APPLY THERMODYNAMICS PRINCIPLES

UNIT CODE:ENG/OS/WEF/CC/05/6/A

UNIT DESCRIPTION

This unit describes the competencies required by a technician in order to apply thermodynamics principles in their work. It includes understanding fundamentals of thermodynamics, performing steady flow processes, performing non-steady flow processes, understanding perfect gases, generating steam, performing thermodynamics reversibility and entropy, understanding idea gas cycle, demonstrating fuel and combustion, perform heat transfer, understanding heat exchangers, understanding air compressors, understanding gas turbines and understanding of impulse steam turbines.

ELEMENTS AND PERFORMANCE CRITERIA

ELEMENT These describe the key outcomes which make up workplace function.	**PERFORMANCE CRITERIA** These are assessable statements which specify the required level of performance for each of the elements. ***Bold and italicized terms are elaborated in the Range.***
1. Understand fundamentals of thermodynamics	1.1 Terms used in thermodynamics are described 1.2 Thermodynamics processes and cycles are described 1.3 First law of thermodynamics is applied
2. Perform steady flow processes	2.1 Steady flow energy equation is derived 2.2 Steady flow energy equation is applied in problem solving 2.3 Steady flow energy equation is applied in ***utilities***
3. Perform non steady flow processes	3.1 Non-flow energy equation is derived 3.2 Non-flow energy equation is applied in problem solving
4. Understand perfect gases	4.1 ***Perfect gas laws*** are stated 4.2 Gas laws experiment are carried out 4.3 Gas laws are applied
5. Generate steam	5.1 Dryness fraction is determined

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	5.2 Relationship between pressure and boiling point is determined 5.3 Energy balance is carried out 5.4 Relationship between temperature and pressure is determined.
6. Perform thermodynamics reversibility and entropy	6.1 Thermodynamics reversibility is explained 6.2 Principles of heat engine are explained 6.3 Second law of thermodynamics is applied 6.4 Entropy is explained in thermodynamics cycle
7. Understand idea gas cycle	7.1 Ideal gas cycle processes are explained 7.2 Air standard efficiency and actual efficiency are differentiated 7.3 Problems are solved in ideal gas cycle
8. Demonstrate fuel and combustion	8.1 Fuels are classified 8.2 Properties of fuels are described 8.3 Combustion equation are derived 8.4 Combustion equation is applied to combustion and exhaust gas problems
9. Perform heat transfer	9.1 Conduction equation is derived and applied from Fourier's law 9.2 Heat transfer equation is derived and applied from Newton's law of cooling and Fourier's law
10. Understand heat exchangers	10.1 Heat exchangers are classified 10.2 Recuperative heat exchangers are described 10.3 Heat equations are applied to solve heat exchanger problems
11. Understand air compressors	11.1 Air compressors are classified 11.2 ***Types of air compressors*** are described 11.3 Equations of reciprocating compressors are derived and applied
12. Understand gas turbines	12.1 Theoretical cycle for gas turbines is

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	explained 12.2 Open cycle gas turbine is described 12.3 Closed cycle gas turbine is described 12.4 Gas turbine equations are derived and applied
13. Understand impulse steam turbines	13.1 ***Principles of operations*** of the impulse steam turbines is described 13.2 Impulse steam turbine equation is derived and applied

RANGE

This section provides work environments and conditions to which the performance criteria apply. It allows for different work environments and situations that will affect performance.

Variable	Range
1. Utilities may include but not limited to:	• Boilers • Condensers • Compressors • Nozzles • Throttling processes
2. Perfect gas laws may include but not limited to:	• Boyle's law • Charle's law • Joule's law
3. Principles may include but not limited to:	• Newton's laws of motion • Law of conservation of linear momentum • Law of conservation of energy • Archimedes' principle
4. Types of air compressors may include but not limited to:	• Reciprocating • Blowers • Sliding valves

5. Types of air compressors may include but not limited to:	• Compounding • Multistage impulse turbine

REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit of competency.

Required Skills

The individual needs to demonstrate the following skills:

- Apply basic mechanical formulas
- Use of basic mechanical machines
- Perform various unit conversions of mechanical quantities
- Basic mechanical systems design
- Mechanical machine operation
- Logical thinking
- Problem solving
- Applying statistics
- Drawing graphs
- Using different measuring tools

Required knowledge

The individual needs to demonstrate knowledge of:

- Newton's law
- Levers
- Gear trains
- Laws of conservation of energy
- Laws of friction
- Type of forces
- Thermodynamics
- Calculation of fluid pressure and flow rate
- Mechanical advantage and efficiency calculations
- Gas laws

SI units of mechanical energy.

- Power transmission systems
- Parameters of fluid system

- Operation of mechanical machines
- Mechanical calculation of power, energy, work done, torque and safety factor
- Units of measurement, conversions and abbreviations

EVIDENCE GUIDE

This provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge and range.

1. Critical aspects of Competency	Assessment requires evidence that the candidate: 1.1 Identified Principles of mechanical science 1.2 Performed mechanical calculations of a system 1.3 Identified types of forces on a system 1.4 Calculated resultant forces on plane framework 1.5 Identified application of forces on the production flow 1.6 Tested mechanical properties of a materials 1.7 Identified tools and equipment for measuring system parameters 1.8 Recorded and interpreted measured parameters. 1.9 Operated Power transmission systems
2. Resource Implications	The following resources should be provided: 5.1 Access to relevant workplace or appropriately simulated environment where assessment can take place 5.2 Measuring tools and equipment 5.3 Sample materials to be tested
3. Methods of Assessment	Competency in this unit may be assessed through: 3.1 Direct Observation 3.2 Demonstration with Oral Questioning 3.3 Case studies 3.4 Written tests
4. Context of Assessment	Competency may be assessed 4.1 On job 4.2 Off job 4.3 During industrial attachment
5. Guidance information for assessment	Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended.