

OPERATE INDUSTRIAL STEAM TURBINE

UNIT CODE: ENG/OS/IPO/CR/O2/4/A

UNIT DESCRIPTION

This unit describes competencies required to operate industrial steam turbine. It involves apply industrial steam turbine safety procedures, identifying industrial steam turbine parts, starting-up industrial steam turbine operations, running and monitoring industrial steam turbines, shutting down industrial steam turbines, performing industrial steam turbine basic maintenance and generating industrial steam turbine operation report

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. <i>Bold and italicized terms are elaborated in the Range</i>
1. Apply Industrial Steam Turbine Safety Procedures	1.1 Prescribed personal safety gear is worn as per rules and regulations of the <i>Occupational Safety and Health Act (OSHA)</i> 1.2 Safety measures for the operation of the steam turbines are applied as per the rules and regulations of the <i>Occupational Safety and Health Act (OSHA)</i> 1.3 Work environment safety rules and regulations are observed as per the <i>Occupational Safety Act</i> 1.4 <i>Potential, workplace employee and equipment hazards</i> , and their <i>risk</i> control measures are identified as per OSHA to ensure the safety of personnel and equipment
2. Identify Industrial Steam Turbine Parts	2.1 Operation manuals are obtained and interpreted as per manufacturers specification and sops 2.2 The model of industrial steam turbine is identified as per manufacturer's specification 2.3 Different components of the industrial steam turbine are identified as per manufacturer's specification
3. Start-Up Industrial Steam Turbine Operations	3.1 <i>Pre-start up checks</i> are carried out according to manufacturer's procedures and sops 3.2 Type of Turbine is identified and its application 3.3 <i>Tests</i> are performed in accordance with defined procedures

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. <i>Bold and italicized terms are elaborated in the Range</i>
	applicable to the operational test 3.4 Steam turbine operation response is observed 3.5 Industrial steam turbine is started up as per manufactures specification and sops
4. Run and Monitor Industrial Steam Turbines	4.1 Industrial turbine inputs and output are adjusted in accordance with the demands and manufacturers recommendations 4.2 Temperature and pressure for incoming live steam are constantly monitored to avoid ingress of wet steam according to sops 4.3 Steam turbine is operated in accordance with the plant's demands and manufactures <i>operating procedures</i> 4.4 Operating status of the steam turbine is monitored 4.5 <i>Operating logs</i> are clearly and accurately maintained according to <i>procedures</i>
5. Shut Down Industrial Steam Turbines	5.1 <i>Steam turbine Shut down</i> is conducted for inspection according to manufacturer's specification and <i>sops</i> 5.2 System checks are conducted as per manufactures specification and sops 5.3 Steam turbine <i>operating log</i> for <i>shutdown are completed</i> 5.4 Housekeeping is undertaken in accordance with the sops
6. Perform Industrial Steam Turbine Basic Maintenance	6.1 <i>Maintenance requirements</i> are identified according to sops 6.2 Isolations associated with in-service <i>maintenance</i> are completed as per sops 6.3 <i>Turbines</i> are externally cleaned according to sops 6.4 Loose turbine components and auxiliaries are adjusted as per manufactures specification
7. Generate Industrial Steam Turbine Operation Report	7.1 <i>Documentation</i> of plant status reported and logged in accordance with sops 7.2 The documented turbine operations report is shared as per the sops

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
<ul style="list-style-type: none"> • <i>Occupational Safety and Health Act 2007</i> may include but not limited to: 	<ul style="list-style-type: none"> • Personal safety equipment • Responsibility of the employee • Responsibility of the employer • Work area safety • Work area hazards • Accident reporting procedure
<ul style="list-style-type: none"> • <i>Types of turbines</i> may include but not limited to: 	<ul style="list-style-type: none"> • Impulse turbine • Reaction turbine
<ul style="list-style-type: none"> • <i>Plant/Equipment</i> may include but not limited to: 	<ul style="list-style-type: none"> • Turbine and auxiliary plant • Turbine lubrication and power/control oil systems • Turbine by-pass system plant • Condensate and feed water system plant to boiler economizer inlet NRV • Condensate polishing plant • High- and low-pressure heating systems • Steam condensing and cooling systems • Condenser vacuum raising equipment • Turbine gland sealing equipment • Cooling water systems plant • Boiler feed water desecrating equipment • Condensate and feed water chemical treatment equipment • Electricity generation and distribution systems A.C and D.C • Station water distribution systems • Hydraulic oil system • Pumps • Computers with equipment control functions • Supervisory, alarm, protection and control equipment

Variable	Range
<ul style="list-style-type: none"> • <i>Hazards</i> may include but not limited to: 	<ul style="list-style-type: none"> • Asbestos lagging • Chemical hazards • Thermal hazards • Manual handling hazards • Machinery guard requirements □ • Leakage of steam • Fumes from a liquid chemical spill • Faulty/broken ladder or hand rail • Flammable liquids • Fire and explosion • Electrical hazards • Work area, including: <ul style="list-style-type: none"> ○ Illumination ○ Excessive noise from machinery ○ Spillage of oil ○ Rubbish and combustibles ○ Obstruction
<ul style="list-style-type: none"> • <i>Risk control methods</i> may include but not limited to: 	<p>Risk control methods refer to the systematic process of eliminating or reducing the risk to personnel and property through the application of controls.</p> <p>It includes the application of the hierarchy of control:</p> <ul style="list-style-type: none"> • Elimination • Substitution • Isolation • Engineering controls • Administrative controls • Personal protective equipment (PPE)
<ul style="list-style-type: none"> • <i>Safety Standards</i> may include but not limited to: 	<ul style="list-style-type: none"> • Relevant sections of Occupational Health and Safety legislation • Industry standards • Manufacturers' recommendations • National standards for plant and relevant state legislation.
<ul style="list-style-type: none"> • <i>Procedures</i> may include but not limited to: 	<ul style="list-style-type: none"> • Manufacturer guidelines (e.g. Instructions, specifications or checklists) • Industry operating procedures • Workplace procedures (e.g. Work instructions,

Variable	Range
	operating procedures or checklists)
<ul style="list-style-type: none"> • <i>Information and Documentation</i> may include but not limited to: 	<ul style="list-style-type: none"> • Verbal or written communications • Industry safety rules documentation • Industry operating instructions • Manufacturer operational manuals • Equipment and alarm manuals • Industry log books • Dedicated computer equipment • Plant notes.
<ul style="list-style-type: none"> • <i>Communication</i> may include but not limited to: 	<ul style="list-style-type: none"> • Telephone and/or mobile phones • Two-way radio • Computer (electronic mail) • Operating log (written or verbal).
<ul style="list-style-type: none"> • <i>Appropriate/Relevant personnel</i> may include but not limited to: 	<ul style="list-style-type: none"> • Production personnel • Maintenance personnel • Supervisors/Team leaders and managers or equivalent • Technical and engineering officers or equivalent • Operating staff and contractor staff. • Other coordinators of energy production or equivalent
<ul style="list-style-type: none"> • <i>Technical and operational indicators</i> may include but not limited to: 	<ul style="list-style-type: none"> • Stimuli (audio, smell, touch, visual) • Remote or local indicators and recorders • Computers and alarms (visible and or audible).
<ul style="list-style-type: none"> • <i>Personal Protective Equipment (PPE)</i> may include but not limited to: 	<ul style="list-style-type: none"> • Thermally insulated gloves • Helmet • Ear protection (muffs or plugs) • Working protective gloves • Whole body heat-resistant clothing • Safety boots

Variable	Range
<ul style="list-style-type: none"> • <i>Faults/ abnormal operating conditions</i> may include but not limited to: 	<ul style="list-style-type: none"> • Loss of a major auxiliary • Loss of electrical Generation to auxiliaries • Turbine water ingress • Excessively high turbine and turbine valves heating/cooling rates/differentials • High condenser vacuum • Condenser tube leak • High dissolved oxygen, conductivity • High turbine bearing temperatures/vibration • High/low bearing oil temperature • Loss of turbine bearing oil flow/pressure • Low/high pressure heaters malfunctions • Actuator/valve mechanical/electrical faults/failure • Failed field devices • Turbine protection
<ul style="list-style-type: none"> • <i>Appropriate emergency response</i> may include but not limited to: 	<ul style="list-style-type: none"> • Identification of emergency • Isolation of heat source • Selection and application of appropriate fire-fighting equipment and PPE • Notification of downstream users • Operation of boiler only when safe to do so • Notification of appropriate regulatory authorities

REQUIRED KNOWLEDGE AND SKILLS

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

Required Skills

The trainee needs to demonstrate knowledge of:

- Relevant environmental, occupational health and safety legislation and regulations
- Classification of turbines
- Turbine construction and operating principles
- Plant drawings
- Steam Turbine Preventative maintenance
- Introduction to and typical arrangements of power production plant
- Relevant plant and equipment, its location and operating parameters
- Pump types and characteristics

- Recording procedures
- Turbine speed control equipment
- The system components and their interaction with other plant and equipment external to that covered by this competency
- Steam distribution systems
- Turbine by-pass system
- Vacuum raising and turbine gland sealing systems
- Lubrication and bearings
- Turbine lubrication and oil systems, types and characteristics
- Condensate and feed water systems
- Fire protection control systems
- First aid

Skills Required

The trainee needs to demonstrate the following fundamental skills;

- Communication skills
- Numeracy skills
- Digital literacy skills
- Entrepreneurship skills
- Environmental Literacy
- Employability skills
- Occupational health safety and Practices

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	1.1 Observed safety at workplace and sound housekeeping 1.2 Identified different types of steam turbine 1.3 Identified turbine components 1.4 Operated and monitored steam turbine performance 1.5 Conducted basic First Aid and Emergency evacuation
2. Resource Implications	2.1 Steam Turbine/model of Steam Turbine 2.2 Steam Turbine manuals 2.3 Relevant legislations, e.g. OSHA, Environmental Act; and regulations 2.4 Workshop tools
3. Methods of Assessment	Competency may be assessed through: 3.1 Observed behavior of the learners 3.2 Inspection of written operation procedures 3.3 Inspection of log books

4. Context of Assessment	Competency will be assessed individually in the actual workplace or through accredited institution
5. Guidance information for Assessment	Holistic assessment of other units relevant to the industry sector, workplace and job role is recommended

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