

MAINTAIN INDUSTRIAL STEAM TURBINE

UNIT CODE: ENG/OS/IPO/CC/02/5/A

UNIT DESCRIPTION

This unit covers competencies required to maintaining industrial steam turbine. It involves applying industrial steam turbine maintenance safety procedures, conducting routine/ preventative industrial steam turbine maintenance, troubleshooting industrial steam turbine equipment/ component faults, conducting industrial steam turbine maintenance-commissioning industrial steam turbine and perform operation test and preparing industrial steam turbine maintenance 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 maintenance safety Procedures	1.1 Personal safety gear is prescribed as per rules and regulations of the <i>Occupational Safety Act</i> 1.2 Safety measures for the maintenance of the steam turbines are defined as the rules and regulations of the <i>Occupational Safety Act</i> 1.3 Industrial steam alarm systems are tested for functionality as per SOPs
2. Conduct routine/ preventative industrial steam Turbine maintenance	2.1 Logs charts, daily check charts and steam turbine reports are implemented 2.2 Tools and equipment for maintenance are identified as per manufactures manual and SOPs 2.3 Tube / pipe leaks are fixed according to SOPs 2.4 Oil leaks are addressed according to SOPs
3. Troubleshoot industrial steam Turbine equipment/ component faults	3.1 Causes of rotor vibration are diagnosed according manufacturer instructions 3.2 Increased bearing drain oil temperature is diagnosed according manufacturer instructions 3.3 Decreased turbine performance is diagnosed according manufacturer instructions 3.4 Changes in stage pressure are checked according manufacturer instructions 3.5 Steam leakages from the casing are diagnosed according manufacturer instructions 3.6 Water induction is checked according manufacturer

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	instructions 3.7 Labyrinth packaging damage is diagnosed according manufacturer instructions 3.8 Cracking of the turbine parts are checked according manufacturer instructions 3.9 Blade problems are checked according manufacturer instructions
4. Conduct industrial steam turbine maintenance	4.1 Logs charts, daily check charts and steam turbine reports are implemented 4.2 Tools and equipment for maintenance are identified as per manufactures manual and SOPs 4.3 Speed governors are serviced according to SOPs 4.4 Tube / pipe leaks are fixed according to SOPs 4.5 Oil leaks are addressed according to SOPs 4.6 Vacuum cleaning is carried out on the steam turbine panels according to SOP 4.7 Tools and material inventory updated
5. Re-commission industrial steam turbine and perform operation test	5.1 The laid down start-up procedures are followed as per manufacturer's specification 5.2 Industrial steam turbine is tested for functionality as per manufacturer's specification 5.3 The industrial steam turbine is re-commissioned for operation
6. Prepare industrial steam turbine maintenance report	6.1 Standard maintenance procedures are followed as recorded in maintenance manuals 6.2 Maintenance scheduling is documented according to manufacturer specifications 6.3 Maintenance report is developed and stored as per workplace procedure

RANGE

This section provides work environment and condition to which the performance criteria (PC) apply. It allows for different work environment and situation 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
<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

Variable	Range
	<ul style="list-style-type: none"> • Flammable liquids • Fire and explosion 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: 	<ul style="list-style-type: none"> • Risk control methods refer to the systematic process of eliminating or reducing the risk to personnel and property through the application of controls. • It includes the application of the hierarchy of control: <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, 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 and maintenance manuals • Equipment and alarm manuals • Industry log books

Variable	Range
	<ul style="list-style-type: none"> • 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>Tests</i> may include but not limited to: 	<ul style="list-style-type: none"> • Loss of a major auxiliary controls' response checks • Stand-by plant "cut-in" tests • Valves operating checks • On-load turbine valve and emergency governor operation test • Performance tests • Condenser pressure test • Heater leak checks • Alarm and protection tests.
<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
<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 Generation to auxiliaries • Turbine water ingress

Variable	Range
	<ul style="list-style-type: none"> • 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/ 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
- Occupational health safety and Practices
- Environmental Literacy
- Employability skills
- Entrepreneurship skills

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 preventative maintenance 1.6 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