THE NATIONAL COUNCIL FOR TECHNICAL AND VOCATIONAL EDUCATION AND TRAINING

OCCUPATIONAL STANDARDS

OCCUPATION: PETROCHEMICAL ENGINEERING TECHNICIAN

LEVEL: NTA LEVEL 6

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ABBREVIATIONS

CBET	-	Competency Based Education and Training
DCS	-	Distributed Control System
NACTVET	-	National Council for Technical and Vocational Education and Training
NOS	-	National Occupational Standards
OS	-	Occupational Standards
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 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, related 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.
Occupational Competence:	The application and performance of knowledge and skills to perform consistently to that consistently meet the standards required by in the work context.

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, with a high level of human development. 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 (NACTVET) has begun the job of drafting Occupational Standards (OS) that will eventually be adopted as National Occupational Standards (NOS) for use in the delivery of TET that meets the needs of the labour market and the country's economic agenda.

Occupational Standards (OS) are performance criteria that are matched with labour market demands. Each of them describes the functions, performance standards, and understanding or knowledge underpinning a given occupation. They combine skills, knowledge, and attitudes to describe best practice. They are useful tools for establishing job roles, personnel recruitment, supervision, and appraisal, as well as TET Standards. They are also helpful for benchmarking and harmonizing job 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 application across all public and private institutions.

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

For the purpose of TET delivery, Tanzania has 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. Therefore, it is quite pertinent for TET institutions to use the relevant occupational standards as a benchmark for formulating their curricula.

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.

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 process of developing these Occupational Standards involved both local and international expertise. The process began with an examination of major documents that guide Tanzanian skills development including the *10-year National Skills Development Strategy (2016-2026).* NACTVET 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 team of experts in consultation with practitioners developed draft occupational standards. The draft document was used to develop an occupational profile for each occupation (DACUM Chart), which is attached as an **Appendix** to every Occupational Standard.

The occupational standards were validated during the stakeholders' forum held on 22nd and 23rd February 2024 at Morogoro. The information from the stakeholders' forum provides insight from the workplaces, professional bodies, regulatory bodies and sector ministries regarding trends and changes in the profession, including how well graduates are prepared for working in the occupation.

3.0. THE SCOPE AND OVERVIEW OF THE OCCUPATION STANDARDS FOR PETROCHEMICAL ENGINEERING TECHNICIAN

The standards cover a broad range of duties and tasks that can be performed by a Petrochemical Product 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 petrochemical engineering technician may perform tasks in a number of key areas of the occupational standards, but not necessarily in all areas. For example, in large operations, other individuals may be employed or designated to perform specific tasks.

Petrochemical product technicians shall operate, run and maintain the main equipment capable of producing petrochemical products under the supervision of petrochemical product process engineer. These mainly include the start-up and shutdown of compressor unit, distillation column, absorption and desorption device, and the adjustment of the process parameters of the device to ensure the normal operation of the device, correct identification and handling of faults in the operation of pumps, and the maintenance of heat exchanger.

Generally, the petrochemical engineering technician performs the following duties:

a) Carry out material handling
b) Conduct material heat exchange
c) Conduct material heating
d) Conduct Material reaction
e) Carry out material separation
f) Carry out maintenance of pump and pipeline
g) Conduct material compression
h) Perform material separation
i) Identify faults and fix the process equipment
g) Conduct maintenance of process equipment

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

4.0. VALIDITY PERIOD

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

5.0 OCCUPATIONAL STANDARDS

5.1 OCCUPATIONAL STANDARDS FOR PETROCHEMICAL ENGINEERING TECHNICIAN - NTA LEVEL 6

<table>
<tr><td>OCCUPATION</td><td>PETROCHEMICAL ENGINEERING TECHNICIAN</td><td>OCCUPATION CODE</td><td></td></tr>
<tr><td>DUTY TITLE</td><td>CONDUCT MATERIAL COMPRESSION</td><td>DUTY NO.</td><td>601</td></tr>
<tr><td>TASK TITLE</td><td>START UP THE COMPRESSOR UNIT</td><td>TASK NO.</td><td>6011</td></tr>
<tr><td>PERFORMANCE CRITERIA</td><td colspan="3">The person performing this task must be able to start up the compressor unit according to technical requirements.</td></tr>
<tr><td>RANGE STATEMENT</td><td colspan="3">The task can be performed in the production equipment under the supervision of petrochemical product process engineers. The equipment and tools to be used include:
1. PPE, such as work clothes, safety shoes, helmet, gloves, safety glasses, earplugs, etc.
2. Compressor;
3. Cooler;
4. Lubricating oil pump and oil tank;
5. Normal supply of high voltage power, low voltage power, cooling water, instrument air and other public materials;
6. Instrument system;
7. Walkie-talkie;
8. Wrench;
9. Pipe tongs;
10. Thermo detector;
11. Vibration meter.</td></tr>
<tr><td colspan="4">EVIDENCE REQUIREMENTS</td></tr>
<tr><td colspan="2">PRACTICAL PERFORMANCE</td><td colspan="2">UNDERPINNING KNOWLEDGE</td></tr>
<tr><td colspan="2">The person performing this task must be able to do the following:
1. Wear labour protection appliance before performing tasks;
2. Select appropriate tools and equipment for this task;
3. Inspect utilities;
4. Supply power for equipment;
5. Check compressor;
6. Check lubricating oil system;
7. Start the auxiliary oil pump and oil system operation;
8. Monitor oil temperature, oil pressure, and oil level;
9. Close the feed pipeline valve;
10. Open the nitrogen pipeline valve;
11. Reset compressor interlocking;
12. Start the main motor;</td><td colspan="2">Detailed knowledge about:
1.0. Methods
The person performing this task must be able to explain how to:
1.1. Start up the lubricating oil system;
1.2. Reset and start the compressor;
1.3. Start up with nitrogen;
1.4. Switch conveying gas;
1.5 Adjust parameters.

2.0. Principles
The person performing this task must be able to explain the following principles:
2.1 Principles of safe operation of compressor units;
2.2 Bernoulli equation;
2.3 Straight pipe resistance;
2.4 Local resistance;</td></tr>
</table>

13. Open the exhaust valve at the outlet; 14. Open the inlet and outlet valves of the cooler; 15. Monitor the operating pressure, temperature, and vibration of compressor; 16. Open the feed pipeline valve and close the nitrogen pipeline valve; 17. Close the exhaust valve at the outlet and open the compressor outlet valve; 18. Monitor compressor operating inlet pressure, outlet pressure, conveying gas cooling temperature, oil temperature, oil pressure, and vibration data. 19. Observe health, occupational and environmental safety rules and regulations.	2.5 Operating principles of compressor; 2.6 Structure of compressor equipment; 2.7 Structure of heat exchanger equipment. **3.0. Theories** The person performing this task must be able to explain the following: 3.1 Start-up steps of compressor; 3.2. Adjustment of DCS central control system; 3.3 Compressor pressure control method; 3.4 Compressor temperature control method; 3.5 Compressor flow regulation method; 3.6 Oil circuit process and compression process. **4.0 Essential Skills** 4.1 Communication skills; 4.2 Teamwork skills; 4.3 Autonomous learning skills; 4.4 Emergency handling skills; 4.5 Safety protection skills; 4.6 Record filling skills. **5.0 Math Skills** 5.1 Calculus.
DESCRIPTION ON THE END PRODUCTS / SERVICE	The compressor unit is started according to technical requirements.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Safety and health knowledge; 2. Equipment maintenance knowledge; 3. Knowledge of process flow and equipment structure diagram reading; 4. Knowledge of electrical instrument; 5. Knowledge of environmental protection.

OCCUPATION	PETROCHEMICAL ENGINEERING TECHNICIAN	**OCCUPATION CODE**	
DUTY TITLE	CONDUCT MATERIAL COMPRESSION	**DUTY NO.**	601
TASK TITLE	ADJUST AND OPERATE THE COMPRESSOR UNIT	**TASK NO.**	6012
PERFORMANCE CRITERIA	The person performing this task must be able to adjust and operate the compressor unit according to technical requirements.		
RANGE STATEMENT	The task can be performed in the production equipment under the supervision of petrochemical product process engineers. The equipment and tools to be used include: 1. PPE, such as work clothes, safety shoes, helmet; 2. Compressor; 3. Cooler; 4. Lubricating oil pump and oil tank; 6. Instrument system; 7. DCS operation system; 8. Walkie-talkie;		

EVIDENCE REQUIREMENTS	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Wear labour protection appliance before performing tasks; 2. Select appropriate tools and equipment for this task; 3. Adjust the inlet pressure, outlet pressure and cooler water valve to use the downstream device gas flow and pressure, temperature as the main parameters; 4. Adjust the water valve opening of the oil cooler to stabilize the oil temperature; 5. Adjust the water valve opening of the gas cooler to stabilize the gas temperature; 6. Monitor compressor operating inlet pressure, outlet pressure, conveying gas cooling temperature, oil temperature, oil pressure, and vibration data. 7. Observe health, occupational and environmental safety rules and regulations.	**Detailed knowledge about:** **1.0. Methods** The person performing this task must be able to explain how to: 1.1 Set process parameters; 1.2 Control the opening of inlet and outlet valves; 1.3 Control oil temperature; 1.4 Control gas cooling temperature. **2.0. Principles** The person performing this task must be able to explain the following principles: 2.1 Principles of safe operation of compressor units; 2.2 Performance parameters of compressor; 2.3 Characteristic curve of compressor; 2.4 Operating principles of compressor; 2.5 Principles of enhanced heater transfer; 2.6 Principles of reduced heat transfer; 2.7 Structure of compressor equipment; 2.8 Structure of heat exchanger equipment. **3.0. Theories**

	The person performing this task must be able to explain the following: 3.1 Setting of temperature, pressure, flow and other instrument parameters; 3.2 Basis for adjusting instrument parameters such as temperature, pressure and flow; 3.3 Operation and adjustment of DCS central control system; 3.4 Factors affecting compressor operation. **4.0 Essential Skills** 4.1 Communication skills; 4.2 Teamwork skills; 4.3 Autonomous learning skills; 4.4 Emergency handling skills; 4.5 Safety protection skills; 4.6 Record filling skills. **5.0 Math Skills** 5.1 Calculus.
DESCRIPTION ON THE END PRODUCTS / SERVICE	The compressor unit is adjusted and operated according to technical requirements.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Safety and health knowledge; 2. Equipment maintenance knowledge; 3. Knowledge of process flow and equipment structure diagram reading; 4. Knowledge of electrical instrument operation; 5. Knowledge of environmental protection. 6. Computer operation knowledge.

OCCUPATION	PETROCHEMICAL ENGINEERING TECHNICIAN	**OCCUPATION CODE**	
DUTY TITLE	CONDUCT MATERIAL COMPRESSION	**DUTY NO.**	601
TASK TITLE	SHUT DOWN THE COMPRESSOR UNIT	**TASK NO.**	6013
PERFORMANCE CRITERIA	The person performing this task must be able to shut down the compressor unit according to technical requirements.		
RANGE STATEMENT	The task can be performed in the production equipment under the supervision of petrochemical product process engineers. The equipment and tools to be used include: 1. PPE, such as work clothes, safety shoes, helmets, gloves, safety glasses, earplugs, etc. 2. Compressor; 3. Cooler; 4. Lubricating oil pump and oil tank; 5. Normal supply of high voltage power, low voltage power, cooling water, instrument air, nitrogen and other public materials; 6. Instrument system; 7. Walkie-talkie; 8. Wrench; 9. Pipe tongs; 10. Thermo detector; 11. Vibration meter.		

EVIDENCE REQUIREMENTS	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Wear labour protection appliance before performing tasks; 2. Select appropriate tools and equipment for this task; 3. Open the exhaust valve and close the compressor outlet valve; 4. Open the nitrogen feed valve and close the inlet valve of the compressor unit; 5. Confirm that the replacement of the compressor unit is qualified; 6. Turn off the main motor; 7. Confirm that the cooling of the compressor unit is qualified; 8. Turn off the oil pump; 9. Adjust the valve to its initial state; 10. Power off the instrument; 11. Turn off the main power supply. 12. Observe health, occupational and environmental safety rules and	**Detailed knowledge about:** **1.0. Methods** The person performing this task must be able to explain how to: 1.1 Reduce load; 1.2 Switch gas; 1.3 Replace system; 1.4 Cool down. **2.0. Principle** The person performing this task must be able to explain the following principles: 2.1 Principles of safe operation of compressor units; 2.2 Bernoulli equation; 2.3 Straight pipe resistance; 2.4 Local resistance; 2.5 Operating principles of compressor; 2.6 Structure of compressor equipment; 2.7 Structure of heat exchanger equipment.

regulations.	**3.0. Theories** The person performing this task must be able to explain the following: 3.1 Shutdown steps of compressor; 3.2 Pressure drop regulation method; 3.3 Flow reduction adjustment method; 3.4 Temperature drop adjustment method; 3.5 Compressor system processing method. **4.0 Essential Skills** 4.1 Communication skills; 4.2 Teamwork skills; 4.3 Autonomous learning skills; 4.4 Emergency handling skills; 4.5 Safety protection skills; 4.6 Record filling skills. **5.0 Math Skills** 5.1 Calculus.
DESCRIPTION ON THE END PRODUCTS / SERVICE	The compressor unit is shut down according to technical requirements.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Safety and health knowledge; 2. Equipment maintenance knowledge; 3. Knowledge of process flow and equipment structure diagram reading; 4. Knowledge of electrical instrument operation; 5. Knowledge of environmental protection. 6. Computer operation knowledge.

OCCUPATION	PETROCHEMICAL ENGINEERING TECHNICIAN	**OCCUPATION CODE**	
DUTY TITLE	CARRY OUT MATERIAL SEPARATION	**DUTY NO.**	602
TASK TITLE	START UP THE DISTILLATION COLUMN	**TASK NO.**	6021
PERFORMANCE CRITERIA	The person performing this task must be able to start up the distillation column according to technical requirements.		
RANGE STATEMENT	The task can be performed in the production equipment under the supervision of petrochemical product process engineers. The equipment and tools to be used include: 1. PPE, such as work clothes, safety shoes, helmet, gloves, safety glasses, etc.; 2. Distillation column; 3. Overhead condenser; 4. Overhead reflux tank; 5. Reflux pump; 6. Bottom reboiler; 7. Bottom steam buffer tank; 8. Instrument system. 9. Walkie-talkie; 10. Wrench; 11. Pipe tongs; 12. Thermo detector; 13. Vibration meter.		

EVIDENCE REQUIREMENTS	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Wear labour protection appliance before performing tasks; 2. Select appropriate tools and equipment for this task; 3. Inspect utilities; 4. Supply power for equipment; 5. Check overhead product tank, feedstock tank, reflux tank, etc.; 6. Feed finished materials (with distillation cycle); 7. Start the circulating pump; 8. Monitor bottom level indication; 9. Start reboiler; 10. Monitor the temperature indication of each column plate on the column body and overhead pressure indication; 11. Open the overhead condenser to cool water;	**Detailed knowledge about:** **1.0. Methods** The person performing this task must be able to explain how to: 1.1 Feed the distillation column; 1.2. Start the reboiler; 1.3. Establish reflux; 1.4. Adjust parameters. **2.0. Principle** The person performing this task must be able to explain the following principles: 2.1 Principles of safe operation of distillation column; 2.2 Distillation principle. 2.3 Gas-liquid phase equilibrium relationship; 2.4 Temperature phase diagram; 2.5 Full column material balance; 2.6 Operating line equations for

12. Start the reflux pump and perform a full reflux operation; 13. Analyse feedstock composition; 14. Open the feed pipeline valve; 15. Control the flow of the reflux pump; 16. Adjust the output value of the frequency converter; 17. Start the overhead extraction pump for product discharge; 18. Start the bottom extraction pump for product discharge. 19. Observe health, occupational and environmental safety rules and regulations.	distillation and stripping sections; 2.7 Feed heat condition equation; 2.8 Calculation of reflux ratio; 2.9 Heat balance; 2.10 Structure of distillation column; 2.11 Type of column plate; 2.12 Process flow of distillation. **3.0. Theories** The person performing this task must be able to explain the following: 3.1 Start-up steps of distillation column; 3.2 Adjustment method for material balance; 3.3 Adjustment method for reflux ratio; 3.4 Adjustment method for feed heat condition; 3.5 Adjustment of feed quantity; 3.6 Adjustment method for overhead temperature; 3.7 Adjustment method for bottom temperature; 3.9 Adjustment of operating pressure. **4.0 Essential Skills** 4.1 Communication skills; 4.2 Teamwork skills; 4.3 Autonomous learning skills; 4.4 Emergency handling skills; 4.5 Safety protection skills; 4.6 Record filling skills. **5.0 Math Skills** 5.1 Calculus.
DESCRIPTION ON THE END PRODUCTS / SERVICE	The distillation column is started according to technical requirements.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Safety and health knowledge; 2. Equipment maintenance knowledge; 3. Knowledge of process flow and equipment structure diagram reading; 4. Knowledge of electrical instrument operation; 5. Knowledge of environmental protection. 6. Computer operation knowledge.

OCCUPATION	PETROCHEMICAL ENGINEERING TECHNICIAN	**OCCUPATION CODE**	
DUTY TITLE	PERFORM MATERIAL SEPARATION	**DUTY NO.**	602
TASK TITLE	ADJUST AND OPERATE THE DISTILLATION COLUMN	**TASK NO.**	6022
PERFORMANCE CRITERIA	The person performing this task must be able to adjust and operate the distillation column according to technical requirements.		
RANGE STATEMENT	The task can be performed in the production equipment under the supervision of petrochemical product process engineers. The equipment and tools to be used include: 1. PPE, such as work clothes, safety shoes, helmet, gloves, safety glasses, etc.; 2. Distillation column; 3. Overhead condenser; 4. Overhead reflux tank; 5. Reflux pump; 6. Bottom reboiler; 7. Bottom steam buffer tank; 8. DCS operation system; 9. Walkie-talkie;		

EVIDENCE REQUIREMENTS	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Wear labour protection appliance before performing tasks; 2. Select appropriate tools and equipment for this task; 3. Adjust the reboiler and control the heating steam flow by taking the temperature of the sensitive plate in the distillation section as the main parameter; 4. Adjust cooling water volume of the overhead condenser to control pressure; 5. Adjust the gas phase discharge of the reflux tank to control pressure parameters; 6. Adjust the bottom product extraction volume to control the bottom liquid level; 7. Adjust the overhead product extraction volume to control the liquid level of the reflux tank; 8. Adjust the feed quantity and quantity of reflux. 9. Observe health, occupational and environmental safety rules and regulations.	**Detailed knowledge about:** **1.0. Methods** The person performing this task must be able to explain how to: 1.1 Control the bottom temperature; 1.2 Control the overhead temperature; 1.3 Control the overhead pressure; 1.4 Control the bottom liquid level; 1.5 Control the liquid level of the reflux tank; 1.6 Control the liquid level of overhead product tank; 1.7 Control the feedstock flow; 1.8 Control the liquid level of bottom product tank; **2.0. Principles** The person performing this task must be able to explain the following principles: 2.1 Principles of safe operation of distillation column; 2.2 Distillation principle. 2.3 Gas-liquid phase equilibrium relationship;

	2.4 Temperature phase diagram; 2.5 Full column material balance; 2.6 Normal contact state of gas-liquid on the column plate; 2.7 Operating line equations for distillation and stripping sections; 2.8 Feed heat condition equation; 2.9 Column plate efficiency and actual number of column plates; 2.10 Heat balance. **3.0. Theories** The person performing this task must be able to explain the following: 3.1 Overhead temperature control methods; 3.2 Bottom temperature control methods; 3.3 Pressure control methods; 3.4 Feed quantity control methods; 3.5 Control method for feed heat condition; 3.6 Liquid level control method for product tank; 3.7 Liquid level control method for reflux tank; 3.8 Bottom liquid level control methods; 3.9 Adjustment method for reflux ratio; 3.10 Adjustment method for overhead product discharge volume; 3.11 Adjustment method for bottom product discharge volume. **4.0 Essential Skills** 4.1 Communication skills; 4.2 Teamwork skills; 4.3 Autonomous learning skills; 4.4 Emergency handling skills; 4.5 Safety protection skills; 4.6 Record filling skills. **5.0 Math Skills** 5.1 Calculus.
DESCRIPTION ON THE END PRODUCTS / SERVICE	The distillation column is adjusted and operated according to technical requirements.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Safety and health knowledge; 2. Equipment maintenance

	knowledge; 3. Knowledge of process flow and equipment structure diagram reading; 4. Knowledge of electrical instrument operation; 5. Knowledge of environmental protection. 6. Computer operation knowledge.

OCCUPATION	PETROCHEMICAL ENGINEERING TECHNICIAN	**OCCUPATION CODE**	
DUTY TITLE	MATERIAL SEPARATION	**DUTY NO.**	602
TASK TITLE	SHUT DOWN THE DISTILLATION COLUMN	**TASK NO.**	6023
PERFORMANCE CRITERIA	The person performing this task must be able to shut down the distillation column according to technical requirements.		
RANGE STATEMENT	The task can be performed in the production equipment under the supervision of petrochemical product process engineers. The equipment and tools to be used include: 1. PPE, such as work clothes, safety shoes, helmet, gloves, safety glasses, etc.; 2. Distillation column; 3. Overhead condenser; 4. Overhead reflux tank; 5. Reflux pump; 6. Bottom reboiler; 7. Bottom steam buffer tank; 8. Walkie-talkie; 9. Wrench; 10. Pipe tongs; 11. Thermo detector; 12. Vibration meter.		

EVIDENCE REQUIREMENTS	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Wear labour protection appliance before performing tasks; 2. Select appropriate tools and equipment for this task; 3. Stop the overhead extraction pump; 4. Close the feed valve; 5. Stop heating the reboiler; 6. Stop the reflux pump; 7. Close the overhead condenser to cool water; 8. Adjust the valve to its initial state; 9. Power off. 10. Observe health, occupational and environmental safety rules and regulations.	**Detailed knowledge about:** **1.0. Methods** The person performing this task must be able to explain how to: 1.1 Reduce load; 1.2 Stop feeding and reboiler; 1.3 Stop reflux; 1.4 Reduce pressure and cool down. **2.0. Principles** The person performing this task must be able to explain the following principles: 2.1 Principles of safe operation of distillation column; 2.2 Distillation principle. 2.3 Heat exchange principle; 2.4 Structure of distillation column. **3.0. Theories** The person performing this task must be able to explain the following: 3.1 Adjustment method for reducing feed;

	3.2 Temperature drop adjustment method; 3.3 Adjustment method for stopping reflux; 3.4 Pressure drop regulation method. **4.0 Essential Skills** 4.1 Communication skills; 4.2 Teamwork skills; 4.3 Autonomous learning skills; 4.4 Emergency handling skills; 4.5 Safety protection skills; 4.6 Record filling skills. **5.0 Math Skills** 5.1 Calculus.
DESCRIPTION ON THE END PRODUCTS / SERVICE	The distillation column is shut down according to technical requirements.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Safety and health knowledge; 2. Equipment maintenance knowledge; 3. Knowledge of process flow and equipment structure diagram reading; 4. Knowledge of electrical instrument operation; 5. Knowledge of environmental protection. 6. Computer operation knowledge.

OCCUPATION	PETROCHEMICAL ENGINEERING TECHNICIAN	**OCCUPATION CODE**	
DUTY TITLE	MATERIAL SEPARATION	**DUTY NO.**	602
TASK TITLE	START UP THE ABSORPTION AND DESORPTION DEVICES	**TASK NO.**	6024
PERFORMANCE CRITERIA	The person performing this task must be able to start up the absorption and desorption devices according to technical requirements.		
RANGE STATEMENT	The task can be performed in the production equipment under the supervision of petrochemical product process engineers. The equipment and tools to be used include: 1. PPE, such as work clothes, safety shoes, helmet, gloves, safety glasses, etc.; 2. Storage tanks; 3. Knockout drum; 4. Overhead condenser of absorption column; 5. Circulating oil cooler; 6. Centrifugal pump; 7. Desorption column; 8. Overhead reflux tank of desorption column; 9. Heat exchanger; 10. Overhead condenser of desorption column; 11. Bottom reboiler of desorption column; 12. Overhead reflux extraction pump of desorption column; 13. Overhead extraction pump; 14. Walkie-talkie; 15. Wrench; 16. Pipe tongs; 17. Thermo detector; 18. Vibration meter.		

EVIDENCE REQUIREMENTS	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Wear labour protection appliance before performing tasks; 2. Select appropriate tools and equipment for this task; 3. Inspect utilities; 4. Check each valve; 5. Supply power for equipment; 6. Stamp Nitrogen; 7. Prepare materials (absorption liquid, desorption solution); 8. Start the desorption solution pump; 9. Start the absorption liquid pump; 10. Establish absorption liquid and	**Detailed knowledge about:** **1.0. Methods** The person performing this task must be able to explain how to: 1.1 Set the pressure in the column; 1.2 Feed absorption oil into the absorption column; 1.3 Feed absorption oil into the desorption column; 1.4 Establish cold circulation; 1.5 Establish reflux. **2.0. Principle** The person performing this task must be able to explain the following principles:

desorption solution circulation; 11. Start the heating of the desorption column reboiler; 12. Start the overhead condenser of desorption column; 13. Open the material feeding valve; 14. Control the bottom liquid level of the absorption column; 15. Control the bottom liquid level of the desorption column. 16. Observe health, occupational and environmental safety rules and regulations.	2.1 Principles of safe operation of absorption and desorption device; 2.2 Absorption rate equation; 2.3 Full column material balance; 2.4 Calculation of absorbent dosage; 2.5 Absorption operating line equation; 2.6 Structure of absorption column; 2.7 Structure of desorption column; 2.8 Packing type. **3.0. Theories** The person performing this task must be able to explain the following: 3.1 Start-up steps of absorption and desorption device; 3.2 Adjustment method for material balance; 3.3 Adjustment of gas feed quantity; 3.4 Adjustment method for absorbent dosage; 3.5 Adjustment method for absorption temperature of the absorption column; 3.6 Temperature regulation method for desorption column; 3.7 Adjustment of operating pressure; 3.8 Gas-liquid phase equilibrium relationship; 3.9 Two-film theory. **4.0 Essential Skills** 4.1 Communication skills; 4.2 Teamwork skills; 4.3 Autonomous learning skills; 4.4 Emergency handling skills; 4.5 Safety protection skills; 4.6 Record filling skills. **5.0 Math Skills** 5.1 Calculus.
DESCRIPTION ON THE END PRODUCTS / SERVICE	The absorption and desorption devices are started according to technical requirements.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Safety and health knowledge; 2. Equipment maintenance knowledge; 3. Knowledge of process flow and equipment structure diagram reading; 4. Knowledge of electrical instrument operation; 5. Knowledge of environmental protection.

	6. Computer operation knowledge.

OCCUPATION	PETROCHEMICAL ENGINEERING TECHNICIAN	**OCCUPATION CODE**	
DUTY TITLE	MATERIAL SEPARATION	**DUTY NO.**	602
TASK TITLE	ADJUST AND OPERATE THE ABSORPTION AND DESORPTION DEVICES	**TASK NO.**	6025
PERFORMANCE CRITERIA	The person performing this task must be able to adjust and operate the absorption and desorption devices according to technical requirements.		
RANGE STATEMENT	The task can be performed in the production equipment under the supervision of petrochemical product process engineers. The equipment and tools to be used include: 1. PPE, such as work clothes, safety shoes, helmet; 2. Storage tanks; 1. Knockout drum; 2. Overhead condenser of absorption column; 3. Circulating oil cooler; 4. Centrifugal pump; 5. Desorption column; 6. Overhead reflux tank of desorption column; 7. Heat exchanger; 8. Overhead condenser of desorption column; 9. Bottom reboiler of desorption column; 10. Overhead reflux extraction pump of desorption column; 11. Overhead extraction pump; 12. DCS operation system. 13. Walkie-talkie;		
EVIDENCE REQUIREMENTS			
PRACTICAL PERFORMANCE		**UNDERPINNING KNOWLEDGE**	
The person performing this task must be able to do the following: 1. Wear labour protection appliance before performing tasks; 2. Select appropriate tools and equipment for this task; 3. Regulate gas flow; 4. Regulate absorption liquid flow; 5. Regulate desorption solution flow; 6. Observe the in-column phenomenon (flooding); 7. Regulate the pressure of the absorption column; 8. Regulate the pressure of the desorption column; 9. Regulate the liquid level of the absorption column;		**Detailed knowledge about:** **1.0. Methods** The person performing this task must be able to explain how to: 1.1 Adjust process parameters; 1.2 Add new oil; 1.3 Drain; 1.4 Control column pressure. **2.0. Principles** The person performing this task must be able to explain the following principles: 2.1 Principles of safe operation of absorption and desorption device; 2.2 Gas-liquid phase equilibrium relationship; 2.3 Absorption rate equation;	

10. Regulate the liquid level of the desorption column; 11. Control the bottom temperature of desorption column; 12. Regulate the liquid level of the absorption column reflux tank; 13. Regulate the liquid level of the desorption column reflux tank. 14. Observe health, occupational and environmental safety rules and regulations.	2.4 Full column material balance; 2.5 Adjustment of absorbent dosage; 2.6 Absorption operating line equation. **3.0. Theories** The person performing this task must be able to explain the following: 3.1 Absorption temperature control methods; 3.2 Operating pressure control methods; 3.3 Gas feed quantity control methods; 3.4 Absorption column liquid level control methods; 3.5 Desorption column liquid level control methods; 3.6 Absorbent flow control methods; 3.7 Two-film theory. **4.0 Essential Skills** 4.1 Communication skills; 4.2 Teamwork skills; 4.3 Autonomous learning skills; 4.4 Emergency handling skills; 4.5 Safety protection skills; 4.6 Record filling skills. **5.0 Math Skills** 5.1 Calculus.
DESCRIPTION ON THE END PRODUCTS / SERVICE	The absorption and desorption devices are adjusted and operated according to technical requirements.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Safety and health knowledge; 2. Equipment maintenance knowledge; 3. Knowledge of process flow and equipment structure diagram reading; 4. Knowledge of electrical instrument operation; 5. Knowledge of environmental protection. 6. Computer operation knowledge.

OCCUPATION	PETROCHEMICAL ENGINEERING TECHNICIAN	**OCCUPATION CODE**	
DUTY TITLE	PERFORM MATERIAL SEPARATION	**DUTY NO.**	602
TASK TITLE	SHUT DOWN THE ABSORPTION AND DESORPTION DEVICES	**TASK NO.**	6026
PERFORMANCE CRITERIA	The person performing this task must be able to shut down the absorption and desorption devices according to technical requirements.		
RANGE STATEMENT	The task can be performed in the production equipment under the supervision of petrochemical product process engineers. The equipment and tools to be used include: 1. PPE, such as work clothes, safety shoes, helmet, gloves, safety glasses, etc.; 2. Storage tanks; 3. Knockout drum; 4. Overhead condenser of absorption column; 5. Circulating oil cooler; 6. Centrifugal pump; 7. Desorption column; 8. Overhead reflux tank of desorption column; 9. Heat exchanger; 10. Overhead condenser of desorption column; 11. Bottom reboiler of desorption column; 12. Overhead reflux extraction pump of desorption column; 13. Overhead extraction pump; 14. Walkie-talkie; 15. Wrench; 16. Pipe tongs; 17. Thermo detector; 18. Vibration meter.		

EVIDENCE REQUIREMENTS	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Wear labour protection appliance before performing tasks; 2. Select appropriate tools and equipment for this task; 3. Close the material feeding valve; 4. Turn off the absorption liquid pump; 5. Turn off the desorption solution pump; 6. Close the reflux extraction pump of the desorption column; 7. Close the steam valve of the desorption column reboiler; 8. Close the cooling water valve; 9. Turn off the main power supply.	**Detailed knowledge about:** **1.0. Methods** The person performing this task must be able to explain how to: 1.1 Stop feeding; 1.2 Discharge oil of the absorption column system; 1.3 Feed absorption oil into the desorption column; 1.4 Stop product discharge; 1.5 Stop the reboiler to reduce the column temperature; 1.6 Stop reflux; **2.0. Principle**

10. Restore all equipment and valves to their original state. 11. Observe health, occupational and environmental safety rules and regulations.	The person performing this task must be able to explain the following principles: 2.1 Principles of safe operation of absorption and desorption device; 2.2 Heat exchange principle; 2.3 Basis for determining the absorbent dosage; 2.4 Structure of absorption column; 2.5 Structure of desorption column; **3.0. Theories** The person performing this task must be able to explain the following: 3.1 Adjustment method for reducing gas feed; 3.2 Temperature drop adjustment method; 3.4 Pressure drop regulation method. 3.5 Absorbent regulation method; 3.6 Packing type. **4.0 Essential Skills** 4.1 Communication skills; 4.2 Teamwork skills; 4.3 Autonomous learning skills; 4.4 Emergency handling skills; 4.5 Safety protection skills; 4.6 Record filling skills. **5.0 Math Skills** 5.1 Calculus.
DESCRIPTION ON THE END PRODUCTS / SERVICE	The absorption and desorption devices are shut down according to technical requirements.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Safety and health knowledge; 2. Equipment maintenance knowledge; 3. Knowledge of process flow and equipment structure diagram reading; 4. Knowledge of electrical instrument operation; 5. Knowledge of environmental protection. 6. Computer operation knowledge.

OCCUPATION	PETROCHEMICAL ENGINEERING TECHNICIAN	**OCCUPATION CODE**	
DUTY TITLE	IDENTIFY FAULTS AND HANDLE PUMP EQUIPMENT	**DUTY NO.**	603
TASK TITLE	IDENTIFY AND HANDLE FAULTS SUCH AS LEAKAGE AND ABNORMAL NOISE IN CENTRIFUGAL PUMPS	**TASK NO.**	6031
PERFORMANCE CRITERIA	The person performing this task must be able to identify and handle the leakage, abnormal sound and other faults of centrifugal pump according to technical requirements.		
RANGE STATEMENT	The task can be performed in the production equipment under the supervision of petrochemical product process engineers. The equipment and tools to be used include: 1. PPE, such as work clothes, safety shoes, helmet, gloves, safety glasses, etc.; 2. Centrifugal pump; 3. Outlet flow meter; 4. Inlet pressure gauge; 5. Outlet pressure gauge; 6. Inlet filter; 7. Circulating cold water system; 8. Frequency converter; 9. Walkie-talkie; 10. Wrench; 11. Pipe tongs; 12. Thermo detector; 13. Vibration meter.		

EVIDENCE REQUIREMENTS	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Wear labour protection appliance before performing tasks; 2. Select appropriate tools and equipment for this task; 3. Check the vibration and abnormal noise of the pump; 4. Determine whether the centrifugal pump is leaking and switch to the standby pump; 5. Determine the blockage of the inlet pipeline and switch to the backup pump; 6. Determine pump cavitation phenomenon and switch to the standby pump; 7. Determine air binding phenomenon and switch to the standby pump;	**Detailed knowledge about:** **1.0. Methods** The person performing this task must be able to explain how to: 1.1 Stop pumps; 1.2 Switch pumps; 1.3 Identify and handle leakage; 1.4 Identify and handle the blockage of inlet pipelines; 1.5 Identify and handle pump cavitation; 1.6 Identify and handle pump air binding; **2.0. Principle** The person performing this task must be

8. Power off and empty the medium. 9. Observe health, occupational and environmental safety rules and regulations.	able to explain the following principles: 2.1 Bernoulli equation; 2.2 Principle of centrifugal pump cavitation; 2.3 Principle of centrifugal pump air binding; 2.4 Structure and equipment characteristics of centrifugal pumps. **3.0. Theories** The person performing this task must be able to explain the following: 3.1 Pump leakage phenomenon and solutions; 3.2 Pump cavitation phenomenon and solutions; 3.3 Pump air binding phenomenon and solutions. **4.0 Essential Skills** 4.1 Communication skills; 4.2 Teamwork skills; 4.3 Autonomous learning skills; 4.4 Emergency handling skills; 4.5 Safety protection skills; 4.6 Skills in fault identification and handling;
DESCRIPTION ON THE END PRODUCTS / SERVICE	Leakage, abnormal sound and other faults of centrifugal pump are identified and handled according to technical requirements.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Safety and health knowledge; 2. Equipment maintenance knowledge; 3. Knowledge of equipment structure diagram reading; 4. Knowledge of electrical instrument operation; 5. Knowledge of environmental protection.

OCCUPATION	PETROCHEMICAL ENGINEERING TECHNICIAN	**OCCUPATION CODE**	
DUTY TITLE	IDENTIFY FAULTS AND HANDLE PUMP EQUIPMENT	**DUTY NO.**	603
TASK TITLE	IDENTIFY AND HANDLE FAULTS SUCH AS INSUFFICIENT FLOW AND LEAKAGE IN RECIPROCATING PUMPS	**TASK NO.**	6032
PERFORMANCE CRITERIA	The person performing this task must be able to identify and handle the insufficient flow, leakage and other faults of reciprocating pump according to technical requirements and operation manual, as well as the operating conditions of the reciprocating pump.		
RANGE STATEMENT	The task can be performed in the production equipment under the supervision of petrochemical product process engineers. The equipment and tools to be used include: 1. PPE, such as work clothes, safety shoes, helmet, gloves, safety glasses, etc.; 2. Reciprocating pump; 3. Outlet flow meter; 4. Inlet pressure gauge; 5. Outlet pressure gauge; 6. Inlet filter; 7. Outlet safety valve; 8. Stroke adjustment mechanism; 9. Walkie-talkie; 10. Wrench; 11. Pipe tongs; 12. Thermo detector; 13. Vibration meter.		

EVIDENCE REQUIREMENTS	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Wear labour protection appliance before performing tasks; 2. Select appropriate tools and equipment for this task; 3. Check the inlet valve; 4. Check inlet filter; 5. Check inlet/outlet pressure gauge; 6. Check outlet flow meters; 7. Check for leakage at each sealing point; 8. Check the lubricating oil condition; 9. Check the vibration of reciprocating	**Detailed knowledge about:** **1.0. Methods** The person performing this task must be able to explain how to: 1.1 Stop pumps; 1.2 Switch pumps; 1.3 Identify leakage; 1.4 Identify insufficient flow; 1.5 Identify vibration and abnormal noise; 1.6 Identify outlet overpressure and safety valve jumping.

pump and motor; 10. Switch to the standby pumps. 11. Power off and empty the medium. 12. Observe health, occupational and environmental safety rules and regulations.	**2.0. Principle** The person performing this task must be able to explain the following principles: 2.1 Bernoulli equation; 2.2 Structure and equipment characteristics of reciprocating pumps. 2.3 Operating principles of reciprocating pumps. **3.0. Theories** The person performing this task must be able to explain the following: 3.1 Reciprocating pump leakage phenomenon and solutions; 3.2 Reasons and handling measures for outlet overpressure and safety valve jumping; **4.0 Essential Skills** 4.1 Communication skills; 4.2 Teamwork skills; 4.3 Autonomous learning skills; 4.4 Emergency handling skills; 4.5 Safety protection skills; 4.6 Skills in fault identification and handling;
DESCRIPTION ON THE END PRODUCTS / SERVICE	The insufficient flow and leakage in the reciprocating pump are identified and handled according to technical requirements.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Safety and health knowledge; 2. Equipment maintenance knowledge; 3. Knowledge of equipment structure diagram reading; 4. Knowledge of electrical instrument operation; 5. Knowledge of environmental protection.

OCCUPATION	PETROCHEMICAL ENGINEERING TECHNICIAN	**OCCUPATION CODE**	
DUTY TITLE	CONDUCT MAINTENANCE OF HEAT EXCHANGER	**DUTY NO.**	604
TASK TITLE	CONDUCT EXTERNAL MAINTENANCE OF HEAT EXCHANGER	**TASK NO.**	6041
PERFORMANCE CRITERIA	The person performing this task must be able to conduct external maintenance of the heat exchanger as per instruction according to technical requirements.		
RANGE STATEMENT	The task can be performed in the production equipment under the supervision of petrochemical product process engineers. The equipment and tools to be used include: 1. PPE, such as work clothes, safety shoes, helmet, safety belt, protective gloves, safety glasses, etc. 2. Grease; 3. Electric hand drill, abrader; 4. Oil paints; 5. Insulation blanket; 6. Insulation outer protective layer (iron sheet, PVC sheet, etc.); 7. Scaffold; 8. Movable frame; 9. Walkie-talkie; 10. Wrench; 11. Pipe tongs; 12. Thermo detector; 13. Vibration meter.		

EVIDENCE REQUIREMENTS	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Wear labour protection appliance before performing tasks; 2. Select appropriate tools and equipment for this task; 3. Check the insulation condition of heat exchanger; 4. Check the integrity of the heat exchanger insulation skin; 5. Replace the insulation and external protection layer; 6. Check the corrosion of the heat exchanger shell; 7. Polish and dedust heat exchanger shell; 8. Paint the shell of the heat exchanger; 9. Check the integrity of bolt protection; 10. Ensure that the heat exchanger label is intact.	**Detailed knowledge about:** **1.0. Methods** The person performing this task must be able to explain how to: 1.1 Conduct insulation maintenance; 1.2 Conduct maintenance. **2.0. Principle** The person must be able to explain the following principles: 2.1 Heat transfer principle; 2.2 Metal corrosion principle; 2.3 Metal anti-corrosion principle; 2.4 Insulation standards; 2.5 Paint protection standards; 2.6 Bolt protection standards; 2.7 Rust removal standards. **3.0. Theories**

11. Observe health, occupational and environmental safety rules and regulations.	The person performing this task must be able to explain the following: 3.1 Structure and type of heat exchanger. **4.0 Essential Skills** 4.1 Communication skills; 4.2 Teamwork skills; 4.3 Autonomous learning skills; 4.4 Emergency handling skills; 4.5 Safety protection skills; 4.6 Record filling skills.
DESCRIPTION ON THE END PRODUCTS / SERVICE	The external maintenance of heat exchanger is performed according to technical requirements.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Safety and health knowledge; 2. Metal corrosion and protection knowledge; 3. Knowledge of equipment structure diagram reading; 4. Paint coating knowledge; 5. Knowledge of environmental protection.

OCCUPATION	PETROCHEMICAL ENGINEERING TECHNICIAN	**OCCUPATION CODE**	
DUTY TITLE	CONDUCT MAINTENANCE OF HEAT EXCHANGER	**DUTY NO.**	604
TASK TITLE	CONDUCT MAINTENANCE OF SAFETY FACILITIES	**TASK NO.**	6042
PERFORMANCE CRITERIA	The person performing this task must be able to complete the maintenance of the heat exchanger safety facilities as per instruction according to technical requirements and the operation manual.		
RANGE STATEMENT	The task can be performed in the production equipment under the supervision of petrochemical product process engineers. The equipment and tools to be used include: 1. PPE, such as work clothes, safety shoes, helmet, safety belt, protective gloves, safety glasses, etc. 2. Wrench; 3. Special tools; 4. Scaffold; 5. Movable frame; 6. Walkie-talkie; 7. Wrench; 8. Pipe tongs; 9. Thermo detector; 10. Vibration meter.		

EVIDENCE REQUIREMENTS	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Wear labour protection appliance before performing tasks; 2. Select appropriate tools and equipment for this task; 3. Check the integrity of pressure gauge; 4. Remove pressure gauge; 5. Check pressure gauge; 6. Install pressure gauge; 7. Check the integrity of thermometer; 8. Remove thermometer; 9. Check thermometer; 10. Install thermometer; 11. Check the integrity of safety valve; 12. Close the hand valve in front of the safety valve; 13. Remove safety valve; 14. Install safety valve; 15. Open the hand valve in front of the safety valve. 16. Observe health, occupational and	**Detailed knowledge about:** **1.0. Methods** The person performing this task must be able to explain how to: 1.1 Implement the pressure gauge maintenance plan; 1.2 Implement the thermometer maintenance plan; 1.3 Implement the safety valve maintenance plan. **2.0. Principle** The person must be able to explain the following principles: 2.1 Operating principles of pressure gauge; 2.2 Operating principles of thermometer; 2.3 Operating principles of safety valve. **3.0. Theories** The person performing this task must be

environmental safety rules and regulations.	able to explain the following: 3.1 Pressure gauge integrity standards; 3.2 Thermometer protection standards; 3.3 Safety valve protection standards. **4.0 Essential Skills** 4.1 Communication skills; 4.2 Teamwork skills; 4.3 Autonomous learning skills; 4.4 Emergency handling skills; 4.5 Safety protection skills; 4.6 Record filling skills.
DESCRIPTION ON THE END PRODUCTS / SERVICE	The maintenance of heat exchanger safety facilities is performed according to technical requirements.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Safety and health knowledge; 2. Equipment maintenance knowledge; 3. Knowledge of equipment structure diagram reading; 4. Knowledge of electrical instrument operation; 5. Knowledge of environmental protection.

OCCUPATION	PETROCHEMICAL ENGINEERING TECHNICIAN	**OCCUPATION CODE**	
DUTY TITLE	CONDUCT MAINTENANCE OF HEAT EXCHANGER	**DUTY NO.**	604
TASK TITLE	CLEAN THE HEAT EXCHANGER	**TASK NO.**	6043
PERFORMANCE CRITERIA	The person performing this task must be able to clean the heat exchanger according to technical requirements.		
RANGE STATEMENT	The task can be performed in the production equipment under the supervision of petrochemical product process engineers. The equipment and tools to be used include: 1. PPE, such as work clothes, safety shoes, helmet, safety belt, protective gloves, safety glasses, etc. 2. Wrench; 3. Special tools; 4. Scaffold; 5. Movable frame; 6. Walkie-talkie; 7. Wrench; 8. Pipe tongs; 9. Thermo detector; 10. Vibration meter.		

EVIDENCE REQUIREMENTS	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Wear labour protection appliance before performing tasks; 2. Select appropriate tools and equipment for this task; 3. Close the inlet valve of heat exchanger; 4. Close the outlet valve of heat exchanger; 5. Remove the heads on both sides of the heat exchanger; 6. Install cleaning water tank; 7. Power on the cleaning tool; 8. Clean heat exchanger; 9. Install head; 10. Test pressure and leakage; 11. Open the inlet valve of heat exchanger; 12. Open the outlet valve of the heat exchanger and put it into operation. 13. Observe health, occupational and environmental safety rules and regulations.	**Detailed knowledge about:** **1.0. Methods** The person performing this task must be able to explain how to: 1.1 Disassemble and assemble heat exchanger; 1.2 Clean heat exchanger; **2.0. Principle** The person must be able to explain the following principles: 2.1 Structure of heat exchanger; 2.2 Mechanical cleaning principles; 2.3 Chemical cleaning principles. **3.0. Theories** The person performing this task must be able to explain the following: 3.1 Steps and standards for disassembly and assembly of heat exchanger; 3.2 Steps and standards for cleaning of heat exchanger; 3.3 Cleaning plan and safety measures for heat exchanger.

	4.0 Essential Skills 4.1 Communication skills; 4.2 Teamwork skills; 4.3 Autonomous learning skills; 4.4 Emergency handling skills; 4.5 Safety protection skills; 4.6 Record filling skills.
DESCRIPTION ON THE END PRODUCTS / SERVICE	The heat exchanger is cleaned according to technical requirements.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Safety and health knowledge; 2. Equipment maintenance knowledge; 3. Knowledge of equipment structure diagram reading; 4. Knowledge of environmental protection.

OCCUPATION	PETROCHEMICAL ENGINEERING TECHNICIAN	**OCCUPATION CODE**	
DUTY TITLE	CONDUCT MAINTENANCE OF HEAT EXCHANGER	**DUTY NO.**	604
TASK TITLE	SWITCH THE HEAT EXCHANGER OPERATION EQUIPMENT	**TASK NO.**	6044
PERFORMANCE CRITERIA	The person performing this task must be able to switch the heat exchanger operation equipment according to technical requirements.		
RANGE STATEMENT	The task can be performed in the production equipment under the supervision of petrochemical process engineers. The equipment and tools to be used include: 1. PPE, such as work clothes, safety shoes, helmet, protective gloves, safety glasses, etc.; 2. Wrench; 3. Walkie-talkie;		

EVIDENCE REQUIREMENTS	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Wear labour protection appliance before performing tasks; 2. Select appropriate tools and equipment for this task; 3. Test pressure and leakage of standby equipment and confirm that it is intact; 4. Open the outlet valve of standby heat exchanger; 5. Gradually close the inlet valve of the operating heat exchanger; 6. Gradually open the outlet valve of the standby heat exchanger at the same time; 7. Close the outlet valve of the operating equipment; 8. Put standby equipment into operation; 9. Check whether the device runs abnormally; 10. Shut down the heat exchanger and drain the materials for standby. 11. Observe health, occupational and environmental safety rules and regulations.	**Detailed knowledge about:** **1.0. Methods** The person performing this task must be able to explain how to: 1.1 Develop a heat exchanger shutdown plan; 1.2 Develop a standby heat exchanger activation plan. **2.0. Principles** The person must be able to explain the following principles: 3.1 Operating principles of heat exchanger. **3.0. Theories** The person performing this task must be able to explain the following: 3.1 Key points for stable switching of heat exchangers; 3.2 Steps for switching heat exchangers. **4.0 Essential Skills** 4.1 Communication skills; 4.2 Teamwork skills; 4.3 Autonomous learning skills; 4.4 Emergency handling skills; 4.5 Safety protection skills; 4.6 Record filling skills.

DESCRIPTION ON THE END PRODUCTS / SERVICE	The heat exchanger operation equipment is switched according to technical requirements.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Safety and health knowledge; 2. Knowledge of equipment structure diagram reading; 3. Knowledge of electrical instrument operation; 4. Knowledge of environmental protection.

APPENDIX: DACUM CHARTS FOR PETROCHEMICAL ENGINEERING TECHNICIAN - NTA LEVEL 6

DUTIES	TASKS	ENABLERS
1.0 Conduct material compression	1.1 Start up compressor unit 1.2 Adjust and operate the compressor unit 1.3 Shut down compressor unit	**General skills and knowledge** • Cooperate with others using communication skills and report to the superiors • Operating procedures of compressor unit • Skills and knowledge in chemical production safety, equipment operation, and equipment maintenance • Read process flow diagrams • Interpretation of structure diagram of compressor equipment • 5.1Calculus **Tools and equipment** • PPE, such as work clothes, safety shoes, helmet, gloves, safety glasses, earplugs, etc. • Compressor • Cooler • Lubricating oil pump and oil tank • Normal supply of high voltage power, low voltage power, cooling water, instrument air, nitrogen and other public materials • Instrument system • Walkie-talkie • Wrench • Pipe tongs • Thermo detector • Vibration meter • DCS operation system **Materials** Nitrogen, compressed air, gas valve, bearing, lubricating oil, Teflon tape, gasket **Requirements for employees** Teamwork spirit, integrity, time management, and keeping promises; Environmental awareness, and safety operation awareness
2.0 Carry out material separation	2.1 Start up distillation column 2.2 Adjust and operate the	**General skills and knowledge** • Cooperate with others using communication skills and report

DUTIES	TASKS	ENABLERS
	distillation column 2.3 Shut down distillation column 2.4 Start up the absorption and desorption devices 2.5 Adjust and operate the absorption and desorption devices. 2.6 Shut down the absorption and desorption devices.	to the superiors • Operating procedures for using distillation columns • Operating procedures for using absorption and desorption device • Skills and knowledge in chemical production safety, equipment operation, and equipment maintenance • Read process flow diagrams • Interpretation of structure diagram of distillation column equipment • Interpretation of structure diagram of absorption column equipment • Interpretation of structure diagram of desorption column equipment • 5.1Calculus **Tools and equipment** • PPE, such as work clothes, safety shoes, helmet, gloves, safety glasses, etc. • Distillation column • Overhead condenser of distillation column • Overhead reflux tank of distillation column • Reflux pump • Bottom reboilers • Bottom steam buffer tank • Wrench • Pipe tongs • Thermo detector • Vibration meter • Storage tanks • Knockout drum • Overhead condenser of absorption column • Circulating oil cooler • Centrifugal pump • Desorption column • Overhead reflux tank of desorption column • Heat exchanger • Overhead condenser of desorption column

DUTIES	TASKS	ENABLERS
		• Bottom reboiler of desorption column • Overhead reflux extraction pump of desorption column • Overhead extraction pump of desorption column • Walkie-talkie **Materials** Steam, nitrogen, compressed air, bearing, gasket, Teflon tape **Requirements for employees** Teamwork spirit, integrity, time management, and keeping promises; Environmental awareness, and safety operation awareness
3.0 Identify Faults and handle pump equipment	3.1 Identify and handle faults such as leakage and abnormal noise in centrifugal pumps 3.2 Identify and handle faults such as insufficient flow and leakage in reciprocating pumps	**General skills and knowledge** • Cooperate with others using communication skills and report to the superiors • Manual of maintenance procedures for pump • Skills and knowledge in chemical production safety, equipment operation, and equipment maintenance • Interpretation of structure diagram of centrifugal pump and reciprocating pump equipment • Knowledge of fluid transportation • Knowledge of cavitation • Knowledge of air binding • Complex mathematical and math skills **Tools and equipment** • PPE, such as work clothes, safety shoes, helmet, safety belt, protective gloves, safety glasses, etc. • Walkie-talkie • Wrench • Pipe tongs • Thermo detector • Vibration meter **Materials** Bolt, gasket, Teflon tape, filler **Requirements for employees** Teamwork spirit, integrity, time management, and keeping promises;

DUTIES	TASKS	ENABLERS
		Environmental awareness, and safety operation awareness
4.0 Conduct maintenance of heat exchanger	4.1 Conduct external maintenance 4.2 Conduct maintenance of safety facilities 4.3 Clean the heat exchanger 4.4 Switch operating devices periodically	**General skills and knowledge** • Cooperate with others using communication skills and report to the superiors • Manual of maintenance procedures for heat exchanger • Skills and knowledge in chemical production safety, equipment operation, and equipment maintenance • Read process flow diagrams • Interpretation of structure diagram of heat exchanger • Anticorrosion knowledge • Insulation knowledge • Dedusting knowledge • Knowledge of pipe wall thickness • Complex mathematical and math skills **Tools and equipment** • PPE, such as work clothes, safety shoes, helmet, safety belt, protective gloves, safety glasses, etc. • Grease • Electric hand drill, abrader • Oil paints • Insulation blanket • Insulation outer protective layer (iron sheet, PVC sheet, etc.) • Scaffold • Movable frame • Walkie-talkie • Wrench • Pipe tongs • Thermo detector • Vibration meter **Materials** Grease, oil paints Insulation blanket; Insulation outer protective layer (iron sheet, PVC sheet, etc.) **Requirements for employees** Teamwork spirit, integrity, time management, and keeping promises; Environmental awareness, and safety operation awareness