appropriate methods to problem solving and diagnosis.
Problem Solving
Seek advice from others to help resolve problems
Anticipate potential problems and choose which action to take to deal with them
Identify where technical documentation, resources, equipment, materials or tools are not available and deal with the deficiency in accordance with your organisation's procedures
Ensure that all necessary connections to the equipment are complete, deal promptly and effectively with problems within your control and report those that cannot be solved
Review and use all relevant information on the symptoms and problems associated with the products or assets
Use a variety of diagnostic aids and equipment, such as: <ul style="list-style-type: none">• Manufacturer's manual• Logic diagrams• Algorithms• Flow charts• Probability charts/reports• Fault analysis charts (such as fault trees)• Equipment self-diagnostics• Troubleshooting guides• Circuit diagrams/specifications• Electronic aids• Computer-aided test equipment• Manufacturers' manuals
Fault Diagnosis
Use the following fault diagnostic procedures: <ul style="list-style-type: none">• Inspection• Operation• Measurement
The procedures to be followed to investigate faults, and how to deal with intermittent conditions

Core Skills

<p>Solve problems: Identify problems and apply a structured approach and appropriate methods to problem solving and diagnosis.</p>
<p>Fault Diagnosis continued</p>
<p>Carry out the following during the fault diagnostic activity:</p> <ul style="list-style-type: none"> • Plan the fault diagnosis prior to beginning the work • Obtain and use the correct issue of company and/or manufacturer's drawings and maintenance documentation • Adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations and procedures to realise a safe system of work • Ensure the safe isolation of equipment • Provide and maintain safe access and working arrangements for the fault finding area • Warn others in the area if they are at risk of injury from the activity being tested • Carry out the fault diagnosis activities using appropriate procedures • Identify the fault and determine appropriate corrective action • Dispose of waste items in a safe and environmentally friendly manner and leave the work area in a safe condition
<p>Select, use and apply diagnostic techniques, tools and test equipment appropriate to the symptoms of the fault to accurately locate the fault</p>
<p>Collect information about the fault from the following sources:</p> <ul style="list-style-type: none"> • The person or operator who reported the fault • Sensory (such as sight, sound, smell, touch) • Monitoring equipment or gauges • Equipment records/history • Recording devices • Functional test data • Other sources (such as electronic, images)
<p>Collect fault diagnosis evidence from the following sources:</p> <ul style="list-style-type: none"> • Person or operator who reported the fault • Recording devices • Test instrument measurements • Sensory (such as sight, sound, smell, touch) • Equipment records • Circuit meters • Equipment self-diagnostics
<p>How to source and evaluate information relating to the fault, including as appropriate, eye witness accounts, re-occurring faults</p>
<p>How to use the various aids and reports available for fault diagnosis</p>
<p>How to evaluate the various types of information available for fault diagnosis</p>

Core Skills

Solve problems: Identify problems and apply a structured approach and appropriate methods to problem solving and diagnosis.
Fault Diagnosis continued
Investigate and establish the most likely causes of the faults
Analyse the evidence gained to draw valid conclusions about the nature and probable cause of the fault, including as appropriate, re-occurring faults
Determine the implications of the fault for other work and for safety considerations
How to relate previous reports/records of similar fault conditions
Provide a record of the outcome of the fault diagnosis, using the following: <ul style="list-style-type: none"> • Step-by-step analytical report • Corrective action report • Preventative log/report • Company-specific reporting procedure
Identify and analyse the implications of the fault for other work and for safety considerations and report the implication of the fault(s) to the relevant person(s)
Investigate and confirm the fault diagnosis within the agreed time and inform the appropriate person(s) when this cannot be achieved
Analyse Problems
Identify, analyse and report those requirements which cannot be achieved
Identify and report the implications arising from the assessments
How to analyse evidence and evaluate possible characteristics and causes of specific faults or problems
How to evaluate sensory information from sight, sound, smell, touch
Analyse problems in full and choose effective solutions that will maintain the quality and progress of the work
Use the evidence gained to draw valid conclusions about the nature and probable cause of the fault
How to analyse results, and how to use comparison and sequential techniques
Produce/contribute to improvements in existing standard operating procedures for the following: <ul style="list-style-type: none"> • Customer service • Health and safety practices • Product quality • Cleaning of equipment/work area • Process procedures • Maintenance of equipment • Manufacturing operations <p>Employee development (such as apprenticeship programme)</p>

Core Skills

11. Manage resources

Manage resources including the correct utilisation and storage of tools, materials and equipment, and the lifting and moving of materials, components and equipment.

Resources

Your organisation's methods and techniques for effective monitoring of resources
Ensure resource information and documentation is up-to-date and in line with your organisation's procedures
Access resources, verify them for sufficiency and accuracy and deploy them effectively
How the planned use of resources could alter and the implications that may follow
The types of problems that can occur when obtaining resources and how these problems can be overcome
The methods and techniques for allocating resources
Confirm the resources required
Advise the appropriate person(s) where changes to resources have occurred or are likely to occur and the implications involved
Resource: Tools & Equipment
Your organisation's procedures for the use, care, control and storage of tools and equipment including calibration and the implications of not following policies
Your organisation/clients methods and procedures for storing materials and equipment
Your organisation's procedures for the labelling, storage and/or disposal of components
The methods and procedures for monitoring equipment including ensuring consistency of data retrieval
<p>The types of manual, mechanical or hydraulic equipment available, including as appropriate:</p> <ul style="list-style-type: none"> • Hand tools • Small plant • Measuring equipment • Application devices • Lifting tackle • Manual handling • Large plant
The methods and techniques for small plant, measuring equipment and tool preparation relevant to your role
The range of methods techniques for lifting, moving and handling components, assets and/or equipment approved by your organisation

Core Skills

<p>Manage resources including the correct utilisation and storage of tools, materials and equipment, and the lifting and moving of materials, components and equipment.</p>
<p>Resource: Tools & Equipment continued</p>
<p>The methods and techniques for slinging, lifting, securing and protecting including as appropriate:</p> <ul style="list-style-type: none"> • Hand signals • Dealing with obstructions • Securing of loads
<p>The implications of not following the procedures for the use, care and control of tools and equipment</p>
<p>Separate equipment, components, and materials for re-use from waste items and materials</p>
<p>Establish a safe and secure storage area for the placement of waste materials for later collection</p>
<p>Monitor the preparation of small plant, measuring equipment and tools</p>
<p>The types of problems that can occur when preparing small plant, measuring equipment and tools and how these can be overcome</p>
<p>Identify where technical documentation, resources, equipment, materials or tools are not available and deal with the deficiency in accordance with your organisation's procedures</p>
<p>The characteristics and limitations of equipment and systems</p>
<p>How to check that tools and equipment are free from damage or defects, are in a safe and usable condition, and are configured correctly for the intended purpose</p>
<p>Ensure that those using resources are aware of their responsibilities for the care and use of the resources</p>
<p>How to source and analyse the required equipment and system documentation</p>
<p>Use the following types of approved/calibrated tools and equipment as applicable to the components being removed:</p> <ul style="list-style-type: none"> • Power tools • Hand tools • Wire and cable strippers/cutters • IDC tools • Termination tools • Wrenches • Soldering irons • Manual handling equipment
<p>Protect, report and deal with any damage or disturbance to operational equipment in accordance to operational processes</p>
<p>The implications of not following the methods and techniques for safe component handling</p>

Core Skills

12. Communicate effectively

Communicate effectively. Use oral, written, electronic and IT based methods and systems for the accurate communication, reporting & recording of technical and other information, using correct terms, standards, templates and certifications.
Communication Procedures
The types of maintenance records and documentation procedures required by your organisation, including paper based and/or computer based
Your organisation's methods and techniques for effective communication including the appropriate method for communicating changes, including, when a plan may need changing. Following change control processes
Your organisation's procedures for incident and contingency reporting
How to deal with the various incidents and contingencies including the advice and support to give when dealing with requests for rapid response, including communicating effectively with others, in line with your organisation's procedures
The information systems and procedures as approved by your organisation/client relevant to the work activities of the team
Your organisation's procedures for recording adjustment details
Your organisation's procedures for recording the removal activity
Your organisation's methods and techniques for resource planning, including as appropriate: <ul style="list-style-type: none"> • Computerised • Diagrammatic • The use of estimating tools
Communicate Information
The type of information needed to be communicated and the appropriate methods of communication
The relevant person(s) with whom communication must be established and maintained
How and who to contact to clarify information
Advise the appropriate person(s) where changes to resources have occurred or are likely to occur and the implications involved
Communicate system requirements and the responsibilities of individuals to the appropriate person(s)
How to obtain timely feedback on the support and advice provided
Provide colleagues with valid and up-to-date information, advice and guidance as necessary
Clarify and give guidance and assistance when information is unclear, inaccurate or conflicting

Core Skills

<p>Communicate effectively. Use oral, written, electronic and IT based methods and systems for the accurate communication, reporting & recording of technical and other information, using correct terms, standards, templates and certifications.</p>
<p>Communicate Information continued</p>
<p>Identify and report any defects promptly, and agree a suitable course of action with the relevant person(s)</p>
<p>Present and communicate the following information related to the engineering activities as applicable to the equipment:</p> <ul style="list-style-type: none"> • Special notices • Engineering standards • Work instructions • Technical briefings • Safety briefings
<p>Presenting Information</p>
<p>How to complete the relevant installation documentation</p>
<p>Record the results of the assessments in the appropriate format</p>
<p>Check that the assessment provides clear and accurate information</p>
<p>Ensure all required documentation is complete, accurate, formatted and processed in accordance with your organisation's policies and procedures</p>
<p>Record details on the use of resources including where appropriate any changes that have occurred</p>
<p>Identify, evaluate and report any instances where the equipment fails to meet the required performance after adjustments or where there are identified defects outside the required adjustments</p>
<p>Record details on the extent and location of the faults in an appropriate format, including as appropriate, drawing valid conclusions on the options for rectifying the fault and the changes required to possession and protection arrangements</p>
<p>Record the results of the tests in the appropriate format</p>
<p>Check that the progression of work is recorded accurately, clearly and in line with your organisation's procedures</p>
<p>Maintain documentation in accordance with your organisation's procedures</p>
<p>How information and equipment can be displayed for various work applications (IT systems)</p>
<p>The requirements for presenting information as approved by your organisation, including as appropriate, using set proformas and templates</p>