NATIONAL COUNCIL FOR TECHNICAL AND VOCATIONAL EDUCATION AND TRAINING

FEBRUARY 2023

PROPOSED OCCUPATIONAL STANDARDS

OCCUPATION: MECHATRONICS ENGINEER

LEVEL: NTA 7

TABLE OF CONTENT

CONTENTS

ABBREVIATIONS

AS	After-sales Service
CBET	Competency Based Education and Training
MPM	Manufacturing Process Management
NACTVET	National Council for Technical and Vocational Education and Training
NOS	National Occupational Standards
OS	Occupational Standards
PL	Production Line
SOP	Standard Operating Procedures
TET	Technical Education and Training
TP	Teaching Pendant
TVET	Technical and Vocational Education and Training

GLOSSARY OF TERMS

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.
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 and Vocational Education and Training 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 circuit, 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 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 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 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 MECHATRONICS ENGINEERS

The standards cover a broad range of duties and tasks that can be performed by a Mechatronics 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 Mechatronics Engineer 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.

Mechatronics Engineers perform production management, complex technical activities and so on. They also undertake tasks such as production process management, application, operation and maintenance of complex electromechanical equipment, troubleshooting of faults in complex electromechanical equipment in the workshop. Generally, the Mechatronics Engineer performs the following responsibilities:

a) Production management
b) Programming and debugging of industrial robot
c) Overhaul of electromechanical equipment
d) Operation and maintenance of equipment and production line (PL)
e) Aftersales service for electromechanical equipment
f) Technical transformation of electromechanical equipment
g) Electromechanical equipment project management
h) Mechanical design of electromechanical equipment
i) Electrical design of electromechanical equipment
j) Electrical debugging of electromechanical equipment
k) Operation and maintenance of intelligent production line

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 MECHATRONICS ENGINEER- NTA 7

OCCUPATION	MECHATRONICS ENGINEER	**OCCUPATION CODE**	700
DUTY TITLE	PRODUCTION MANAGEMENT	**DUTY NO.**	701
TASK TITLE	FULFILLMENT OF CUSTOMER NEEDS	**TASK NO.**	7011
PERFORMANCE CRITERIA	The person performing this task must be able to fulfill customer needs based on product requirement and in accordance with the SOP of customer cooperation in the technical production standards.		
RANGE STATEMENT	The task can be performed in the workshop under the supervision of mechatronics engineers or mechanical engineers. The tools and equipment to be used include: 1. Printers, computers, office paper; 2. Technical and process drawings; 3. Market demand analysis report; 4. Allocation of human resource; 5. Equipment operating status.		

EVIDENCE REQUIREMENT	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Analyse customers' product requirement; 2. Cooperate with the customers in terms of product information and review; 3. Sign cooperative contracts; 4. Manage the orders; 5. Reply to customer consultation; 6. Analyse and position the products; 7. Acquire product and material information through communication; 8. Track the logistics; 9. Keep the data.	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Collect information of product requirement; 1.2 Sort out product requirement information; 1.3 Analyse product requirement; 1.4 Position the products. **2.0 Principles** The person performing this task must be able to explain the following principles: 2.1 Standards for product requirement; 2.2 Technical standards of the production. **3.0 Theories** The person performing this task must be able to explain the following: 3.1 Methods of reading product process documents; 3.2 Technical data of production equipment; 3.3 Methods of analysing product requirement. **4.0 Essential Skills** 4.1 Communication skills; 4.2 Information analysing competence;

	4.3 Computer using skills. **5.0 Math Skills** 5.1 Computing tool using skills; 5.2 Measuring skills; 5.3 Skills of understanding and making drawings; 5.4 Analytical skills; 5.5 Computing skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	Demand analysis reports are prepared based on customer needs and technical requirements.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Requirements of civilized on-site production; 2. Standards for product requirement; 3. Contract formulation; 4. Order management.

OCCUPATION	MECHATRONICS ENGINEER	**OCCUPATION CODE**	700
DUTY TITLE	PRODUCTION MANAGEMENT	**DUTY NO.**	701
TASK TITLE	PRODUCTION ARRANGEMENT IN ACCORDANCE WITH THE PRODUCTION PLAN	**TASK NO.**	7012
PERFORMANCE CRITERIA	The person performing this task must be able to systematically develop the production plan in accordance with customer orders.		
RANGE STATEMENT	The task can be performed in the workshop under the supervision of mechatronics engineers or mechanical engineers. The tools and equipment to be used include: 1. Printers, computers, office paper; 2. Allocation of materials; 3. Technical and process drawings; 4. Allocation of human resource; 5. Equipment operating status.		

EVIDENCE REQUIREMENT	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Balance the overall production plan; 2. Prepare the production plan; 3. Allocate the personnel, equipment and materials; 4. Issue normative production plan; 5. Monitor the entire process; 6. Coordinate the departments; 7. Follow the production schedule; 8. Keep the data.	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Develop the production plan; 1.2 Coordinate the production schedule and material supply. **2.0 Principles** The person performing this task must be able to explain the following principles: 2.1 Development and optimization of the production plan; 2.2 Strategies for the whole-process plan management. **3.0 Theories** The person performing this task must be able to explain the following: 3.1 Methods of reading product process documents; 3.2 Strategies of production management; 3.3 Technical data of production equipment; 3.4 Standards for developing the production plan. **4.0 Essential Skills** 4.1 Communication skills; 4.2 Management skills;

	4.3 Information analysing competence; 4.4 Computer skills; 4.5 Organization and coordination skills; 4.6 Writing skills. **5.0 Math Skills** 5.1 Computing tool using skills; 5.2 Measuring skills; 5.3 Skills of understanding and making drawings; 5.4 Analytical skills; 5.5 Computing skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	The production plan is developed based on the customer needs and technical requirements and managed on a unified basis.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Product process documents; 2. Strategies of production management; 3. Technical data of production equipment; 4. Standards for developing the production plan.

OCCUPATION	MECHATRONICS ENGINEER	**OCCUPATION CODE**	700
DUTY TITLE	PRODUCTION MANAGEMENT	**DUTY NO.**	701
TASK TITLE	PRODUCTION PROCESS MANAGEMENT	**TASK NO.**	7013
PERFORMANCE CRITERIA	The person performing this task must be able to record the process, manage the materials and product quality in accordance with the requirements for production process management.		
RANGE STATEMENT	The task can be performed in the workshop under the supervision of mechatronics engineers or mechanical engineers. The tools and equipment to be used include: 1. Printers, computers, office paper; 2. Technical and process drawings; 3. Allocation of materials; 4. Allocation of human resource; 5. Equipment operating status; 6. Standard operation procedures for the production; 7. Testing tools.		

EVIDENCE REQUIREMENT	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Record the production procedures; 2. Convey the materials on a balanced basis; 3. Manage the product quality; 4. Manage the production procedures; 5. Manage the process; 6. Manage non-conforming products; 7. Allocate the personnel; 8. Manage the hygiene and safety; 9. Manage product packages; 10. Keep the data.	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Supervise and manage the entire production; 1.2 Manage and control the quality. **2.0 Principles** The person performing this task must be able to explain the following principles: 2.1 Technical standards of the process; 2.2 Technical standards for product test. **3.0 Theories** The person performing this task must be able to explain the following: 3.1 Methods of reading product process documents; 3.2 Technical requirements of product test; 3.3 Technical data of production equipment; 3.4 Non-conforming product management methods. **4.0 Essential Skills** 4.1 Communication skills; 4.2 Management skills;

	4.3 Data collection and processing skills; 4.4 Observation skills; 4.5 Organization and coordination skills; 4.6 Competence in reflecting and generating solutions. **5.0 Math Skills** 5.1 Computing tool using skills; 5.2 Measuring skills; 5.3 Skills of understanding and making drawings; 5.4 Analytical skills; 5.5 Computing skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	Production procedure organization and product quality control are performed in accordance with technical requirements and process documents.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Process document reading; 2. Testing technologies; 3. Technical data of production equipment; 4. Non-conforming product management methods; 5. Quality control; 6. Safety management; 7. Using methods of testing tools.

OCCUPATION	MECHATRONICS ENGINEER	**OCCUPATION CODE**	700
DUTY TITLE	PRODUCTION MANAGEMENT	**DUTY NO.**	701
TASK TITLE	WORKSHOP COST CONTROL	**TASK NO.**	7014
PERFORMANCE CRITERIA	The person performing this task must be able to control the workshop costs in accordance with regulations for managing the production and operation procedures.		
RANGE STATEMENT	The task can be performed in the workshop under the supervision of mechatronics engineers or mechanical engineers. The tools and equipment to be used include: 1. Printers, computers, office paper; 2. Technical and process drawings; 3. Allocation of materials; 4. Allocation of human resource; 5. Equipment operating status; 6. Standard operation procedures for the production; 7. Instructions for new equipment, technologies and processes.		

EVIDENCE REQUIREMENT

PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Control variable costs, including raw material costs (taking and distributing materials, consumption verification, utilization rate); 2. Increase the percentage of finished products (reduce the raw material waste rate); 3. Standardize the production operation; 4. Optimize the batch production; 5. Control labor costs; 6. Control other workshop costs; 7. Keep the data.	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Calculate the costs; 1.2 Control and optimize costs of all the stages. **2.0 Principles** The person performing this task must be able to explain the following principles: 2.1 Cost accounting methods; 2.2 Technologies for improving the product quality. **3.0 Theories** The person performing this task must be able to explain the following: 3.1 Cost budgeting methods; 3.2 New process knowledge; 3.3 New knowledge about operating procedures; 3.4 Cost accounting methods. **4.0 Essential Skills** 4.1 Communication skills; 4.2 Management skills; 4.3 Data collection and processing skills;

	4.4 Competence in innovation; 4.5 Organization and coordination skills; 4.6 Competence in making summaries. **5.0 Math Skills** 5.1 Computing tool using skills; 5.2 Measuring skills; 5.3 Skills of understanding and making drawings; 5.4 Analytical skills; 5.5 Computing skills; 5.6 Accounting skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	Cost accounting, process updating, preparation of budget report and instruction for new process are completed in accordance with technical requirements.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Cost budgeting methods; 2. New processes; 3. Operating procedures; 4. Process documents; 5. Quality control; 6. Safety management.

OCCUPATION	MECHATRONICS ENGINEER	**OCCUPATION CODE**	700
DUTY TITLE	PROGRAMMING AND DEBUGGING OF INDUSTRIAL ROBOT	**DUTY NO.**	702
TASK TITLE	CONNECTION OF INDUSTRIAL ROBOTS AND COMMONLY-USED PERIPHERAL EQUIPMENT	**TASK NO.**	7021
PERFORMANCE CRITERIA	The person performing this task must be able to connect industrial robots and commonly-used peripheral equipment in accordance with control needs.		
RANGE STATEMENT	The task can be performed in the manufacturing workshop under the supervision of mechatronics engineers or mechanical engineers. The tools and equipment to be used include: 1. Tools for mechanical assembly; 2. Tooling and fixtures; 3. Robots; 4. Peripheral equipment of robots; 5. Electrical wiring tools; 6. Multimeters; 7. Personal protective equipment, such as safety shoes, goggles, safety helmets and protective gloves.		

EVIDENCE REQUIREMENT	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Read the general assembly drawing and assembly process documents of a robot station or system; 2. Choose assembly tools, tooling and fixtures; 3. Assemble peripheral equipment of a robot station or system; 4. Install the electrical cabinet and so on of a robot station or system; 5. Connect the eletrical circuit for the electical cabinet of the robot; 6. Clean the tools, equipment and workplaces; 7. Arrange and store the tools and equipment.	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Mechanically install the robot station or system; 1.2 Complete the electrical connection of the robot station or system. **2.0 Principles** The person performing this task must be able to explain the following principles: 2.1 Principles of mechanical equipment assembly; 2.2 The electrical wiring principle. **3.0 Theories** The person performing this task must be able to explain the following: 3.1 Methods for reading the general assembly drawing and assembly process documents; 3.2 Methods of assembly tool, tooling and fixture usage; 3.3 Knowledge about the robot structure and peripheral equipment;

	3.4 Specification for electrical circuit connection; 3.5 Electrical operation skills and assembly methods. **4.0 Essential Skills** 4.1 Communication skills; 4.2 Management skills; 4.3 Problem analysis and problem solving skills; 4.4 Computer skills; 4.5 Self-study abilities. **5.0 Math Skills** 5.1 Computing skills; 5.2 Measuring skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	Connection of industrial robots and commonly-used peripheral equipment is performed in accordance with control needs.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Requirements of civilized on-site production; 2. Safety operation and labour protection; 3. Safe utilization of electric power; 4. Environmental protection.

OCCUPATION	MECHATRONICS ENGINEER	**OCCUPATION CODE**	700
DUTY TITLE	PROGRAMMING AND DEBUGGING OF INDUSTRIAL ROBOT	**DUTY NO.**	702
TASK TITLE	APPLICATION PROGRAMMING FOR INDUSTRIAL ROBOT UNIT	**TASK NO.**	7022
PERFORMANCE CRITERIA	The person performing this task must be able to program applications for industrial robot unit in accordance with the control needs.		
RANGE STATEMENT	The task can be performed in the manufacturing workshop under the supervision of mechatronics engineers or mechanical engineers. The tools and equipment to be used include: 1. Teaching pendant (TP); 2. Industrial robots; 3. Computers; 4. Peripheral equipment of robots; 5. Personal protective equipment, such as safety shoes, goggles, safety helmets and protective gloves.		

EVIDENCE REQUIREMENT

PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Create coordinate systems for tools and workpieces; 2. Set the loading parameters; 3. Set control parameters for the external axis of the robot; 4. Set network communication parameters of the robot system; 5. Program the program for the robot station or system using the teaching pendant (TP); 6. Use offline programming software to program the robot trajectory and generate the robot program.	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Set the coordinate systems for the tools and workpieces; 1.2 Use TP to program the industrial robot; 1.3 Program the industrial robot off-line. **2.0 Principles** The person performing this task must be able to explain the following principles: 2.1 Coordinate system defining; 2.2 Principle for TP-based progamming; 2.3 Principle for off-line programming. **3.0 Theories** The person performing this task must be able to explain the following: 3.1 Methods for defining the coordinate systems of tools and workpieces; 3.2 Load parameter setting method; 3.3 Network communication setting method; 3.4 TP-based programming method; 3.5 Methods for using off-line programming software.

	4.0 Essential Skills 4.1 Communication skills; 4.2 Problem analysis and problem solving skills; 4.3 Computer skills; 4.4 Self-study abilities. **5.0 Math Skills** 5.1 Computing tool using skills; 5.2 Measuring skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	The application of industrial robot unit is programmed in accordance with control needs.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Requirements of civilized on-site production; 2. Safety operation and labour protection; 3. Safe utilization of electric power; 4. Environmental protection.

OCCUPATION	MECHATRONICS ENGINEER	**OCCUPATION CODE**	700
DUTY TITLE	PROGRAMMING AND DEBUGGING OF INDUSTRIAL ROBOT	**DUTY NO.**	702
TASK TITLE	DEBUGGING OF INDUSTRIAL ROBOT STATIONS OR SYSTEMS	**TASK NO.**	7023
PERFORMANCE CRITERIA	The person performing this task must be able to debug the industrial robot station or system in accordance with control needs.		
RANGE STATEMENT	The task can be performed in the manufacturing workshop under the supervision of mechatronics engineers or mechanical engineers. The tools and equipment to be used include: 1. Teaching pendant (TP); 2. Industrial robots; 3. Computers; 4. Peripheral equipment of robots; 5. Personal protective equipment, such as safety shoes, goggles, safety helmets and protective gloves.		

EVIDENCE REQUIREMENT

PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Modify the program based on the position data, operating status and trajectory of the robot; 2. Adjust peripheral equipment based on the operation of the robot station or system; 3. Set the safety protection system for the robot station or system; 4. Make on-line adjustment and performance optimization for off-line programs based on the site conditions.	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Adjust and optimize the robot program; 1.2 Set the safety protection system for the robot station or system. **2.0 Principles** The person performing this task must be able to explain the following principles: 2.1 Safety protection mechanism; 2.2 Program optimization principle. **3.0 Theories** The person performing this task must be able to explain the following: 3.1 Methods of program optimization; 3.2 Methods of trajectory optimization; 3.3 Methods of process parameter optimization; 3.4 Methods for setting the safety protection system. **4.0 Essential Skills** 4.1 Communication skills; 4.2 Problem analysis and problem solving skills;

	4.3 Computer skills; 4.4 Self-study abilities. **5.0 Math Skills** 5.1 Computing tool using skills; 5.2 Measuring skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	The industrial robot station or system is debugged in accordance with control needs.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Requirements of civilized on-site production; 2. Safety operation and labour protection; 3. Safe utilization of electric power; 4. Environmental protection.

OCCUPATION	MECHATRONICS ENGINEER	**OCCUPATION CODE**	700
DUTY TITLE	OVERHAUL OF ELECTROMECHANICAL EQUIPMENT	**DUTY NO.**	703
TASK TITLE	PREPARATION OF THE EQUIPMENT OVERHAUL SCHEME	**TASK NO.**	7031
PERFORMANCE CRITERIA	The person performing this task must be able to prepare technical documents for equipment overhaul based on the pre-examination, and prepare technical data, tools, testing tools, spare parts and materials for the overhaul.		
RANGE STATEMENT	The task can be performed in the electromechanical equipment workshop under the supervision of mechatronics engineers or mechanical engineers. The tools and equipment to be used include: 1. Production tools; 2. Tooling and fixtures; 3. Disassembling tools; 4. Special fixtures; 5. Measuring tools with high precision; 6. Auxiliary tools; 7. Personal protective equipment, such as safety shoes, goggles, safety helmets and protective gloves.		

EVIDENCE REQUIREMENT

PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Pre-examine the equipment and determine the parts to be replaced or repaired; 2. Develop the technical assignment of equipment overhaul to define the main repair tasks and quality requirements of the repair; 3. Determine the dismantling order, method of the whole body and parts, as well as the data to be tested and key points of the dismantle; 4. Develop the inspection, repair and assembly processes for main parts and the technical conditions to be reached; 5. Master the precision & technical requirements and testing & measuring methods of the overall assembly procedure and assembly process; 6. Prepare the detailed list of general or special tools, testing	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Develop the overhaul scheme for the mechanical part of the equipment; 1.2 Develop the overhaul scheme for the electrical part of the equipment; 1.3 Develop the overhaul scheme for the hydraulic part of the equipment; 1.4 Develop the process for equipment overhaul. **2.0 Principles** The person performing this task must be able to explain the following principles: 2.1 Principles of mechanical equipment assembly; 2.2 Electrical control principle; 2.3 Working principle of hydraulic system. **3.0 Theories** The person performing this task must be able to explain the following: 3.1 Equipment instruction and illustrated manual reading;

tools, abrasive tools and gauges needed for the equipment overhaul; 7. Develop safety rules for the overhaul; 8. Determine quality standards for the overhaul.	3.2 Quality standards for overall assembly in the overhaul; 3.3 Methods of assembly tool, tooling and fixture usage; 3.3 Methods for repairing the basic parts; 3.4 Methods for repairing and adjusting the electrical and hydraulic system of the mechanical equipment; 3.5 Acceptance standards for the equipment overhaul. **4.0 Essential Skills** 4.1 Competence in mechanical equipment assembly; 4.2 Maintenance and debugging competence; 4.3 Problem analysis and problem solving skills; 4.4 Computer skills; 4.5 Good teamwork skills. **5.0 Math Skills** 5.1 Mathematical and logical analysis competence; 5.2 Symbol and numerical data processing competence.
DESCRIPTION OF THE END PRODUCT / SERVICE	Technical documents for equipment overhaul are prepared based on the pre-examination, with technical data, tools, testing tools, spare parts and materials in place for the overhaul.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Requirements of civilized on-site production; 2. Safety operation and labour protection; 3. Consciousness of safe and civilized production; 4. Environmental protection.

OCCUPATION	MECHATRONICS ENGINEER	**OCCUPATION CODE**	700
DUTY TITLE	OVERHAUL OF ELECTROMECHANICAL EQUIPMENT	**DUTY NO.**	703
TASK TITLE	ORGANIZATION OF EQUIPMENT OVERHAUL	**TASK NO.**	7032
PERFORMANCE CRITERIA	The person performing this task must be able to complete typical assembly, maintenance and debugging of mechanical equipment in accordance with the technical scheme of equipment overhaul.		
RANGE STATEMENT	The task can be performed in the electromechanical equipment workshop under the supervision of mechatronics engineers or mechanical engineers. The tools and equipment to be used include: 1. Production tools; 2. Tooling and fixtures; 3. Disassembling tools; 4. Special fixtures; 5. Measuring tools with high precision; 6. Auxiliary tools; 7. Personal protective equipment, such as safety shoes, goggles, safety helmets and protective gloves.		

EVIDENCE REQUIREMENT	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Determine the main contents of the overhaul plan, including reviewing the accessories, equipment data and overhaul scheme; 2. Form the leading team, technical team and safety team for the overhaul; 3. Clean the dirt and dust, and dismantle the equipment; 4. Dismantle and clean the mechanical part; 5. Inspect and classify the parts, prepare a detailed list of the parts repaired; 6. Repair and manufacture the parts, assemble and adjust the components; 7. Complete the overall assemble and make adjustments; 8. Perform debugging and trial	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Dismantle, clean, repair and replace the mechanical equipment; 1.2 Repair typical parts; 1.3 Check the quality and accuracy after equipment overhaul. **2.0 Principles** The person performing this task must be able to explain the following principles: 2.1 Principles for dismantling the mechanical equipment; 2.2 Standards for typical part repair; 2.3 Process principles for repair and assembly; 2.4 Standards for common part repair and replacement; 2.5 Quality requirement and accuracy standards for the overhaul. **3.0 Theories**

operation; 9. Check the quality and accuracy; 10. Complete the acceptance.	The person performing this task must be able to explain the following: 3.1 Disassembly and cleaning methods of the parts; 3.2 Methods of part inspection and repair; 3.3 Methods of assembly tool, tooling and fixture usage; 3.4 Methods for repairing basic universal parts; 3.5 Methods for repairing and adjusting the electrical and hydraulic system of the mechanical equipment; 3.6 Acceptance standards for the equipment overhaul. **4.0 Essential Skills** 4.1 Competence in mechanical equipment disassembly and assembly; 4.2 Maintenance and debugging competence; 4.3 Problem analysis and problem solving skills; 4.4 Quality and accuracy inspection skills; 4.5 Good teamwork skills. **5.0 Math Skills** 5.1 Mathematical and logical analysis competence; 5.2 Symbol and numerical data processing competence.
DESCRIPTION OF THE END PRODUCT / SERVICE	The assembly, maintenance and debugging of typical mechanical equipment are performed in accordance with the technical scheme for equipment overhaul.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Requirements of civilized on-site production; 2. Safety operation and labour protection; 3. Environmental protection.

OCCUPATION	MECHATRONICS ENGINEER	**OCCUPATION CODE**	700
DUTY TITLE	OVERHAUL OF ELECTROMECHANICAL EQUIPMENT	**DUTY NO.**	703
TASK TITLE	OVERALL ANALYSIS AND HANDLING OF FAULTS AND PROBLEMS	**TASK NO.**	7033
PERFORMANCE CRITERIA	The person performing this task must be able to analyse, diagnose and handle the faults in accordance with basic methods of mechanical equipment fault diagnosis.		
RANGE STATEMENT:	The task can be performed in the electromechanical equipment workshop under the supervision of mechatronics engineers or mechanical engineers. The tools and equipment to be used include: 1. Disassembling tools; 2. Tooling and fixtures; 3. Fault diagnosis instrument; 4. Measuring tools with high precision; 5. Auxiliary tools; 6. Personal protective equipment, such as safety shoes, goggles, safety helmets and protective gloves.		

EVIDENCE REQUIREMENT

PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Investigate the faults on the site; 2. Analyse the on-site faults preliminarily following an order of "electrical part first, mechanical part second"; 3. Organize consultation for overall analysis, propose basic ideas for further analysing and dealing with the faults; 5. Use item-by-item test and the consultation findings to identify the fault cause; 6. Rate the fault and find the fault position; 7. Predict the development of the fault.	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Determine the fault status in accordance with the standards for simple diagnosis; 1.2 Use vibration, temperature and other methods to diagnose the faults; 1.3 Determine the points of vibration measurement. **2.0 Principles** The person performing this task must be able to explain the following principles: 2.1 Basic laws of the generation of mechanical equipment faults; 2.2 Data analysis principle of vibration diagnosis; 2.3 Criteria used in the vibration monitoring; 2.4 Principle of vibration sensor selection. **3.0 Theories** The person performing this task must be able to explain the following: 3.1 Types and characteristics of faults; 3.2 Simple fault diagnosis methods;

	3.3 The relation between status monitoring and fault diagnosis; 3.3 Vibration diagnosis technologies; 3.4 Temperature diagnosis technologies. **4.0 Essential Skills** 4.1 Competence in working condition identification; 4.2 Signal analysis and processing competence; 4.3 Fault diagnosis competence; 4.4 Problem analysis and problem solving skills; 4.5 Good teamwork skills. **5.0 Math Skills** 5.1 Mathematical and logical analysis competence; 5.2 Symbol and numerical data processing competence.
DESCRIPTION OF THE END PRODUCT / SERVICE	Comprehensive analysis, fault and problem handling are performed based on the simple diagnosis using fault diagnosis and detecting technologies.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Requirements of civilized on-site production; 2. Safety operation and labour protection; 3. Environmental protection.

OCCUPATION	MECHATRONICS ENGINEER	**OCCUPATION CODE**	700
DUTY TITLE	OPERATION AND MAINTENANCE OF THE EQUIPMENT AND PRODUCTION LINE	**DUTY NO.**	704
TASK TITLE	ASSEMBLY OF EQUIPMENT AND UNIT MODULE OF THE PRODUCTION LINE	**TASK NO.**	7041
PERFORMANCE CRITERIA	The person performing this task must be able to assemble the equipment and unit modules of the production line in accordance with the control needs.		
RANGE STATEMENT	The task can be performed in the workshop under the supervision of mechatronics engineers or mechanical engineers. The tools and equipment to be used include: 1. Unit modules; 2. Electric tools; 3. Measuring instruments; 4. Mechanical equipment; 5. Special tools such as tool holders and wrenches; 6. Handling equipment; 7. Bundled software; 8. Personal protective equipment, such as safety shoes, goggles, safety helmets, protective gloves and insulating gloves; 9. First aid kit.		

EVIDENCE REQUIREMENT	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Read the general assembly drawing and assembly process documents of the equipment and production line (PL); 2. Prepare modules for the production line based on the production needs; 3. Choose assembly tools, tooling and fixtures; 4. Assemble the production line and connect the intelligent modules; 5. Install the electrical cabinet of installations or the production line; 6. Connect electrical circuits of equipment and the production line; 7. Complete the power-on, start and stop debugging of the single unit	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Complete the assembly and production line based on the needs; 1.2 Choose assembly tools, tooling and fixtures; 1.3 Assemble the production line and connect the intelligent modules; 1.4 Install the electrical cabinet of installations or the production line; 1.5 Connect electrical circuits of equipment and the production line. **2.0 Principles** The person performing this task must be able to explain the following principles: 2.1 Functions and working principles of each part of the equipment and production line; 2.2 Principle of electrical control system of the equipment

in accordance with the instructions for the equipment and production line; 8. Complete the power-on and debugging of on-line units in accordance with the instructions for the equipment and production line.	and production line; 2.3 Procedures of equipment and production line debugging. **3.0 Theories** The person performing this task must be able to explain the following: 3.1 Instructions for the equipment and production line, and the reading and use of the instructions; 3.2 Reading of mechanical assembly drawings of the equipment and production line; 3.3 Reading of electrical control drawings of the equipment or production line. **4.0 Essential Skills** 4.1 Communication skills; 4.2 Management skills; 4.3 Problem analysis and problem solving skills; 4.4 Technical document retrieval skills; 4.5 Self-study skills and hands-on skills. **5.0 Math Skills** 5.1 Basic mathematical skills; 5.2 Algebra skills; 5.3 Geometric skills; 5.4 Statistical skills; 5.5 Skills in probability; 5.6 Mathematical modelling skills; 5.7 Calculus skills; 5.8 Linear algebra skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	The assembly and debugging of the installations and production line are performed based on the needs.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Mechanical foundation; 2 Electrical control technology; 3. Materials science; 4. Specifications of work safety; 5. Programming operation; 6. Detection.

OCCUPATION	MECHATRONICS ENGINEER	**OCCUPATION CODE**	700
DUTY TITLE	OPERATION AND MAINTENANCE OF THE EQUIPMENT AND PRODUCTION LINE	**DUTY NO.**	704
TASK TITLE	MONITORING, OPERATION AND MAINTENANCE OF THE EQUIPMENT AND PRODUCTION LINE	**TASK NO.**	7042
PERFORMANCE CRITERIA	The person performing this task must be able to conduct the monitoring, fault handling and maintenance, daily operation and service of the equipment and production line in accordance with the requirements to ensure their safety and stable operation in the long term.		
RANGE STATEMENT	The task can be performed in the workshop under the supervision of mechatronics engineers or mechanical engineers. The tools and equipment to be used include: 1. Basic tools; 2. Electric tools; 3. Measuring instruments; 4. Mechanical equipment; 5. Special tools; 6. Monitoring instrument; 7. Bundled software; 8. Computer and supporting equipment; 9. Personal protective equipment, such as safety shoes, goggles, safety helmets, protective gloves and insulating gloves; 10. First aid kit.		

EVIDENCE REQUIREMENT	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Power on, start, operate and stop the equipment and production line; 2. Monitor the operation of the equipment and production line; 3. Judge and deal with fault signals of the equipment and production line; 4 Shut down the equipment and production line in case of emergencies; 5. Identify faults of the equipment and production line; 6. Repair faults of the equipment and production line; 7. Examine and test the equipment	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Operate the equipment and production line; 1.2 Focus on the key points of equipment and production line monitoring; 1.3 Detect and repair faults of the equipment and production line; 1.4 Conduct daily maintenance and examination of the equipment and production line. **2.0 Principles** The person performing this task must be able to explain the following principles: 2.1 Working principle of the equipment and production line;

and product line after the maintenance; 8. Conduct daily maintenance and examination of the equipment and production line.	2.2 Principle for equipment and production line monitoring during their operation; 2.3 Principle for dealing with and repairing faults indicated by the signals; 2.4 Principle and purpose of daily maintenance and examination. **3.0 Theories** The person performing this task must be able to explain the following: 3.1 Instructions for the equipment and production line, and the reading and use of the instructions; 3.2 Reading and using of instructions for the equipment and production line; 3.3 Mechanical principle of the parts of the equipment and production line; 3.4 Principle of electrical control of the equipment and production line; 3.5 Methods for troubleshooting, repairing and replacing faults of mechanical parts or electrical control circuits. **4.0 Essential Skills** 4.1 Communication skills; 4.2 Management skills; 4.3 Problem analysis and problem solving skills; 4.4 Technical document retrieval skills; 4.5 Self-study skills and hands-on skills. **5.0 Math Skills** 5.1 Basic mathematical skills; 5.2 Algebra skills; 5.3 Geometric skills; 5.4 Statistical skills; 5.5 Skills in probability; 5.6 Mathematical modelling skills; 5.7 Calculus skills; 5.8 Linear algebra skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	The monitoring, fault handling and maintenance, daily operation and service of the equipment and production line are conducted in accordance with the requirements to ensure their safety and stable operation in the long term.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Mechanical foundation; 2. Electrical control technology; 3. Materials science;

	4. Specifications of work safety; 5. Programming operation; 6. Detection.

OCCUPATION	MECHATRONICS ENGINEER	**OCCUPATION CODE**	700
DUTY TITLE	AFTERSALES SERVICE FOR ELECTROMECHANICAL EQUIPMENT	**DUTY NO.**	705
TASK TITLE	ON-SITE TECHNICAL SUPPORT	**TASK NO.**	7051
PERFORMANCE CRITERIA	The person performing this task must be able to provide technical support for customers in accordance with technical requirements and specifications.		
RANGE STATEMENT	The task can be performed remotely or on-site under the supervision of mechatronics engineers or mechanical engineers. The tools and equipment to be used include: 1. Mechanical maintenance tools; 2. Electrical maintenance tools; 3. Maintenance equipment; 4. Equipment parts; 5. Traffic tools; 6. Communication tools; 7. Personal protective equipment.		

EVIDENCE REQUIREMENT

PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Complete on-site/remote maintenance of electromechanical equipment to normalize the equipment operation for the customers; 2. Provide customer trainings in equipment use and maintenance; 3. Maintain the equipment regularly; 4. Upgrade the software and hardware of the equipment; 5. Provide timely technical support such as technical data, maintenance manual, instructions and fault removal service for the customers; 6. Provide technical support including equipment part supply and replacement for the customers.	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Operate the electromechanical equipment; 1.2 Maintain the electrical control system of electromechanical equipment; 1.3 Update or upgrade the equipment. **2.1 Principles** The person performing this task must be able to explain the following principles: 2.1 Electrical control principle; 2.2 Mechanical foundation. **3.0 Theories** The person performing this task must be able to explain the following: 3.1 Procedures of equipment testing; 3.2 Specifications for electromechanical equipment installation; 3.3 Methods of reading mechanical drawings; 3.4 Electrical drawing reading skills. **4.0 Essential Skills**

	4.1 Communication skills; 4.2 Writing skills; 4.3 Fault analysis skills; 4.4 Innovation skills; 4.5 Equipment installation skills; 4.6 Skills in using commonly-used mechanical tools; 4.7 Skills in using commonly-used electrical tools; 4.8 Equipment software upgrading skills; 4.9 Equipment hardware upgrading skills; 4.10 Customer service skills; 4.11 Teamwork skills. **5.0 Math Skills** 5.1 Basic mathematical skills; 5.2 Algebra skills; 5.3 Geometric skills; 5.4 Statistical skills; 5.5 Skills in probability; 5.6 Calculus skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	Technical support is provided in accordance with technical requirements and customer needs.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Safety operation specifications of the equipment; 2. Safe utilization of electric power; 3. Operating procedures of electromechanical equipment maintenance; 4. Specification for the disposal of scrap parts.

OCCUPATION	MECHATRONICS ENGINEER	**OCCUPATION CODE**	700
DUTY TITLE	AFTERSALES SERVICE FOR ELECTROMECHANICAL EQUIPMENT	**DUTY NO.**	705
TASK TITLE	EQUIPMENT SERVICE CONDITION TRACKING	**TASK NO.**	7052
PERFORMANCE CRITERIA	The person performing this task must be able to track, follow up and record the basic information and service conditions of the equipment in accordance with technical requirements, occupational health and safety specifications.		
RANGE STATEMENT	The task can be performed in the workshop under the supervision of mechatronics engineers or mechanical engineers. The tools and equipment to be used include: 1. User manual of the equipment; 2. Archive; 3. Service record sheet; 4. Communication tools; 5. Report generating tools; 6. Laptops; 7. Equipment marking tools; 8. Database system; 9. Software.		

EVIDENCE REQUIREMENT	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Deal with and timely report technical complaints from the customers, inform the customers of the results timely and make regular follow-ups; 2. Follow the equipment service condition and timely remove the faults for the customers; 3. Fill in the equipment service record in detail to set up a complete set of equipment service archive.	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Perform customer communication, feedback and follow-up tasks; 1.2 Track, follow and record basic equipment information; 1.3 Track, follow and record the equipment service conditions; 1.4 Train the customers regularly in equipment maintenance; 1.5 Fill in the equipment service record sheet in detail to set up a complete set of equipment service archive. **2.0 Principles** The person performing this task must be able to explain the following principles: 2.1 Aftersales service principle; 2.2 Customer follow-up procedures; 2.3 Principle for keeping the service files.

	3.0 Theories The person performing this task must be able to explain the following: 3.1 Equipment management methods; 3.2 Archive management methods; 3.3 Methods for recording the follow-ups. **4.0 Essential Skills** 4.1 Communication skills; 4.2 Management skills; 4.3 Problem analysis and problem solving skills; 4.4 Computer skills; 4.5 Self-study abilities; 4.6 Data collection and processing; 4.7 Survey of user needs; 4.8 Analysis of customer needs; 4.9 Coordination skills; 4.10 Intellectual property protection regulations. **5.0 Math Skills** 5.1 Basic mathematical skills; 5.2 Algebra skills; 5.3 Geometric skills; 5.4 Statistical skills; 5.5 Skills in probability; 5.6 Calculus skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	The basic information and service conditions of the equipment is tracked, followed and recorded in accordance with technical requirements, occupational health and safety specifications.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Requirements of civilized on-site production; 2. Safety operation and labour protection; 3. Safety operation skills; 4. Service follow-up methods and principles.

OCCUPATION	MECHATRONICS ENGINEER	**OCCUPATION CODE**	700
DUTY TITLE	AFTERSALES SERVICE FOR ELECTROMECHANICAL EQUIPMENT	**DUTY NO.**	705
TASK TITLE	ORGANIZATION OF TRAININGS IN EQUIPMENT MAINTENANCE	**TASK NO.**	7053
PERFORMANCE CRITERIA	The person performing this task must be able to organize trainings in equipment maintenance in accordance with technical requirements and occupational health and safety specifications.		
RANGE STATEMENT	The task can be performed at the seminar or remotely under the supervision of mechatronics engineers or mechanical engineers. The tools and equipment to be used include: 1. The training venue; 2. Multimedia equipment; 3. Training room or site; 4. Model equipment; 5. Tool and equipment maintenance kit; 6. Laptops and projectors; 7. Whiteboards; 8. Marker pen; 9. Desks; 10. Chairs; 11. Leaflet for the activity; 12. Pens.		

EVIDENCE REQUIREMENT	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Introduce basic knowledge about the equipment; 2. Introduce common faults of the equipment and maintenance methods; 3. Introduce the preventative maintenance of the equipment; 4. Demonstrate the use of maintenance tools; 5. Demonstrate the safety operation and maintenance; 6. Make communication and discussions.	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Maintain the equipment; 1.2 Maintain and operate the equipment; 1.3 Master the safety operation specifications; 1.4 Write the equipment maintenance report. **2.0 Principles** The person performing this task must be able to explain the following principles: 2.1 Principle and structure of the equipment; 2.2 Training skills. **3.0 Theories** The person performing this task must be able to explain the following:

	3.1 The importance of equipment maintenance; 3.2 Diagnosis and troubleshooting of faults; 3.3 SOPs; 3.4 Multimedia equipment operation; 3.5 Application of new technologies and materials. **4.0 Essential Skills** 4.1 Knowledge spreading skills; 4.2 Supervision skills; 4.3 Feedback skills; 4.4 Communication skills; 4.5 Teamwork skills; 4.6 Teaching skills; 4.7 Technology updating skills; 4.8 Organization skills; 4.9 Interaction skills; 4.10 Multimedia production skills; 4.11 Report writing skills. **5.0 Math Skills** 5.1 Basic mathematical skills; 5.2 Algebra skills; 5.3 Geometric skills; 5.4 Statistical skills; 5.5 Skills in probability; 5.6 Calculus skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	Targeted training seminars are organized in accordance with technical requirements and customer needs.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Safety operation specifications of the equipment; 2. Safe utilization of electric power; 3. Operating procedures of electromechanical equipment maintenance; 4. Specification for the disposal of scrap parts; 5. Training procedures and specifications.

OCCUPATION	MECHATRONICS ENGINEER	**OCCUPATION CODE**	700
DUTY TITLE	AFTERSALES SERVICE FOR ELECTROMECHANICAL EQUIPMENT	**DUTY NO.**	705
TASK TITLE	ESTABLISHMENT OF EQUIPMENT SERVICE FILES	**TASK NO.**	7054
PERFORMANCE CRITERIA	The person performing this task must be able to establish and manage technical files in accordance with technical requirements and management standards.		
RANGE STATEMENT	The task can be performed in the archive under the supervision of mechatronics engineers or mechanical engineers. The tools and equipment to be used include: 1. Computers; 2. Database software; 3. Document editing software; 4. Scanners; 5. Cameras; 6. Measuring tools; 7. Calculators; 8. Operation manual; 9. Maintenance manuals; 10. Communication tools; 11. Safety equipment.		

EVIDENCE REQUIREMENT	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Keep the technical manuals, part manuals, part price lists, technical diagrams, technical instructions and magazines and other necessary materials of the company's products; 2. Keep the electromechanical equipment maintenance file in a centralized manner; 3. Keep the documents of key electromechanical equipment; 4. Keep installation and debugging records and acceptance report of equipment, and agreements for entrusted electromechanical equipment installation and testing; 5. Keep the regular maintenance records, part replacement records, major fault handling records, equipment operation records/ledgers and so on. 6. Keep technical verification materials,	**Detailed knowledge about: Unified specifications of punctuations.** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Collect equipment documents; 1.2 Process and analyze equipment documents; 1.3 Sort out the equipment documents. **2.0 Principles** The person performing this task must be able to explain the following principles: 2.1 File management system; 2.2 The system for filing and managing the electromechanical equipment documents. **3.0 Theories** The person performing this task must be able to explain the following: 3.1 Methods for reporting the overall condition

reports and replies from competent departments regarding obsolete equipment; 7. Check the materials and files of electromechanical equipment on a semi-annual basis and timely deal with problems identified.	of the equipment; 3.2 Bases of equipment use, management and maintenance; 3.3 Service file management methods. **4.0 Essential Skills** 4.1 Modern management skills; 4.2 File management system; 4.3 The system for filing and managing the electromechanical equipment documents; 4.4 File classification and sorting; 4.5 Arrangement of files; 4.6 Modern equipment use; 4.7 Technical file management skills; 4.8 Communication skills; 4.9 Teamwork skills; 4.10 Safety operation; 4.11 Document editing skills; 4.12 Knowledge in labels and barcodes. **5.0 Math Skills** 5.1 Basic mathematical skills; 5.2 Algebra skills; 5.3 Geometric skills; 5.4 Statistical skills; 5.5 Skills in probability; 5.6 Calculus skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	The technical files are established and managed in accordance with technical requirements and management standards.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. File keeping; 2. Specifications of safety protections; 3. Filing; 4. Knowledge of electromechanical equipment.

TABLE 1: DACUM CHARTS FOR MECHATRONICS ENGINEER - NTA 7

DUTIES	TASKS	ENABLERS
1.0 Production management	1.1 Fulfillment of customer needs. 1.2 Production arrangement in accordance with the production plan. 1.3 Production process management. 1.4 Control of workshop production costs.	**General skills and knowledge** · Cooperation with others using communication skills and conveying of messages to the subordinators · Use of the manufacturer's manual · Knowledge of work safety in workshops · Interpretation of technical drawings · Development of production technologies · Product quality management · Accounting and control of production costs · Production process management · Occupational health and safety **Tools and equipment** · Printers · Computes · Office paper · Technical and process drawings · Allocation of materials; · Allocation of human resource; · Equipment operating status · Standard operation procedures for the production · Work plan for key control points · Quality testing tools · Personal protective equipment, such as safety shoes, goggles, safety helmets and protective gloves **Materials** · Office paper · Testing tools **Requirements for employees** · Teamwork spirit · Safety consciousness · Quality consciousness

DUTIES	TASKS	ENABLERS
2.0 Programming and debugging of industrial robot	2.1 Connection of industrial robots and commonly-used peripheral equipment. 2.2 Application programming for industrial robot unit. 2.3 Debugging of industrial robot stations or systems.	**General skills and knowledge** · Cooperation with others using communication skills and submission of reports to the superiors · Use of the manufacturer's manual · Knowledge of work safety in workshops · Interpretation of technical drawings · Mechanical installation of the robot station or system; · Electrical connection of the robot station or system · TP-based programming and off-line programming of robots · Adjustment and optimization of robot program · Occupational health and safety **Tools and equipment** · Tools for mechanical assembly · Tooling and fixtures · Robot · Peripheral equipment of robots · Electrical wiring tool; · Teaching Pendant (TP) · Computer · Multimeter · Personal protective equipment, such as safety shoes, goggles, safety helmets and protective gloves **Materials** · Connecting cable · Hydraulic and pneumatic elements · Sensors **Requirements for employees** · Teamwork spirit · Safety consciousness · Integrity · Quality consciousness

DUTIES	TASKS	ENABLERS
3.0 Overhaul of electromechanical equipment	3.1 Preparation of the equipment overhaul scheme. 3.2 Organization of equipment overhaul. 3.3 Overall analysis and handling of faults and problems.	**General skills and knowledge** · Development of the equipment overhaul plan · Preparation of the maintenance process and specifications · Development of the technical scheme for mechanical equipment overhaul · Process and procedures of the overhaul · Knowledge of work safety in workshops · Interpretation of technical illustrations and maintenance plan · Troubleshooting techniques · Disassembly, cleaning and assembly of general equipment · Repairing methods for typical parts · Occupational health and safety **Tools and equipment** · Tools for mechanical disassembly and assembly · Tooling and fixtures · Lifting equipment · Oil filling equipment · Fault diagnosis instrument · Accuracy measuring tool · Computer · Multimeter · Personal protective equipment, such as safety shoes, goggles, safety helmets and protective gloves **Materials** · Spare parts for repair or replacement · Special tools, testing tools and abrasive tools **Requirements for employees** · Teamwork spirit · Pursuit of excellence · Safety consciousness

DUTIES	TASKS	ENABLERS
		· Quality consciousness · Time management
4.0 Operation and maintenance of the equipment and production line	4.1 Unit module equipped with and integrating intelligent operation and maintenance system. 4.2 Monitoring, operation and maintenance of the equipment and production line.	**General skills and knowledge** · Communication skills · Management skills · Problem analysis and problem solving skills; · Technical document retrieval skills · Self-study skills and hands-on skills · Mechanical foundation · Electrical control technology · Materials science · Specifications of work safety · Programming operation · Detection **Tools and equipment** · Basic tools · Electric tools · Measuring instruments · Mechanical equipment · Special tools · Handling tools · Bundled software · PPE · First aid kit **Materials** · Connecting cable · Unit modules · Electrical element **Requirements for employees** · Sense of responsibility · Teamwork spirit · Communication skills · Knowledge updating skills · Safety consciousness · Quality consciousness
5.0 Aftersales service for	5.1 On-site technical support. 5.2 Equipment service	**General skills and knowledge** · Use of communication skills

DUTIES	TASKS	ENABLERS
electromechanical equipment	condition tracking. 5.3 Organization of trainings in equipment maintenance.	· Use of the manufacturer's manual · Tool using skills · Teamwork skills · Customer service skills · Coordination skills · Electromechanical equipment manual reading skills · Safety operation · Multimedia using skills **Tools and equipment** · Multimedia · Computer · Equipment manual · Maintenance tools · Equipment parts · Communication tools; · PPE · Measuring tools · Pen **Materials** · Paper · Equipment components · Equipment labels **Requirements for employees** · Teamwork spirit · Communication skills · Knowledge updating skills · Safety consciousness · Quality consciousness