# NATIONAL COUNCIL FOR TECHNICAL AND VOCATIONAL EDUCATION AND TRAINING

**FEBRUARY 2023**

# PROPOSED OCCUPATIONAL STANDARDS

# OCCUPATION: MECHATRONICS TECHNICIAN

# LEVEL: NTA 6

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**ABBREVIATION**

| | |
|---|---|
| **CCD** | Control Circuit Diagram |
| **CAD** | Computer-Aided Design |
| **CBET** | Competency Based Education and Training |
| **DDM** | Digital Multimeter |
| **EF** | Electromechanical Equipment |
| **HC** | Hydraulic Circuit |
| **I/O** | Input/Output |
| **LED** | Light Emitting Diode |
| **MDI** | Manual Data Input |
| **MOPP** | Maintenance Operation Processes and Procedures |
| **NACTVET** | National Council for Technical and Vocational Education and Training |
| **NOS** | National Occupational Standards |
| **OS** | Occupational Standards |
| **PC** | Personal Computer |
| **PID** | Proportional-Integral-Derivative |
| **PLC** | Programmable Logic Controller |
| **PPE** | Personal Protective Equipment |
| **SFC** | Sequential Function Diagram |
| **TET** | Technical Education and Training |
| **TVET** | Technical and Vocational Education and Training |
| **UM** | Micrometer |

## GLOSSARY OF TERMS

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| **Circumstantial Knowledge:** | Detailed knowledge, which allows the decision-making in regard to different circumstances and cross cutting issues. |
| **Competence:** | The ability to use knowledge, understanding, practical, and thinking skills to perform effectively to the workplace standards required in employment. |
| **Competency:** | A description of the ability one possesses when able to perform a given occupational task effectively and efficiently. |
| **Competency-based Education:** | An instructional programme that derives its content from validated tasks and bases assessment on the learner's performance. |
| **Curriculum:** | 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". |
| **Educational/Training Programme:** | 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. |
| **Occupation:** | A specific position requiring the performance of specific tasks – essentially the same tasks are performed by all employees having the same title. (Example: baker) |
| **Occupational Area:** | This is a broad grouping of related jobs. (Example: food service) |
| **Occupational Competence:** | The application of knowledge and skills that consistently meet the standards required by the work context. |
| **Occupational Standards:** | 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. |
| **Occupational/Job Analysis:** | A process used to identify the tasks that are important to employees in any given occupation. |

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| **Performance Criteria:** | Indicate expected end results or outcomes in the form of evaluative statements. |
| **Skills:** | 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 Mechatronics Technician 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 standards 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 Mechatronics Technicians 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 MECHATRONICS TECHNICIANS

The standards cover a broad range of duties and tasks that can be performed by a Mechatronics technician. 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 Mechatronics Technician may perform tasks in a number of key areas in 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 Mechatronics Technicians work under the supervision of engineers. They can install simple circuits, prepare the preliminary work of mechanical parts processing, process simple mechanical parts, operate and maintain electromechanical equipment, install electromechanical equipment, debug electromechanical equipment, operate and maintain numerical control equipment, install and debug automatic production lines, analyse and correct faults with electromechanical equipment, and engage in electromechanical equipment sales activities.

Generally, the Mechatronics Technician performs the following responsibilities:

a) Simple part machining

b) Machining preparation of mechanical parts

c) Simple machining of mechanical parts

d) Operation and maintenance of electromechanical equipment

e) Installation of electromechanical equipment

f) Debugging of electromechanical equipment

g) Operation and maintenance of NC machining equipment

h) Installation and debugging of automatic production line

i) Operation and maintenance of electromechanical equipment

j) Sales of electromechanical equipment

The Occupational Standards have been clustered into NTA qualification levels, i.e. NTA level 4, 5 and 6.

## 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 MECHATRONICS TECHNICIAN - NTA 6

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| **OCCUPATION** | MECHATRONICS TECHNICIAN | **OCCUPATION CODE** | 600 |
| **DUTY TITLE** | OPERATION AND MAINTENANCE OF NC MACHINING EQUIPMENT | **DUTY NO.** | 601 |
| **TASK TITLE** | INSTALLATION AND ADJUSTMENT OF COMMONLY-USED MACHINING TOOLS | **TASK NO.** | 6011 |
| **PERFORMANCE CRITERIA** | The person performing this task must be able to select machining tools and complete the tool installation and setting in accordance with the machining requirements. | | |
| **RANGE STATEMENT** | The task can be performed in the NC workshop under the supervision of senior NC operators or NC programming technicians.<br>The tools and equipment to be used include:<br>1. NC lathes and NC milling machines;<br>2. Tool holders, tools, blades and measuring tools;<br>3. Tool setting gauges, tool presetters, alignment devices and tool locking seats. | | |

| **EVIDENCE REQUIREMENT** | |
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| **PRACTICAL PERFORMANCE** | **UNDERPINNING KNOWLEDGE** |
| The person performing this task must be able to do the following:<br>1. Observe the preventive measures for health and safety during working;<br>2. Select appropriate tools and equipment for the task;<br>3. Clamp workpieces;<br>4. Select appropriate tools and blades in accordance with the requirements of workpieces and processing technology;<br>5. Check the installation size of tools through tool interference and machining diagrams;<br>6. Change tools through the processing programs of [MDI] and [automatic] buttons or manual control of the tool holders via the panel;<br>6. Conduct tool setting to allow the cutting point of the tool to coincide with the tool location point of the workpiece through manual operation;<br>7. Test and adjust the tool;<br>8. Clean the tools, equipment and workplaces; | **Detailed knowledge about:**<br>**1.0 Methods**<br>The person performing this task must be able to explain how to:<br>1.1 Select suitable tools;<br>1.2 Carry out tool setting;<br>1.3 Select appropriate blades according to handicrafts;<br>1.4 Master the operating procedure of control panels.<br><br>**2.0 Principles**<br>The person performing this task must be able to explain the following principles:<br>2.1 Principles and methods of tool setting;<br>2.2 Testing principles of workpiece coordinates;<br>2.3 Principles for the use of panels.<br><br>**3.0 Theories**<br>The person performing this task must be able to explain the following: |

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| 9. Arrange and store the tools and equipment. | 3.1 Working principles of NC machine tools;<br>3.2 Adjustment methods of feed rate of NC machine tools;<br>3.3 Precautions in workpiece installation;<br>3.4 Installation process of tools;<br>3.5 Process and precautions in tool setting;<br>3.6 Troubleshooting during operation;<br>3.7 Tool setting tests.<br><br>**4.0 Essential Skills**<br>4.1 Communication skills;<br>4.2 Teamwork skills;<br>4.3 Report writing skills;<br>4.4 Time management;<br>4.5 Entrepreneurial skills. |
| **DESCRIPTION OF THE END PRODUCT / SERVICE** | The selection and installation of appropriate tools and adjustment of tool setting are completed in accordance with the corresponding requirements and specifications. |
| **CIRCUMSTANTIAL KNOWLEDGE** | **Detailed knowledge about:**<br>1. Safety operation of NC machine tools;<br>2. Safety operation of measuring instruments;<br>3. Occupational health and safety;<br>4. Waste disposal methods. |

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| **OCCUPATION** | MECHATRONICS TECHNICIAN | **OCCUPATION CODE** | 600 |
| **DUTY TITLE** | OPERATION AND MAINTENANCE OF NC MACHINING EQUIPMENT | **DUTY NO.** | 601 |
| **TASK TITLE** | PROGRAMMING AND OPERATION OF NC MACHINING EQUIPMENT | **TASK NO.** | 6012 |
| **PERFORMANCE CRITERIA** | The person performing this task must be able to select tools, write and input NC programs, debug programs and complete machining operations in accordance with machining requirements. | | |
| **RANGE STATEMENT** | The task can be performed in the NC workshop under the supervision of senior NC operators or NC programming technicians.<br>The tools and equipment to be used include:<br>1. NC programming software;<br>2. NC machine tools: NC milling machines, NC lathes, NC drilling machines, etc.;<br>3. Tools: drill bits, milling cutters, turning tools, thread cutters, etc.;<br>4. Fixtures: locating pins, clamping screws, chucks, etc.;<br>5. Measuring equipment;<br>6. Computers;<br>7. Measuring tools. | | |

**EVIDENCE REQUIREMENT**

| **PRACTICAL PERFORMANCE** | **UNDERPINNING KNOWLEDGE** |
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| The person performing this task must be able to do the following:<br>1. Observe the preventive measures for health and safety during working;<br>2. Select appropriate tools and equipment for the task;<br>3. Prepare NC machining technology;<br>4. Write NC machining procedures;<br>5. Input NC machining instructions;<br>6. Operate NC machining equipment;<br>7. Clean the tools, equipment and workplaces;<br>8. Arrange and store the tools and equipment. | Detailed knowledge about:<br>**1.0 Methods**<br>The person performing this task must be able to explain how to:<br>1.1 Operate the mechanical structure, electrical control system and programming control system;<br>1.2 Understand the NC programming language and write and modify programs;<br>1.3 Read and understand part drawings, process drawings and related technical documents;<br>1.4 Master the setting of automatic tool switching, automatic clamping, tool radius compensation and workpiece coordinate system;<br>1.5 Clamp tools and workpieces correctly;<br>1.6 Select tools and machining parameters;<br>1.7 Conduct refueling and cleaning and carry out periodic maintenance and overhaul of machine tools.<br><br>**2.0 Principles**<br>The person performing this task must be able to explain the following principles:<br>2.1 Preparation principles of NC machining technology;<br>2.2 Programming methods of NC machining; |

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| | 2.3 Safety requirements and principles of operating procedures;<br>2.4 Basic concepts of automatic processing.<br><br>**3.0 Theories**<br>The person performing this task must be able to explain the following:<br>3.1 Working principles of NC machine tools;<br>3.2 Operation methods of NC machine tools;<br>3.3 Inspection methods of workpieces.<br><br>**4.0 Essential Skills**<br>4.1 Communication skills;<br>4.2 Teamwork skills;<br>4.3 Report writing skills;<br>4.4 Time management;<br>4.5 Entrepreneurial skills. |
| **DESCRIPTION OF THE END PRODUCT / SERVICE** | Programming and basic operations of NC machining equipment are completed in accordance with the corresponding requirements and specifications. |
| **CIRCUMSTANTIAL KNOWLEDGE** | **Detailed knowledge about:**<br>1. Safety operation of NC machine tools;<br>2. Safety operation of measuring instruments;<br>3. Occupational health and safety;<br>4. Waste disposal methods. |

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| **OCCUPATION** | MECHATRONICS TECHNICIAN | **OCCUPATION CODE** | 600 |
| **DUTY TITLE** | OPERATION AND MAINTENANCE OF NC MACHINING EQUIPMENT | **DUTY NO.** | 601 |
| **TASK TITLE** | MAINTENANCE OF NC MACHINING EQUIPMENT | **TASK NO.** | 6013 |
| **PERFORMANCE CRITERIA** | The person performing this task must be able to select appropriate tools to maintain NC machining equipment in accordance with the requirements for equipment maintenance. | | |
| **RANGE STATEMENT** | The task can be performed in the NC workshop under the supervision of senior NC operators or NC programming technicians.<br>The tools and equipment to be used include:<br>1. NC lathes and NC milling machines;<br>2. Tool holders, tools, blades, measuring tools and electrical tools;<br>3. Tool setting gauges, tool presetters, alignment devices and tool locking seats. | | |

| **EVIDENCE REQUIREMENT** | |
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| **PRACTICAL PERFORMANCE** | **UNDERPINNING KNOWLEDGE** |
| The person performing this task must be able to do the following:<br>1. Observe the preventive measures for health and safety during working;<br>2. Select appropriate tools and equipment for the task;<br>3. Prepare the maintenance process manual of NC lathe processing equipment;<br>4. Maintain the hardware control unit in the NC system;<br>5. Maintain the mechanical unit of machine tools;<br>6. Maintain the spindle motor of machine tools;<br>7. Maintain the feed servo motor of machine tools;<br>8. Maintain the measurement feedback element of machine tools;<br>9. Clean the tools, equipment and workplaces;<br>10. Arrange and store the tools and equipment. | **Detailed knowledge about:**<br>**1.0 Methods**<br>The person performing this task must be able to explain how to:<br>1.1 Master the main component, performance and function of the equipment;<br>1.2 Understand the use method and operating procedure of the equipment;<br>1.3 Master the maintenance and repair technique of the equipment, including cleaning, lubrication, inspection and adjustment;<br>1.4 Master the troubleshooting method and repair technique of the equipment;<br>1.5 Master the safety operation requirement of the equipment and accident treatment methods;<br>1.6 Master the quality control and inspection standard of the equipment.<br><br>**2.0 Principles**<br>The person performing this task must be able to explain the following principles: |

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| | 2.1 Working principles of the NC system;<br>2.2 Working principles of the feed servo motor of machine tools;<br>2.3 Working principle of the measurement feedback element of machine tools;<br>2.4 Basic structure and working principles of NC machining equipment.<br><br>**3.0 Theories**<br>The person performing this task must be able to explain the following:<br>3.1 Maintenance methods for the control unit;<br>3.2 Maintenance methods for the feed servo motor of machine tools;<br>3.3 Maintenance methods for the spindle motor of machine tools;<br>3.4 Maintenance methods for the measurement feedback element of machine tools;<br>3.5 Precautions for the maintenance of NC machine tools.<br><br>**4.0 Essential Skills**<br>4.1 Communication skills;<br>4.2 Teamwork skills;<br>4.3 Report writing skills;<br>4.4 Time management;<br>4.5 Entrepreneurial skills. |
| **DESCRIPTION OF THE END PRODUCT / SERVICE** | The maintenance of NC machining equipment is completed in accordance with the corresponding requirements and specifications to ensure the normal operation of the equipment to improve production efficiency and quality. |
| **CIRCUMSTANTIAL KNOWLEDGE** | **Detailed knowledge about:**<br>1. Safety operation of NC machine tools;<br>2. Safety operation of measuring instruments;<br>3. Maintenance of the NC system;<br>4. Occupational health and safety;<br>5. Waste disposal methods. |

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| **OCCUPATION** | MECHATRONICS TECHNICIAN | **OCCUPATION CODE** | 600 |
| **DUTY TITLE** | INSTALLATION AND DEBUGGING OF AUTOMATIC PRODUCTION LINE | **DUTY NO.** | 602 |
| **TASK TITLE** | DISASSEMBLY AND DEBUGGING OF MECHANICAL PARTS | **TASK NO.** | 6021 |
| **PERFORMANCE CRITERIA** | The person performing this task must be able to disassemble and debug the mechanical parts of the automatic production line in accordance with assembly process requirements. | | |
| **RANGE STATEMENT** | The task can be performed in the factory under the supervision of electrical engineers or mechanical engineers.<br>The tools and equipment to be used include:<br>1. Wrenches and socket wrench sets;<br>2. Screwdrivers;<br>3. Pliers;<br>4. Hammers;<br>5. Contact measuring tools: micrometers, outside micrometer calipers, etc.;<br>6. Contactless measuring tools: laser rangefinders, measuring instruments, etc.;<br>7. Grinding and drilling equipment;<br>8. Welding equipment;<br>9. Hydraulic equipment: hydraulic jacks, horizontal hydraulic stretchers, etc.;<br>10. Machine tools: lathes, milling machines, drilling machines, etc.;<br>11. Molds: mold bending machines, embossing machines, etc.;<br>12. Protective equipment. | | |

| **EVIDENCE REQUIREMENT** | |
|---|---|
| **PRACTICAL PERFORMANCE** | **UNDERPINNING KNOWLEDGE** |
| The person performing this task must be able to do the following:<br>1. Observe the preventive measures for health and safety during working;<br>2. Verify the tools and measuring instruments used during installation;<br>3. Isolate the power supply before installation;<br>4. Disassemble mechanical parts in accordance with process requirements;<br>5. Test the installed mechanical parts;<br>6. Clean the equipment, tools and work areas; | **Detailed knowledge about:**<br>**1.0 Methods**<br>The person performing this task must be able to explain how to:<br>1.1 Disassemble mechanical parts correctly in accordance with installation drawings;<br>1.2 Use tools and equipment for assembly;<br>1.3 Measure and debug mechanical parts.<br><br>**2.0 Principles**<br>The person performing this task must be able to explain the following principles: |

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| 7. Dispose waste;<br>8. Store the equipment and tools. | 2.1 Principles of mechanical disassembly and debugging;<br>2.2 Work specifications and operating procedures;<br>2.3 Structures and working principles of machine;<br>2.4 Basic maintenance methods.<br><br>**3.0 Theories**<br>The person performing this task must be able to explain the following:<br>3.1 Knowledge of safe use of electric tools;<br>3.2 Structures of mechanical parts;<br>3.3 Assembly process;<br>3.4 Tolerance fit and measurement.<br><br>**4.0 Essential Skills**<br>4.1 Communication skills;<br>4.2 Customer service skills;<br>4.3 Entrepreneurial skills;<br>4.4 Time management;<br>4.5 Teamwork skills;<br>4.6 Report writing skills. |
| **DESCRIPTION OF THE END PRODUCT / SERVICE** | The mechanical parts of the automatic production line are disassembled and debugged in accordance with the corresponding requirements and specifications. |
| **CIRCUMSTANTIAL KNOWLEDGE** | **Detailed knowledge about:**<br>1. Safety operation of operating machines and tools;<br>2. Safety operation of measuring instruments;<br>3. Occupational health and safety;<br>4. Waste disposal methods. |

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| **OCCUPATION** | MECHATRONICS TECHNICIAN | **OCCUPATION CODE** | 600 |
| **DUTY TITLE** | INSTALLATION AND DEBUGGING OF AUTOMATIC PRODUCTION LINE | **DUTY NO.** | 602 |
| **TASK TITLE** | INSTALLATION, REPLACEMENT AND DEBUGGING OF ELECTRICAL PARTS | **TASK NO.** | 6022 |
| **PERFORMANCE CRITERIA** | The person performing this task must be able to install and debug the electrical parts of the automatic production line in accordance with electrical schematic diagrams. | | |
| **RANGE STATEMENT** | The task can be performed in the factory under the supervision of electrical engineers or mechanical engineers.<br>The tools and equipment to be used include:<br>1. Clamp ammeters;<br>2. Grounding resistance testers;<br>3. Multimeters;<br>4. Cable testers;<br>5. Electrical testers;<br>6. Screwdrivers and wrenches;<br>7. Diagonal pliers and angle jaw tongs;<br>8. Jointing clamps;<br>9. Wire pliers;<br>10. Claw-type multimeter clamps;<br>11. Personal protective equipment;<br>12. Electrical toolboxes. | | |

| **EVIDENCE REQUIREMENT** | |
|---|---|
| **PRACTICAL PERFORMANCE** | **UNDERPINNING KNOWLEDGE** |
| The person performing this task must be able to do the following:<br>1. Observe the preventive measures for health and safety during working;<br>2. Verify the tools and measuring instruments used during installation;<br>3. Isolate the power supply before installation;<br>4. Install electrical elements and equipment in the reasonable layout according to the | **Detailed knowledge about:**<br>**1.0 Methods**<br>The person performing this task must be able to explain how to:<br>1.1 Arrange the layout of electrical elements and equipment;<br>1.2 Use various electrical tools and equipment;<br>1.3 Replace electrical elements or equipment;<br>1.4 Standardize the hardware diagram of wiring electrical systems;<br>1.5 Debug the electrical control system.<br><br>**2.0 Principles**<br>The person performing this task must be able to explain the following principles: |

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| principle of electrical element layout;<br>5. Conduct wiring in strict accordance with the circuit diagram;<br>6. Replace electrical elements or equipment;<br>7. Debug the automatic production line;<br>8. Store the equipment and tools. | 2.1 Layout principles of electrical elements and equipment;<br>2.2 Analysis method of circuit schematic diagrams;<br>2.3 Specifications for circuit wiring.<br><br>**3.0 Theories**<br>The person performing this task must be able to explain the following:<br>3.1 Knowledge of safe use of electrical tools;<br>3.2 Structures, working principles and knowledge of safe use of electrical elements and equipment;<br>3.3 Knowledge of electrical equipment measurement.<br><br>**4.0 Essential Skills**<br>4.1 Communication skills;<br>4.2 Customer service skills;<br>4.3 Entrepreneurial skills;<br>4.4 Time management;<br>4.5 Teamwork skills;<br>4.6 Report writing skills. |
| **DESCRIPTION OF THE END PRODUCT / SERVICE** | The installation, replacement and debugging of the electrical parts of the automatic production line is completed in accordance with process requirements. |
| **CIRCUMSTANTIAL KNOWLEDGE** | **Detailed knowledge about:**<br>1. Safety operation of operating machines and tools;<br>2. Safety operation of measuring instruments;<br>3. Occupational health and safety;<br>4. Waste disposal methods. |

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| **OCCUPATION** | MECHATRONICS TECHNICIAN | **OCCUPATION CODE** | 600 |
| **DUTY TITLE** | INSTALLATION AND DEBUGGING OF AUTOMATIC PRODUCTION LINE | **DUTY NO.** | 602 |
| **TASK TITLE** | INSTALLATION, REPLACEMENT AND DEBUGGING OF PNEUMATIC AND HYDRAULIC CONTROL PARTS | **TASK NO.** | 6023 |
| **PERFORMANCE CRITERIA** | The person performing this task must be able to conduct layout design, installation, disassembly, debugging and pipeline assembly for hydraulic and pneumatic elements and carry out initial fault diagnosis and maintenance for the hydraulic and pneumatic system in accordance with the implementation standards and principles of the hydraulic and pneumatic system used in the production line. | | |
| **RANGE STATEMENT** | The task can be performed in the factory under the supervision of electrical engineers or mechanical engineers.<br>The tools and equipment to be used include:<br>1. Pressure gauges;<br>2. Flowmeters;<br>3. Liquid level gauges;<br>4. Valves;<br>5. Sensors;<br>6. Pneumatic tongs;<br>7. Pipeline cutting tools;<br>8. Pipe clamps and joints;<br>9. Debugging toolboxes;<br>10. Hydraulic pliers;<br>11. Cleaning supplies;<br>12. Personal protective equipment;<br>13. Computers. | | |

| **EVIDENCE REQUIREMENT** | |
|---|---|
| **PRACTICAL PERFORMANCE** | **UNDERPINNING KNOWLEDGE** |
| The person performing this task must be able to do the following:<br>1. Observe the preventive measures for health and safety during working;<br>2. Read hydraulic and pneumatic design drawings;<br>3. Know various hydraulic and pneumatic elements and select various valves correctly;<br>4. Disassemble, install and debug various valves;<br>5. Debug the hydraulic and pneumatic system; | **Detailed knowledge about:**<br>**1.0 Methods**<br>The person performing this task must be able to explain how to:<br>1.1 Read schematic diagrams of the hydraulic and pneumatic system;<br>1.2 Select suitable hydraulic and pneumatic elements;<br>1.3 Debug the hydraulic and pneumatic system;<br>1.4 Diagnose and troubleshoot hydraulic and pneumatic faults.<br><br>**2.0 Principles** |

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| 6. Diagnose and repair the fault of the hydraulic and pneumatic system;<br>7. Arrange the equipment, tools and work areas;<br>8. Store the tools and equipment;<br>9. Abide by safety specifications and construction standards. | The person performing this task must be able to explain the following principles:<br>2.1 Structures and working principles of hydraulic and pneumatic pumps and valves;<br>2.2 Working principles of hydraulic and pneumatic basic control circuit;<br>2.3 Layout specifications of hydraulic and pneumatic elements;<br>2.4 Standards and specifications for hydraulic and pneumatic pipeline assembly.<br><br>**3.0 Theories**<br>The person performing this task must be able to explain the following:<br>3.1 Control methods of hydraulic and pneumatic systems;<br>3.2 The composition of hydraulic and pneumatic systems and the functions of various components;<br>3.3 Working characteristics of various valves and pumps;<br>3.4 Selection and action principles of various valves, and mastery of the median function of three-position reversing valves.<br><br>**4.0 Essential Skills**<br>4.1 Technical communication skills;<br>4.2 Time management skills;<br>4.3 Teamwork skills;<br>4.4 Learning and exploration skills;<br>4.5 Summary and recording skills. |
| **DESCRIPTION OF THE END PRODUCT / SERVICE** | Components of the hydraulic and pneumatic control systems of the automatic production line are installed, dismantled and interchanged in accordance with the requirements of the hydraulic and pneumatic control of the production line. |
| **CIRCUMSTANTIAL KNOWLEDGE** | **Detailed knowledge about:**<br>1. Cognition of hydraulic and pneumatic transmission;<br>2. Safety operation of operating machines and tools;<br>3. Installation and debugging of hydraulic pump stations and valve groups;<br>4. Installation and debugging of pneumatic control systems in the production line;<br>5. Occupational health and safety;<br>6. Disposal methods of waste and waste oil. |

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| **OCCUPATION** | MECHATRONICS TECHNICIAN | **OCCUPATION CODE** | 600 |
| **DUTY TITLE** | INSTALLATION AND DEBUGGING OF AUTOMATIC PRODUCTION LINE | **DUTY NO.** | 602 |
| **TASK TITLE** | IDENTIFICATION OF CONTROL PROGRAMS AND LOCAL MODIFICATION AND UPGRADING | **TASK NO.** | 6024 |
| **PERFORMANCE CRITERIA** | The person performing this task must be able to run, debug, monitor and analyse, optimize and upgrade the program in accordance with the specific control requirements and technical index requirements of the production line. | | |
| **RANGE STATEMENT** | The task can be performed in the factory area under the supervision of electrical engineers/technicians.<br>The tools and equipment to be used include:<br>1. Wrenches;<br>2. Electric hand drills and screwdrivers;<br>3. Chain fixtures and steel wire ropes;<br>4. Welding tools;<br>5. Adjusting bolts;<br>6. Measuring instruments;<br>7. Vibration testing instruments;<br>8. Elastic force testing instrument for measuring values of the tightening and loosening forces of various parts of mechanical equipment;<br>9. Air compressors;<br>10. Wheeled handling equipment;<br>11. Pressure control devices;<br>12. Contactless temperature measurement;<br>13. Hydraulic pressure testing instruments;<br>14. Electrical test instruments;<br>15. Personal protective equipment, such as safety shoes, goggles and work clothes. | | |

| **EVIDENCE REQUIREMENT** | |
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| **PRACTICAL PERFORMANCE** | **UNDERPINNING KNOWLEDGE** |
| The person performing this task must be able to do the following:<br>1. Observe the preventive measures for health and safety during working;<br>2. Read the instruction of the product and clarify the tasks, control requirements and technical index requirements of the production line;<br>3. Check the hardware equipment connected with PLC before debugging the program;<br>4. Upload or download PLC programs to computer; | **Detailed knowledge about:**<br>**1.0 Methods**<br>The person performing this task must be able to explain how to:<br>1.1 Read and analyse the control programs;<br>1.2 Use programming softwares;<br>1.3 Debug and optimize the control programs;<br>1.4 Monitor programs.<br><br>**2.0 Principles**<br>The person performing this task must be able to explain the following principles: |

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| 5. Test the input points and output points of PLC;<br>6. Monitor, debug and optimize procedures in accordance with the control requirements and technical index requirements in the production line;<br>7. Clean the equipment, tools and work areas;<br>8. Store the equipment and tools. | 2.1 Working principles of PLC;<br>2.2 Methods of PLC programming;<br>2.3 Safety principles;<br>2.4 Technical principles;<br>2.5 Principles of data acquisition;<br>2.6 Principles of quality control.<br><br>**3.0 Theories**<br>The person performing this task must be able to explain the following:<br>3.1 Hardware structures of the PLC;<br>3.2 Internal soft components, basic logic instructions, special function instructions, and program structures of PLC;<br>3.3 Methods of ladder diagram design and methods of sequence control (SFC) design;<br>3.4 Signal acquisition programming of common sensors in automatic lines;<br>3.5 Communications between PLC and frequency converters, servo drives and touch screens.<br><br>**4.0 Essential Skills**<br>4.1 Computer and software usage skills;<br>4.2 Customer service skills;<br>4.3 Innovation skills;<br>4.4 Time management skills;<br>4.5 Teamwork skills;<br>4.6 Report writing skills. |
| **DESCRIPTION OF THE END PRODUCT / SERVICE** | Programs of automatic production line are debugged and optimized according to the requirements of production line control. |
| **CIRCUMSTANTIAL KNOWLEDGE** | **Detailed knowledge about:**<br>1. PLC programming and application;<br>2. Safety operation of operating machines and tools;<br>3. Safety operation of measuring instruments;<br>4. Occupational health and safety;<br>5. Waste disposal methods. |

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| **OCCUPATION** | MECHATRONICS TECHNICIAN | **OCCUPATION CODE** | 600 |
| **DUTY TITLE** | ELECTROMECHANICAL EQUIPMENT OPERATION AND MAINTENANCE | **DUTY NO.** | 603 |
| **TASK TITLE** | DEVELOPMENT OF ELECTROMECHANICAL EQUIPMENT INSPECTION AND MAINTENANCE PROCESSES | **TASK NO.** | 6031 |
| **PERFORMANCE CRITERIA** | The person performing this task must be able to overhaul electromechanical equipment in accordance with technical requirements and the manufacturer's maintenance manual. | | |
| **RANGE STATEMENT** | The task can be performed in the electromechanical equipment workshop under the supervision of mechatronics engineers or mechanical engineers.<br>The tools and equipment to be used include:<br>1. Personal protective equipment;<br>2. Electrical toolboxes;<br>3. Computers. | | |

**EVIDENCE REQUIREMENT**

| PRACTICAL PERFORMANCE | UNDERPINNING KNOWLEDGE |
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| The person performing this task must be able to do the following:<br>1. Obtain the tools and equipment needed to perform the task;<br>2. Observe the preventive measures for health and safety during working;<br>3. Detect equipment faults;<br>4. Analyse the cause of the faults;<br>5. Design restoration schemes;<br>6. Repair equipment faults;<br>7. Test electromechanical equipment;<br>8. Maintain and service electromechanical equipment;<br>9. Clean the tools, equipment and workplaces;<br>10. Arrange and store the tools and equipment. | **Detailed knowledge about:**<br>**1.0 Methods**<br>The person performing this task must be able to explain how to:<br>1.1 Diagnose the fault points of equipment;<br>1.2 Rectify faults;<br>1.3 Analyse the causes of the faults.<br><br>**2.0 Principles**<br>The person performing this task must be able to explain the following principles:<br>2.1 Principles of troubleshooting equipment.<br><br>**3.0 Theories**<br>The person performing this task must be able to explain the following:<br>3.1 Design and installation methods of pneumatic proportional and servo system loops;<br>3.2 Methods of fault diagnosis and elimination of pneumatic systems;<br>3.3 The parameter adjustment methods of pid regulators;<br>3.4 Methods of fault diagnosis and elimination of hydraulic systems;<br>3.5 Communication connection methods between PLC and pneumatic-hydraulic equipment;<br>3.6 Communication connection methods between PLC and PC. |

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| | **4.0 Essential Skills**<br>4.1 Teamwork skills;<br>4.2 Communication skills;<br>4.3 Independent thinking skills;<br>4.4 Time management;<br>4.5 Report writing skills. |
| **DESCRIPTION OF THE END PRODUCT / SERVICE** | Overhaul processes of mechatronic equipment are developed in accordance with technical requirements and manufacturer's specifications. |
| **CIRCUMSTANTIAL KNOWLEDGE** | **Detailed knowledge about:**<br>1. Safety operation of operating machines and tools;<br>2. Safety operation of measuring instruments;<br>3. Occupational health and safety;<br>4. Maintenance operation processes and procedures (MOPP);<br>5. Waste disposal methods. |

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| **OCCUPATION** | MECHATRONICS TECHNICIAN | **OCCUPATION CODE** | 600 |
| **DUTY TITLE** | ELECTROMECHANICAL EQUIPMENT OPERATION AND MAINTENANCE | **DUTY NO.** | 603 |
| **TASK TITLE** | ANALYSIS AND ELIMINATION OF MECHANICAL FAULTS | **TASK NO.** | 6032 |
| **PERFORMANCE CRITERIA** | The person performing this task must be able to analyse the causes and eliminate the existing mechanical faults. | | |
| **RANGE STATEMENT** | The task can be performed in the machine workshop under the supervision of mechanical engineers.<br>The tools and equipment to be used include:<br>1. Common tools: general tools, fitter tools, special tools and measuring tools;<br>2. General tools: monkey wrench, dull-head wrench, box-end wrench, socket wrench, pliers, screwdriver, etc.;<br>3. Fitter tools: platform, vise, saw, file, drill, grinder, etc.;<br>4. Professional tools: air compressor, electric welding machine, gas cutting/welding, etc.;<br>5. Measuring tools: caliper, micrometer, dial indicator, height/depth gauge, angle ruler, speedometer, thermometer, pressure gauge, etc. | | |

| **EVIDENCE REQUIREMENT** | |
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| **PRACTICAL PERFORMANCE** | **UNDERPINNING KNOWLEDGE** |
| The person performing this task must be able to do the following:<br>1. Check mechanical functional components;<br>2. Understand the general assembly drawings and component assembly drawings of mechanical equipment;<br>3. Describe mechanical faults, fill in mechanical reports of them and analyse the fault causes and overhaul them;<br>4. Check the function and accuracy of mechanical functional components;<br>5. Assemble and debug the functional components of mechanical equipment;<br>6. Overhaul and adjust bearings, cams, chain drives, gear drives, worm gear drives, crank sliders, screw drives, hydraulic, pneumatic systems and other mechanisms; | **Detailed knowledge about:**<br>**1.0 Methods**<br>The person performing this task must be able to explain how to:<br>1.1 Remove the mechanical faults;<br>1.2 Test mechanical properties.<br><br>**2.0 Principles**<br>The person performing this task must be able to explain the following principles:<br>2.1 Equipment structures and working principles;<br>2.2 Fault causes of each component.<br><br>**3.0 Theories**<br>The person performing this task must be able to explain the following:<br>3.1 Components and operation of mechanical systems;<br>3.2 Possible faults of mechanical systems and their causes;<br>3.3 Measures for eliminating mechanical faults.<br><br>**4.0 Essential Skills** |

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| 7. Clean the tools, equipment and safe places;<br>8. Arrange and store the tools and equipment. | 4.1 Communication skills;<br>4.2 Customer service skills;<br>4.3 Teamwork skills;<br>4.4 Report writing skills;<br>4.5 Entrepreneurial skills;<br>4.6 Time management. |
| **DESCRIPTION OF THE END PRODUCT / SERVICE** | Mechanical faults of mechatronic equipment are overhauled in accordance with technical requirements and manufacturer's specifications. |
| **CIRCUMSTANTIAL KNOWLEDGE** | **Detailed knowledge about:**<br>1. Safety operation of operating machines and tools;<br>2. Safety operation of measuring instruments;<br>3. Occupational health and safety;<br>4. Maintenance operation processes and procedures (MOPP);<br>5. Waste disposal methods. |

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| **OCCUPATION** | MECHATRONICS TECHNICIAN | **OCCUPATION CODE** | 600 |
| **DUTY TITLE** | ELECTROMECHANICAL EQUIPMENT OPERATION AND MAINTENANCE | **DUTY NO.** | 603 |
| **TASK TITLE** | ANALYSIS AND ELIMINATION OF ELECTRICAL CIRCUITS FAULTS | **TASK NO.** | 6033 |
| **PERFORMANCE CRITERIA** | The person performing this task must be able to analyse and eliminate faults of electrical circuits in accordance with technical requirements and manufacturer's maintenance manual. | | |
| **RANGE STATEMENT** | The task can be performed on the production and manufacturing site under the supervision of mechatronics engineers.<br>The tools and equipment to be used include:<br>1. Electrical toolboxes;<br>2. All kinds of wrenches;<br>3. Ladders. | | |

| **EVIDENCE REQUIREMENT** | |
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| **PRACTICAL PERFORMANCE** | **UNDERPINNING KNOWLEDGE** |
| The person performing this task must be able to do the following:<br>1. Observe the preventive measures for health and safety during working;<br>2. Obtain the tools and equipment needed to perform the task;<br>3. Test battery voltage;<br>4. Check, fix and tighten each wiring terminal;<br>5. Repair open circuit faults;<br>6. Repair short circuit faults;<br>7. Overhaul fuses, circuit breakers, contactors, relays and other components;<br>8. Modify PLC control procedures;<br>9. Execute circuit function tests;<br>10. Adjust parameters of frequency converters, stepper drives and servo drives;<br>11. Clean the tools, equipment and safe places;<br>12. Arrange and store the tools and equipment. | **Detailed knowledge about:**<br>**1.0 Methods**<br>The person performing this task must be able to explain how to:<br>1.1 Troubleshoot electrical circuit faults;<br>1.2 Handle and settle the faults.<br><br>**2.0 Principles**<br>The person performing this task must be able to explain the following principles:<br>2.1 Principles of eliminating electrical circuit faults.<br><br>**3.0 Theories**<br>The person performing this task must be able to explain the following:<br>3.1 Composition and operation of electrical circuit components;<br>3.2 Methods of eliminating electrical circuit faults;<br>3.3 Modification methods of PLC control programs.<br><br>**4.0 Essential Skills**<br>4.1 Communication skills;<br>4.2 Customer service skills;<br>4.3 Teamwork skills;<br>4.4 Report writing skills;<br>4.5 Entrepreneurial skills;<br>4.6 Time management. |

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| **DESCRIPTION OF THE END PRODUCT / SERVICE** | Electrical circuit faults of the equipment are eliminated in accordance with technical requirements and the manufacturer's maintenance manual. |
| **CIRCUMSTANTIAL KNOWLEDGE** | Detailed knowledge about:<br>1. Safety operation of operating machines and tools;<br>2. Safety operation of measuring instruments;<br>3. Occupational health and safety;<br>4. Maintenance operation processes and procedures;<br>5. Waste disposal methods. |

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| **OCCUPATION** | MECHATRONICS TECHNICIAN | **OCCUPATION CODE** | 600 |
| **DUTY TITLE** | ELECTROMECHANICAL EQUIPMENT OPERATION AND MAINTENANCE | **DUTY NO.** | 603 |
| **TASK TITLE** | ANALYSIS AND ELIMINATION OF FAULTS OF HYDRAULIC AND PNEUMATIC SYSTEMS | **TASK NO.** | 6034 |
| **PERFORMANCE CRITERIA** | The person performing this task must be able to repair the hydraulic and pneumatic system of mechatronics equipment in accordance with technical requirements and manufacturer's specifications. | | |
| **RANGE STATEMENT** | The task can be performed in the workshop under the supervision of mechatronics engineers or mechanical engineers.<br>The tools and equipment to be used include:<br>1. General tools: monkey wrench, dull-head wrench, box-end wrench, socket wrench, pliers, screwdriver, etc;<br>2. Fitter tools: platform, vise, saw, file, drill, grinder, etc;<br>3. Professional tools: air compressor, electric welding machine, gas cutting/welding, etc;<br>4. Measuring tools, such as straightedges, pad irons, micrometers, dial indicators and angle rulers;<br>5. Personal protective equipment, such as safety shoes, goggles, gloves, work clothes, etc. | | |

| **EVIDENCE REQUIREMENT** | |
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| **PRACTICAL PERFORMANCE** | **UNDERPINNING KNOWLEDGE** |
| The person performing this task must be able to do the following:<br>1. Observe the preventive measures for health and safety during working;<br>2. Select appropriate tools and equipment;<br>3. Check the hydraulic pneumatic circuits;<br>4. Repair/replace pumps, cylinders, motors, valves, auxiliary components, etc. in hydropneumatic circuits;<br>5. Filter/replace hydraulic oil;<br>6. Replace the oil/air filters;<br>7. Test repaired/replaced components;<br>8. Clean the tools, equipment and workplaces;<br>9. Arrange and store the tools and equipment. | **Detailed knowledge about:**<br>**1.0 Methods**<br>The person performing this task must be able to explain how to:<br>1.1 Repair the hydraulic and pneumatic systems;<br>1.2 Eliminate the faults of hydraulic and pneumatic systems.<br><br>**2.0 Principles**<br>The person performing this task must be able to explain the following principles:<br>2.1 Principles of the hydraulic and pneumatic systems;<br>2.2 Structures and working principles of pumps, cylinders, motors, valves and auxiliary components of the hydraulic and pneumatic systems.<br><br>**3.0 Theories**<br>The person performing this task must be able to explain the following: |

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| | 3.1 Composition of the hydraulic and pneumatic systems;<br>3.2 Fault analysis and elimination methods of the hydraulic and pneumatic systems.<br><br>**4.0 Essential Skills**<br>4.1 Communication skills;<br>4.2 Customer service skills;<br>4.3 Entrepreneurial skills;<br>4.4 Teamwork skills;<br>4.5 Report writing skills;<br>4.6 Time management. |
| **DESCRIPTION OF THE END PRODUCT / SERVICE** | The hydraulic and pneumatic systems of mechatronic equipment are overhauled in accordance with technical requirements and manufacturer's specifications. |
| **CIRCUMSTANTIAL KNOWLEDGE** | **Detailed knowledge about:**<br>1. Safety operation of operating machines and tools;<br>2. Safety operation of measuring instruments;<br>3. Occupational health and safety;<br>4. Maintenance operation processes and procedures (MOPP);<br>5. Waste disposal methods. |

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| **OCCUPATION** | MECHATRONICS TECHNICIAN | **OCCUPATION CODE** | 600 |
| **DUTY TITLE** | SALES OF ELECTROMECHANICAL EQUIPMENT | **DUTY NO.** | 604 |
| **TASK TITLE** | EQUIPMENT PROCUREMENT AND SALES | **TASK NO.** | 6041 |
| **PERFORMANCE CRITERIA** | The person performing this task must be able to organize the procurement and sales of equipment according to the enterprise and market conditions | | |
| **RANGE STATEMENT** | The procurement and sales of equipment can be performed in the mechanical and electrical product markets under the supervision of mechatronics engineers/mechanical engineers.<br>The tools and equipment to be used include:<br>1. Computers;<br>2. Telephones;<br>3. Projectors. | | |

| **EVIDENCE REQUIREMENT** | |
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| **PRACTICAL PERFORMANCE** | **UNDERPINNING KNOWLEDGE** |
| The person performing this task must be able to do the following:<br>1. Observe the preventive measures for health and safety during working;<br>2. Select appropriate tools and equipment for the task;<br>3. Complete the preparation of various documents such as inquiry, procurement and bidding for materials and equipment supplied by Party A;<br>4. Carry out on-site acceptance, inventory, warehousing, recording and filing of materials and equipment;<br>5. Conduct market survey, inquiry and market information collection;<br>6. Establish a market information system and develop a product marketing mix;<br>7. Maintain good communication with customers to maintaing the customer relationship;<br>8. Set sales targets and plans;<br>9. Clean the tools, equipment and workplaces;<br>10. Arrange and store the tools and equipment. | **Detailed knowledge about:**<br>**1.0 Methods**<br>The person performing this task must be able to explain how to:<br>1.1 Conduct inquiry, procurement and bidding for electromechanical equipment;<br>1.2 Set sales targets and plans.<br><br>**2.0 Principles**<br>The person performing this task must be able to explain the following principles:<br>2.1 Preparation principle of various documents such as inquiry, procurement and bidding for materials and equipment supplied by Party A;<br>2.2 Principles of market research and inquiry;<br>2.3 Principles for setting sales targets and plans.<br><br>**3.0 Theories**<br>The person performing this task must be able to explain the following:<br>3.1 The development methods of the procurement plan and bidding documents of mechanical and electrical products;<br>3.2 Market research methods for mechanical and electrical products;<br>3.3 Methods for setting sales targets and plans;<br>3.4 Methods of maintaining the customer relationship;<br>3.5 Approaches to maintaining and improving market competitiveness; |

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| | 3.6 Sales and operation procedures of mechanical and electrical products;<br>3.7 Intermediate evaluation method of cooperators.<br><br>**4.0 Essential Skills**<br>4.1 Communication skills;<br>4.2 Teamwork skills;<br>4.3 Report writing skills;<br>4.4 Time management;<br>4.5 Entrepreneurial skills. |
| **DESCRIPTION OF THE END PRODUCT / SERVICE** | Bidding documents, sales plan and evaluation materials are developed in accordance with the corresponding requirements and specifications |
| **CIRCUMSTANTIAL KNOWLEDGE** | **Detailed knowledge about:**<br>1. Market research and inquiry of electromechanical equipment;<br>2. Sales targets and plans;<br>3. Occupational health and safety;<br>4. Waste disposal methods. |

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| **OCCUPATION** | MECHATRONICS TECHNICIAN | **OCCUPATION CODE** | 600 |
| **DUTY TITLE** | SALES OF ELECTROMECHANICAL EQUIPMENT | **DUTY NO.** | 604 |
| **TASK TITLE** | REGULAR COMMUNICATION WITH CUSTOMERS TO MAINTAIN THE CUSTOMER RELATIONSHIP | **TASK NO.** | 6042 |
| **PERFORMANCE CRITERIA** | The person performing this task must be able to communicate with customers regularly according to the enterprise and market conditions to maintain the customer relationship. | | |
| **RANGE STATEMENT:** | The communication with customers can be performed to maintain the customer relationship in mechanical and electrical products market under the supervision of sales engineers.<br>The tools and equipment to be used include:<br>1. Computers;<br>2. Telephones;<br>3. Projectors. | | |

**EVIDENCE REQUIREMENT**

| **PRACTICAL PERFORMANCE** | **UNDERPINNING KNOWLEDGE** |
|---|---|
| The person performing this task must be able to do the following:<br>1. Observe the preventive measures for health and safety during working;<br>2. Ensure the reliability of tools and equipment in the customer relationship maintenance service;<br>3. Collect basic information about customers or potential customers by telephone or computer;<br>4. Establish customer files according to the importance of customer relationship;<br>5. Maintain and manage customer relationship by mail or telephone;<br>6. Analyse customer files and grade customers. | **Detailed knowledge about:**<br>**1.0 Methods**<br>The person performing this task must be able to explain how to:<br>1.1 Explore channels for collecting customer information;<br>1.2 Establish and manage customer files;<br>1.3 Analyse customer consumption and classify customers.<br><br>**2.0 Principles**<br>The person performing this task must be able to explain the following principles:<br>2.1 Basic principle of customer relationship maintenance.<br><br>**3.0 Theories**<br>The person performing this task must be able to explain the following:<br>3.1 Methods of product sales;<br>3.2 Customer behaviours and consumption patterns;<br>3.3 Methods of market investigation;<br>3.4 Enterprise sales planning methods.<br><br>**4.0 Essential Skills**<br>4.1 Oral and written communication skills;<br>4.2 Punctuality; |

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| | 4.3 Being trustworthy;<br>4.4 Dedication;<br>4.5 Honesty and trustworthiness;<br>4.6 Time management;<br>4.7 Report writing skills. |
| **DESCRIPTION OF THE END PRODUCT / SERVICE** | Collection of customer information and establishment of customer files are performed according to post requirements of sales to maintain and manage the customer relationship. |
| **CIRCUMSTANTIAL KNOWLEDGE** | **Detailed knowledge about:**<br>1. Principle of marketing;<br>2. Marketing laws and regulations;<br>3. Collection method of customer information;<br>4. Method of establishing customer files;<br>5. Consumer behavior. |

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| **OCCUPATION** | MECHATRONICS TECHNICIAN | **OCCUPATION CODE** | 600 |
| **DUTY TITLE** | SALES OF ELECTROMECHANICAL EQUIPMENT | **DUTY NO.** | 604 |
| **TASK TITLE** | ORGANIZATION OF PRODUCT MARKETING | **TASK NO.** | 6043 |
| **PERFORMANCE CRITERIA** | The person performing this task must be able to conduct product marketing according to the enterprise and market conditions. | | |
| **RANGE STATEMENT** | The market promotion of equipment can be performed in the mechanical and electrical product markets under the supervision of mechatronics engineers/mechanical engineers.<br>The tools and equipment to be used include:<br>1. Computers;<br>2. Telephones;<br>3. Projectors. | | |

**EVIDENCE REQUIREMENT**

| **PRACTICAL PERFORMANCE** | **UNDERPINNING KNOWLEDGE** |
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| The person performing this task must be able to do the following:<br>1. Plan and organize the internal and external public activities of an enterprise;<br>2. Maintain the corporate image consciously and implement various promotion strategies correctly;<br>3. Develop strategies for better reputation of enterprises;<br>4. Observe appropriate etiquette norms from three aspects: grooming and appearance, dressing and posture on different occasions;<br>5. Use general etiquette knowledge to carry out introduction, conversation, phone calls, letters and so on, and use business etiquette knowledge to conduct invitation, negotiation, banquet, and visitor welcoming;<br>6. Explain the working principle of the marketed products to potential customers;<br>7. Collect and process market information;<br>8. Know well the characteristics of mechanical and electrical products and common marketing methods;<br>9. Develop a product promotion plan with high feasibility based on the enterprise and market conditions; | **Detailed knowledge about:**<br>**1.0 Methods**<br>The person performing this task must be able to explain how to:<br>1.1 Plan internal and external public activities of enterprises;<br>1.2 Conduct marketing promotion of products;<br><br>**2.0 Principles**<br>The person must be able to explain the following principles:<br>2.1 Art of public relations;<br>2.2 Appearance and business etiquette;<br>2.3 Market development plan;<br>2.4 Working principle of mechanical and electrical products.<br><br>**3.0 Theories**<br>The person performing this task must be able to explain the following:<br>3.1 Collection and processing methods of market information;<br>3.2 Marketing methods of electromechanical equipment.<br><br>**4.0 Essential Skills**<br>4.1 Communication skills;<br>4.2 Customer service skills; |

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| 10. Write a routine public relations plan;<br>11. Develop a market development plan for a certain region and plan regional promotion activities;<br>12. Complete the marketing of mechanical and electrical products in accordance with laws and regulations. | 4.3 Entrepreneurial skills;<br>4.4 Teamwork skills;<br>4.5 Report writing skills;<br>4.6 Time management. |
| **DESCRIPTION OF THE END PRODUCT / SERVICE** | Market promotion of mechanical and electrical product is performed according to enterprises and market conditions. |
| **CIRCUMSTANTIAL KNOWLEDGE** | **Detailed knowledge about:**<br>1. Basic principle of marketing;<br>2. Principles and procedures of marketing planning for mechanical and electrical products;<br>3. Laws and regulations related to marketing of mechanical and electrical products;<br>4. Procedures for promotional activities of mechanical and electrical products;<br>5. Waste disposal methods. |

**TABLE 1: DACUM CHARTS FOR MECHATRONICS TECHNICIAN – NTA 6**

| DUTIES | TASKS | ENABLERS |
|---|---|---|
| 1.0 Operation and maintenance of NC machining equipment | 1.1 Installation and adjustment of commonly-used machining tools.<br>1.2 Programming and operation of NC machining equipment.<br>1.3 Maintenance of NC machining equipment. | **General skills and knowledge**<br>· Cooperation with others using communication skills and submission of reports to the superiors<br>· Correct reading of part drawings<br>· Processing technology of parts<br>· Basic operation of NC machine tools<br>· Basic maintenance of NC machine tools<br><br>**Tools and equipment**<br>· Safety helmet<br>· Goggle<br>· NC machine tool<br>· Tool<br>· Tool holder<br>· Vernier caliper<br><br>**Materials**<br>· Processing bar, lubricating oil, coolant, and duster cloth<br><br>**Requirements for employees**<br>· Teamwork spirit<br>· Integrity<br>· Time management<br>· Emphasis on commitment |
| 2.0 Installation and debugging of automatic production line | 2.1 Disassembly and debugging of mechanical parts.<br>2.2 Installation, replacement and debugging of electrical parts.<br>2.3 Installation, replacement and debugging of pneumatic and hydraulic control parts.<br>2.4 Identification of control programs and local modification and upgrading. | **General skills and knowledge**<br>· Cooperating with others using communication skills<br>· Structural principle of machines;<br>· Sensor and detection principle;<br>· Hydraulic and pneumatic principle;<br>· PLC programming principle<br>· Workflows and methods of equipment debugging |

| DUTIES | TASKS | ENABLERS |
|---|---|---|
| | | **Tools and equipment**<br>· Personal protective equipment, such as safety shoes, work clothes, protective gloves, safety helmets, etc.<br>· Electrical tool kit, such as electric pen, multimeter, diagonal pliers, needle-nose pliers, wire stripper, electric soldering iron, etc.<br>· Caliper, micrometer, dial indicator, height/depth gauge, angle ruler, speedometer, thermometer and pressure gauge, etc.<br>· Cross screwdriver, slotted screwdriver, wire pliers, wire stripper, diagonal pliers, crimpling plier, needle-nose pliers, electrician knife, adjustable wrench, inner hexagon wrench and ladder<br>· Hydraulic pliers, diagonal pliers, wire stripper, pipe bender, three-claw puller and hole opener.<br>· Computer and elastic cloth for drying.<br><br>**Materials**<br>· Conductor, fusible cutout, circuit breaker, relay, hydraulic oil, lubricating grease, insulating tape, heat-shrinkable sleeve, duster cloth, etc.<br><br>**Requirements for employees**<br>· Skills in using computers and software<br>· Technical communication skills<br>· Hands-on skills<br>· Time management skills<br>· Teamwork skills |

| DUTIES | TASKS | ENABLERS |
|---|---|---|
| | | · Summary and recording skills |
| 3.0 Electromechanical equipment operation and maintenance | 3.1 Development of electromechanical equipment inspection and maintenance processes. | **General skills and knowledge**<br>· Cooperating with others using communication skills<br>· Use of the manufacturer's manual<br>· The working principle of products<br>· Workflows and principle of troubleshooting<br><br>**Tools and equipment**<br>· Monkey wrench, dull-head wrench, box-end wrench, socket wrench, pliers and screwdriver, etc.<br>· Platform, vise, saw, file, drill and grinder, etc.<br>· Air compressor, electric welding machine, gas cutting/welding, etc.<br>· Caliper, micrometer, dial indicator, height/depth gauge, angle ruler, speedometer, thermometer and pressure gauge, etc.<br>· Test pencil, multimeter, cross screwdriver, slotted screwdriver, wire pliers, wire stripper, diagonal pliers, crimpling plier, needle-nose pliers, electrician knife, adjustable wrench, inner hexagon wrench and ladder<br>· Safety shoes, goggles, gloves, overalls, etc.<br><br>**Materials**<br>· Conductor, fusible cutout, circuit breaker, relay, hydraulic oil, lubricating grease, insulating tape, heat-shrinkable sleeve, duster cloth, etc. |
| | 3.2 Development of electromechanical equipment inspection and maintenance processes. | |
| | 3.3 Development of electromechanical equipment inspection and maintenance processes. | |
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| DUTIES | TASKS | ENABLERS |
|---|---|---|
| | | **Requirements for employees**<br>· Teamwork skills<br>· Communication skills<br>· Independent thought<br>· Report writing |
| 4.0 Sales of electromechanical equipment | 4.1 Equipment procurement and sales.<br>4.2 Regular communication with customers to maintain the customer relationship.<br>4.3 Organization of product marketing. | **General skills and knowledge**<br>· Principle of marketing<br>· Marketing laws and regulations<br>· Knowledge of market investigation<br>· Consumer behavior<br>· Enterprise sales planning<br>· Art of public relations<br>· Appearance and business etiquette<br><br>**Tools and equipment**<br>· Computer<br>· Telephone<br><br>**Requirements for employees**<br>· Communication skills<br>· Customer service skills<br>· Entrepreneurial skills<br>· Teamwork skills<br>· Report writing skills<br>· Time management skills |