NATIONAL COUNCIL FOR TECHNICAL AND VOCATIONAL EDUCATION AND TRAINING

APRIL 2023

PROPOSED OCCUPATIONAL STANDARDS

OCCUPATION: MECHANICAL EQUIPMENT INSTALLATION TECHNICIAN

LEVEL: NTA 5

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ABBREVIATIONS

CAD	Computer-aided Design
CBET	Competency Based Education and Training
MOPP	Maintenance Operational Procedures
NACTVET	National Council for Technical and Vocational Education and Training
NOS	National Occupational Standards
OS	Occupational Standards
PLC	Programmable Logic Controller
PPT	PowerPoint
QC	Quality Control
TET	Technical Education and Training
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 of Tanzania 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 Occupational 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 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 Mechanical Equipment Installation 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 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 experts 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, experienced mechanical equipment installation technicians were key informants in the survey to discover occupational trends. The 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. At least 3 online surveys were completed by experts from the labour market across the country. Apart from the survey 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 28 participants from different parts of the country representing various companies.

3.0. THE SCOPE AND OVERVIEW OF THE OCCUPATION STANDARDS FOR MECHANICAL EQUIPMENT INSTALLATION TECHNICIANS

The standards cover a broad range of duties and tasks that can be performed by a Mechanical Equipment Installation 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 Mechanical Equipment Installation Technician may perform tasks in a number of key areas of the Occupational Standards, but not necessarily in all areas. For example, in large operations, other individuals may be employed or designated to perform specific tasks.

The Mechanical Equipment Installation Technician uses machines and tools in the installation and commissioning of mechanical equipment. Generally, the Mechanical Equipment Installation Technician performs the following responsibilities:

a) Preparations before operation
b) Assembly of typical components
c) Production and installation of typical mechanical components
d) Installation of auxiliary pipeline
e) General equipment installation
f) Special equipment installation
g) General equipment commissioning
h) Special equipment commissioning
i) Assembly and commissioning of typical equipment
j) Maintenance of general equipment
k) Maintenance of special equipment
l) Maintenance of typical equipment
m) Organization and management of mechanical equipment installation

The Occupational Standards have been clustered into NTA qualification levels, i.e. NTA 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 MECHANICAL EQUIPMENT INSTALLATION TECHNICIAN – NTA 5

OCCUPATION	MECHANICAL EQUIPMENT INSTALLATION TECHNICIAN	**OCCUPATION CODE**	
DUTY TITLE	PREPARATIONS BEFORE OPERATION	**DUTY NO.**	501
TASK TITLE	READING OF DRAWINGS AND OTHER TECHNICAL DATA	**TASK NO.**	5011
PERFORMANCE CRITERIA	The person performing this task must be able to read the knowledge in complex engineering drawing and technical scheme of larger construction projects.		
RANGE STATEMENT	The task can be performed in the mechanical equipment installation workshop under the supervision of senior mechanical equipment installation technician or mechanical engineers. The tools and equipment to be used include: 1. A complete set of drawing instruments; 2. A complete set of testing tools; 3. Installation drawings; 4. Technical documents for test run; 5. Technical document for construction organization design or technical scheme of the construction; 6. General specifications and quality standards for the installation of mechanical equipment; 7. Personal protective equipment, such as safety helmet, safety shoes, goggles and protective gloves.		

EVIDENCE REQUIREMENT	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Read various installation plans, general drawings for station equipment, assembly drawings of higher complexity, electrical control drawings, pipeline drawings, and related building drawings; 2. Read technical documents for the test run of complex equipment and equipment with high rotation speed; 3. Read technical documents such as organization design or technical scheme of larger construction projects; 4. Prepare a summary report.	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Understand the design intent; 1.2 Understand the project tasks; 1.3 Read technical schemes; 1.4 Prepare a summary report. **2.0 Principles** The person performing this task must be able to explain the following principles: 2.1 National standards of drawing; 2.2 Use of measuring tools; 2.3 Principle of dimensional measurement; 2.4 Technical documents such as construction organization design and technical scheme of the construction; 2.5 General specifications and quality standards for the installation of mechanical equipment.

	3.0 Theories The person performing this task must be able to explain the following: 3.1 Knowledge about mechanical drawing; 3.2 Knowledge about tolerance fit and technical measurement; 3.3 Knowledge about mechanical design and mechanical principles. **4.0 Essential Skills** 4.1 Communication skills; 4.2 Customer service skills; 4.3 Teamwork skills; 4.4 Report writing skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	Drawings and other technical data are read.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. The use and maintenance of drawing instruments and tools; 2. Basic knowledge about general specifications and quality standards for the installation of mechanical equipment.

OCCUPATION	MECHANICAL EQUIPMENT INSTALLATION TECHNICIAN	**OCCUPATION CODE**	
DUTY TITLE	PREPARATIONS BEFORE OPERATION	**DUTY NO.**	501
TASK TITLE	PREPARING MACHINES AND TOOLS FOR THE ASSEMBLY AND CHECKING WORK CONDITIONS	**TASK NO.**	5012
PERFORMANCE CRITERIA	The person performing this task must be able to prepare construction machines and tools and testing tools and check working conditions.		
RANGE STATEMENT	The task can be performed in the mechanical equipment installation workshop under the supervision of senior mechanical equipment installation technician or mechanical engineers. The tools and equipment to be used include: 1. Machines and tools for mechanical equipment installation; 2. Testing tools; 3. Installation materials; 4. Plan for safety implementation; 5. Technical standards; 6. General specifications and quality standards for the installation of mechanical equipment; 7. Personal protective equipment, such as safety helmet, safety shoes, goggles and protective gloves.		

EVIDENCE REQUIREMENT	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Propose plans for construction machines and tools, testing tools, installation materials, and safety facilities based on the project needs; 2. Carry out technical quality inspection on construction machines and tools and materials; 3. Inspect the basic appearance, built-in and embedded parts, surrounding environment, road, center, elevation benchmark and so on to check the installation conditions; 4. Inspect the safety facilities and tools.	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Prepare for the construction; 1.2 Prepare the construction plan; 1.3 Check the installation conditions. **2.0 Principles** The person performing this task must be able to explain the following principles: 2.1 Principle of preparing assembly machines and tools; 2.2 The safety facilities planning principle; 2.3 Knowledge about technical quality inspection. **3.0 Theories** 3.1 The person performing this task must be able to explain the following: 3.2 Commonly-used mechanical equipment installation tools and their types; 3.3 Commonly-used testing tools for mechanical

	equipment installation; 3.4 Procedures of mechanical equipment installation; 3.5 Items included in basic inspection and acceptance; 3.6 Items included in safety facility and tool inspection. **4.0 Essential Skills** 4.1 Communication skills; 4.2 Customer service skills; 4.3 Teamwork skills; 4.4 Report writing skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	Construction and testing machines and tools are prepared and working conditions are checked.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Machines and tools, instruments, materials and safety facilities; 2. Occupational health and safety.

OCCUPATION	MECHANICAL EQUIPMENT INSTALLATION TECHNICIAN	**OCCUPATION CODE**	
DUTY TITLE	PREPARATIONS BEFORE OPERATION	**DUTY NO.**	501
TASK TITLE	LABOR PROTECTION	**TASK NO.**	5013
PERFORMANCE CRITERIA	The person performing this task must be able to complete labour protection, safety management and other related jobs based on the equipment installation needs.		
RANGE STATEMENT	The task can be performed in the mechanical equipment installation workshop under the supervision of senior mechanical equipment installation technician or mechanical engineers. The tools and equipment to be used include: 1. Construction machines and tools; 2. Safety protection equipment and tools: Safety rope, falling protector, sound-proof tools and so on; 3. Personal protective equipment: safety belts, safety helmets, work clothes, safety shoes, goggles, protective gloves, etc.; 4. Safety technical regulations and rules.		

EVIDENCE REQUIREMENT

PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Develop safety rules and regulations for mechanical equipment installers; 2. Prepare labour protection equipment based on the construction needs; 3. Implement safety technical regulations and rules to ensure the safety of production equipment	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Develop safety rules and regulations; 1.2 Prepare labour protection equipment; 1.3 Ensure the implementation of safety standards for production equipment. **2.0 Principles** The person performing this task must be able to explain the following principles: 2.1 Safety rules and regulations for mechanical equipment installers; 2.2 Safety technical regulations for mechanical equipment, electrical equipment and construction engineering. **3.0 Theories** The person performing this task must be able to explain the following: 3.1 Correct use and wearing of labour protection equipment; 3.2 Safety technical regulations for mechanical equipment; 3.3 Safety technical regulations for electrical equipment; 3.4 Safety technical regulations for the construction and

	engineering. **4.0 Essential Skills** 4.1 Communication skills; 4.2 Customer service skills; 4.3 Teamwork skills; 4.4 Report writing skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	Labour protection is carried out based on circumstantial knowledge regarding the Labor Law, Construction Law and Environmental Protection Law.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Basic knowledge about occupational health; 2. Scientific production requirements for mechanical equipment installation; 3. Knowledge about operational safety.

OCCUPATION	MECHANICAL EQUIPMENT INSTALLATION TECHNICIAN	**OCCUPATION CODE**	
DUTY TITLE	ASSEMBLY OF TYPICAL COMPONENTS	**DUTY NO.**	502
TASK TITLE	COUPLING INSTALLATION	**TASK NO.**	5021
PERFORMANCE CRITERIA	The person performing this task must be able to install couplings.		
RANGE STATEMENT	The task can be performed in the mechanical equipment installation workshop under the supervision of senior technicians or mechanical engineers. The tools and equipment to be used include: 1. A complete set of drawing instruments; 2. A complete set of testing tools; 3. Installation drawings; 4. Technical documents for test run; 5. Technical document for construction organization design or technical scheme of the construction 5. General specifications and quality standards for the installation of mechanical equipment; 6. Personal protective equipment, such as safety helmet, safety shoes, goggles and protective gloves.		

EVIDENCE REQUIREMENT	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Measure and inspect the couplings; 2. Install the couplings on the axis; 3. Adjust the concentricity of the couplings.	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Read drawings of couplings; 1.2 Read the mechanical equipment assembly drawing. **2.0 Principles** The person performing this task must be able to explain the following principles: 2.1 Principle in the Installation drawings; 2.2 Technical scheme of the construction. **3.0 Theories** The person performing this task must be able to explain the following: 3.1 Knowledge about mechanical drawing; 3.2 Knowledge about tolerance fit and technical measurement; 3.3 Knowledge about mechanical design and mechanical principles; 3.4 Knowledge about the measurement of couplings; 3.5 Knowledge about the installation of couplings and the

	use of machines and tools; 3.6 Method of regulating the concentricity of couplings. **4.0 Essential Skills** 4.1 Communication skills; 4.2 Customer service skills; 4.3 Teamwork skills; 4.4 Report writing skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	The couplings are installed.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Basic knowledge about occupational health; 2. Scientific production requirements for mechanical equipment installation; 3. Knowledge about operational safety.

OCCUPATION	MECHANICAL EQUIPMENT INSTALLATION TECHNICIAN	**OCCUPATION CODE**	
DUTY TITLE	ASSEMBLY OF TYPICAL COMPONENTS	**DUTY NO.**	502
TASK TITLE	INSTALLATION OF ROLLER BEARING	**TASK NO.**	5022
PERFORMANCE CRITERIA	The person performing this task must be able to install roller bearings in accordance with engineering needs.		
RANGE STATEMENT	The task can be performed in the mechanical equipment installation workshop under the supervision of senior technicians or mechanical engineers. The tools and equipment to be used include: 1. Machines and tools for mechanical equipment installation; 2. Testing tools; 3. Installation materials; 4. Plan for safety implementation; 5. Technical standards; 6. General specifications and quality standards for the installation of mechanical equipment; 7. Personal protective equipment, such as safety helmet, safety shoes, goggles and protective gloves.		

EVIDENCE REQUIREMENT	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Install the bearing in the axis and the bearing seat hole; 2. Adjust the bearing clearance according to the requirements.	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Prepare for the construction; 1.2 Prepare the construction plan; 1.3 Check the installation conditions. **2.0 Principles** The person performing this task must be able to explain the following principles: 2.1 Principles for selecting assembly machines and tools; 2.2 Construction conditions. **3.0 Theories** The person performing this task must be able to explain the following: 3.1 Commonly-used mechanical equipment installation tools and their types; 3.2 Commonly-used testing tools for mechanical equipment installation; 3.3 Procedures of mechanical equipment installation; 3.4 Items included in basic inspection and acceptance;

	3.5 Items included in safety facility and tool inspection. **4.0 Essential Skills** 4.1 Communication skills; 4.2 Customer service skills; 4.3 Teamwork skills; 4.4 Report writing skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	Roller bearings are installed according to engineering requirements.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Basic knowledge about occupational health; 2. Scientific production requirements for mechanical equipment installation; 3. Knowledge about operational safety; 4. Knowledge about tolerance and fit.

OCCUPATION	MECHANICAL EQUIPMENT INSTALLATION TECHNICIAN	**OCCUPATION CODE**	
DUTY TITLE	ASSEMBLY OF TYPICAL COMPONENTS	**DUTY NO.**	502
TASK TITLE	INSTALLATION OF SLIDING BEARING	**TASK NO.**	5023
PERFORMANCE CRITERIA	The person performing this task must be able to install sliding bearings in accordance with engineering needs.		
RANGE STATEMENT	The task can be performed in the mechanical equipment installation workshop under the supervision of senior technicians or mechanical engineers. The tools and equipment to be used include: 1. Construction machines and tools; 2. Safety protection equipment and tools: Safety rope, falling protector, sound-proof tools and so on; 3. Personal protective equipment: safety belts, safety helmets, work clothes, safety shoes, goggles, protective gloves, etc.; 4. Safety technical regulations and rules.		

EVIDENCE REQUIREMENT	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Wash and inspect the bearings and inspect the back of bearing shell and the seat hole; 2. Scrap and adjust the bearing shell; 3. Complete all the installation tasks and record the installation and adjustment.	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Develop safety rules and regulations; 1.2 Prepare labour protective equipment; 1.3 Ensure the implementation of safety standards for production equipment. **2.0 Principles** The person performing this task must be able to explain the following principles: 2.1 Labour protection; 2.2 Safety. **3.0 Theories** The person performing this task must be able to explain the following: 3.1 Correct use and wearing of labour protection equipment; 3.2 Safety technical regulations for mechanical equipment; 3.3 Safety technical regulations for electrical equipment; 3.4 Safety technical regulations for the construction and engineering;

	3.5 Knowledge about bearing inspection; 3.6 Method of scrapping and adjusting bearing shell; 3.7 Knowledge about installation and quality inspection of sliding bearing. **4.0 Essential Skills** 4.1 Communication skills; 4.2 Customer service skills; 4.3 Teamwork skills; 4.4 Report writing skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	Sliding bearings are installed according to engineering requirements.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Basic knowledge about occupational health; 2. Scientific production requirements for mechanical equipment installation; 3. Knowledge about operational safety.

OCCUPATION	MECHANICAL EQUIPMENT INSTALLATION TECHNICIAN	**OCCUPATION CODE**	
DUTY TITLE	ASSEMBLY OF TYPICAL COMPONENTS	**DUTY NO.**	502
TASK TITLE	COOL (HOT) ASSEMBLY OF AXES AND SLEEVES	**TASK NO.**	5024
PERFORMANCE CRITERIA	The person performing this task must be able to complete cool (hot) assembly of axes and sleeves based on equipment installation needs.		
RANGE STATEMENT	The task can be performed in the mechanical equipment installation workshop under the supervision of senior technicians or mechanical engineers. The tools and equipment to be used include: 1. Construction machines and tools; 2. Safety protection equipment and tools: Safety rope, falling protector, sound-proof tools and so on; 3. Personal protective equipment: safety belts, safety helmets, work clothes, safety shoes, goggles, protective gloves, etc.; 4. Safety technical regulations and rules.		

EVIDENCE REQUIREMENT

PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Check the axis-sleeve fit; 2. Choose the heating (or cooling) method; 3. Complete the hot (cool) assembly and mechanical press fitting of bearings and sleeves.	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Develop safety rules and regulations; 1.2 Prepare labour protective equipment; 1.3 Ensure the implementation of safety standards for production equipment. **2.0 Principles** The person performing this task must be able to explain the following principles: 2.1 Safety principle **3.0 Theories** The person performing this task must be able to explain the following: 3.1 Correct use and wearing of labour protection equipment; 3.2 Safety technical regulations for mechanical equipment; 3.3 Safety technical regulations for electrical equipment; 3.4 Safety technical regulations for the construction and engineering; 3.5 Method for measuring and inspecting the axes and sleeves;

	3.6 Knowledge about the heating (cooling) method of axes and sleeves; 3.7 Knowledge about major heating and hot assembly operations of axes and sleeves. **4.0 Essential Skills** 4.1 Communication skills; 4.2 Customer service skills; 4.3 Teamwork skills; 4.4 Report writing skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	Cool (heat) assembly of axes and sleeves is completed.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Basic knowledge about occupational health; 2. Scientific production requirements for mechanical equipment installation; 3. Knowledge about operational safety.

OCCUPATION	MECHANICAL EQUIPMENT INSTALLATION TECHNICIAN	**OCCUPATION CODE**	
DUTY TITLE	ASSEMBLY OF TYPICAL COMPONENTS	**DUTY NO.**	502
TASK TITLE	GEAR INSTALLATION	**TASK NO.**	5025
PERFORMANCE CRITERIA	The person performing this task must be able to install the gear based on the equipment installation needs.		
RANGE STATEMENT	The task can be performed in the mechanical equipment installation workshop under the supervision of senior technicians or mechanical engineers. The tools and equipment to be used include: 1. Construction machines and tools; 2. Safety protection equipment and tools: Safety rope, falling protector, sound-proof tools and so on; 3. Personal protective equipment: safety belts, safety helmets, work clothes, safety shoes, goggles, protective gloves, etc.; 4. Safety technical regulations and rules.		

EVIDENCE REQUIREMENT	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Inspect the fit dimensions, surface roughness, geometry and geometric tolerances; 2. Select the installation method and construction machines and tools and install the gear onto the axis; 3. Inspect the installation quality.	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Develop safety rules and regulations; 1.2 Prepare labour protective equipment; 1.3 Ensure the implementation of safety standards for production equipment. **2.0 Principles** The person performing this task must be able to explain the following principles: 2.1 Safety principle **3.0 Theories** The person performing this task must be able to explain the following: 3.1 Correct use and wearing of labour protection equipment; 3.2 Safety technical regulations for mechanical equipment; 3.3 Safety technical regulations for electrical equipment; 3.4 Safety technical regulations for the construction and engineering; 3.5 Methods of gear inspection; 3.6 Method of gear installation, and knowledge about

	machines and tools and their use; 3.7 Knowledge about and testing method of gear installation quality. **4.0 Essential Skills** 4.1 Communication skills; 4.2 Customer service skills; 4.3 Teamwork skills; 4.4 Report writing skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	Gear installation is completed.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Basic knowledge about occupational health; 2. Scientific production requirements for mechanical equipment installation; 3. Knowledge about operational safety.

OCCUPATION	MECHANICAL EQUIPMENT INSTALLATION TECHNICIAN	**OCCUPATION CODE**	
DUTY TITLE	INSTALLATION OF AUXILIARY PIPELINE	**DUTY NO.**	503
TASK TITLE	INSTALLATION OF CARBON STEEL PIPELINE	**TASK NO.**	5031
PERFORMANCE CRITERIA	The person performing this task must be able to measure the pipeline, prefabricate the pipeline materials, and install the pipeline.		
RANGE STATEMENT	The task can be performed in the mechanical equipment installation workshop under the supervision of senior technicians or mechanical engineers. The tools and equipment to be used include: 1. A complete set of drawing instruments; 2. A complete set of testing tools; 3. Installation drawings; 4. Technical documents for test run; 5. Technical document for construction organization design or technical scheme of the construction; 6. General specifications and quality standards for the installation of mechanical equipment; 7. Personal protective equipment, such as safety helmet, safety shoes, goggles and protective gloves.		

EVIDENCE REQUIREMENT	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Measure the pipeline and prefabricate the pipeline materials; 2. Make and install all kinds of supports and racks; 3. Install the pipeline; 4. Test the pipeline pressure and wash the internal pipeline.	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Understand the design intent; 1.2 Read technical documents. **2.0 Principles** The person performing this task must be able to explain the following principles: 2.1 Principle of reading the Installation drawings; 2.2 Principle of reading technical documents. **3.0 Theories** The person performing this task must be able to explain the following: 3.1 Knowledge about on-site measurement and material fabrication; 3.2 Knowledge about making and installing supports and racks; 3.3 Knowledge about pipeline installation process; 3.4 Pipeline testing method;

	3.5 Knowledge about pipeline descaling and corrosion protection. **4.0 Essential Skills** 4.1 Communication skills; 4.2 Customer service skills; 4.3 Teamwork skills; 4.4 Report writing skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	The pipeline is installed with construction materials and tools prepared based on the engineering needs.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Knowledge about the use and maintenance of drawing instruments and tools; 2. Basic knowledge about general specifications and quality standards for the installation of mechanical equipment.

OCCUPATION	MECHANICAL EQUIPMENT INSTALLATION TECHNICIAN	**OCCUPATION CODE**	
DUTY TITLE	INSTALLATION OF AUXILIARY PIPELINE	**DUTY NO.**	503
TASK TITLE	INSTALLATION OF COPPER PIPES	**TASK NO.**	5032
PERFORMANCE CRITERIA	The person performing this task must be able to identify the material, specification and application of copper pipe and install the pipe.		
RANGE STATEMENT	The task can be performed in the mechanical equipment installation workshop under the supervision of senior technicians or mechanical engineers. The tools and equipment to be used include: 1. Machines and tools for mechanical equipment installation; 2. Testing tools; 3. Installation materials; 4. Plan for safety implementation; 5. Technical standards; 6. General specifications and quality standards for the installation of mechanical equipment; 7. Personal protective equipment, such as safety helmet, safety shoes, goggles and protective gloves.		

EVIDENCE REQUIREMENT	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Identify the material, specification and application of copper pipe; 2. Prefabricate the copper pipe and its connector; 3. Install and expand the copper pipe; 4. Test the copper pipe pressure and wash the pipe.	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Prepare for the construction; 1.2 Prepare the construction plan; 1.3 Check the installation conditions. **2.0 Principles** The person performing this task must be able to explain the following principles: 2.1 Principle of preparing assembly machines and tools; 2.2 Principle of checking construction conditions. **3.0 Theories** The person performing this task must be able to explain the following: 3.1 Knowledge about the material of copper pipe; 3.2 Knowledge about copper pipe processing and prefabrication; 3.3 Knowledge about the installation process, welding, thread connection and expansion connection of copper pipe; 3.4 Method for testing copper pipe pressure and pipe

	washing. **4.0 Essential Skills** 4.1 Communication skills; 4.2 Customer service skills; 4.3 Teamwork skills; 4.4 Report writing skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	The pipeline is installed with construction materials and tools prepared based on the engineering needs.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Technical standards and method of the test; 2. Inspection methods and technical standards: 3. Technical conditions for safety facilities and equipment; 4. Knowledge about occupational health and safety.

OCCUPATION	MECHANICAL EQUIPMENT INSTALLATION TECHNICIAN	**OCCUPATION CODE**	
DUTY TITLE	SPECIAL EQUIPMENT INSTALLATION	**DUTY NO.**	504
TASK TITLE	LARGE DRAUGHT FAN AND WATER PUMP INSTALLATION	**TASK NO.**	5041
PERFORMANCE CRITERIA	The person performing this task must be able to install large draught fan and water pump in accordance with technical requirements and the manufacturer's manual.		
RANGE STATEMENT	The task can be performed in the mechanical equipment installation workshop under the supervision of senior technicians or mechanical engineers. The tools and equipment to be used include: 1. Personal protective equipment, such as: Safety shoes, goggles, gloves, and work clothes; 2. Mechanical installation tool kit; 3. Crowbar; 4. Multimeters.		

EVIDENCE REQUIREMENT	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Adhere to safety precautions when performing tasks; 2. Select appropriate operation tools and equipment; 3. Check the parts against the list; 4. Install bearing box; 5. Complete primary/secondary leveling and alignment; 6. Align the coupler to the center; 7. Install the process pipe; 8. Complete the trial run of large draught fan and water pump; 9. Clean the tools, equipment and workplaces; 10. 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 Install the bearing box; 1.2 Align the coupler to the center; 1.3 Install the process pipe; 1.4 Complete the trial run of large draught fan and water pump. **2.0 Principles** The person performing this task must be able to explain the following principles: 2.1 Definition and working principle of the pump; 2.2 Definition and working principle of the draught fan; 2.3 Definition and working principle of the bearing box; 2.4 Working principle of the coupler. **3.0 Theories** The person performing this task must be able to explain the following: 3.1 The process and method of the assembly and installation of large draught fan and water pump; 3.2 The procedures and method of trial run of large draught fan and water pump.

	4.0 Essential Skills 4.1 Communication skills; 4.2 Customer service skills; 4.3 Teamwork skills; 4.4 Report writing skills; 4.5 Entrepreneurial skills; 4.6 Learning skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	Installation of large draught fan and water pump is performed in accordance with technical requirements and the manufacturer's manual.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Occupational health and safety; 2. Maintenance operation processes and procedures (MOPP); 3. Waste disposal methods.

OCCUPATION	MECHANICAL EQUIPMENT INSTALLATION TECHNICIAN	**OCCUPATION CODE**	
DUTY TITLE	SPECIAL EQUIPMENT INSTALLATION	**DUTY NO.**	504
TASK TITLE	INSTALLATION OF MIDDLE-SIZED BRIDGE CRANE	**TASK NO.**	5042
PERFORMANCE CRITERIA	The person performing this task must be able to install middle-sized bridge crane in accordance with technical requirements and the manufacturer's manual.		
RANGE STATEMENT	The task can be performed in the mechanical equipment installation workshop under the supervision of senior technicians or mechanical engineers. The tools and equipment to be used include: 1. Personal protective equipment, such as: Safety shoes, goggles, gloves, and work clothes. 2. Mechanical installation tool kit.		

EVIDENCE REQUIREMENT

PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Adhere to safety precautions when performing tasks; 2. Select appropriate operation tools and equipment; 3. Assemble, test and measure large vehicles; 4. Help the lifting worker install the crane on the track; 5. Test the crane loading, and make records of the test run and inspection; 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 Assemble and test large vehicles; 1.2 Install the crane; 1.3 Prepare for and perform the test run of the crane safely. **2.0 Principles** The person performing this task must be able to explain the following principles: 2.1 Main structure of the middle-sized bridge crane; 2.2 Working principle of middle-sized bridge crane; 2.3 Principle of middle-sized bridge crane loading measurement. **3.0 Theories** The person performing this task must be able to explain the following: 3.1 Methods of large vehicle assembly and testing; 3.2 Methods of troubleshooting the start-up system; 3.3 Preparation for and methods of the test run of the crane and safety knowledge. **4.0 Essential Skills** 4.1 Communication skills; 4.2 Customer service skills;

	4.3 Teamwork skills; 4.4 Report writing skills; 4.5 Entrepreneurial skills; 4.6 Learning skills; 4.7 Tool and equipment operation skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	The middle-sized bridge crane is installed in accordance with technical requirements and the manufacturer's manual.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Occupational health and safety; 2. Maintenance operation processes and procedures (MOPP); 3. Waste disposal methods.

OCCUPATION	MECHANICAL EQUIPMENT INSTALLATION TECHNICIAN	**OCCUPATION CODE**	
DUTY TITLE	SPECIAL EQUIPMENT INSTALLATION	**DUTY NO.**	504
TASK TITLE	METAL VESSEL INSTALLATION	**TASK NO.**	5043
PERFORMANCE CRITERIA	The person performing this task must be able to install metal vessel in accordance with technical requirements and the manufacturer's manual.		
RANGE STATEMENT	The task can be performed in the mechanical equipment installation workshop under the supervision of senior technicians or mechanical engineers. The tools and equipment to be used include: 1. Personal protective equipment, such as: Safety shoes, goggles, gloves, and work clothes. 2. Mechanical installation tool kit.		

EVIDENCE REQUIREMENT

PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Adhere to safety precautions when performing tasks; 2. Select appropriate operation tools and equipment; 3. Install and inspect multi-piece vessels; 4. Draw lines for matching and installation positioning; 5. Build the matching platform; 6. Correct vessel defects; 7. Assemble, connect, position and fix the vessels; 8 Adjust and align the vessels; 9. Install external and internal attachments of the vessels; 10. Clean the tools, equipment and workplaces; 11. 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 Draw lines for matching and installation positioning; 1.2 Correct vessel defects. **2.0 Principles** The person performing this task must be able to explain the following principles: 2.1 Definition of metal vessel; 2.2 Principle of metal defect correction; 2.3 Installation order of external and internal attachments of vessels. **3.0 Theories** The person performing this task must be able to explain the following: 3.1 Knowledge about the quality inspection of multi-piece vessels; 3.2 Method of lineation for vessels; 3.3 Knowledge about the matching platform; 3.4 Method of vessel defect correction; 3.5 Matching method and requirements, and positioning method; 3.6 Metal vessel aligning and adjusting method; 3.7 Method of internal and external attachment installation for vessels; 3.8 Requirements of metal vessel strength and

	airtightness tests. **4.0 Essential Skills** 4.1 Communication skills; 4.2 Customer service skills; 4.3 Teamwork skills; 4.4 Report writing skills; 4.5 Entrepreneurial skills; 4.6 Learning skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	The installation of metal vessel is performed in accordance with technical requirements and the manufacturer's manual.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Occupational health and safety; 2. Maintenance operation processes and procedures (MOPP); 3. Waste disposal methods.

OCCUPATION	MECHANICAL EQUIPMENT INSTALLATION TECHNICIAN	**OCCUPATION CODE**	
DUTY TITLE	SPECIAL EQUIPMENT INSTALLATION	**DUTY NO.**	504
TASK TITLE	LIFT INSTALLATION	**TASK NO.**	5044
PERFORMANCE CRITERIA	The person performing this task must be able to install lifts in accordance with technical requirements and the manufacturer's manual.		
RANGE STATEMENT	The task can be performed in the mechanical equipment installation workshop under the supervision of senior technicians or mechanical engineers. The tools and equipment to be used include: 1. Personal protective equipment, such as: Safety shoes, goggles, gloves, and work clothes. 2. Mechanical installation tool kit.		

EVIDENCE REQUIREMENT

PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Adhere to safety precautions when performing tasks; 2. Select appropriate operation tools and equipment; 3. Check, test, adjust as necessary and safekeep the equipment parts; 4. Complete necessary preliminary matching for quality inspection and numbering; 5. Set up the shaft scaffold or lift platform; 6. Prepare the template rack, draw the lines for installation and hang steel wires; 7. Complete the installation of all the lift parts in accordance with the process requirements, including the guide rail, traction machine, lift car, landing doors; 8. Complete installation and adjustment tests of safety devices (safety gear, speed governor, brake, buffer, lock, etc.); 9. Conduct trial run of the entire lift, such as no-load test, static and dynamic load test, and overload test; 10. Conduct lift balance coefficient test; 11. Make quality inspection records;	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Set up the shaft scaffold or lift platform; 1.2 Complete all the lift installation tasks; 1.3 Complete installation, adjustment, and fault correction of safety devices (safety gear, speed governor, brake, buffer, lock, etc.); 1.4 Conduct lift balance coefficient test. **2.0 Principles** The person performing this task must be able to explain the following principles: 2.1 Working principle of the lift; 2.2 Principle of lift balance coefficient calculation. **3.0 Theories** The person performing this task must be able to explain the following: 3.1 Knowledge about part checking, testing and maintenance; 3.2 Matching and testing method; 3.3 Knowledge about scaffold and lift platform installation; 3.4 Knowledge about template rack and lineation; 3.5 Process and method of lift installation; 3.6 Knowledge about the installation and adjustment of lift safety devices; 3.7 Method of lift balance coefficient test;

12. Clean the tools, equipment and workplaces.	3.8 Knowledge about quality standards of the lift. **4.0 Essential Skills** 4.1 Communication skills; 4.2 Customer service skills; 4.3 Teamwork skills; 4.4 Report writing skills; 4.5 Entrepreneurial skills; 4.6 Learning skills; 4.7 Tool and instrument operation skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	The installation of metal vessel is performed in accordance with technical requirements and the manufacturer's manual.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Occupational health and safety; 2. Maintenance operation processes and procedures (MOPP); 3. Waste disposal methods.

OCCUPATION	MECHANICAL EQUIPMENT INSTALLATION TECHNICIAN	**OCCUPATION CODE**	
DUTY TITLE	SPECIAL EQUIPMENT INSTALLATION	**DUTY NO.**	504
TASK TITLE	ROTARY KILN INSTALLATION	**TASK NO.**	5045
PERFORMANCE CRITERIA	The person performing this task must be able to install rotary kiln in accordance with technical requirements and the manufacturer's manual.		
RANGE STATEMENT	The task can be performed in the mechanical equipment installation workshop under the supervision of senior technicians or mechanical engineers. The tools and equipment to be used include: 1. Personal protective equipment, such as: Safety shoes, goggles, gloves, and work clothes. 2. Mechanical installation tool kit.		

EVIDENCE REQUIREMENT

PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Adhere to safety precautions when performing tasks; 2. Select appropriate operation tools and equipment; 3. Complete the equipment acceptance inspection; 4. Perform basic inspection and lineation; 5. Complete the installation of traction gear set and the overall inspection of traction gear sets; 6. Match the cylinder set and adjust the concentricity; 7. Install large gears and transmission equipment; 8. Install the attachments and seals to the kiln head and tail.	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Complete basic inspection and lineation; 1.2 Install and test the traction gear set; 1.3 Match the cylinders and adjust the concentricity; 1.4 Install large gears and transmission equipment. **2.0 Principles** The person performing this task must be able to explain the following principles: 2.1 Working principle of the rotary kiln. **3.0 Theories** The person performing this task must be able to explain the following: 3.1 Rotary kiln testing and measuring methods; 3.2 Method of lineation for basic kiln inspection; 3.3 Method of traction gear installation and inspection; 3.4 Method of cylinder matching, concentricity measurement and adjustment; 3.5 Method of large gear and transmission equipment installation; 3.6 Method of seal installation. **4.0 Essential Skills** 4.1 Communication skills; 4.2 Customer service skills;

	4.3 Teamwork skills; 4.4 Report writing skills; 4.5 Entrepreneurial skills; 4.6 Learning skills; 4.7 Tool and equipment operation skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	The installation of metal vessel is performed in accordance with technical requirements and the manufacturer's manual.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Occupational health and safety; 2. Maintenance operation processes and procedures (MOPP); 3. Waste disposal methods.

OCCUPATION	MECHANICAL EQUIPMENT INSTALLATION TECHNICIAN	**OCCUPATION CODE**	
DUTY TITLE	SPECIAL EQUIPMENT COMMISSIONING	**DUTY NO.**	505
TASK TITLE	LARGE DRAUGHT FAN AND WATER PUMP COMMISSIONING	**TASK NO.**	5051
PERFORMANCE CRITERIA	The person performing this task must be able to finish the large draught fan commissioning in accordance with technical requirements.		
RANGE STATEMENT	The task can be performed in the mechanical equipment installation workshop under the supervision of senior mechanical equipment installation technician or mechanical engineers. The tools and equipment to be used include: 1. Pressure meter; 2. Multimeters; 3. Personal protective equipment: Safety shoes, goggles, gloves, and work clothes; 4. Mechanical installation tool kit.		

EVIDENCE REQUIREMENT	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Abide by the preventive measures for health and safety when performing this task; 2. Select appropriate operation tools and equipment; 3. Start the water pump; 4. Confirm that all the joints are reliable without loosening or leakage; 5. Confirm that all the electrical appliances and instruments work; Confirm that no leakage exists in oil, gas, water and other pipelines; Confirm that the pressure and fluid level are normal; 6. Confirm that the trail run continues for at least 2h with the required range and flow rate; 7. Close the valves in accordance with the requirements in the technical document of the equipment once the trial run ends. Confirm that the anti-backflow device in the flow passage works. 8. Check if the pump stops when its water level is lower than the minimum water level.	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Start the water pump; 1.2 Confirm that all the joints are reliable without loosening or leakage; 1.3 Confirm that all the electrical appliances and instruments work; confirm that no leakage exists in oil, gas, water and other pipelines; and confirm that the pressure and fluid level are normal; 1.4 Confirm that the trail run continues for at least 2h with the required range and flow rate; 1.5 Close the valves in accordance with the requirements in the technical document of the equipment once the trial run ends; and confirm that the anti-backflow device in the flow passage works. **2.0 Principles** The person performing this task must be able to explain the following principles: 2.1 Definition and working principle of the pump; 2.2 Definition and working principle of the draught fan; 2.3 Definition and working principle of the bearing box; 2.4 Working principle of the coupler. **3.0 Theories** The person performing this task must be able to explain

	the following: 3.1 The importance of draught fan and water pump commissioning; 3.2 Items included in draught fan and water pump commissioning. **4.0 Essential Skills** 4.1 Teamwork skills; 4.2 Report writing skills; 4.3 Tool and equipment operation skills;
DESCRIPTION OF THE END PRODUCT / SERVICE	Commissioning of large draught fan is performed in accordance with technical requirements.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Occupational health and safety; 2. Waste disposal methods.

OCCUPATION	MECHANICAL EQUIPMENT INSTALLATION TECHNICIAN	**OCCUPATION CODE**	
DUTY TITLE	SPECIAL EQUIPMENT COMMISSIONING	**DUTY NO.**	505
TASK TITLE	COMMISSIONING OF MIDDLE-SIZED BRIDGE CRANE	**TASK NO.**	5052
PERFORMANCE CRITERIA	The person performing this task must be able to finish the commissioning of middle-sized bridge crane in accordance with technical requirements.		
RANGE STATEMENT	The task can be performed in the mechanical equipment installation workshop under the supervision of senior mechanical equipment installation technician or mechanical engineers. The tools and equipment to be used include: 1. A complete set of electrical tool 2. Personal protective equipment: Safety shoes, goggles, gloves, and work clothes; 3. Mechanical installation tool kit.		

EVIDENCE REQUIREMENT	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Inspect and power on all the control circuits; 2. Adjust the thresholds of air circuit breakers; 3. Complete the commissioning of the open circuit; 4. Complete the no-load commissioning with the loop closed.	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Inspect control circuits and operation circuits with the power on; 1.2 Set the thresholds of air circuit breakers; 1.3 Complete the commissioning of the open circuit; 1.4 Complete the commissioning of the close circuit. **2.0 Principles** The person performing this task must be able to explain the following principles: 2.1 Main structure of the middle-sized bridge crane; 2.2 Working principle of middle-sized bridge crane; 2.3 Principle of middle-sized bridge crane loading measurement. **3.0 Theories** The person performing this task must be able to explain the following: 3.1 The operation circuit and control circuit of bridge crane; 3.2 The setting of thresholds of air circuit breaker; 3.3 Contents of the commissioning of the open circuit; 3.4 Contents of the no-load commissioning of the close circuit.

	4.0 Essential Skills 4.1 Teamwork skills; 4.2 Report writing skills; 4.3 Tool and equipment operation skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	The commissioning of middle-sized bridge crane is performed in accordance with technical requirements.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Occupational health and safety.

OCCUPATION	MECHANICAL EQUIPMENT INSTALLATION TECHNICIAN	**OCCUPATION CODE**	
DUTY TITLE	SPECIAL EQUIPMENT COMMISSIONING	**DUTY NO.**	505
TASK TITLE	METAL VESSEL COMMISSIONING	**TASK NO.**	5053
PERFORMANCE CRITERIA	The person performing this task must be able to finish metal vessel commissioning in accordance with technical requirements.		
RANGE STATEMENT	The task can be performed in the mechanical equipment installation workshop under the supervision of senior mechanical equipment installation technician or mechanical engineers. The tools and equipment to be used include: 1. Pressure meter; 2. Water pump; 3. Air pump; 4. Personal protective equipment, such as safety shoes, goggles, gloves, and work clothes; 5. Mechanical installation tool kit.		

EVIDENCE REQUIREMENT	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Check the scale, accuracy, lead seal and test label of the pressure meter; 2. Fill fluid in the vessel for pressure test; 3. Open the outlet to discharge the fluid and dry the internal vessel with compressed air after the pressure test.	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Check the scale, accuracy, lead seal and test label of the pressure meter; 1.2 Fill fluid in the vessel for pressure test; 1.3 Dry the internal vessel after the pressure test. **2.0 Principles** The person performing this task must be able to explain the following principles: 2.1 Definition of metal vessel; 2.2 Principle of metal defect correction; 2.3 Installation order of external and internal attachments of vessels. **3.0 Theories** The person performing this task must be able to explain the following: 3.1 Requirements of metal vessel pressure test; 3.2 The check on the scale, accuracy, lead seal and test label of the pressure meter. **4.0 Essential Skills** 4.1 Teamwork skills; 4.2 Report writing skills;

	4.3 Tool and equipment operation skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	Pressure test of metal vessel is performed in accordance with technical requirements.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Occupational health and safety; 2. Waste disposal methods.

OCCUPATION	MECHANICAL EQUIPMENT INSTALLATION TECHNICIAN	**OCCUPATION CODE**	
DUTY TITLE	SPECIAL EQUIPMENT COMMISSIONING	**DUTY NO.**	505
TASK TITLE	LIFT COMMISSIONING	**TASK NO.**	5054
PERFORMANCE CRITERIA	The person performing this task must be able to complete the lift commissioning in accordance with technical requirements.		
RANGE STATEMENT	The task can be performed in the mechanical equipment installation workshop under the supervision of senior mechanical equipment installation technician or mechanical engineers. The tools and equipment to be used include: 1. Walkie-talkie; 2. DC ammeter; 3. Sound meter; 4. Tachometer; 5. Spring scale; 6. Stopwatch; 7. Personal protective equipment, such as safety shoes, goggles, gloves, and work clothes.		

EVIDENCE REQUIREMENT	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Complete the trial run of the lift, including idling test, static and dynamic test and overload test; 2. Complete the lift balance coefficient test; 3. Record the quality inspection.	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Complete the trial run of the lift; 1.2 Test the balance coefficient of the lift; 1.3 Record the quality inspection. **2.0 Principles** The person performing this task must be able to explain the following principles: 2.1 Working principle of the lift; 2.2 Principle of lift balance coefficient calculation. **3.0 Theories** The person performing this task must be able to explain the following: 3.1 Knowledge about the trail run of the lift; 3.2 Method of lift balance coefficient experiment; 3.3 Knowledge about quality standards of the lift. **4.0 Essential Skills** 4.1 Teamwork spirit; 4.2 Report writing skills;

	4.3 Tool and equipment operation skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	Pressure test of the lift is performed in accordance with technical requirements.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Occupational health and safety; 2. Waste disposal methods.

OCCUPATION	MECHANICAL EQUIPMENT INSTALLATION TECHNICIAN	**OCCUPATION CODE**	
DUTY TITLE	SPECIAL EQUIPMENT COMMISSIONING	**DUTY NO.**	505
TASK TITLE	ROTARY KILN COMMISSIONING	**TASK NO.**	5055
PERFORMANCE CRITERIA	The person performing this task must be able to complete the rotary kiln commissioning in accordance with technical requirements.		
RANGE STATEMENT	The task can be performed in the mechanical equipment installation workshop under the supervision of senior mechanical equipment installation technician or mechanical engineers. The tools and equipment to be used include: 1. Pressure meter; 2. Electrical tool kit; 3. Safety protection equipment; 4. Mechanical installation tool kit.		

EVIDENCE REQUIREMENT	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Inspect the rotary kiln and its attachments thoroughly before the commissioning; 2. Complete the commissioning and inspection of the main motor, adjust its torsion to make the motor parameters in line with the design or regulations; 3. Start the main motor to initiate an independent trail run for 2h, and use the main motor to drive the main gearbox for 4h before opening the cooling and vibrating system, then use the transmission system powered by the main motor to drive a 8h operation of the rotary kiln. Confirm all the equipment function well.	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Inspect the rotary kiln and its attachments thoroughly before the commissioning; 1.2 Complete the commissioning of the main motor; 1.3 Complete the commissioning of the rotary kiln. **2.0 Principles** The person performing this task must be able to explain the following principles: 2.1 Working principle of the rotary kiln **3.0 Theories** The person performing this task must be able to explain the following: 3.1 Procedures of the rotary kiln test run. **4.0 Essential Skills** 4.1 Teamwork skills; 4.2 Report writing skills; 4.3 Tool and equipment operation skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	Test run of the rotary kiln is performed in accordance with technical requirements.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Occupational health and safety; 2. Waste disposal methods.

OCCUPATION	MECHANICAL EQUIPMENT INSTALLATION TECHNICIAN	**OCCUPATION CODE**	
DUTY TITLE	MAINTENANCE OF SPECIAL EQUIPMENT	**DUTY NO.**	506
TASK TITLE	MAINTENANCE OF LARGE DRAUGHT FAN AND WATER PUMP	**TASK NO.**	5061
PERFORMANCE CRITERIA	The person performing this task must be able to maintain large draught fan or water pump in accordance with product specification, technical requirements, the manufacturer's maintenance manual and other documents.		
RANGE STATEMENT:	The task can be performed on the mechanical equipment installation site under the supervision of relevant technicians or mechanical engineers. The tools and equipment to be used include: 1. Wrenches (open-ended wrench, socket wrench, Hexwrench, etc.); 2. Straight and cross screwdrivers; 3. Other manual tools (hammer, chisel, pipe wrench, etc.); 4. Power tools (electric hand drill, impact drill, etc.); 5. Measuring tools (steel ruler, dial indicator/micrometer, vernier caliper, etc.); 6. Personal protective equipment (such as safety shoes, goggles, gloves, and work clothes).		

EVIDENCE REQUIREMENT

PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Obtain the tools and equipment required for performing this task; 2. Abide by the preventive measures for health and safety when performing this task; 3. Check the air inlet of the draught fan and the conditions of equipment and protective grill regularly; 4. Clean the dust and dirt in the fraught fan and inside the pipeline; 5. Replace the lubricating oil regularly; 6. Troubleshoot violent vibration of the draught fan; 7. Troubleshoot overheat bearings of the draught fan; 8. Troubleshoot current overload in the draught fan; 9. Maintain parts of the centrifugal pump body (base, seals and lubricated locations, couplers,	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Check the air inlet of the draught fan; 1.2 Clean the draught fan and the pipeline; 1.3 Troubleshoot faults of the draught fan, such as violent vibration, bearing overheat and current overload; 1.4 Maintain parts of the centrifugal pump body; 1.5 Troubleshoot common faults of centrifugal pump. **2.0 Principles** The person performing this task must be able to explain the following principles: 2.1 Structural principle of the draught fan; 2.2 Maintenance of the draught fan; 2.3 Structural principle of the centrifugal pump; 2.4 Maintenance of the centrifugal pump. **3.0 Theories** The person performing this task must be able to explain the following: 3.1 Working principle of the draught fan;

instruments and pipes) regularly; 10. Test and inspect key parts of the centrifugal pump (vacuum gauge, high voltage motor, relay, etc.) regularly; 11. Lubricate and maintain the centrifugal pump regularly; 12. Clean the centrifugal pump regularly; 13. Troubleshoot common faults of the centrifugal pump; 14. Clean the tools, equipment and workplaces, and store the tools and equipment.	3.2 Common faults of the draught fan; 3.3 Troubleshoot common faults of the draught fan; 3.4 Working principle of the centrifugal pump; 3.5 Common faults of the centrifugal pump; 3.6 Troubleshoot common faults of the centrifugal pump. **4.0 Essential Skills** 4.1 Communication skills; 4.2 Teamwork skills; 4.3 Report writing skills; 4.4 Drawing reading skills; 4.5 Learning skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	The maintenance of the centrifugal fan and centrifugal pump is performed in accordance with technical requirements and the manufacturer's manual.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Occupational health and safety. 2. Maintenance operation processes and procedures (MOPP); 3. Waste disposal methods.

OCCUPATION	MECHANICAL EQUIPMENT INSTALLATION TECHNICIAN	**OCCUPATION CODE**	
DUTY TITLE	MAINTENANCE OF SPECIAL EQUIPMENT	**DUTY NO.**	506
TASK TITLE	MAINTENANCE OF MIDDLE-SIZED BRIDGE CRANE	**TASK NO.**	5062
PERFORMANCE CRITERIA	The person performing this task must be able to maintain middle-sized bridge crane in accordance with product specification, technical requirements, the manufacturer's maintenance manual and other documents.		
RANGE STATEMENT:	The task can be performed on the mechanical equipment installation site under the supervision of relevant technicians or mechanical engineers. The tools and equipment to be used include: 1. Wrenches (open-ended wrench, socket wrench, Hexwrench, etc.); 2. Straight and cross screwdrivers; 3. Other manual tools (hammer, chisel, pipe wrench, etc.); 4. Power tools (electric hand drill, impact drill, etc.); 5. Measuring tools (digital multimeter, tramegger, vernier caliper, etc.); 6. Personal protective equipment (such as safety shoes, goggles, gloves, and work clothes).		

EVIDENCE REQUIREMENT

PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Obtain the tools and equipment required for performing this task; 2. Abide by the preventive measures for health and safety when performing this task; 3. Check safety warnings and nameplate; 4. Check if the metal structures are safe; 5. Check the lifting tools and their blocks; 6. Check the braking devices; 7. Check the wearing of the steel wire rope and the fixture at the rope ends; 8. Check if there are deformation, crack and wearing on key parts; 9. Check if there are damages on couplers, drums, pulleys and chains; 10. Check the track conditions; 11. Check the safety and protections of the driver's cab; 12. Check the safety protections; 13. Check the components of electric and hydraulic systems and their	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Demonstrate the operation of a middle-sized bridge crane; 1.2 Determine the safety level of a middle-sized bridge crane; 1.3 Diagnose and troubleshoot common faults in middle-sized bridge cranes; 1.4 Test the performance of middle-sized bridge crane; 1.5 Read the circuit diagram and hydraulic schematic of middle-sized bridge crane. **2.0 Principles** The person performing this task must be able to explain the following principles: 2.1 Structural principle of middle-sized bridge crane 2.2 Specification for the maintenance of middle-sized bridge crane. **3.0 Theories** The person performing this task must be able to explain the following:

reliabilities; 14. Check electric protections; 15. Check the lubrication system; 16. Check the reliability and accuracy of indicators; 17. Check the safe distance from the working place of the lifting machinery; 18. Check the overall equipment performance; 19. Identify and deal with safety hazards; 20. Keep ledgers and files for the maintenance.	3.1 Working principle of middle-sized bridge crane; 3.2 Inspection items of the middle-sized bridge crane; 3.3 Elimination of safety hazards of the middle-sized bridge crane. **4.0 Essential Skills** 4.1 Communication skills; 4.2 Teamwork skills; 4.3 Report writing skills; 4.4 Drawing reading skills; 4.5 Tool and equipment operation skills; 4.6 Learning skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	The maintenance of middle-sized bridge crane is performed in accordance with technical requirements and the manufacturer's manual.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Occupational health and safety; 2. Maintenance operation processes and procedures (MOPP).

OCCUPATION	MECHANICAL EQUIPMENT INSTALLATION TECHNICIAN	**OCCUPATION CODE**	
DUTY TITLE	MAINTENANCE OF SPECIAL EQUIPMENT	**DUTY NO.**	506
TASK TITLE	MAINTENANCE OF METAL VESSELS	**TASK NO.**	5063
PERFORMANCE CRITERIA	The person performing this task must be able to maintain metal vessel in accordance with product specification, technical requirements, the manufacturer's maintenance manual and other documents.		
RANGE STATEMENT:	The task can be performed on the mechanical equipment installation site under the supervision of relevant technicians or mechanical engineers. The tools and equipment to be used include: 1. Wrenches (open-ended wrench, socket wrench, Hexwrench, etc.); 2. Straight and cross screwdrivers; 3. Other manual tools (hammer, chisel, pipe wrench, etc.); 4. Power tools (electric hand drill, impact drill, etc.); 5. Measuring tools (steel ruler, dial indicator/micrometer, vernier caliper, etc.); 6. Personal protective equipment (such as safety shoes, goggles, gloves, and work clothes).		

EVIDENCE REQUIREMENT

PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Obtain the tools and equipment required for performing this task; 2. Abide by the preventive measures for health and safety when performing this task; 3. Check the vessel body; 4. Check safety attachments such as safety valves; 5. Check instruments and apparatus such as the pressure meter, level gauge and thermometer; 6. Check the static grounding of the pressure vessel; 7. Check the integrity of the anti-corrosion coating; 8. Remove corrosive chemicals; 9. Maintain the vessel body when it is left unused; 10. Identify and deal with safety hazards; 11. Set a regular inspection system and keep ledgers and files for the inspection and maintenance.	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Demonstrate the monitoring procedures of metal vessels; 1.2 Diagnose and troubleshoot common faults in metal vessels; 1.3 Check the safety conditions of metal vessels; 1.4 Read the circuit diagram and hydraulic schematic of metal vessels. **2.0 Principles** The person performing this task must be able to explain the following principles: 2.1 Structure and working principle of metal vessels; 2.2 Specification for the maintenance of metal vessels. **3.0 Theories** The person performing this task must be able to explain the following: 3.1 Working principle of metal vessels; 3.2 Material characteristics and parameter testing methods for metal vessels;

	3.3 Specification for the maintenance of metal vessels. **4.0 Essential Skills** 4.1 Communication skills; 4.2 Teamwork skills; 4.3 Report writing skills; 4.4 Drawing reading skills; 4.5 Learning skills; 4.6 Tool and equipment operation skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	The maintenance of boilers and pressure vessels is performed in accordance with technical requirements and the manufacturer's manual.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Occupational health and safety; 2. Maintenance operation processes and procedures (MOPP); 3. Waste disposal methods.

OCCUPATION	MECHANICAL EQUIPMENT INSTALLATION TECHNICIAN	**OCCUPATION CODE**	
DUTY TITLE	MAINTENANCE OF SPECIAL EQUIPMENT	**DUTY NO.**	506
TASK TITLE	LIFT MAINTENANCE	**TASK NO.**	5064
PERFORMANCE CRITERIA	The person performing this task must be able to maintain the lifts in accordance with product specification, technical requirements and the manufacturer's manual.		
RANGE STATEMENT:	The task can be performed on the mechanical equipment installation site under the supervision of relevant technicians or mechanical engineers. The tools and equipment to be used include: 1. Wrenches (open-ended wrench, socket wrench, Hexwrench, etc.); 2. Straight and cross screwdrivers; 3. Other manual tools (such as steel handsaw, bench vice, needle-nose plier, wire stripper, etc.); 4. Illuminating and communication tools (such as hand lamp, flashlight, walkie-talkie); 5. Power tools (electric hand drill, impact drill, etc.); 6. Measuring tools (such as steel ruler, vernier caliper, flaw detector for steel wire rope, and squareness gauge of guide rail); 7. Personal protective equipment (such as safety shoes, goggles, gloves, and work clothes).		

EVIDENCE REQUIREMENT	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Obtain the tools and equipment required for performing this task; 2. Abide by the preventive measures for health and safety when performing this task; 3. Check the environment of machine room and pulley room; 4. Check the manual emergency device; 5. Check the traction machine and motor; 6. Check the axis pins of the brakes; 7. Check the brake clearance; 8. Check the encoder; 9. Check the axis pins of the speed governors; 10. Check the car roof; 11. Check the overhaul and emergency switches on the car roof; 12. Check the oil cup of guide shoe; 13. Check the counterweight filler and its	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Demonstrate the operation of the lift; 1.2 Check the operating safety of the lift; 1.3 Diagnose and troubleshoot common faults in lift operation; 1.4 Check the conditions of lift parts, specifically the brake and speed governor; 1.5 Check the safety of the lift car and shaft; 1.6 Check the situation of the safety detection and alarming system; 1.7 Maintain the lift. **2.0 Principles** The person performing this task must be able to explain the following principles: 2.1 The structure and principle of the lift; 2.2 Specification for lift maintenance.

pressure plate; 14. Check the shaft; 15. Check the (emergency) illumination and fan in the car; 16. Check the overhaul and emergency switches on the car roof; 17. Check the alarming device, intercom system and warning signs; 18. Check the display and command buttons in the car; 19. Check safety devices in the car; 20. Check electrical contacts on car door locks; 21. Check the operation of car doors; 22. Check the self-closing device of landing doors; 23. Check the automatic resetting of landing door locks; 24. Check electrical contacts on the landing door locks; 25. Check the length of engagement of the landing door lock; 26. Check the emergency switch and environment in the lift pit; 27. Keep ledgers and files for the maintenance.	**3.0 Theories** The person performing this task must be able to explain the following: 3.1 Working principle of the lift; 3.2 Items included in the lift maintenance; 3.3 Maintenance method regarding the lift inspection items. **4.0 Essential Skills** 4.1 Communication skills; 4.2 Teamwork skills; 4.3 Report writing skills; 4.4 Drawing reading skills; 4.5 Learning skills; 4.6 Tool and equipment operation skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	The maintenance of lifts such as passenger lift, freight lift and dumbwaiter lift is performed in accordance with technical requirements and the manufacturer's manual.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Occupational health and safety; 2. Maintenance operation processes and procedures (MOPP); 3. Waste disposal methods.

OCCUPATION	MECHANICAL EQUIPMENT INSTALLATION TECHNICIAN	**OCCUPATION CODE**	
DUTY TITLE	MAINTENANCE OF SPECIAL EQUIPMENT	**DUTY NO.**	506
TASK TITLE	ROTARY KILN MAINTENANCE	**TASK NO.**	5065
PERFORMANCE CRITERIA	The person performing this task must be able to maintain rotary kiln in accordance with product specification, technical requirements, the manufacturer's maintenance manual and other documents.		
RANGE STATEMENT:	The task can be performed on the mechanical equipment installation site under the supervision of relevant technicians or mechanical engineers. The tools and equipment to be used include: 1. Wrenches (open-ended wrench, socket wrench, Hexwrench, etc.); 2. Straight and cross screwdrivers; 3. Other manual tools (such as sledge hammer, crowbar, steel wire rope, chain block and safety rope); 4. Illuminating tools (such as hand lamp and flashlight); 5. Electric tools (such as electric hand drill, polisher and fall arrester); 6. Measuring tools (such as measuring tape, vernier caliper, theodolite and ruler); 7. Personal protective equipment (such as safety shoes, goggles, gloves, and work clothes).		

EVIDENCE REQUIREMENT	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Obtain the tools and equipment required for performing this task; 2. Abide by the preventive measures for health and safety when performing this task; 3. Inspect the transmission devices during the production; 4. Inspect the tire and supports during the production; 5. Inspect the kiln cylinder during the production; 6. Inspect the sealing devices during the production; 7. Inspect other items required in the daily kiln operation; 8. Inspect the uneven settlement of the base; 9. Inspect during the shutdown of the kiln; 10. Identify and deal with safety hazards;	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Check the safety of the rotary kiln body and its accessories. 1.2 Diagnose and detect common faults in the rotary kiln; 1.3 Check the status of key rotary kiln components, such as the kiln cylinder and transmission system; 1.4 Maintain the rotary kiln. **2.0 Principles** The person performing this task must be able to explain the following principles: 2.1 The structure and working principle of the rotary kiln; 2.2 Specification for rotary kiln maintenance. **3.0 Theories** The person performing this task must be able to explain the following:

11. Troubleshoot common faults; 12. Set a regular inspection system and keep ledgers and files for the inspection and maintenance.	3.1 Working principle of the rotary kiln; 3.2 Structural drawing of the rotary kiln; 3.3 Specification for rotary kiln maintenance. **4.0 Essential Skills** 4.1 Communication skills; 4.2 Teamwork skills; 4.3 Report writing skills; 4.4 Drawing reading skills; 4.5 Learning skills; 4.6 Tool and equipment operation skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	The rotary kiln maintenance is performed in accordance with technical requirements and the manufacturer's manual.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Occupational health and safety. 2. Maintenance operation processes and procedures (MOPP); 3. Waste disposal methods.

TABLE 1: DACUM CHARTS FOR MECHANICAL EQUIPMENT INSTALLATION TECHNICIAN - NTA 5

DUTIES	TASKS	ENABLERS
1.0 Preparations before operation	1.1 Understanding of drawings and other technical data. 1.2 Preparing machines and tools for the assembly and checking work conditions. 1.3 Labour protection.	**General skills and knowledge** · Cooperating with others using communication skills and reporting to the superiors · Installation drawing reading · Preparation of assembly machines and tools · Labour protection and standards **Tools and equipment** · A complete set of drawing instruments · A complete set of testing tools · Personal protective equipment, such as safety helmet, safety shoes, goggles, protective gloves, and work clothes **Materials** · Installation materials **Requirements for employees** · Teamwork spirit, integrity, time management and commitment
2.0 Assembly of typical components	2.1 Coupling installation. 2.2 Installation of roller bearing. 2.3 Installation of sliding bearing. 2.4 Cool (hot) assembly of axes and sleeves. 2.5 Gear installation.	**General skills and knowledge** · Cooperating with others using communication skills and reporting to the superiors · Knowledge about mechanical drawing · Knowledge about tolerance fit and technical measurement · Knowledge about mechanical design and mechanical principles · Commonly-used mechanical equipment installation tools and their types · Knowledge about bearings · Knowledge about gears **Tools and equipment** · Construction machines and tools

DUTIES	TASKS	ENABLERS
		· Safety protection equipment and tools Safety rope, falling protector, sound-proof tools and so on · Personal protective equipment: safety belts, safety helmets, work clothes, safety shoes, goggles, protective gloves, etc. **Materials** · Installation materials · Lubricating oil **Requirements for employees** · Teamwork spirit, integrity, time management and commitment
3.0 Installation of auxiliary pipeline	3.1 Installation of carbon steel pipeline. 3.2 Installation of copper pipes.	**General skills and knowledge** · Cooperating with others using communication skills and reporting to the superiors · Knowledge about on-site measurement and material fabrication · Knowledge about making and installing supports and racks · Knowledge about pipeline installation process · Pipeline testing method · Knowledge about pipeline descaling and corrosion protection · Knowledge about the material of copper pipe · Knowledge about copper pipe processing and prefabrication · Knowledge about the installation process, welding, thread connection and expansion connection of copper pipe · Method for testing copper pipe pressure and pipe washing **Tools and equipment** · Tools for testing the machines and tools of the mechanical equipment installation technician · Personal protective equipment, such as safety helmet, safety shoes,

DUTIES	TASKS	ENABLERS
		goggles and protective gloves **Materials** · Installation materials **Requirements for employees** · Teamwork spirit, integrity, time management and commitment
4.0 Special equipment installation	4.1 Large draught fan and water pump installation. 4.2 Installation of middle-sized bridge crane. 4.3 Metal vessel installation. 4.4 Lift installation. 4.5 Rotary Kiln Installation.	**General skills and knowledge** · Cooperating with others using communication skills and reporting to the superiors · The process and method of the assembly and installation of large draught fan and water pump · Assembly and testing methods of the vehicles · Preparation for and methods of the test run of the crane and safety knowledge · Working principle of metal vessels · Working principle of the lift · Working principle of the rotary kiln **Tools and equipment** · Personal protective equipment, such as safety shoes, goggles, gloves, and work clothes · Mechanical installation tool kit · Crowbar · Multimeters · Cane meter **Materials** · Installation materials **Requirements for employees** · Teamwork spirit, integrity, time management and commitment
5.0 Special equipment commissioning	5.1 Large draught fan and water pump commissioning. 5.2 Commissioning of middle-sized bridge crane. 5.3 Metal vessel commissioning.	**General skills and knowledge** · Cooperating with others using communication skills and reporting to the superiors · Working principle of the draught

DUTIES	TASKS	ENABLERS
	5.4 Lift commissioning. 5.5 Rotary kiln commissioning.	fan and water pump · Circuit principle of the bridge crane · Pressure test of metal vessels · Mechanical structure and circuit principle of the lift · Mechanical structure and circuit principle of the rotary kiln **Tools and equipment** · Pressure meter · Personal protective equipment, such as safety shoes, goggles, gloves, and work clothes · Mechanical installation tool kit · A complete set of electrical tools · Water pump · Air pump · Walkie-talkie · Sound meter · Tachometer · Spring scale **Materials** · Installation materials **Worker behaviors** · Teamwork spirit, integrity, time management and commitment
6.0 Maintenance of special equipment	6.1 Maintenance of large draught fan and water pump. 6.2 Maintenance of middle-sized bridge crane. 6.3 Installation and maintenance of metal vessels. 6.4 Lift maintenance. 6.5 Rotary kiln maintenance.	**General skills and knowledge** · Cooperating with others using communication skills and reporting to the superiors · Structural principle of the draught fan · Maintenance of the draught fan · Structural principle of the centrifugal pump · Maintenance of the centrifugal pump. · Working principle of middle-sized bridge crane · Inspection items of the middle-sized bridge crane · Elimination of safety hazards of the

DUTIES	TASKS	ENABLERS
		middle-sized bridge crane · Structure and working principle of metal vessels · Specification for the maintenance of metal vessels · The structure and principle of the lift · Specification for lift maintenance · Working principle of the rotary kiln · Structural drawing of the rotary kiln · Specification for rotary kiln maintenance **Tools and equipment** · Hammer · Chisel · Wrenches (open-ended wrench, socket wrench, Hexwrench, etc.) · Pipe wrench · Crowbar · Straight and cross screwdrivers · Wheel remover · Personal protective equipment, such as safety shoes, goggles, gloves, and work clothes · Electric hand drill · Angle grinder · Electric wrench · Electric hammer · Electric impact drill · Dial indicator/micrometer · Screw micrometer · Vernier calipers · Outside caliper · Feeler gauge · Steel ruler **Materials** · Installation materials **Worker behaviors** · Teamwork spirit, integrity, time management and commitment