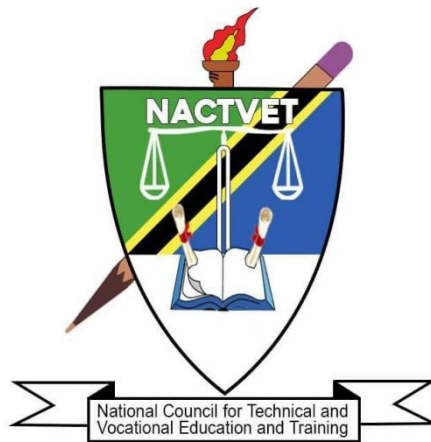


**NATIONAL COUNCIL FOR TECHNICAL AND VOCATIONAL EDUCATION AND  
TRAINING**



**FEBRUARY 2023**

**PROPOSED OCCUPATIONAL STANDARDS**

**OCCUPATION: RAILWAY LOCOMOTIVE OPERATION AND MAINTENANCE**

**ENGINEER**

**LEVEL: NTA 7**

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## **ABBREVIATIONS**

|                |  |
|----------------|--|
| <b>APU</b>     | Auxiliary Power Unit   |
| <b>BCU</b>     | Braking Control Unit   |
| <b>CIR</b>     | Cab Integrated Radio   |
| <b>CTCS</b>    | Chinese Train Control System   |
| <b>CBET</b>    | Competency Based Education and Training                                |
| <b>CCU</b>     | Central Control Unit   |
| <b>CI</b>      | Traction Inverter  |
| <b>EBV</b>     | Electronic Brake Valve   |
| <b>HVB</b>     | Main Circuit Breaker   |
| <b>LCDM</b>    | Liquid Crystal Display Module  |
| <b>LBJ</b>     | Train Protection Alarm Equipment (Lieche Baohu Jingbao)                |
| <b>LKJ</b>     | Train Operation Monitoring and Recording Device (Lieche Jiankong Jilu) |
| <b>MOPP</b>    | Maintenance Operation Processes and Procedures                         |
| <b>MVB</b>     | Multifunction Vehicle Bus  |
| <b>NACTVET</b> | National Council for Technical and Vocational Education and Training   |
| <b>NOS</b>     | National Occupational Standards  |
| <b>OS</b>      | Occupational Standards   |
| <b>PLC</b>     | Programmable Logic Controller  |
| <b>PPE</b>     | Personal Protective Equipment  |

|             |   |
|-------------|---|
| <b>PWM</b>  | Pulse Width Modulation                          |
| <b>TET</b>  | Technical Education and Training                |
| <b>TVET</b> | Technical and Vocational Education and Training |
| <b>VVVF</b> | Variable Voltage Variable Frequency             |
| <b>WTB</b>  | Wire Train Bus                                  |

## GLOSSARY OF TERMS

|  |  |
|--|--|
| <b>Circumstantial Knowledge:</b>       | Detailed knowledge, which allows the decision-making in regard to different circumstances and cross cutting issues.  |
| <b>Competence:</b>                     | The ability to use knowledge, understanding, practical, and thinking skills to perform effectively to the workplace standards required in employment.  |
| <b>Competency:</b>                     | A description of the ability one possesses when able to perform a given occupational task effectively and efficiently.   |
| <b>Competency-based Education:</b>     | An instructional programme that derives its content from validated tasks and bases assessment on the learner's performance.  |
| <b>Curriculum:</b>                     | A description or composite of statements about "what is to be learned" by the trainee/student in a particular instructional programme; a product that states the "intended learning outcomes".                                       |
| <b>Educational/Training Programme:</b> | The complete curriculum and instruction (what and how) that is designed to prepare a person for employment in a job or other particular performance situation.   |
| <b>Occupation:</b>                     | A specific position requiring the performance of specific tasks – essentially the same tasks are performed by all employees having the same title. (Example: baker)  |
| <b>Occupational Area:</b>              | This is a broad grouping of related jobs. (Example: food service)  |
| <b>Occupational Competence:</b>        | The application of knowledge and skills that consistently meet the standards required by the work context.   |
| <b>Occupational Standards:</b>         | Specific requirements of competences people are expected to demonstrate in a particular occupational area, including knowledge and relevant attitudes. They also act as a performance tool of assessment of the prescribed outcomes. |
| <b>Occupational/Job Analysis:</b>      | A process used to identify the tasks that are important to employees in any given occupation.  |
| <b>Performance Criteria:</b>           | Indicate expected end results or outcomes in the form of evaluative statements.  |
| <b>Skills:</b>                         | The ability to perform occupational tasks with a high degree of proficiency within a given occupation. Skill is conceived of as a  |

composite of three completely interdependent components: cognitive, affective, and psychomotor.

- Standards:** A set of statements, which if proved true under working conditions, means that an individual is meeting an expected level and type of performance.
- Task Analysis:** The process of analysing each task to determine the steps, circumstantial knowledge, attitudes, performance standards, tools and materials needed, as well as safety concerns required for the employees performing it.
- Task:** A work activity that has a definite beginning and ending, is observable or measurable, and consists of two or more definite steps that leads to a product, service, or decision.
- Underpinning Knowledge:** Crucial knowledge that an individual must acquire in order to demonstrate competences that are associated in performing a given task.
- Verification Process:** The process of having experts review and confirm the importance of the task (competency) statements identified through occupational analysis. Other questions, such as the degree of task learning difficulty are also frequently asked. This process is also sometimes referred to as validation.

## 1.0. INTRODUCTION

Technical Education and Training (TET) is one of the most important education sub-sectors in Tanzania, responsible for developing a skilled workforce to support the country's industrialization economic agenda. Tanzania's *Development Vision 2025* intends to raise the country's economy to a middle-income status. This requires a skilled workforce that is aligned with the needs of the public and private sectors of the economy. The National Council for Technical Education has begun the job of drafting Occupational Standards that will eventually be adopted as National Occupational Standards for TET in order to ensure that it meets the needs of the labour market and the country's economic agenda.

National Occupational Standards (NOS) are performance criteria that are matched with labour market demands. Each National Occupation Standard describes functions, performance standards, and knowledge/understanding for one important function or task. They combine skills, knowledge, and attitudes to describe best practice. They are useful tools for establishing job roles, personnel recruiting, supervision, and appraisal, as well as TET standards. They're also helpful for benchmarking and harmonizing qualifications on a national and international level. Standards, in general, provide a solid framework for high-quality TET that is labour market-relevant, current, and consistent in delivery across all public and private institutions.

However, it must be noted that, Occupational Standards and Training standards/qualifications standards are different. Occupational standards are defined in terms of activities performed by a person in a selected occupation (e.g., an electrical engineer designs electrical wiring circuits, performs troubleshooting in electrical wiring, etc.) and they are usually defined by employers following procedures agreed upon by all stakeholders. Education and training standards are developed from the activities defined in occupational standards, and they include learning objectives to ensure that the necessary skills and knowledge are developed by a person to enable him or her to function at an agreed level in an occupation. Education and Training standards are used to define curricula in training institutions. It is however critical that there must be a direct link between the occupational standards and the training standards to respond to the demands of the labour market.

In TET delivery, Tanzania adopted the Competence Based Education and Training (CBET)

approach. The CBET approach focuses on providing learners with the skills and knowledge required to meet the occupational standards. Occupational standards are thus the starting point for developing competency-based training (CBET) programmes. TET institutions will be required to benchmark their curricula with relevant occupational standards.

Occupational Standards are developed based on a given occupation's current and future demands. As a result, they serve as a means of bridging the gap between the worlds of employment and technical education and training (TET).

The Railway Locomotive Operation and Maintenance Engineer Occupation has its own set of occupational standards. The document explains how the occupational standards were developed, as well as the scope, the occupational profile in the form of DACUM charts, and the Occupational Standards.

## **2.0. OCCUPATIONAL STANDARD DEVELOPMENT PROCESS**

The Occupational standard development process began with an examination of major documents that guide Tanzanian skill development. The *10-year National Skills Development Strategy (2016-2026)* was one of the documents reviewed, and it outlined six (6) economic sectors that should be prioritized when developing skills development programmes.

These sectors include: Transport and Logistics, Tourism and Hospitality, Agribusiness, Construction, Energy and ICT. NACTE labour market reports were also used in the literature review to determine the skills demand in the Tanzanian labour market as a whole.

After the literature review, a workshop comprised of expert workers and educators with substantial knowledge and experience in the occupation conducted an occupational analysis utilizing the DACUM approach to produce the occupational profile. The analysis resulted in DACUM Charts, which are attached as **Appendix 1** to this document.

The occupational standards were then developed. Experts in Occupational Analysis and the Development of Occupational Standards facilitated the workshop. Interviews, online surveys, and a stakeholder forum were used to validate the Occupational Standards. Engineers, supervisory technicians on the job, and experienced Railway Locomotive Operation and Maintenance Engineers were key informants in the survey to discover occupational trends. This information was used to

gain insight from the workplaces regarding trends and changes in the profession, including how well graduates are prepared for working in the occupation. A total of ... online surveys were completed by experts from the labour market across the country. Apart from the surveys aiding in defining the scope for the occupational analysis, they also served to engage a wide cross-section of experts in the occupation. Apart from this, the stakeholders' forum was attended by participants from different parts of the country representing various companies.

### **3.0. THE SCOPE AND OVERVIEW OF THE OCCUPATION STANDARDS FOR RAILWAY LOCOMOTIVE OPERATION AND MAINTENANCE ENGINEERS**

These standards cover a broad range of duties and tasks that can be performed by a Railway Locomotive Operation and Maintenance Engineer. However, the occupational standards are not meant to replace individual job descriptions. Instead, they are to be used for guidance in defining skill levels and knowledge for the technician in specific settings or positions. The Locomotive Engineering Technician may perform tasks in a number of key areas of the Occupational Standards, but not necessarily in all areas. For example, in large operations, other individuals may be employed or designated to perform specific tasks.

The Railway Locomotive Operation and Maintenance Engineer operates, inspects, maintains, and repairs railway locomotives under the supervision of an engineer. The technician is able to handle unusual situations on the circuit that are encountered by railway locomotives during crew operations; while in the workshop, the technician completes inspections and maintenance, and is able to deal with faults in the locomotive's running gear, braking system, traction transmission system and running safety devices.

Generally, the Railway Locomotive Operation and Maintenance Engineer performs the following responsibilities:

- a) Troubleshooting of locomotive running gears
- b) Troubleshooting of locomotive braking systems
- c) Troubleshooting of locomotive transmission systems
- d) Troubleshooting of running safety devices
- e) Handling of abnormal running

The Occupational Standards have been clustered into NTA qualification levels, i.e. NTA level 7 and 8.

#### **4.0. VALIDITY PERIOD**

Due to the rapid development of technology, the validity period of occupational standards is 3-5 years. The review will proceed in the same manner as the one before it, with new occupational standards being developed based on current trends of the labour market.

#### **5.0. OCCUPATIONAL STANDARDS**

**5.1 OCCUPATIONAL STANDARDS FOR RAILWAY LOCOMOTIVE OPERATION  
AND MAINTENANCE ENGINEER - NTA 7**

|  |  |   |                        |      |
|--|--|---|------------------------|------|
| <b>OCCUPATION</b>  | RAILWAY LOCOMOTIVE OPERATION AND MAINTENANCE ENGINEER  |   | <b>OCCUPATION CODE</b> |      |
| <b>DUTY TITLE</b>  | TROUBLESHOOTING OF LOCOMOTIVE RUNNING GEARS  |   | <b>DUTY NO.</b>        | 701  |
| <b>TASK TITLE</b>  | TROUBLESHOOTING OF LOCOMOTIVE FRAMES AND ACCESSORY DEVICES   |   | <b>TASK NO.</b>        | 7011 |
| <b>PERFORMANCE CRITERIA</b>  | The person performing this task must be able to troubleshoot the locomotive frame and accessory devices in accordance with technical requirements and manufacturer's manual specifications.  |   |                        |      |
| <b>RANGE STATEMENT</b>   | <p>The task can be performed in the locomotive overhaul workshop under the supervision of railway locomotive operation and maintenance engineers.</p> <p>The tools and equipment to be used include:</p> <ol style="list-style-type: none"> <li>1. Underfloor lifting machines;</li> <li>2. Overhead cranes;</li> <li>3. Specialized turning machines and tools;</li> <li>4. Specialized cleaning equipment;</li> <li>5. Press machines;</li> <li>6. Rail flat cars;</li> <li>7. Flaw detection equipment;</li> <li>8. Gas (electric) welding equipment;</li> <li>9. Platforms;</li> <li>10. Steel rulers;</li> <li>11. Flashlights;</li> <li>12. Checking hammers.</li> </ol> |   |                        |      |
| <b>EVIDENCE REQUIREMENT</b>  |  |   |                        |      |
| <b>PRACTICAL PERFORMANCE</b>   |  | <b>UNDERPINNING KNOWLEDGE</b>   |                        |      |
| <p>The person performing this task must be able to do the following:</p> <ol style="list-style-type: none"> <li>1. Select operating tools;</li> <li>2. Inspect the bogie frame;</li> <li>3. Inspect accessory devices;</li> <li>4. Inspect the dimensions of each component;</li> <li>5. Perform manual decontamination;</li> <li>6. Perform structural flaw detection;</li> <li>7. Record fault information;</li> </ol> |  | <p>Detailed knowledge about:</p> <p><b>1.0 Methods</b></p> <p>The person performing this task must be able to explain how to:</p> <ol style="list-style-type: none"> <li>1.1 Inspect the bogie frame;</li> <li>1.2 Inspect accessory devices;</li> <li>1.3 Inspect the dimensions of each component;</li> <li>1.4 Perform manual decontamination;</li> <li>1.5 Perform structural flaw detection;</li> <li>1.6 Perform repair work such as welding, straightening,</li> </ol> |                        |      |

|   |   |
|---|---|
| <ol style="list-style-type: none"> <li>8. Analyze the cause of faults;</li> <li>9. Perform repair work such as welding, straightening, and cutting;</li> <li>10. Make anti-slowdown markings;</li> <li>11. Observe safety regulations;</li> <li>12. Clean the workplace;</li> <li>13. Arrange and store the tools and equipment.</li> </ol> | <p style="text-align: right;">and cutting;</p> <ol style="list-style-type: none"> <li>1.7 Make anti-slowdown markings.</li> </ol> <p><b>2.0 Principles</b><br/>The person performing this task must be able to explain the following principles:</p> <ol style="list-style-type: none"> <li>2.1 Principles of inspecting locomotive frames and accessory devices.</li> </ol> <p><b>3.0 Theories</b><br/>The person performing this task must be able to explain the following:</p> <ol style="list-style-type: none"> <li>3.1 Classification, composition and technical parameter requirements of locomotive frames;</li> <li>3.2 Composition and technical parameter requirements of accessory devices;</li> <li>3.3 Fault analysis and treatment of locomotive frames and accessory devices;</li> <li>3.4 Usage of proper tools and equipment.</li> </ol> <p><b>4.0 Essential Skills</b></p> <ol style="list-style-type: none"> <li>4.1 Communication skills;</li> <li>4.2 Computer skills;</li> <li>4.3 Data analysis skills;</li> <li>4.4 Standardized operation skills;</li> <li>4.5 Teamwork skills;</li> <li>4.6 Report writing skills.</li> </ol> |
| <p><b>DESCRIPTION OF THE END PRODUCT / SERVICE</b></p>  | <p>Inspection and troubleshooting of locomotive wheel pairs are performed in accordance with the railway locomotive maintenance manual.</p>   |
| <p><b>CIRCUMSTANTIAL KNOWLEDGE</b></p>  | <p>Detailed knowledge about:</p> <ol style="list-style-type: none"> <li>1. Safety operation of operating machines and tools;</li> <li>2. Safety operation of detection equipment;</li> <li>3. Occupational health and safety;</li> <li>4. Waste disposal methods.</li> </ol>  |

|   |   |  |      |
|---|---|--|------|
| <b>OCCUPATION</b>   | RAILWAY LOCOMOTIVE OPERATION AND MAINTENANCE ENGINEER   | <b>OCCUPATION CODE</b>   |      |
| <b>DUTY TITLE</b>   | TROUBLESHOOTING OF LOCOMOTIVE RUNNING GEARS   | <b>DUTY NO.</b>  | 701  |
| <b>TASK TITLE</b>   | TROUBLESHOOTING OF LOCOMOTIVE WHEEL PAIRS   | <b>TASK NO.</b>  | 7012 |
| <b>PERFORMANCE CRITERIA</b>   | The person performing this task must be able to troubleshoot the locomotive wheel pairs in accordance with technical requirements and manufacturer's manual specifications.   |  |      |
| <b>RANGE STATEMENT</b>  | <p>The task can be performed in the locomotive overhaul workshop under the supervision of railway locomotive operation and maintenance engineers.</p> <p>The tools and equipment to be used include:</p> <ol style="list-style-type: none"> <li>1. Underfloor wheel lathes;</li> <li>2. Wheel lathes;</li> <li>3. Ultrasonic flaw detectors;</li> <li>4. Electromagnetic flaw detectors;</li> <li>5. Angle grinders;</li> <li>6. Checkers;</li> <li>7. Specialized measuring tools for wheel diameters;</li> <li>8. Inside gauges;</li> <li>9. Taper gages;</li> <li>10. Boring machines;</li> <li>11. Flashlights;</li> <li>12. Checking hammers.</li> </ol> |  |      |
| <b>EVIDENCE REQUIREMENT</b>   |   |  |      |
| <b>PRACTICAL PERFORMANCE</b>  |   | <b>UNDERPINNING KNOWLEDGE</b>  |      |
| <p>The person performing this task must be able to do the following:</p> <ol style="list-style-type: none"> <li>1. Select operating tools;</li> <li>2. Inspect the wheel pairs;</li> <li>3. Inspect the dimensions of each component;</li> <li>4. Perform flaw detection for wheel pairs;</li> <li>5. Record fault information;</li> <li>6. Analyze the cause of faults;</li> <li>7. Perform rotary repair of wheels;</li> <li>8. Replace the wheel hub;</li> <li>9. Make anti-slowdown markings;</li> <li>10. Observe safety regulations;</li> <li>11. Clean the workplace;</li> </ol> |   | <p>Detailed knowledge about:</p> <p><b>1.0 Methods</b></p> <p>The person performing this task must be able to explain how to:</p> <ol style="list-style-type: none"> <li>1.1 Inspect the wheel pairs;</li> <li>1.2 Inspect the dimensions of each component;</li> <li>1.3 Perform flaw detection for wheel pairs;</li> <li>1.4 Perform rotary repair of wheels;</li> <li>1.5 Replace the wheel hub.</li> </ol> <p><b>2.0 Principles</b></p> <p>The person performing this task must be able to explain the following principles:</p> <ol style="list-style-type: none"> <li>2.1 Working principles of locomotive wheel pairs.</li> </ol> |      |

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|--|---|
| <p>12. Arrange and store the tools and equipment.</p>  | <p><b>3.0 Theories</b><br/> The person performing this task must be able to explain the following:</p> <p>3.1 Inspection procedures for locomotive wheel pairs;<br/> 3.2 Assembly and technical parameter requirements for locomotive wheel pairs;<br/> 3.3 Fault analysis and treatment plan for locomotive wheel pairs;<br/> 3.4 Usage of proper tools and equipment.</p> <p><b>4.0 Essential Skills</b><br/> 4.1 Communication skills;<br/> 4.2 Computer skills;<br/> 4.3 Standardized operation skills;<br/> 4.4 Teamwork skills;<br/> 4.5 Report writing skills.</p> |
| <p><b>DESCRIPTION OF THE END PRODUCT / SERVICE</b></p> | <p>Inspection and troubleshooting of locomotive wheel pairs are performed in accordance with the railway locomotive maintenance manual.</p>   |
| <p><b>CIRCUMSTANTIAL KNOWLEDGE</b></p>                 | <p>Detailed knowledge about:</p> <ol style="list-style-type: none"> <li>1. Safety operation of operating machines and tools;</li> <li>2. Safety operation of detection equipment;</li> <li>3. Occupational health and safety;</li> <li>4. Fault analysis and treatment;</li> <li>5. Waste disposal methods.</li> </ol>  |

| <b>OCCUPATION</b>   | RAILWAY LOCOMOTIVE OPERATION AND MAINTENANCE ENGINEER  | <b>OCCUPATION CODE</b>  |      |
|---|--|---|------|
| <b>DUTY TITLE</b>   | TROUBLESHOOTING OF LOCOMOTIVE RUNNING GEARS  | <b>DUTY NO.</b>   | 701  |
| <b>TASK TITLE</b>   | TROUBLESHOOTING OF LOCOMOTIVE DRIVING DEVICES  | <b>TASK NO.</b>   | 7013 |
| <b>PERFORMANCE CRITERIA</b>   | The person performing this task must be able to troubleshoot the locomotive driving devices in accordance with technical requirements and manufacturer's manual specifications.  |   |      |
| <b>RANGE STATEMENT</b>  | <p>The task can be performed in the locomotive overhaul workshop under the supervision of railway locomotive operation and maintenance engineers.</p> <p>The tools and equipment to be used include:</p> <ol style="list-style-type: none"> <li>1. Magnetic particle flaw detectors;</li> <li>2. Angle grinders;</li> <li>3. Wheel hub thickness gauges;</li> <li>4. Wheel pair inside gauges;</li> <li>5. Oiling and press-mounting equipment for wheel pairs;</li> <li>6. Specialized equipment and instruments for installing and disassembling bearing units;</li> <li>7. Torque wrenches;</li> <li>8. Sockets;</li> <li>9. Overhead cranes;</li> <li>10. Flashlights;</li> <li>11. Checking hammers.</li> </ol> |   |      |
| <b>EVIDENCE REQUIREMENT</b>   |  |   |      |
| <b>PRACTICAL PERFORMANCE</b>  |  | <b>UNDERPINNING KNOWLEDGE</b>   |      |
| <p>The person performing this task must be able to do the following:</p> <ol style="list-style-type: none"> <li>1. Select operating tools;</li> <li>2. Inspect the driving device;</li> <li>3. Inspect the dimensions of each component;</li> <li>4. Supplement or replace the gearbox oil;</li> <li>5. Clean the magnetic plug;</li> <li>6. Perform magnetic particle flaw detection;</li> <li>7. Record fault information;</li> <li>8. Analyze the cause of faults;</li> <li>9. Perform polishing;</li> </ol> |  | <p>Detailed knowledge about:</p> <p><b>1.0 Methods</b></p> <p>The person performing this task must be able to explain how to:</p> <ol style="list-style-type: none"> <li>1.1 Inspect the driving device;</li> <li>1.2 Inspect the dimensions of each component;</li> <li>1.3 Supplement or replace the gearbox oil;</li> <li>1.4 Clean the magnetic plug;</li> <li>1.5 Perform magnetic particle flaw detection;</li> <li>1.6 Perform polishing;</li> <li>1.7 Perform the welding repair;</li> <li>1.8 Make anti-slowdown markings.</li> </ol> <p><b>2.0 Principles</b></p> |      |

|   |   |
|---|---|
| <p>10. Perform the welding repair;<br/> 11. Make anti-slowdown markings;<br/> 12. Observe safety regulations;<br/> 13. Clean the workplace;<br/> 14. Arrange and store the tools and equipment.</p> | <p>The person performing this task must be able to explain the following principles:<br/> 2.1 Principles of performing inspections for locomotive driving devices.</p> <p><b>3.0 Theories</b><br/> The person performing this task must be able to explain the following:<br/> 3.1 Inspection procedures for locomotive driving devices;<br/> 3.2 Types, assembly and technical parameter requirements of locomotive driving devices;<br/> 3.3 Fault analysis and treatment of locomotive driving devices;<br/> 3.4 Usage of proper tools and equipment;<br/> 3.5 The importance of using the proper gear oil.</p> <p><b>4.0 Essential Skills</b><br/> 4.1 Communication skills;<br/> 4.2 Computer skills;<br/> 4.3 Data analysis skills;<br/> 4.4 Standardized operation skills;<br/> 4.5 Teamwork skills;<br/> 4.6 Report writing skills.</p> |
| <p><b>DESCRIPTION OF THE END PRODUCT / SERVICE</b></p>  | <p>Inspection and troubleshooting of locomotive driving devices are performed in accordance with the railway locomotive maintenance manual.</p>   |
| <p><b>CIRCUMSTANTIAL KNOWLEDGE</b></p>  | <p>Detailed knowledge about:<br/> 1. Safety operation of operating machines and tools;<br/> 2. Safety operation of detection equipment;<br/> 3. Occupational health and safety;<br/> 4. Fault analysis and treatment;<br/> 5. Waste disposal methods.</p>   |

|                              |   |                               |      |
|------------------------------|---|-------------------------------|------|
| <b>OCCUPATION</b>            | RAILWAY LOCOMOTIVE OPERATION AND MAINTENANCE ENGINEER   | <b>OCCUPATION CODE</b>        |      |
| <b>DUTY TITLE</b>            | TROUBLESHOOTING OF LOCOMOTIVE RUNNING GEARS   | <b>DUTY NO.</b>               | 701  |
| <b>TASK TITLE</b>            | TROUBLESHOOTING OF LOCOMOTIVE TRACTION DEVICES  | <b>TASK NO.</b>               | 7014 |
| <b>PERFORMANCE CRITERIA</b>  | The person performing this task must be able to troubleshoot the locomotive traction devices in accordance with technical requirements and manufacturer's manual specifications.  |                               |      |
| <b>RANGE STATEMENT</b>       | <p>The task can be performed in the locomotive overhaul workshop under the supervision of railway locomotive operation and maintenance engineers.</p> <p>The tools and equipment to be used include:</p> <ol style="list-style-type: none"> <li>1. Magnetic particle flaw detectors;</li> <li>2. Drawbar removal trolleys;</li> <li>3. Overhaul platforms;</li> <li>4. Press machines;</li> <li>5. Torque wrenches;</li> <li>6. Jacks;</li> <li>7. Hammers;</li> <li>8. Crowbars;</li> <li>9. Sockets;</li> <li>10. Gas (electric) welding equipment;</li> <li>11. Specialized lifting trolleys;</li> <li>12. Oil presses;</li> <li>13. Coupler overhauling platforms;</li> <li>14. Slings;</li> <li>15. Hand emery wheels;</li> <li>16. Cotter pins for disassembly and assembly;</li> <li>17. Coupler inspection template rules;</li> <li>18. Coupler height measuring gauges;</li> <li>19. Wire brushes;</li> <li>20. Brushes;</li> <li>21. Vernier calipers;</li> <li>22. Inside and outside calipers;</li> <li>23. Steel rulers;</li> <li>24. Flashlights;</li> <li>25. Checking hammers.</li> </ol> |                               |      |
| <b>EVIDENCE REQUIREMENT</b>  |   |                               |      |
| <b>PRACTICAL PERFORMANCE</b> |   | <b>UNDERPINNING KNOWLEDGE</b> |      |

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| <p>The person performing this task must be able to do the following:</p> <ol style="list-style-type: none"> <li>1. Select operating tools;</li> <li>2. Inspect drawbar devices;</li> <li>3. Inspect traction buffer devices;</li> <li>4. Inspect the dimensions of each component;</li> <li>5. Perform magnetic particle flaw detection;</li> <li>6. Record fault information;</li> <li>7. Analyze the cause of faults;</li> <li>8. Clean assembly surfaces;</li> <li>9. Grease assembly surfaces;</li> <li>10. Perform the welding repair;</li> <li>11. Make anti-slowdown markings;</li> <li>12. Observe safety regulations;</li> <li>13. Clean the workplace;</li> <li>14. Arrange and store the tools and equipment.</li> </ol> | <p>Detailed knowledge about:</p> <p><b>1.0 Methods</b></p> <p>The person performing this task must be able to explain how to:</p> <ol style="list-style-type: none"> <li>1.1 Inspect drawbar devices;</li> <li>1.2 Inspect traction buffer devices;</li> <li>1.3 Inspect the dimensions of each component;</li> <li>1.4 Perform magnetic particle flaw detection;</li> <li>1.5 Clean assembly surfaces;</li> <li>1.6 Grease assembly surfaces;</li> <li>1.7 Perform the welding repair;</li> <li>1.8 Make anti-slowdown markings.</li> </ol> <p><b>2.0 Principles</b></p> <p>The person performing this task must be able to explain the following principles:</p> <ol style="list-style-type: none"> <li>2.1 Principles of performing inspections for locomotive traction devices.</li> </ol> <p><b>3.0 Theories</b></p> <p>The person performing this task must be able to explain the following:</p> <ol style="list-style-type: none"> <li>3.1 Inspection procedures for locomotive traction devices;</li> <li>3.2 Types, assembly and technical parameter requirements of locomotive traction devices;</li> <li>3.3 Fault analysis and treatment of locomotive traction devices;</li> <li>3.4 Usage of proper tools and equipment;</li> <li>3.5 The importance of using the proper lubricating grease.</li> </ol> <p><b>4.0 Essential Skills</b></p> <ol style="list-style-type: none"> <li>4.1 Communication skills;</li> <li>4.2 Computer skills;</li> <li>4.3 Data analysis skills;</li> <li>4.4 Standardized operation skills;</li> <li>4.5 Teamwork skills;</li> <li>4.6 Report writing skills.</li> </ol> |
| <p><b>DESCRIPTION OF THE END PRODUCT / SERVICE</b></p>  | <p>Inspection and troubleshooting of locomotive traction devices are performed in accordance with the railway locomotive maintenance manual.</p>   |
| <p><b>CIRCUMSTANTIAL KNOWLEDGE</b></p>  | <p>Detailed knowledge about:</p> <ol style="list-style-type: none"> <li>1. Safety operation of operating machines and tools;</li> </ol>  |

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|  | <ol style="list-style-type: none"><li>2. Safety operation of detection equipment;</li><li>3. Occupational health and safety;</li><li>4. Fault analysis and treatment;</li><li>5. Waste disposal methods.</li></ol> |
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| <b>OCCUPATION</b>   | RAILWAY LOCOMOTIVE OPERATION AND MAINTENANCE ENGINEER  | <b>OCCUPATION CODE</b> |      |
| <b>DUTY TITLE</b>   | TROUBLESHOOTING OF LOCOMOTIVE RUNNING GEARS  | <b>DUTY NO.</b>        | 701  |
| <b>TASK TITLE</b>   | TROUBLESHOOTING OF LOCOMOTIVE SUSPENSION DEVICES   | <b>TASK NO.</b>        | 7015 |
| <b>PERFORMANCE CRITERIA</b>   | The person performing this task must be able to troubleshoot the locomotive suspension devices in accordance with technical requirements and manufacturer's manual specifications.   |                        |      |
| <b>RANGE STATEMENT</b>  | <p>The task can be performed in the locomotive overhaul workshop under the supervision of railway locomotive operation and maintenance engineers.</p> <p>The tools and equipment to be used include:</p> <ol style="list-style-type: none"> <li>1. Ultrasonic flaw detectors;</li> <li>2. Magnetic particle flaw detectors;</li> <li>3. Angle grinders;</li> <li>4. Feeler gauges;</li> <li>5. Platforms;</li> <li>6. Spring special fixtures;</li> <li>7. Press machines;</li> <li>8. Spring pressure testing machines;</li> <li>9. Scimitar-shaft external circlip pliers;</li> <li>10. Motor brackets;</li> <li>11. Torque wrenches;</li> <li>12. Special sockets;</li> <li>13. Outside micrometers;</li> <li>14. Specialized equipment and instruments for installing and disassembling bearing units;</li> <li>15. Overhead cranes;</li> <li>16. Flashlights;</li> <li>17. Checking hammers.</li> </ol> |                        |      |
| <b>EVIDENCE REQUIREMENT</b>   |  |                        |      |
| <b>PRACTICAL PERFORMANCE</b>  | <b>UNDERPINNING KNOWLEDGE</b>  |                        |      |
| <p>The person performing this task must be able to do the following:</p> <ol style="list-style-type: none"> <li>1. Select operating tools;</li> <li>2. Inspect the locomotive suspension device;</li> <li>3. Inspect the dimensions of each component;</li> <li>4. Perform flaw detection;</li> </ol> | <p>Detailed knowledge about:</p> <p><b>1.0 Methods</b></p> <p>The person performing this task must be able to explain how to:</p> <ol style="list-style-type: none"> <li>1.1 Inspect the locomotive suspension device;</li> <li>1.2 Inspect the dimensions of each component;</li> <li>1.3 Perform flaw detection;</li> <li>1.4 Disassemble and assemble the axle box;</li> </ol>  |                        |      |

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| <ol style="list-style-type: none"> <li>5. Record fault information;</li> <li>6. Analyze the cause of faults;</li> <li>7. Disassemble and assemble the axle box;</li> <li>8. Disassemble and assemble the oleo damper;</li> <li>9. Disassemble and assemble the spring;</li> <li>10. Perform spring compression test;</li> <li>11. Clean assembly surfaces;</li> <li>12. Grease assembly surfaces;</li> <li>13. Make anti-slowdown markings;</li> <li>14. Observe safety regulations;</li> <li>15. Clean the workplace;</li> <li>16. Arrange and store the tools and equipment.</li> </ol> | <ol style="list-style-type: none"> <li>1.5 Disassemble and assemble the oleo damper;</li> <li>1.6 Disassemble and assemble the spring;</li> <li>1.7 Perform spring compression test;</li> <li>1.8 Clean assembly surfaces;</li> <li>1.9 Grease assembly surfaces;</li> <li>1.10 Make anti-slowdown markings.</li> </ol> <p><b>2.0 Principles</b><br/>The person performing this task must be able to explain the following principles:</p> <ol style="list-style-type: none"> <li>2.1 Principles of performing inspections for locomotive suspension devices.</li> </ol> <p><b>3.0 Theories</b><br/>The person performing this task must be able to explain the following:</p> <ol style="list-style-type: none"> <li>3.1 Inspection procedures for locomotive suspension devices;</li> <li>3.2 Types, assembly and technical parameter requirements of locomotive suspension devices;</li> <li>3.3 Fault analysis and treatment of locomotive suspension devices;</li> <li>3.4 Usage of proper tools and equipment;</li> <li>3.5 The importance of using the proper lubricating grease.</li> </ol> <p><b>4.0 Essential Skills</b><br/>The person performing this task must have the following skills:</p> <ol style="list-style-type: none"> <li>4.1 Communication skills;</li> <li>4.2 Computer skills;</li> <li>4.3 Data analysis skills;</li> <li>4.4 Standardized operation skills;</li> <li>4.5 Teamwork skills;</li> <li>4.6 Report writing skills.</li> </ol> |
| <p><b>DESCRIPTION OF THE END PRODUCT / SERVICE</b></p>  | <p>Inspection and troubleshooting of locomotive suspension devices are performed in accordance with the railway locomotive maintenance manual.</p>  |
| <p><b>CIRCUMSTANTIAL KNOWLEDGE</b></p>  | <p>Detailed knowledge about:</p> <ol style="list-style-type: none"> <li>1. Safety operation of operating machines and tools;</li> <li>2. Safety operation of detection equipment;</li> <li>3. Occupational health and safety;</li> <li>4. Fault analysis and treatment;</li> <li>5. Waste disposal methods.</li> </ol>  |

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| <b>OCCUPATION</b>   | RAILWAY LOCOMOTIVE OPERATION AND MAINTENANCE ENGINEER   | <b>OCCUPATION CODE</b>  |      |
| <b>DUTY TITLE</b>   | TROUBLESHOOTING OF LOCOMOTIVE BRAKING SYSTEM  | <b>DUTY NO.</b>   | 702  |
| <b>TASK TITLE</b>   | TROUBLESHOOTING OF LOCOMOTIVE AIR SOURCE SYSTEMS  | <b>TASK NO.</b>   | 7021 |
| <b>PERFORMANCE CRITERIA</b>   | The person performing this task must be able to troubleshoot the locomotive air source system in accordance with the railway locomotive overhaul process, disposal regulations for abnormal conditions during railway locomotive utilization, other regulations of the locomotive department, railway safety regulations and technical requirements.  |   |      |
| <b>RANGE STATEMENT</b>  | <p>The task can be performed in the railway locomotive overhaul workshop or the railway operating area under the supervision of railway locomotive operation and maintenance engineers.</p> <p>The tools and equipment to be used include:</p> <ol style="list-style-type: none"> <li>1. Air compressor test benches;</li> <li>2. Oil pump test benches;</li> <li>3. 0.5t cranes;</li> <li>4. Oil bath resistance furnaces;</li> <li>5. Crankshaft storage benches;</li> <li>6. Extractors;</li> <li>7. Piston ring removers;</li> <li>8. Feeler gauges;</li> <li>9. Dial indicators;</li> <li>10. Outside micrometers;</li> <li>11. Dedicated slings;</li> <li>12. Commonly-used tools;</li> <li>13. Multimeters;</li> <li>14. Commonly-used tools.</li> </ol> |   |      |
| <b>EVIDENCE REQUIREMENT</b>   |   |   |      |
| <b>PRACTICAL PERFORMANCE</b>  |   | <b>UNDERPINNING KNOWLEDGE</b>   |      |
| <p>The person performing this task must be able to do the following:</p> <ol style="list-style-type: none"> <li>1. Select operating tools and instruments;</li> <li>2. Check the spare parts required for the task;</li> <li>3. Troubleshoot the air compressor;</li> <li>4. Troubleshoot the air compressor motor;</li> <li>5. Troubleshoot the desiccator;</li> </ol> |   | <p>Detailed knowledge about:</p> <p><b>1.0 Methods</b></p> <p>The person performing this task must be able to explain how to:</p> <ol style="list-style-type: none"> <li>1.1 Troubleshoot the air compressor;</li> <li>1.2 Troubleshoot the air compressor motor;</li> <li>1.3 Troubleshoot the desiccator;</li> <li>1.4 Troubleshoot other locomotive air source system components;</li> </ol> |      |

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| <ol style="list-style-type: none"> <li>6. Troubleshoot other locomotive air source system components;</li> <li>7. Develop solutions to the fault;</li> <li>8. Design the locomotive air source system modification scheme;</li> <li>9. Revise the overhaul process for locomotive air source systems;</li> <li>10. Comply with safety regulations when performing tasks;</li> <li>11. Clean the workplace;</li> <li>12. Arrange and store the tools and equipment.</li> </ol> | <p>1.5 Develop solutions to the fault.</p> <p><b>2.0 Principles</b><br/>The person performing this task must be able to explain the following principles:</p> <p>2.1 Principles of locomotive wind source troubleshooting and treatment.</p> <p><b>3.0 Theories</b><br/>The person performing this task must be able to explain the following:</p> <p>3.1 Troubleshooting logic for locomotive air source systems;</p> <p>3.2 Types of locomotive air source system faults;</p> <p>3.3 Composition and working methods of locomotive air source systems.</p> <p><b>4.0 Essential Skills</b></p> <p>4.1 Management skills;</p> <p>4.2 Computer skills;</p> <p>4.3 Teamwork skills;</p> <p>4.4 Report writing skills.</p> |
| <p><b>DESCRIPTION OF THE END PRODUCT / SERVICE</b></p>  | <p>The troubleshooting of locomotive air source systems is completed in accordance with the locomotive air source system troubleshooting manual and the locomotive crew emergency response manual.</p>  |
| <p><b>CIRCUMSTANTIAL KNOWLEDGE</b></p>  | <p>Detailed knowledge about:</p> <ol style="list-style-type: none"> <li>1. Safety operation of measuring instruments;</li> <li>2. Safety operation of air compressor overhaul equipment;</li> <li>3. Safety regulations.</li> </ol>   |

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| <b>OCCUPATION</b>   | RAILWAY LOCOMOTIVE OPERATION AND MAINTENANCE ENGINEER   | <b>OCCUPATION CODE</b>   |      |
| <b>DUTY TITLE</b>   | TROUBLESHOOTING OF LOCOMOTIVE BRAKING SYSTEMS   | <b>DUTY NO.</b>  | 702  |
| <b>TASK TITLE</b>   | TROUBLESHOOTING OF LOCOMOTIVE AIR BRAKING SYSTEMS   | <b>TASK NO.</b>  | 7022 |
| <b>PERFORMANCE CRITERIA</b>   | The person performing this task must be able to troubleshoot the locomotive air braking system in accordance with the railway locomotive overhaul process, disposal regulations for abnormal conditions during railway locomotive utilization, other regulations of the locomotive department, railway safety regulations and technical requirements.   |  |      |
| <b>RANGE STATEMENT</b>  | <p>The task can be performed in the railway locomotive overhaul workshop or the railway operating area under the supervision of railway locomotive operation and maintenance engineers.</p> <p>The tools and equipment to be used include:</p> <ol style="list-style-type: none"> <li>1. Automatic braking test benches;</li> <li>2. Vernier calipers;</li> <li>3. Feeler gauges;</li> <li>4. Screwdrivers;</li> <li>5. Templates;</li> <li>6. Commonly-used wrenches;</li> <li>7. Needle-nose pliers;</li> <li>8. Circlip pliers;</li> <li>9. Cleaning plates;</li> <li>10. Grinding platforms;</li> <li>11. Oilstones;</li> <li>12. Stopwatches;</li> <li>13. Hammers;</li> <li>14. Straight steel rules;</li> <li>15. Medicinal vaseline;</li> <li>16. Rubber parts;</li> <li>17. Cleaning gasolines;</li> <li>18. Butter;</li> <li>19. Gauzes.</li> </ol> |  |      |
| <b>EVIDENCE REQUIREMENT</b>   |   |  |      |
| <b>PRACTICAL PERFORMANCE</b>  |   | <b>UNDERPINNING KNOWLEDGE</b>  |      |
| The person performing this task must be able to do the following:<br>1. Choose suitable inspection tools; |   | Detailed knowledge about:<br><b>1.0 Methods</b><br>The person performing this task must be able to explain |      |

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| <ol style="list-style-type: none"> <li>2. Check the spare parts required for the task;</li> <li>3. Clarify the phenomenon of locomotive braking system faults;</li> <li>4. Troubleshoot the automatic brake valve;</li> <li>5. Troubleshoot the independent brake valve;</li> <li>6. Troubleshoot the distribution valve;</li> <li>7. Troubleshoot the brake pipe;</li> <li>8. Troubleshoot the brake cylinder;</li> <li>9. Troubleshoot the dual-port relay valve;</li> <li>10. Troubleshoot the general air shutoff valve;</li> <li>11. Troubleshoot the brake auxiliary valve;</li> <li>12. Disassemble locomotive brake valve parts;</li> <li>13. Maintain locomotive brake valve parts;</li> <li>14. Assemble locomotive brake valve parts;</li> <li>15. Test locomotive brake valve parts;</li> <li>16. Clean the workplace;</li> <li>17. Arrange and store the tools and equipment.</li> </ol> | <p>how to:</p> <ol style="list-style-type: none"> <li>1.1 Troubleshoot the brake auxiliary valve;</li> <li>1.2 Disassemble locomotive brake valve parts;</li> <li>1.3 Maintain locomotive brake valve parts;</li> <li>1.4 Assemble locomotive brake valve parts;</li> <li>1.5 Test locomotive brake valve parts.</li> </ol> <p><b>2.0 Principles</b></p> <p>The person performing this task must be able to explain the following principles:</p> <ol style="list-style-type: none"> <li>2.1 Perform troubleshooting and handling of locomotive braking systems.</li> </ol> <p><b>3.0 Theories</b></p> <p>The person performing this task must be able to explain the following:</p> <ol style="list-style-type: none"> <li>3.1 Troubleshooting logic for locomotive braking systems;</li> <li>3.2 Fault type of locomotive braking systems;</li> <li>3.3 Composition of locomotive braking systems;</li> <li>3.4 Composition and working principles of locomotive brake valve parts.</li> </ol> <p><b>4.0 Essential Skills</b></p> <ol style="list-style-type: none"> <li>4.1 Communication skills;</li> <li>4.2 Teamwork skills;</li> <li>4.3 Report writing skills.</li> </ol> |
| <p><b>DESCRIPTION OF THE END PRODUCT / SERVICE</b></p>  | <p>Loop check is completed in accordance with technical requirements.</p>   |
| <p><b>CIRCUMSTANTIAL KNOWLEDGE</b></p>  | <p>Detailed knowledge about:</p> <ol style="list-style-type: none"> <li>1. Safety operation of measuring instruments;</li> <li>2. Safety operation of locomotive braking system overhaul equipment;</li> <li>3. Safety regulations.</li> </ol>  |

| <b>OCCUPATION</b>  | RAILWAY LOCOMOTIVE OPERATION AND MAINTENANCE ENGINEER   | <b>OCCUPATION CODE</b>   |      |
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| <b>DUTY TITLE</b>  | TROUBLESHOOTING OF LOCOMOTIVE TRACTION TRANSMISSION SYSTEMS   | <b>DUTY NO.</b>  | 703  |
| <b>TASK TITLE</b>  | TROUBLESHOOTING OF LOCOMOTIVE MAIN CIRCUITS   | <b>TASK NO.</b>  | 7031 |
| <b>PERFORMANCE CRITERIA</b>  | The person performing this task must be able to inspect and overhaul the main transmission system in accordance with the requirements of the standard operation procedures for the overhaul of internal combustion locomotives.   |  |      |
| <b>RANGE STATEMENT</b>   | <p>The task can be performed in the overhaul workshop under the supervision of senior engineers.</p> <p>The tools and equipment to be used include:</p> <ol style="list-style-type: none"> <li>1. Personal protective equipment;</li> <li>2. Wrenches, screwdrivers, pliers and hand hammers;</li> <li>3. Fine files, emery paper, and cotton cloth;</li> <li>4. Test benches.</li> </ol> |  |      |
| <b>EVIDENCE REQUIREMENT</b>  |   |  |      |
| <b>PRACTICAL PERFORMANCE</b>   |   | <b>UNDERPINNING KNOWLEDGE</b>  |      |
| <p>The person performing this task must be able to do the following:</p> <ol style="list-style-type: none"> <li>1. Select operating tools;</li> <li>2. Inspect the synchronized main generator;</li> <li>3. Inspect the traction motor;</li> <li>4. Inspect the silicon rectifier cabinet;</li> <li>5. Inspect the resistance brake cabinet;</li> <li>6. Inspect the electrical circuit of the main circuit;</li> <li>7. Inspect the main circuit apparatus;</li> <li>8. Inspect other parts of the main circuit;</li> <li>9. Observe safety regulations;</li> <li>10. Clean the workplace;</li> <li>11. Arrange and store the tools and equipment.</li> </ol> |   | <p>Detailed knowledge about:</p> <p><b>1.0 Methods</b></p> <p>The person performing this task must be able to explain how to:</p> <ol style="list-style-type: none"> <li>1.1 Overhaul synchronous main generators;</li> <li>1.2 Overhaul the traction motor;</li> <li>1.3 Overhaul the silicon rectifier cabinet;</li> <li>1.4 Overhaul the resistance brake cabinet;</li> <li>1.5 Overhaul the electrical circuit of the main circuit;</li> <li>1.6 Overhaul the main circuit apparatus;</li> <li>1.7 Overhaul other parts of the main circuit.</li> </ol> <p><b>2.0 Principles</b></p> <p>The person performing this task must be able to explain the following principles:</p> <ol style="list-style-type: none"> <li>2.1 Operational procedures for the main transmission system of internal combustion locomotives.</li> </ol> <p><b>3.0 Theories</b></p> <p>The person performing this task must be able to explain the following:</p> <ol style="list-style-type: none"> <li>3.1 Inspection procedures for each part of the main</li> </ol> |      |

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|   | <p>circuit of internal combustion locomotives;</p> <p>3.2 Preventative maintenance plan;</p> <p>3.3 Usage of proper tools and equipment.</p> <p><b>4.0 Essential Skills</b></p> <p>4.1 Communication skills;</p> <p>4.2 Customer service skills;</p> <p>4.3 Teamwork skills;</p> <p>4.4 Report writing skills.</p> |
| <b>DESCRIPTION OF THE END PRODUCT / SERVICE</b> | Inspection and troubleshooting of locomotive main circuits are completed in accordance with technical requirements and manufacturer's specifications.  |
| <b>CIRCUMSTANTIAL KNOWLEDGE</b>                 | <p>Detailed knowledge about:</p> <ol style="list-style-type: none"> <li>1. Occupational health and safety;</li> <li>2. Safety operation of equipment.</li> </ol>   |

| <b>OCCUPATION</b>   | RAILWAY LOCOMOTIVE OPERATION AND MAINTENANCE ENGINEER   | <b>OCCUPATION CODE</b>   |      |
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| <b>DUTY TITLE</b>   | TROUBLESHOOTING OF LOCOMOTIVE TRACTION TRANSMISSION SYSTEMS   | <b>DUTY NO.</b>  | 703  |
| <b>TASK TITLE</b>   | TROUBLESHOOTING OF LOCOMOTIVE AUXILIARY CIRCUITS  | <b>TASK NO.</b>  | 7032 |
| <b>PERFORMANCE CRITERIA</b>   | The person performing this task must be able to inspect and overhaul the auxiliary transmission system in accordance with the requirements of the standard operation procedures for the overhaul of internal combustion locomotives.  |  |      |
| <b>RANGE STATEMENT</b>  | <p>The task can be performed in the overhaul workshop under the supervision of senior engineers.</p> <p>The tools and equipment to be used include:</p> <ol style="list-style-type: none"> <li>1. Personal protective equipment;</li> <li>2. Wrenches, screwdrivers, pliers and hand hammers;</li> <li>3. Fine files, emery paper, and cotton cloth;</li> <li>4. Test benches.</li> </ol> |  |      |
| <b>EVIDENCE REQUIREMENT</b>   |   |  |      |
| <b>PRACTICAL PERFORMANCE</b>  |   | <b>UNDERPINNING KNOWLEDGE</b>  |      |
| <p>The person performing this task must be able to do the following:</p> <ol style="list-style-type: none"> <li>1. Select operating tools;</li> <li>2. Inspect the lubricating system;</li> <li>3. Inspect the cooling system;</li> <li>4. Inspect the hydrostatic system;</li> <li>5. Inspect the speed control and transmission system;</li> <li>6. Inspect the traction motor ventilator;</li> <li>7. Inspect the electrical circuit of the auxiliary circuit;</li> <li>8. Inspect the auxiliary circuit apparatus;</li> <li>9. Inspect the air filter;</li> <li>10. Inspect other parts of the auxiliary circuit;</li> <li>11. Observe safety regulations;</li> <li>12. Clean the workplace;</li> <li>13. Arrange and store the tools and equipment.</li> </ol> |   | <p>Detailed knowledge about:</p> <p><b>1.0 Methods</b></p> <p>The person performing this task must be able to explain how to:</p> <ol style="list-style-type: none"> <li>1.1 Overhaul the lubricating system;</li> <li>1.2 Overhaul the cooling system;</li> <li>1.3 Overhaul the hydrostatic system;</li> <li>1.4 Overhaul the speed control and transmission system;</li> <li>1.5 Overhaul the traction motor ventilator;</li> <li>1.6 Overhaul the electrical circuit of the auxiliary circuit;</li> <li>1.7 Overhaul the auxiliary circuit apparatus;</li> <li>1.8 Overhaul the air filter;</li> <li>1.9 Overhaul other parts.</li> </ol> <p><b>2.0 Principles</b></p> <p>The person performing this task must be able to explain the following principles:</p> <ol style="list-style-type: none"> <li>2.1 Operational procedures for the auxiliary transmission system of internal combustion locomotives.</li> </ol> |      |

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|   | <p><b>3.0 Theories</b></p> <p>The person performing this task must be able to explain the following:</p> <p>3.1 Inspection procedures for the components of the auxiliary transmission system of internal combustion locomotives;</p> <p>3.2 Preventative maintenance plan;</p> <p>3.3 Usage of proper tools and equipment.</p> <p><b>4.0 Essential Skills</b></p> <p>4.1 Communication skills;</p> <p>4.2 Customer service skills;</p> <p>4.3 Teamwork skills;</p> <p>4.4 Report writing skills.</p> |
| <b>DESCRIPTION OF THE END PRODUCT / SERVICE</b> | Inspection and troubleshooting of locomotive auxiliary circuits are completed in accordance with technical requirements and manufacturer's specifications.  |
| <b>CIRCUMSTANTIAL KNOWLEDGE</b>                 | <p>Detailed knowledge about:</p> <ol style="list-style-type: none"> <li>1. Occupational health and safety;</li> <li>2. Safety operation of equipment.</li> </ol>  |

| <b>OCCUPATION</b>   | RAILWAY LOCOMOTIVE OPERATION AND MAINTENANCE ENGINEER  | <b>OCCUPATION CODE</b>  |      |
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| <b>DUTY TITLE</b>   | TROUBLESHOOTING OF LOCOMOTIVE TRACTION TRANSMISSION SYSTEMS  | <b>DUTY NO.</b>   | 703  |
| <b>TASK TITLE</b>   | TROUBLESHOOTING OF LOCOMOTIVE CONTROL CIRCUITS   | <b>TASK NO.</b>   | 7033 |
| <b>PERFORMANCE CRITERIA</b>   | The person performing this task must be able to inspect and overhaul the control system in accordance with the requirements of the standard operation procedures for the overhaul of internal combustion locomotives.  |   |      |
| <b>RANGE STATEMENT</b>  | <p>The task can be performed in the overhaul workshop under the supervision of senior engineers.</p> <p>The tools and equipment to be used include:</p> <ol style="list-style-type: none"> <li>1. Personal protective equipment;</li> <li>2. Wrenches, screwdrivers, pliers and hand hammers;</li> <li>3. Fine files and emery paper;</li> <li>4. Test benches.</li> </ol> |   |      |
| <b>EVIDENCE REQUIREMENT</b>   |  |   |      |
| <b>PRACTICAL PERFORMANCE</b>  |  | <b>UNDERPINNING KNOWLEDGE</b>   |      |
| <p>The person performing this task must be able to do the following:</p> <ol style="list-style-type: none"> <li>1. Select operating tools;</li> <li>2. Inspect the electrical circuit of the control circuit;</li> <li>3. Inspect the control circuit apparatus;</li> <li>4. Inspect the electronic device of the control circuit;</li> <li>5. Inspect the control circuit instrument;</li> <li>6. Inspect the battery;</li> <li>7. Inspect other parts of the auxiliary circuit;</li> <li>8. Observe safety regulations;</li> <li>9. Clean the workplace;</li> <li>10. Arrange and store the tools and equipment.</li> </ol> |  | <p>Detailed knowledge about:</p> <p><b>1.0 Methods</b></p> <p>The person performing this task must be able to explain how to:</p> <ol style="list-style-type: none"> <li>1.1 Overhaul the electrical circuit of the control circuit;</li> <li>1.2 Overhaul the control circuit apparatus;</li> <li>1.3 Overhaul the electronic device of the control circuit;</li> <li>1.4 Overhaul the control circuit instrument;</li> <li>1.5 Overhaul the battery;</li> <li>1.6 Overhaul other parts of the auxiliary circuit.</li> </ol> <p><b>2.0 Principles</b></p> <p>The person performing this task must be able to explain the following principles:</p> <ol style="list-style-type: none"> <li>2.1 Overhaul workflow for the control circuit of internal combustion locomotives.</li> </ol> <p><b>3.0 Theories</b></p> <p>The person performing this task must be able to explain the following:</p> <ol style="list-style-type: none"> <li>3.1 Inspection procedures for each part of the control</li> </ol> |      |

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|   | <p>circuit of internal combustion locomotives;</p> <p>3.2 Preventative maintenance plan;</p> <p>3.3 Usage of proper tools and equipment.</p> <p><b>4.0 Essential Skills</b></p> <p>4.1 Communication skills;</p> <p>4.2 Customer service skills;</p> <p>4.3 Teamwork skills;</p> <p>4.4 Report writing skills.</p> |
| <b>DESCRIPTION OF THE END PRODUCT / SERVICE</b> | Inspection and troubleshooting of locomotive control circuits are completed in accordance with technical requirements and manufacturer's specifications.   |
| <b>CIRCUMSTANTIAL KNOWLEDGE</b>                 | <p>Detailed knowledge about:</p> <ol style="list-style-type: none"> <li>1. Occupational health and safety;</li> <li>2. Safety operation of equipment.</li> </ol>   |

| <b>OCCUPATION</b>   | RAILWAY LOCOMOTIVE OPERATION AND MAINTENANCE ENGINEER  | <b>OCCUPATION CODE</b>  |      |
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| <b>DUTY TITLE</b>   | TROUBLESHOOTING OF LOCOMOTIVE TRACTION TRANSMISSION SYSTEMS  | <b>DUTY NO.</b>   | 703  |
| <b>TASK TITLE</b>   | TROUBLESHOOTING OF LOCOMOTIVE DIESEL ENGINES   | <b>TASK NO.</b>   | 7034 |
| <b>PERFORMANCE CRITERIA</b>   | The person performing this task must be able to inspect and overhaul the diesel engine in accordance with the requirements of the standard operation procedures for the overhaul of internal combustion locomotives.   |   |      |
| <b>RANGE STATEMENT</b>  | <p>The task can be performed in the overhaul workshop under the supervision of railway locomotive operation and maintenance engineers.</p> <p>The tools and equipment to be used include:</p> <ol style="list-style-type: none"> <li>1. Personal protective equipment;</li> <li>2. Wrenches, screwdrivers, pliers and hand hammers;</li> <li>3. Fine files and emery paper;</li> <li>4. Test benches.</li> </ol> |   |      |
| <b>EVIDENCE REQUIREMENT</b>   |  |   |      |
| <b>PRACTICAL PERFORMANCE</b>  |  | <b>UNDERPINNING KNOWLEDGE</b>   |      |
| <p>The person performing this task must be able to do the following:</p> <ol style="list-style-type: none"> <li>1. Select operating tools;</li> <li>2. Inspect the crankshaft case;</li> <li>3. Inspect the camshaft case;</li> <li>4. Inspect the cylinder end and enclosure;</li> <li>5. Inspect the transmission gear;</li> <li>6. Inspect protective devices;</li> <li>7. Inspect the pressurization system;</li> <li>8. Inspect the oil-water line;</li> <li>9. Observe safety regulations;</li> <li>10. Clean the workplace;</li> <li>11. Arrange and store the tools and equipment.</li> </ol> |  | <p>Detailed knowledge about:</p> <p><b>1.0 Methods</b></p> <p>The person performing this task must be able to explain how to:</p> <ol style="list-style-type: none"> <li>1.1 Overhaul the crankshaft case;</li> <li>1.2 Overhaul the camshaft case;</li> <li>1.3 Overhaul the cylinder end and enclosure;</li> <li>1.4 Overhaul the transmission gear;</li> <li>1.5 Overhaul protective devices;</li> <li>1.6 Overhaul the pressurization system;</li> <li>1.7 Overhaul the oil-water line.</li> </ol> <p><b>2.0 Principles</b></p> <p>The person performing this task must be able to explain the following principles:</p> <ol style="list-style-type: none"> <li>2.1 Overhaul workflow for diesel engines in internal combustion locomotives.</li> </ol> <p><b>3.0 Theories</b></p> <p>The person performing this task must be able to explain the following:</p> <ol style="list-style-type: none"> <li>3.1 Inspection procedures for each structure of internal combustion locomotive diesel engines;</li> </ol> |      |

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|   | <p>3.2 Preventative maintenance plan;</p> <p>3.3 Usage of proper tools and equipment.</p> <p><b>4.0 Essential Skills</b></p> <p>4.1 Communication skills;</p> <p>4.2 Customer service skills;</p> <p>4.3 Teamwork skills;</p> <p>4.4 Report writing skills.</p> |
| <b>DESCRIPTION OF THE END PRODUCT / SERVICE</b> | Inspection and troubleshooting of locomotive diesel engines are completed in accordance with technical requirements and manufacturer's specifications.  |
| <b>CIRCUMSTANTIAL KNOWLEDGE</b>                 | <p>Detailed knowledge about:</p> <ol style="list-style-type: none"> <li>1. Occupational health and safety;</li> <li>2. Safety operation of equipment.</li> </ol>  |

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| <b>OCCUPATION</b>  | RAILWAY LOCOMOTIVE OPERATION AND MAINTENANCE ENGINEER   | <b>OCCUPATION CODE</b>  |      |
| <b>DUTY TITLE</b>  | TROUBLESHOOTING OF RUNNING SAFETY DEVICES   | <b>DUTY NO.</b>   | 704  |
| <b>TASK TITLE</b>  | TROUBLESHOOTING OF LOCOMOTIVE SIGNAL MACHINES   | <b>TASK NO.</b>   | 7041 |
| <b>PERFORMANCE CRITERIA</b>  | The person performing this task must be able to troubleshoot the locomotive signal machine in accordance with technical requirements and manufacturer's manual specifications.  |   |      |
| <b>RANGE STATEMENT</b>   | <p>The task can be performed in the locomotive overhaul workshop under the supervision of railway locomotive operation and maintenance engineers.</p> <p>The tools and equipment to be used include:</p> <ol style="list-style-type: none"> <li>1. Locomotive signaling mainframe test bench;</li> <li>2. Digital multimeters;</li> <li>3. Trameggers;</li> <li>4. Card readers;</li> <li>5. Card reading software;</li> <li>6. Fire extinguishers;</li> <li>7. Personal protective equipment, such as safety shoes, goggles, safety helmets, protective gloves and insulating gloves;</li> <li>8. First aid kits.</li> </ol> |   |      |
| <b>EVIDENCE REQUIREMENT</b>  |   |   |      |
| <b>PRACTICAL PERFORMANCE</b>   |   | <b>UNDERPINNING KNOWLEDGE</b>   |      |
| <p>The person performing this task must be able to do the following:</p> <ol style="list-style-type: none"> <li>1. Observe safety precautions;</li> <li>2. Select appropriate tools and equipment;</li> <li>3. Record the original state of the faulty device;</li> <li>4. Dump the logger data;</li> <li>5. Inspect the wiring and cable jumper;</li> <li>6. Replace the fuse;</li> <li>7. Replace the locomotive signal main board;</li> <li>8. Replace the receiving coil;</li> <li>9. Replace the signal machine.</li> </ol> |   | <p>Detailed knowledge about:</p> <p><b>1.0 Methods</b></p> <p>The person performing this task must be able to explain how to:</p> <ol style="list-style-type: none"> <li>1.1 Troubleshoot the locomotive signal machine.</li> </ol> <p><b>2.0 Principles</b></p> <p>The person performing this task must be able to explain the following principles:</p> <ol style="list-style-type: none"> <li>2.1 Working principles of locomotive signal machines.</li> </ol> <p><b>3.0 Theories</b></p> <p>The person performing this task must be able to explain the following:</p> <ol style="list-style-type: none"> <li>3.1 Equipment composition and functions of locomotive signal machine systems;</li> <li>3.2 Working principles of locomotive signal machines;</li> </ol> |      |

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|   | <p>3.3 Fault analysis and treatment of locomotive signal machines.</p> <p><b>4.0 Essential Skills</b></p> <p>4.1 Communication skills;</p> <p>4.2 Data analysis skills;</p> <p>4.3 Equipment standardized operation skills;</p> <p>4.5 Teamwork skills;</p> <p>4.6 Report writing skills;</p> <p>4.7 Computer operation skills.</p> |
| <b>DESCRIPTION OF THE END PRODUCT / SERVICE</b> | Inspection and troubleshooting of locomotive signal machines are completed in accordance with technical requirements and manufacturer's specifications.   |
| <b>CIRCUMSTANTIAL KNOWLEDGE</b>                 | <p>Detailed knowledge about:</p> <ol style="list-style-type: none"> <li>1. Safety operation of operating machines and tools;</li> <li>2. Safety operation of detection equipment;</li> <li>3. Occupational health and safety;</li> <li>4. Fault analysis and treatment;</li> <li>5. Waste disposal methods.</li> </ol>              |

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| <b>OCCUPATION</b>  | RAILWAY LOCOMOTIVE<br>OPERATION AND<br>MAINTENANCE ENGINEER  | <b>OCCUPATION<br/>CODE</b>   |      |
| <b>DUTY TITLE</b>  | TROUBLESHOOTING OF<br>RUNNING SAFETY DEVICES   | <b>DUTY NO.</b>  | 704  |
| <b>TASK TITLE</b>  | TROUBLESHOOTING OF TRAIN<br>OPERATION MONITORING AND<br>RECORDING DEVICES  | <b>TASK NO.</b>  | 7042 |
| <b>PERFORMANCE<br/>CRITERIA</b>  | The person performing this task must be able to troubleshoot the train operation monitoring and recording devices in accordance with technical requirements and manufacturer's manual specifications.  |  |      |
| <b>RANGE STATEMENT</b>   | <p>The task can be performed in the locomotive machine shop or overhaul workshop under the supervision of railway locomotive operation and maintenance engineers.</p> <p>The tools and equipment to be used include:</p> <ol style="list-style-type: none"> <li>1. Integrated test benches;</li> <li>2. Digital multimeters;</li> <li>3. Trameggers;</li> <li>4. Portable testers;</li> <li>5. Dump units;</li> <li>6. Fire extinguishers;</li> <li>7. Personal protective equipment, such as safety shoes, goggles, safety helmets, protective gloves and insulating gloves;</li> <li>8. First aid kits.</li> </ol> |  |      |
| <b>EVIDENCE REQUIREMENT</b>  |  |  |      |
| <b>PRACTICAL PERFORMANCE</b>   |  | <b>UNDERPINNING KNOWLEDGE</b>  |      |
| <p>The person performing this task must be able to do the following:</p> <ol style="list-style-type: none"> <li>1. Observe safety precautions;</li> <li>2. Select appropriate tools and equipment;</li> <li>3. Record the original state of the faulty device;</li> <li>4. Dump the logger data;</li> <li>5. Inspect the wiring and cable jumper;</li> <li>6. Replace the fuse;</li> <li>7. Replace the main board.</li> </ol> |  | <p>Detailed knowledge about:</p> <p><b>1.0 Methods</b></p> <p>The person performing this task must be able to explain how to:</p> <ol style="list-style-type: none"> <li>1.1 Troubleshoot the train operation monitoring and recording devices.</li> </ol> <p><b>2.0 Principles</b></p> <p>The person performing this task must be able to explain the following principles:</p> <ol style="list-style-type: none"> <li>2.1 Working principles of the train operation monitoring and recording devices.</li> </ol> <p><b>3.0 Theories</b></p> <p>The person performing this task must be able to explain the following:</p> <ol style="list-style-type: none"> <li>3.1 Equipment composition and functions of the train operation monitoring and recording devices;</li> </ol> |      |

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|   | <p>3.2 Working principles of the train operation monitoring and recording devices;</p> <p>3.3 Fault analysis and treatment of the train operation monitoring and recording devices.</p> <p><b>4.0 Essential Skills</b></p> <p>4.1 Communication skills;</p> <p>4.2 Data analysis skills;</p> <p>4.3 Equipment standardized operation skills;</p> <p>4.4 Teamwork skills;</p> <p>4.5 Report writing skills;</p> <p>4.6 Computer operation skills.</p> |
| <b>DESCRIPTION OF THE END PRODUCT / SERVICE</b> | <p>Inspection and troubleshooting of the train operation monitoring and recording devices are completed in accordance with technical requirements and manufacturer's specification.</p>  |
| <b>CIRCUMSTANTIAL KNOWLEDGE</b>                 | <p>Detailed knowledge about:</p> <ol style="list-style-type: none"> <li>1. Safety operation of operating machines and tools;</li> <li>2. Safety operation of measuring instruments;</li> <li>3. Occupational health and safety;</li> <li>4. Maintenance operation processes and procedures;</li> <li>5. Waste disposal methods.</li> </ol>   |

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| <b>OCCUPATION</b>   | RAILWAY LOCOMOTIVE OPERATION AND MAINTENANCE ENGINEER   | <b>OCCUPATION CODE</b>   |      |
| <b>DUTY TITLE</b>   | TROUBLESHOOTING OF RUNNING SAFETY DEVICES   | <b>DUTY NO.</b>  | 704  |
| <b>TASK TITLE</b>   | TROUBLESHOOTING OF LOCOMOTIVE COMMUNICATION EQUIPMENT   | <b>TASK NO.</b>  | 7043 |
| <b>PERFORMANCE CRITERIA</b>   | The person performing this task must be able to troubleshoot the locomotive communication equipment in accordance with technical requirements and manufacturer's manual specifications.   |  |      |
| <b>RANGE STATEMENT</b>  | <p>The task can be performed in the locomotive machine shop or overhaul workshop under the supervision of railway locomotive operation and maintenance engineers.</p> <p>The tools and equipment to be used include:</p> <ol style="list-style-type: none"> <li>1. Locomotive signaling mainframe test benches;</li> <li>2. Digital multimeters;</li> <li>3. Trameggers;</li> <li>4. Card readers;</li> <li>5. Card reading software;</li> <li>6. Fire extinguishers;</li> <li>7. Personal protective equipment, such as safety shoes, goggles, safety helmets, protective gloves and insulating gloves;</li> <li>8. First aid kits.</li> </ol> |  |      |
| <b>EVIDENCE REQUIREMENT</b>   |   |  |      |
| <b>PRACTICAL PERFORMANCE</b>  |   | <b>UNDERPINNING KNOWLEDGE</b>  |      |
| <p>The person performing this task must be able to do the following:</p> <ol style="list-style-type: none"> <li>1. Observe safety precautions;</li> <li>2. Select appropriate tools and equipment;</li> <li>3. Record the original state of the faulty device;</li> <li>4. Dump the data;</li> <li>5. Inspect the wiring and cable jumper;</li> <li>6. Plug in the connecting cable plug;</li> <li>7. Replace the fuse;</li> <li>8. Replace the battery;</li> <li>9. Replace the printer ribbon.</li> </ol> |   | <p>Detailed knowledge about:</p> <p><b>1.0 Methods</b></p> <p>The person performing this task must be able to explain how to:</p> <ol style="list-style-type: none"> <li>1.1 Troubleshoot the locomotive communication equipment.</li> </ol> <p><b>2.0 Principles</b></p> <p>The person performing this task must be able to explain the following principles:</p> <ol style="list-style-type: none"> <li>2.1 Working principles of the locomotive communication equipment.</li> </ol> <p><b>3.0 Theories</b></p> <p>The person performing this task must be able to explain the following:</p> <ol style="list-style-type: none"> <li>3.1 Composition and functions of the locomotive communication equipment;</li> </ol> |      |

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|   | <p>3.2 Working principles of the locomotive communication equipment;</p> <p>3.3 Fault analysis and treatment of the locomotive communication equipment.</p> <p><b>4.0 Essential Skills</b></p> <p>4.1 Communication skills;</p> <p>4.2 Data analysis skills;</p> <p>4.3 Equipment standardized operation skills;</p> <p>4.4 Teamwork skills;</p> <p>4.5 Report writing skills;</p> <p>4.6 Computer operation skills.</p> |
| <b>DESCRIPTION OF THE END PRODUCT / SERVICE</b> | <p>Inspection and troubleshooting of the locomotive communication equipment are completed in accordance with technical requirements and manufacturer's specifications.</p>   |
| <b>CIRCUMSTANTIAL KNOWLEDGE</b>                 | <p>Detailed knowledge about:</p> <ol style="list-style-type: none"> <li>1. Safety operation of operating machines and tools;</li> <li>2. Safety operation of measuring instruments;</li> <li>3. Occupational health and safety;</li> <li>4. Maintenance operation processes and procedures;</li> <li>5. Waste disposal methods.</li> </ol>   |

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| <b>OCCUPATION</b>  | RAILWAY LOCOMOTIVE OPERATION AND MAINTENANCE ENGINEER  | <b>OCCUPATION CODE</b>  |      |
| <b>DUTY TITLE</b>  | HANDLING OF ABNORMAL RUNNING   | <b>DUTY NO.</b>   | 705  |
| <b>TASK TITLE</b>  | HANDLING OF ABNORMAL TRAIN RECEPTION AND DEPARTURE   | <b>TASK NO.</b>   | 7051 |
| <b>PERFORMANCE CRITERIA</b>  | The person performing this task must be able to handle the abnormal train reception and departure in accordance with the requirements of the technical regulations for the railway and other traffic regulations.  |   |      |
| <b>RANGE STATEMENT</b>   | <p>The task can be performed during locomotive utilization under the supervision of railway locomotive operation and maintenance engineers.</p> <p>The tools and equipment to be used include:</p> <ol style="list-style-type: none"> <li>1. Locomotive communication equipment;</li> <li>2. Signal flags for railways;</li> <li>3. Green licenses.</li> </ol> |   |      |
| <b>EVIDENCE REQUIREMENT</b>  |  |   |      |
| <b>PRACTICAL PERFORMANCE</b>   |  | <b>UNDERPINNING KNOWLEDGE</b>   |      |
| <p>The person performing this task must be able to do the following:</p> <ol style="list-style-type: none"> <li>1. Use green licenses to dispatch the train;</li> <li>2. Dispatch trains for special situations on semi-automatic blocking sections;</li> <li>3. Guide and receive the train;</li> <li>4. Specifically guide and receive the train.</li> </ol> |  | <p>Detailed knowledge about:</p> <p><b>1.0 Methods</b></p> <p>The person performing this task must be able to explain how to:</p> <ol style="list-style-type: none"> <li>1.1 Handle the abnormal train reception and departure.</li> </ol> <p><b>2.0 Principles</b></p> <p>The person performing this task must be able to explain the following principles:</p> <ol style="list-style-type: none"> <li>2.1 Handling regulations and procedures for abnormal running.</li> </ol> <p><b>3.0 Theories</b></p> <p>The person performing this task must be able to explain the following:</p> <ol style="list-style-type: none"> <li>3.1 The basic occlusion method;</li> <li>3.2 Handling rules for special running methods;</li> <li>3.3 Running token requirements for special running methods.</li> </ol> <p><b>4.0 Essential Skills</b></p> <ol style="list-style-type: none"> <li>4.1 Communication skills;</li> <li>4.2 Data analysis skills;</li> <li>4.3 Standardized operation skills;</li> </ol> |      |

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|   | <p>4.4 Teamwork skills;</p> <p>4.5 Report writing skills;</p> <p>4.6 Computer operation skills.</p>   |
| <b>DESCRIPTION OF THE END PRODUCT / SERVICE</b> | The abnormal train reception and departure are handled in accordance with the requirements of the technical regulations for the railway and other traffic regulations.  |
| <b>CIRCUMSTANTIAL KNOWLEDGE</b>                 | <p>Detailed knowledge about:</p> <ol style="list-style-type: none"> <li>1. Safety operation of locomotive utilization;</li> <li>2. Safety operation of the locomotive communication equipment;</li> <li>3. Occupational health and safety.</li> </ol> |

| <b>OCCUPATION</b>  | RAILWAY LOCOMOTIVE OPERATION AND MAINTENANCE ENGINEER  | <b>OCCUPATION CODE</b>   |      |
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| <b>DUTY TITLE</b>  | HANDLING OF ABNORMAL RUNNING   | <b>DUTY NO.</b>  | 705  |
| <b>TASK TITLE</b>  | HANDLING OF TRAIN DIVISION AND BACKING-OUT   | <b>TASK NO.</b>  | 7052 |
| <b>PERFORMANCE CRITERIA</b>  | The person performing this task must be able to handle the train division and backing-out in accordance with the requirements of the technical regulations for the railway and other traffic regulations.  |  |      |
| <b>RANGE STATEMENT</b>   | The task can be performed during locomotive utilization under the supervision of railway locomotive operation and maintenance engineers.<br>The tools and equipment to be used include:<br>1. Locomotive communication equipment;<br>2. Signal flags for railways;<br>3. Green licenses. |  |      |
| <b>EVIDENCE REQUIREMENT</b>  |  |  |      |
| <b>PRACTICAL PERFORMANCE</b>   |  | <b>UNDERPINNING KNOWLEDGE</b>  |      |
| The person performing this task must be able to do the following:<br>1. Conduct train backing-out;<br>2. Conduct train operation in divisions;<br>3. Propel the train operation. |  | Detailed knowledge about:<br><b>1.0 Methods</b><br>The person performing this task must be able to explain how to:<br>1.1 Handle the train division and backing-out.<br><b>2.0 Principles</b><br>The person performing this task must be able to explain the following principles:<br>2.1 Rules and procedures for handling train division and backing-out.<br><b>3.0 Theories</b><br>The person performing this task must be able to explain the following:<br>3.1 Requirements of train backing-out;<br>3.2 Requirements for train operation in divisions;<br>3.3 Running token requirements for special running methods.<br><b>4.0 Essential Skills</b><br>4.1 Communication skills;<br>4.2 Data analysis skills;<br>4.3 Standardized operation skills;<br>4.4 Teamwork skills; |      |

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|   | <p>4.5 Report writing skills;</p> <p>4.6 Computer operation skills.</p>   |
| <b>DESCRIPTION OF THE END PRODUCT / SERVICE</b> | The train division and backing-out are handled in accordance with the requirements of the technical regulations for the railway and other traffic regulations.  |
| <b>CIRCUMSTANTIAL KNOWLEDGE</b>                 | <p>Detailed knowledge about:</p> <ol style="list-style-type: none"> <li>1. Safety operation of locomotive utilization;</li> <li>2. Safety operation of the locomotive communication equipment;</li> <li>3. Occupational health and safety.</li> </ol> |

| <b>OCCUPATION</b>  | RAILWAY LOCOMOTIVE OPERATION AND MAINTENANCE ENGINEER  | <b>OCCUPATION CODE</b>  |      |
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| <b>DUTY TITLE</b>  | HANDLING OF ABNORMAL RUNNING   | <b>DUTY NO.</b>   | 705  |
| <b>TASK TITLE</b>  | HANDLING OF FIRE AND EXPLOSION IN TRAINS   | <b>TASK NO.</b>   | 7053 |
| <b>PERFORMANCE CRITERIA</b>  | The person performing this task must be able to handle the fire and explosion in trains in accordance with the requirements of the technical regulations for the railway and other traffic regulations.  |   |      |
| <b>RANGE STATEMENT</b>   | <p>The task can be performed during locomotive utilization under the supervision of railway locomotive operation and maintenance engineers.</p> <p>The tools and equipment to be used include:</p> <ol style="list-style-type: none"> <li>1. Locomotive communication equipment;</li> <li>2. Signal flags for railways;</li> <li>3. Green licenses.</li> </ol> |   |      |
| <b>EVIDENCE REQUIREMENT</b>  |  |   |      |
| <b>PRACTICAL PERFORMANCE</b>   |  | <b>UNDERPINNING KNOWLEDGE</b>   |      |
| <p>The person performing this task must be able to do the following:</p> <ol style="list-style-type: none"> <li>1. Perform immediate stopping operation in case of fire or explosion in trains;</li> <li>2. Avoid oversized bridges, long tunnels, etc., and choose locations that are easy for travelers to evacuate;</li> <li>3. Use train radio dispatch communication equipment to report to the nearest station: stop location, overview;</li> <li>4. Inform the power department of the power outage.</li> </ol> |  | <p>Detailed knowledge about:</p> <p><b>1.0 Methods</b></p> <p>The person performing this task must be able to explain how to:</p> <ol style="list-style-type: none"> <li>1.1 Handle fire and explosion in trains.</li> </ol> <p><b>2.0 Principles</b></p> <p>The person performing this task must be able to explain the following principles:</p> <ol style="list-style-type: none"> <li>2.1 Regulations and procedures for handling fire and explosion in trains.</li> </ol> <p><b>3.0 Theories</b></p> <p>The person performing this task must be able to explain the following:</p> <ol style="list-style-type: none"> <li>3.1 En-route running requirements;</li> <li>3.2 Abnormal running methods.</li> </ol> <p><b>4.0 Essential Skills</b></p> <ol style="list-style-type: none"> <li>4.1 Communication skills;</li> <li>4.2 Data analysis skills;</li> <li>4.3 Standardized operation skills;</li> <li>4.4 Teamwork skills;</li> <li>4.5 Report writing skills;</li> <li>4.6 Computer operation skills.</li> </ol> |      |

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| <b>DESCRIPTION OF THE END PRODUCT / SERVICE</b> | The fire and explosion in trains are handled in accordance with the requirements of the technical regulations for the railway and other traffic regulations.   |
| <b>CIRCUMSTANTIAL KNOWLEDGE</b>                 | Detailed knowledge about: <ol style="list-style-type: none"> <li>1. Safety operation of locomotive utilization;</li> <li>2. Safety operation of the locomotive communication equipment;</li> <li>3. Occupational health and safety.</li> </ol> |

| <b>OCCUPATION</b>   | RAILWAY LOCOMOTIVE OPERATION AND MAINTENANCE ENGINEER  | <b>OCCUPATION CODE</b>   |      |
|---|--|--|------|
| <b>DUTY TITLE</b>   | HANDLING OF ABNORMAL RUNNING   | <b>DUTY NO.</b>  | 705  |
| <b>TASK TITLE</b>   | HANDLING OF RUNNING IN STORMS DURING FLOOD SEASONS   | <b>TASK NO.</b>  | 7054 |
| <b>PERFORMANCE CRITERIA</b>   | The person performing this task must be able to handle the running in storms during flood seasons in accordance with the requirements of the technical regulations for the railway and other traffic regulations.  |  |      |
| <b>RANGE STATEMENT</b>  | <p>The task can be performed during locomotive utilization under the supervision of railway locomotive operation and maintenance engineers.</p> <p>The tools and equipment to be used include:</p> <ol style="list-style-type: none"> <li>1. Locomotive communication equipment;</li> <li>2. Signal flags for railways;</li> <li>3. Green licenses.</li> </ol> |  |      |
| <b>EVIDENCE REQUIREMENT</b>   |  |  |      |
| <b>PRACTICAL PERFORMANCE</b>  |  | <b>UNDERPINNING KNOWLEDGE</b>  |      |
| <p>The person performing this task must be able to do the following:</p> <ol style="list-style-type: none"> <li>1. Enhance lookout and take necessary safety measures when trains pass through flood-endangered areas;</li> <li>2. Perform risk avoidance stopping operation for trains operating in flooded areas at restricted speeds;</li> <li>3. Take emergency safety measures and inform tracking trains, neighboring trains and neighboring stations.</li> </ol> |  | <p>Detailed knowledge about:</p> <p><b>1.0 Methods</b></p> <p>The person performing this task must be able to explain how to:</p> <ol style="list-style-type: none"> <li>1.1 Handle the running in storms during flood seasons.</li> </ol> <p><b>2.0 Principles</b></p> <p>The person performing this task must be able to explain the following principles:</p> <ol style="list-style-type: none"> <li>2.1 Regulations and procedures for running in storms during flood seasons.</li> </ol> <p><b>3.0 Theories</b></p> <p>The person performing this task must be able to explain the following:</p> <ol style="list-style-type: none"> <li>3.1 En-route running requirements;</li> <li>3.2 Abnormal running methods.</li> </ol> <p><b>4.0 Essential Skills</b></p> <ol style="list-style-type: none"> <li>4.1 Communication skills;</li> <li>4.2 Data analysis skills.</li> <li>4.3 Standardized operation skills;</li> <li>4.4 Teamwork skills;</li> <li>4.5 Report writing skills;</li> </ol> |      |

|   |  |
|---|--|
|   | 4.6 Computer operation skills.   |
| <b>DESCRIPTION OF THE END PRODUCT / SERVICE</b> | The running in storms during flood seasons is handled in accordance with the requirements of the technical regulations for the railway and other traffic regulations.  |
| <b>CIRCUMSTANTIAL KNOWLEDGE</b>                 | Detailed knowledge about: <ol style="list-style-type: none"> <li>1. Safety operation of locomotive utilization;</li> <li>2. Safety operation of the locomotive communication equipment;</li> <li>3. Occupational health and safety.</li> </ol> |

|   |  |  |      |
|---|--|--|------|
| <b>OCCUPATION</b>   | RAILWAY LOCOMOTIVE OPERATION AND MAINTENANCE ENGINEER  | <b>OCCUPATION CODE</b>   |      |
| <b>DUTY TITLE</b>   | HANDLING OF ABNORMAL RUNNING   | <b>DUTY NO.</b>  | 705  |
| <b>TASK TITLE</b>   | TROUBLESHOOTING OF TRAINS DURING OPERATION   | <b>TASK NO.</b>  | 7055 |
| <b>PERFORMANCE CRITERIA</b>   | The person performing this task must be able to troubleshoot the trains during operation in accordance with the requirements of the technical regulations for the railway and other traffic regulations.   |  |      |
| <b>RANGE STATEMENT</b>  | The task can be performed during locomotive utilization under the supervision of railway locomotive operation and maintenance engineers.<br>The tools and equipment to be used include:<br>1. Locomotive communication equipment;<br>2. Signal flags for railways;<br>3. Green licenses. |  |      |
| <b>EVIDENCE REQUIREMENT</b>   |  |  |      |
| <b>PRACTICAL PERFORMANCE</b>  |  | <b>UNDERPINNING KNOWLEDGE</b>  |      |
| <p>The person performing this task must be able to do the following:</p> <ol style="list-style-type: none"> <li>1. Perform risk avoidance operation in case of locomotive faults during operation;</li> <li>2. Brake passenger trains with excessive leakage;</li> <li>3. Brake freight trains with excessive leakage.</li> </ol> |  | <p>Detailed knowledge about:</p> <p><b>1.0 Methods</b></p> <p>The person performing this task must be able to explain how to:</p> <ol style="list-style-type: none"> <li>1.1 Handle the faults of trains.</li> </ol> <p><b>2.0 Principles</b></p> <p>The person performing this task must be able to explain the following principles:</p> <ol style="list-style-type: none"> <li>2.1 Handling regulations and procedures for the faults of trains.</li> </ol> <p><b>3.0 Theories</b></p> <p>The person performing this task must be able to explain the following:</p> <ol style="list-style-type: none"> <li>3.1 Methods of troubleshooting the trains;</li> <li>3.2 Running practices for passenger and freight trains under special conditions.</li> </ol> <p><b>4.0 Essential Skills</b></p> <ol style="list-style-type: none"> <li>4.1 Communication skills;</li> <li>4.2 Data analysis skills;</li> <li>4.3 Standardized operation skills;</li> <li>4.4 Teamwork skills;</li> <li>4.5 Report writing skills;</li> </ol> |      |

|   |  |
|---|--|
|   | 4.6 Computer operation skills.   |
| <b>DESCRIPTION OF THE END PRODUCT / SERVICE</b> | The faults of trains are handled in accordance with the requirements of the technical regulations for the railway and other traffic regulations.   |
| <b>CIRCUMSTANTIAL KNOWLEDGE</b>                 | Detailed knowledge about: <ol style="list-style-type: none"> <li>1. Safety operation of locomotive utilization;</li> <li>2. Safety operation of the locomotive communication equipment;</li> <li>3. Occupational health and safety.</li> </ol> |

**TABLE 1: DACUM CHARTS FOR RAILWAY LOCOMOTIVE OPERATION AND MAINTENANCE ENGINEER - NTA 7**

| DUTIES  | TASKS   | ENABLERS   |
|---|---|--|
| 1.0 Troubleshooting of locomotive running gears   | 1.1 Troubleshooting of locomotive frames and accessory devices. | <p><b>General skills and knowledge</b></p> <ul style="list-style-type: none"> <li>• Cooperation with others using communication skills and submission of reports to the superiors</li> <li>• Railway locomotive maintenance manuals, safety regulations and technical requirements</li> <li>• Types, assembly and main technical parameters of each component of the locomotive running gear</li> <li>• Skills and knowledge in locomotive running gear troubleshooting</li> <li>• Machine elements</li> <li>• Interpretation of technical drawings</li> </ul> <p><b>Tools and equipment</b></p> <ul style="list-style-type: none"> <li>• No-movement signs, signal protection flags, iron shoes and other safety protection equipment</li> <li>• Flashlights, inspection hammers, steel rulers, inside gauges, height gauges and other commonly-used testing tools</li> <li>• Commonly-used overhaul equipment such as flaw detection equipment, gas welding equipment, overhead cranes, lathes and angle grinders</li> </ul> <p><b>Materials</b></p> <ul style="list-style-type: none"> <li>• Lubricating grease and gear oil</li> </ul> <p><b>Requirements for employees</b></p> <ul style="list-style-type: none"> <li>• Teamwork spirit, integrity, time management and commitment</li> </ul> |
|   | 1.2 Troubleshooting of locomotive wheel pairs.                  |  |
|   | 1.3 Troubleshooting of locomotive driving devices.              |  |
|   | 1.4 Troubleshooting of locomotive traction devices.             |  |
|   | 1.5 Troubleshooting of locomotive suspension devices.           |  |
| 2.0 Troubleshooting of locomotive braking systems | 2.1 Troubleshooting of locomotive air source systems.           | <p><b>General skills and knowledge</b></p> <ul style="list-style-type: none"> <li>• Cooperation with others using communication skills</li> </ul>  |

| DUTIES   | TASKS  | ENABLERS   |   |   |  |
|--|--|--|---|---|--|
|  | 2.2 Troubleshooting of locomotive air braking systems.   | <ul style="list-style-type: none"> <li>• Mastery of locomotive manufacturer's technical instructions</li> <li>• Skills and knowledge in locomotive air source systems</li> <li>• Skills and knowledge in locomotive air braking</li> <li>• Interpretation of locomotive air pipeline diagrams</li> <li>• Components of locomotive air source systems and air braking systems</li> <li>• Knowledge of pneumatic technology</li> </ul> <p><b>Tools and equipment</b></p> <ul style="list-style-type: none"> <li>• Automatic braking test benches</li> <li>• Commonly-used tools</li> <li>• Special tools</li> <li>• Personal protective equipment</li> </ul> <p><b>Materials</b></p> <ul style="list-style-type: none"> <li>• Air compressors</li> <li>• Desiccators</li> <li>• Brake valves</li> <li>• Relay valves</li> <li>• General air shutoff valves</li> <li>• Emergency valves</li> <li>• Brake hoses</li> </ul> <p><b>Requirements for employees</b></p> <ul style="list-style-type: none"> <li>• Teamwork spirit, excellence, craftsmanship, responsibility</li> </ul> |   |   |  |
| 3.0 Troubleshooting of locomotive transmission systems | <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td>3.1 Troubleshooting of locomotive main circuits.</td> </tr> <tr> <td>3.2 Troubleshooting of locomotive auxiliary circuits.</td> </tr> <tr> <td>3.3 Troubleshooting of locomotive control circuits.</td> </tr> </table> | 3.1 Troubleshooting of locomotive main circuits.   | 3.2 Troubleshooting of locomotive auxiliary circuits. | 3.3 Troubleshooting of locomotive control circuits. | <p><b>General skills and knowledge</b></p> <ul style="list-style-type: none"> <li>• Cooperation with others using communication skills and submission of reports to the superiors</li> <li>• Mastery of locomotive manufacturer's manuals</li> <li>• Mastery of standard operation procedures for the overhaul of internal combustion locomotives</li> </ul> |
| 3.1 Troubleshooting of locomotive main circuits.       |  |  |   |   |  |
| 3.2 Troubleshooting of locomotive auxiliary circuits.  |  |  |   |   |  |
| 3.3 Troubleshooting of locomotive control circuits.    |  |  |   |   |  |

| DUTIES  | TASKS  | ENABLERS  |
|---|--|---|
|   | 3.4 Troubleshooting of locomotive diesel engines.                        | <ul style="list-style-type: none"> <li>• Basic operating skills for internal combustion locomotive electricians</li> <li>• Basic operating skills for internal combustion locomotive fitters</li> <li>• Knowledge of the traction transmission system of internal combustion locomotives</li> <li>• Interpretation of technical drawings</li> </ul> <p><b>Tools and equipment</b></p> <ul style="list-style-type: none"> <li>• Personal protective equipment, such as safety shoes, safety helmets and gloves</li> <li>• Related overhaul tools for internal combustion locomotives</li> <li>• Overhaul test benches</li> </ul> <p><b>Materials</b></p> <ul style="list-style-type: none"> <li>• Cleaner and lubricating grease meeting technical requirements</li> </ul> <p><b>Requirements for employees</b></p> <ul style="list-style-type: none"> <li>• Teamwork spirit, honesty and trustworthiness, carefulness, patience, time management, and commitment</li> </ul> |
| 4.0 Troubleshooting of running safety devices | 4.1 Troubleshooting of locomotive signal machines.                       | <p><b>General skills and knowledge</b></p> <ul style="list-style-type: none"> <li>• Cooperation with others using communication skills and submission of reports to the superiors</li> <li>• Mastery of manufacturer's manuals</li> <li>• Skills and knowledge of running safety devices</li> <li>• Interpretation of technical drawings</li> <li>• Basic materials science</li> </ul> <p><b>Tools and equipment</b></p> <ul style="list-style-type: none"> <li>• Locomotive signaling mainframe test benches</li> <li>• Digital multimeters</li> <li>• Trameggers</li> </ul>   |
|   | 4.2 Troubleshooting of train operation monitoring and recording devices. |   |
|   | 4.3 Troubleshooting of locomotive communication equipment.               |   |

| DUTIES                           | TASKS   | ENABLERS  |
|----------------------------------|---|---|
|                                  |   | <ul style="list-style-type: none"> <li>• Card readers</li> <li>• Card reading software</li> <li>• Fire extinguishers</li> <li>• Safety shoes, goggles, safety helmets, work gloves and insulating gloves</li> <li>• First aid kits</li> </ul> <p><b>Materials</b></p> <ul style="list-style-type: none"> <li>• Cleaner and lubricating grease meeting technical requirements</li> </ul> <p><b>Requirements for employees</b></p> <ul style="list-style-type: none"> <li>• Safety consciousness, compliance, obedience to unified command and teamwork spirit</li> </ul>   |
| 5.0 Handling of abnormal running | 5.1 Handling of abnormal train reception and departure. | <p><b>General skills and knowledge</b></p> <ul style="list-style-type: none"> <li>• Cooperation with others using communication skills and submission of train operation reports to the superiors</li> <li>• Use of railway-related rules and regulations</li> <li>• Skills and knowledge in train operations</li> <li>• Overall locomotive situation</li> <li>• Interpretation of train working diagrams</li> </ul> <p><b>Tools and equipment</b></p> <ul style="list-style-type: none"> <li>• Safety shoes, signal flags for railways, flashlights, railway-specific clothing and other personal protective equipment</li> <li>• License documents related to abnormal running</li> <li>• Torpedoes, torches and shorted copper wires</li> <li>• Re-railer devices, etc.</li> </ul> <p><b>Materials</b></p> <ul style="list-style-type: none"> <li>• Communication equipment meeting</li> </ul> |
|                                  | 5.2 Handling of train division and backing-out.         |   |
|                                  | 5.3 Handling of fire and explosion in trains.           |   |
|                                  | 5.4 Handling of running in storms during flood seasons. |   |
|                                  | 5.5 Troubleshooting of trains during operation.         |   |

| <b>DUTIES</b> | <b>TASKS</b> | <b>ENABLERS</b>   |
|---------------|--------------|---|
|               |              | <p>technical specifications</p> <p><b>Requirements for employees</b></p> <ul style="list-style-type: none"> <li>· Teamwork spirit, integrity, time management and compliance</li> </ul> |