

# TRAINING REGULATIONS



## PLANT MAINTENANCE NC I

### METALS AND ENGINEERING SECTOR

**TECHNICAL EDUCATION AND SKILLS DEVELOPMENT AUTHORITY**

East Service Road, South Superhighway, Taguig City, Metro Manila

## METALS AND ENGINEERING SECTOR

### **PLANT MAINTENANCE NC I**

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**TRAINING REGULATIONS FOR  
PLANT MAINTENANCE NC I**

**SECTION 1 PLANT MAINTENANCE NC I QUALIFICATION**

The Plant Maintenance NC I Qualification consists of competencies that a person must achieve to perform preventive and corrective maintenance, perform planned and unplanned maintenance, fabricate simple items and install machinery.

The Units of Competency comprising this qualification include the following:

<b>Code No.</b>	<b>BASIC COMPETENCIES</b>
500311101	Receive and respond to workplace communication
500311102	Work with others
500311103	Demonstrate Work Values
500311104	Practice Housekeeping Procedures

<b>Code No.</b>	<b>COMMON COMPETENCIES</b>
MEE722201	Apply safety practices
MEE722202	Interpret working drawings and sketches
MEE722204	Perform shop computations (Basic)
MEE722205	Measure workpiece (Basic)

<b>Code No.</b>	<b>CORE COMPETENCIES</b>
MEE723301	Perform Preventive Maintenance
MEE723302	Perform Planned and Unplanned (Emergency) Maintenance
MEE723303	Fabricate Simple Items
MEE723304	Install Machinery

A person who has achieved this qualification is competent to be:

- Plant Maintenance Mechanic

## SECTION 2 COMPETENCY STANDARDS

This section gives the details of the contents of the basic, common and core units of competency required in PLANT MAINTENANCE NC I.

### BASIC COMPETENCIES

**UNIT OF COMPETENCY:** RECEIVE AND RESPOND TO WORKPLACE COMMUNICATION

**UNIT CODE** : 500311101

**UNIT DESCRIPTOR** : This unit covers the knowledge, skills and attitudes required to receive, respond and act on verbal and written communication.

<b>ELEMENT</b>	<b>PERFORMANCE CRITERIA</b> <i>Italicized terms</i> are elaborated in the Range of Variables
1. Follow routine spoken messages	1.1. Required information is gathered by listening attentively and correctly interpreting or understanding information/instructions 1.2. Instructions/information are properly recorded 1.3. Instructions are acted upon immediately in accordance with information received 1.4. Clarification is sought from workplace supervisor on all occasions when any instruction/information is not clear
2. Perform workplace duties following written notices	2.1 <b><i>Written notices and instructions</i></b> are read and interpreted correctly in accordance with <b><i>organizational guidelines</i></b> 2.2 Routine written instruction are followed in sequence 2.3 Feedback is given to workplace supervisor based on the instructions/information received

## RANGE OF VARIABLES

VARIABLE	RANGE
1. Written notices and instructions	It refers to : 1.1. Handwritten and printed material 1.2. Internal memos 1.3. External communications 1.4. Electronic mail 1.5. Briefing notes 1.6. General correspondence 1.7. Marketing materials 1.8. Journal articles
2. Organizational Guidelines	It may include: 2.1. Information documentation procedures 2.2. Company policies and procedures 2.3. Organization manuals 2.4. Service manual

## EVIDENCE GUIDE

<p>1. Critical aspects of Competency</p>	<p>Assessment requires evidence that the candidate:</p> <p>1.1. Demonstrated knowledge of organizational procedures for handling verbal and written communications</p> <p>1.2. Received and acted on verbal messages and instructions</p> <p>1.3. Demonstrated competency in recording instructions/information</p>
<p>2. Underpinning Knowledge and Attitudes</p>	<p>2.1. Knowledge of organizational policies/guidelines in regard to processing internal/external information</p> <p>2.2. Ethical work practices in handling communications</p> <p>2.3. Communication process</p>
<p>3. Underpinning Skills</p>	<p>3.1. Conciseness in receiving and clarifying messages/information/communication</p> <p>3.2. Accuracy in recording messages/information</p>
<p>4. Resource Implications</p>	<p>The following resources <b>MUST</b> be provided:</p> <p>4.1. Pens</p> <p>4.2. Note pads</p>
<p>5. Methods of Assessment</p>	<p>Competency may be assessed through:</p> <p>5.1. Direct Observation</p> <p>5.2. Oral interview</p> <p>5.3. Written Evaluation</p> <p>5.4. Third Party Report</p>
<p>6. Context of Assessment</p>	<p>Competency may be assessed individually in the actual workplace or simulation environment in TESDA accredited institutions</p>

**UNIT OF COMPETENCY : WORK WITH OTHERS**

**UNIT CODE : 500311102**

**UNIT DESCRIPTOR :** This unit cover the skills, knowledge and attitudes required to develop workplace relationship and contribute in workplace activities.

<b>ELEMENT</b>	<b>PERFORMANCE CRITERIA</b> <i>Italicized terms</i> are elaborated in the Range of Variables
1. Develop effective workplace relationship	1.1 <b><i>Duties and responsibilities</i></b> are done in a positive manner to promote cooperation and good relationship 1.2 Assistance is sought from <b><i>workgroup</i></b> when difficulties arise and addressed through discussions 1.3 <b><i>Feedback</i></b> provided by others in the team is encouraged, acknowledged and acted upon 1.4 Differences in personal values and beliefs are respected and acknowledged in the development
2. Contribute to work group activities	2.1 <b><i>Support is provided to team members</i></b> to ensure workgroup goals are met 2.2 Constructive contributions to workgroup goals and tasks are made according to <b><i>organizational requirements</i></b> 2.3 Information relevant to work is shared with team members to ensure designated goals are met

## RANGE OF VARIABLES

VARIABLE	RANGE
1. Duties and responsibilities	1.1 Job description and employment arrangements 1.2 Organization's policy relevant to work role 1.3 Organizational structures 1.4 Supervision and accountability requirements including OHS 1.5 Code of conduct
2. Work group	2.1 Supervisor or manager 2.2 Peers/work colleagues 2.3 Other members of the organization
3. Feedback on performance	3.1 Formal/Informal performance appraisal 3.2 Obtaining feedback from supervisors and colleagues and clients 3.3 Personal, reflective behavior strategies 3.4 Routine organizational methods for monitoring service delivery
4. Providing support to team members	4.1 Explaining/clarifying 4.2 Helping colleagues 4.3 Providing encouragement 4.4 Providing feedback to another team member 4.5 Undertaking extra tasks if necessary
5. Organizational requirements	5.1 Goals, objectives, plans, system and processes 5.2 Legal and organization policy/guidelines 5.3 OHS policies, procedures and programs 5.4 Ethical standards 5.5 Defined resources parameters 5.6 Quality and continuous improvement processes and standards



## EVIDENCE GUIDE

<p>1. Critical aspects of Competency</p>	<p>Assessment requires evidence that the candidate:</p> <ul style="list-style-type: none"> <li>1.1. Provided support to team members to ensure goals are met</li> <li>1.2. Acted on feedback from clients and colleagues</li> <li>1.3. Accessed learning opportunities to extend own personal work competencies to enhance team goals and outcomes</li> </ul>
<p>2. Underpinning Knowledge</p>	<ul style="list-style-type: none"> <li>2.1. The relevant legislation that affects operations, especially with regards to safety</li> <li>2.2. Reasons why cooperation and good relationships are important</li> <li>2.3. Knowledge of the organization's policies, plans and procedures</li> <li>2.4. Understanding how to elicit and interpret feedback</li> <li>2.5. Knowledge of workgroup member's responsibilities and duties</li> <li>2.6. Importance of demonstrating respect and empathy in dealings with colleagues</li> <li>2.7. Understanding of how to identify and prioritize personal development opportunities and options</li> </ul>
<p>3. Underpinning Skills</p>	<ul style="list-style-type: none"> <li>3.1. Ability to read and understand the organization's policies and work procedures</li> <li>3.2. Write simple instructions for particular routine tasks</li> <li>3.3. Interpret information gained from correspondence</li> <li>3.4. Communication skills to request advice, receive feedback and work with a team</li> <li>3.5. Planning skills to organized work priorities and arrangement</li> <li>3.6. Technology skills including the ability to select and use technology appropriate to a task</li> <li>3.7. Ability to relate to people from a range of social, cultural and ethnic backgrounds.</li> </ul>
<p>4. Resource Implications</p>	<p>The following resources <b>MUST</b> be provided:</p> <ul style="list-style-type: none"> <li>4.1. Access to relevant workplace or appropriately simulated environment where assessment can take place</li> <li>4.2. Materials relevant to the proposed activity or task</li> </ul>
<p>5. Methods of Assessment</p>	<p>Competency may be assessed through:</p>

	<p>5.1. Direct observations of work activities of the individual member in relation to the work activities of the group</p> <p>5.2. Observation of simulation and/or role play involving the participation of individual member to the attainment of organizational goal</p> <p>5.3. Case studies and scenarios as a basis for discussion of issues and strategies</p>
<p>6. Context for Assessment</p>	<p>6.1. Competency assessment may occur in workplace or any appropriately simulated environment</p> <p>6.2. Assessment shall be observed while task are being undertaken whether individually or in group</p>

**UNIT OF COMPETENCY: DEMONSTRATE WORK VALUES****UNIT CODE 500311103****UNIT DESCRIPTOR :** This unit covers the knowledge, skills, and attitude in demonstrating proper work values.

<b>ELEMENT</b>	<b>PERFORMANCE CRITERIA</b> <i>Italicized terms</i> are elaborated in the Range of Variables
1. Define the purpose of work	1.1 One's unique sense of purpose for working and the why's of work are identified, reflected on and clearly defined for one's development as a person and as a member of society. 1.2 Personal mission is in harmony with company's values
2. Apply work values/ethics	2.1 <b>Work values/ethics/concepts</b> are classified and reaffirmed in accordance with the transparent company ethical standards, policies and guidelines. 2.2 <b>Work practices</b> are undertaken in compliance with industry work ethical standards, organizational policy and guidelines 2.3 Personal behavior and relationships with co-workers and/or clients are conducted in accordance with ethical standards, policy and guidelines. 2.4 <b>Company resources</b> are used in accordance with transparent company ethical standard, policies and guidelines.
3. Deal with ethical problems	3.1 Company ethical standards, organizational policy and guidelines on the prevention and reporting of unethical conduct are accessed and applied in accordance with transparent company ethical standard, policies and guidelines. 3.2 <b>Work incidents/situations</b> are reported and/or resolved in accordance with company protocol/guidelines. 3.3 Resolution and/or referral of ethical problems identified are used as learning opportunities.
4. Maintain integrity of conduct in the workplace	4.1 Personal work practices and values are demonstrated consistently with acceptable ethical conduct and company's core values. 4.2 <b>Instructions</b> to co-workers are provided based on ethical, lawful and reasonable directives. 4.3 Company values/practices are shared with co-workers using appropriate behavior and language.

## RANGE OF VARIABLES

VARIABLE	RANGE	
1. Work values/ethics/ concepts	May include but are not limited to: 1.1 Commitment/ Dedication 1.2 Sense of urgency 1.3 Sense of purpose 1.4 Love for work 1.5 High motivation 1.6 Orderliness 1.7 Reliability 1.8 Competence 1.9 Dependability 1.10 Goal-oriented 1.11 Sense of responsibility 1.12 Being knowledgeable	1.13 Loyalty to work/ company 1.14 Sensitivity to others 1.15 Compassion/Caring attitude 1.16 Balancing between family and work 1.17 <i>Pakikisama</i> 1.18 <i>Bayanihan</i> spirit/ teamwork 1.19 Sense of nationalism
2. Work practices	2.1 Quality of work 2.2 Punctuality 2.3 Efficiency 2.4 Effectiveness 2.5 Productivity 2.6 Resourcefulness 2.7 Innovativeness/Creativity 2.8 Cost consciousness 2.9 5S 2.10 Attention to details	
3. Incidents/situations	3.1 Violent/intensed dispute or argument 3.2 Gambling 3.3 Use of prohibited substances 3.4 Pilferages 3.5 Damage to person or property 3.6 Vandalism 3.7 Falsification 3.8 Bribery 3.9 Sexual Harassment 3.10 Blackmail	
4. Company resources	4.1 Consumable materials 4.2 Equipment/Machineries 4.3 Human 4.4 Time 4.5 Financial resources	
5. Instructions	5.1 Verbal 5.2 Written	

## EVIDENCE GUIDE

<p>1. Critical Aspects of Competency</p>	<p>Assessment requires evidence that the candidate:</p> <ul style="list-style-type: none"> <li>1.1 Defined one's unique sense of purpose for working</li> <li>1.2 Clarified and affirmed work values/ethics/concepts consistently in the workplace</li> <li>1.3 Demonstrated work practices satisfactorily and consistently in compliance with industry work ethical standards, organizational policy and guidelines</li> <li>1.4 Demonstrated personal behavior and relationships with co-workers and/or clients consistent with ethical standards, policy and guidelines</li> <li>1.5 Used company resources in accordance with company ethical standard, policies and guidelines.</li> <li>1.6 Followed company ethical standards, organizational policy and guidelines on the prevention and reporting of unethical conduct/behavior</li> </ul>
<p>2. Underpinning Knowledge</p>	<ul style="list-style-type: none"> <li>2.1 Occupational health and safety</li> <li>2.2 Work values and ethics</li> <li>2.3 Company performance and ethical standards</li> <li>2.4 Company policies and guidelines</li> <li>2.5 Fundamental rights at work including gender sensitivity</li> <li>2.6 Work responsibilities/job functions</li> <li>2.7 Corporate social responsibilities</li> <li>2.8 Company code of conduct/values</li> <li>2.9 Balancing work and family responsibilities</li> </ul>
<p>3. Underpinning Skills</p>	<ul style="list-style-type: none"> <li>3.1 Interpersonal skills</li> <li>3.2 Communication skills</li> <li>3.3 Self awareness, understanding and acceptance</li> <li>3.4 Application of good manners and right conduct</li> </ul>
<p>4. Resource Implications</p>	<p>The following resources <b>MUST</b> be provided:</p> <ul style="list-style-type: none"> <li>4.1 Workplace or assessment location</li> <li>4.2 Case studies/Scenarios</li> </ul>
<p>5. Methods of Assessment</p>	<p>Competency may be assessed through:</p> <ul style="list-style-type: none"> <li>5.1 Portfolio Assessment</li> <li>5.2 Interview</li> <li>5.3 Third Party Reports</li> </ul>
<p>6. Context of Assessment</p>	<p>Competency may be assessed in the work place or in a simulated work place setting</p>

**UNIT OF COMPETENCY: PRACTICE HOUSEKEEPING PROCEDURES**

**UNIT CODE : 500311104**

**UNIT DESCRIPTOR :** This unit covers the knowledge, skills and attitudes required to apply the basic housekeeping procedures.

<b>ELEMENT</b>	<b>PERFORMANCE CRITERIA</b> <i>Italicized terms</i> are elaborated in the Range of Variables
1. Sort and remove unnecessary items	1.1 Reusable, recyclable materials are sorted in accordance with company/office procedures 1.2 <b>Unnecessary items</b> are removed and disposed of in accordance with company or office procedures
2. Arrange items	2.1 Items are arranged in accordance with company/office housekeeping procedures 2.2 Work area is arranged according to job requirements 2.3 Activities are prioritized based on instructions. 2.4 Items are provided with clear and visible <b>identification marks</b> based on procedure 2.5 Safety equipment and evacuation passages are kept clear and accessible based on instructions
3. Maintain work area, tools and equipment	3.1 Cleanliness and orderliness of work area is maintained in accordance with company/office procedures 3.2 Tools and equipment are cleaned in accordance with manufacturer's instructions/manual 3.3 <b>Minor repairs</b> are performed on tools and equipment in accordance with manufacturer's instruction/manual 3.4 Defective tools and equipment are reported to immediate supervisor
4. Follow standardized work process and procedures	4.1 Materials for common use are maintained in designated area based on procedures 4.2 Work is performed according to standard work procedures 4.3 Abnormal incidents are reported to immediate supervisor
5. Perform work spontaneously	5.1 Work is performed as per instruction 5.2 Company and office <b>decorum</b> are followed and complied with 5.3 Work is performed in accordance with occupational health and safety (OHS) requirements

## RANGE OF VARIABLES

VARIABLE	RANGE
1. Unnecessary items	May include but are not limited to: 1.1 Non-recyclable materials 1.2 Unserviceable tools and equipment 1.3 Pictures, posters and other materials not related to work activity 1.4 Waste materials
2. Identification marks	2.1 Labels 2.2 Tags 2.3 Color coding
3. Decorum	3.1 Company/ office rules and regulations 3.2 Company/ office uniform 3.3 Behavior
4. Minor repair	Minor repair include but not limited to: 4.1 Replacement of parts 4.2 Application of lubricants 4.3 Sharpening of tools 4.4 Tightening of nuts, bolts and screws

## EVIDENCE GUIDE

1. Critical Aspects of Competency	Assessment requires evidence that the candidate Practiced the basic procedures of 5S
2. Underpinning Knowledge and Attitudes	2.1 Principles of 5S 2.2 Work process and procedures 2.3 Safety signs and symbols 2.4 General OH&S principles and legislation 2.5 Environmental requirements relative to work safety 2.6 Accident/Hazard reporting procedures
3. Underpinning Skills	3.1 Basic communication skills 3.2 Interpersonal skills 3.3 Reading skills required to interpret instructions 3.4 Reporting/recording accidents and potential hazards
4. Resource Implications	The following resources <b>MUST</b> be provided: 4.1 Facilities, materials tools and equipment necessary for the activity
5. Methods of Assessment	Competency may be assessed through:  5.1 Third party report 5.2 Interview 5.3 Demonstration with questioning
6. Context for Assessment	Competency may be assessed in the work place or in a simulated work place setting



## COMMON COMPETENCIES

**UNIT OF COMPETENCY : APPLY SAFETY PRACTICES**

**UNIT CODE : MEE722201**

**UNIT DESCRIPTOR** : This unit covers the competencies required to apply safety practices in the workplace.

ELEMENTS	PERFORMANCE CRITERIA
	<i>Italicized terms</i> are elaborated in the Range of Variables
1. Identify hazards	1.1 <b>Hazards</b> are identified correctly in accordance with OHS principles.  1.2 Safety signs and symbols are identified and adhered to.
2. Use protective clothing and devices	2.1 Appropriate <b>protective clothing and devices</b> correctly selected and used in accordance with OHS requirements or industry/company policy
3. Perform safe handling of tools, equipment and materials	3.1 Safety procedures for pre-use check and operation of tools and equipment followed in accordance with industry/ company policies.  3.2 Tools, equipment and materials handled safely in accordance with OHS requirements and industry/ company policies.
4. Perform first aid	4.1 First aid treatment of <b>injuries</b> are carried out according to recommended procedures
5. Use fire extinguisher	5.1 Fire extinguisher selected and operated correctly according to the <b>type of fire</b> .

## RANGE OF VARIABLES

VARIABLE	RANGE
1. Hazards	1.1 Cluttered tools and materials 1.2 Slippery floors (caused by oil, grease or any liquid) 1.3 Exposed electrical wires 1.4 Sharp edges 1.5 Machine without guards or with exposed moving parts 1.6 Uncollected chips or other wastes etc.
2. Protective clothing and devices	Protective clothing and devices may include but is not limited to: 2.1 safety glasses/goggles 2.2 safety shoes 2.3 overalls 2.4 cap
3. Injuries	Injuries may include: 3.1 burns/scalds 3.2 fractures 3.3 cuts and abrasions 3.4 poisoning 3.5 foreign bodies in the eye 3.6 concussion 3.7 shock
4. Type of fires	Fires involving or caused by: 4.1 common combustibles (wood, cloth, paper, rubber and plastic) 4.2 flammable liquids (gasoline, oil, solvents, paints, etc.) 4.3 energized electrical equipment (wiring, fuse boxes, circuit breakers, appliances, etc.) 4.4 combustible metals (magnesium, sodium, etc.)

## EVIDENCE GUIDE

<p>1. Critical aspects of Competency</p>	<p>Assessment requires evidence that the candidate:</p> <ul style="list-style-type: none"> <li>1.1 identified hazardous area</li> <li>1.2 used protective clothing and devices</li> <li>1.3 handled tools, equipment and materials properly</li> <li>1.4 performed first aid</li> <li>1.5 used fire extinguisher</li> </ul>
<p>2. Underpinning knowledge and attitude</p>	<ul style="list-style-type: none"> <li>2.1 Shop safety signs, symbols and alarms</li> <li>2.2 Safety precautionary measures</li> <li>2.3 Housekeeping</li> <li>2.4 Machine tools</li> <li>2.5 First aid</li> <li>2.6 Engineering materials</li> <li>2.7 Fire extinguishers</li> </ul>
<p>3. Underpinning skills</p>	<ul style="list-style-type: none"> <li>3.1 Operating machine tools</li> <li>3.2 Handling tools and materials</li> <li>3.3 Communicating with superiors and co-workers</li> <li>3.4 Interpreting instructions</li> </ul>
<p>4. Resource implications</p>	<p>The following resources <b>MUST</b> be provided</p> <ul style="list-style-type: none"> <li>4.1 Tools, equipment and facilities appropriate to processes or activity</li> <li>4.2 Materials relevant to the proposed activity</li> </ul>
<p>5. Method of assessment</p>	<p>Competency may be assessed through:</p> <ul style="list-style-type: none"> <li>5.1 Demonstration</li> <li>5.2 Written or oral short answer questions</li> <li>5.3 Practical exercises</li> </ul>
<p>6. Context for assessment</p>	<p>Competency may be assessed in the workplace or in simulated workplace environment.</p>

**UNIT OF COMPETENCY : INTERPRET WORKING DRAWINGS AND SKETCHES**

**UNIT CODE : MEE722202**

**UNIT DESCRIPTOR :** This unit covers the competencies required to read and interpret drawings and sketches.

<b>ELEMENTS</b>	<b>PERFORMANCE CRITERIA</b> <i>Italicized terms</i> are elaborated in the Range of Variables
1. Interpret technical drawing	1.1 Components, assemblies or objects recognized as required. 1.2 Dimensions identified as appropriate. 1.3 Instructions identified and followed as required. 1.4 Material requirements identified as required. 1.5 Symbols recognized as appropriate in the <b>drawing</b> . 1.6 <b>Tolerance</b> , limits and fits identified in the drawing.
2. Prepare freehand sketch of parts	2.1 Sketch drawn correctly and appropriately. 2.2 Sketch depicted objects or part appropriately. 2.3 Dimensions indicated in sketch are clear and correct. 2.4 Instructions included in sketch are clear and correct. 2.5 Base line or datum points indicated as required.
3. Interpret details from freehand sketch	3.1 Components, assemblies or objects recognized as required. 3.2 Dimensions identified as appropriate. 3.3 Instructions identified and followed as required. 3.4 Material requirements identified as required. 3.5 Symbols recognized as appropriate in the drawing.

## RANGE OF VARIABLES

VARIABLE	RANGE
1. Drawing	1.1 Drawing technique include 1.1.1 Perspective 1.1.2 Exploded view 1.1.3 Hidden view technique  1.2 Projections 1.2.1 First angle projections 1.2.2 Third angle projections
2. Tolerance	2.1 General tolerance 2.2 Angular tolerance 2.3 Geometric tolerance

## EVIDENCE GUIDE

1. Critical aspects of Competency	Assessment requires evidence that the candidate: 1.1 Interpreted technical drawing 1.2 Prepared sketches 1.3 Interpreted sketches.
2. Underpinning knowledge	2.1 Alphabet of lines 2.2 Projections 2.3 Drawing symbols 2.4 Dimensioning techniques 2.5 Tolerance, limits and fits 2.6 Engineering materials 2.7 Drawing tools and supplies
3. Underpinning skills	3.1 Handling tools and drawing instruments 3.2 Using measuring instruments
4. Resource implications	The following resources <b>MUST</b> be provided 4.1 Drafting room/facilities and drafting instruments and supplies appropriate to the activity 4.2 Measuring tools 4.3 Drawings, sketches or blueprint 4.4 Specimen parts/components
5. Method of assessment	Competency may be assessed through: 5.1 direct observation 5.2 written or oral short answer questions 5.3 demonstration 5.4 project/work sample 5.5 portfolio
6. Context for assessment	Competency may be assessed in the workplace or in simulated workplace environment.

**UNIT OF COMPETENCY : PERFORM SHOP COMPUTATIONS (BASIC)****UNIT CODE : MEE722204****UNIT DESCRIPTOR** : This unit covers the competencies required to perform basic calculations using the four fundamental operation.

<b>ELEMENTS</b>	<b>PERFORMANCE CRITERIA</b> <i>Italicized terms</i> are elaborated in the Range of Variables
1. Perform four fundamental operations.	1.1 Simple calculations performed using <b>four fundamental operations</b> . 1.2 Simple calculations performed involving fractions and mixed numbers using four fundamental operations
2. Perform basic calculations involving fractions and decimals	2.1 Simple calculations are performed involving fractions and decimals using the four fundamental operations. 2.2 Decimal are converted into fraction (and vice versa) accurately,
3. Perform basic calculations involving percentages.	3.1 Simple calculations are performed to obtain percentages from information expressed in either fractional or decimal format
4. Perform basic calculation involving ration and proportion	4.1 Simple calculations are performed involving ratios and proportion using whole numbers, fractions and decimal fractions.
5. Perform calculations on algebraic expressions	5.1 Simple calculations are performed on <b>algebraic expressions</b> using the four fundamental operations. 5.2 Simple transposition of formulae is carried out to isolate the variable required, involving the four fundamental operations.

**RANGE OF VARIABLES**

<b>VARIABLE</b>	<b>RANGE</b>
1. Four fundamental operations	1.1 Addition 1.2 Subtraction 1.3 Multiplication 1.4 Division
2. Algebraic expressions	Calculation using formula for determining 2.1 tap drill size 2.2 feed 2.3 speed

## EVIDENCE GUIDE

1. Critical aspects of Competency	Assessment requires evidence that the candidate performed calculations: 1.1 using four fundamental operations 1.2 involving fractions and mixed numbers 1.3 involving fractions and decimals 1.4 involving percentages 1.5 involving ratio and proportion 1.6 on algebraic expressions 1.7 of simple formulae
2. Underpinning knowledge and attitude	English and metric system of measurements
3. Underpinning skills	Performing calculations using pen and paper or on a calculator.
4. Resource implications	The following resources <b>MUST</b> be provided: 4.1 Tools, equipment and facilities appropriate to processes or activity  4.2 Materials relevant to the proposed activity
5. Method of assessment	Competency may be assessed through: 5.1 written or oral short answer questions 5.2 practical exercises
6. Context for assessment	Competency may be assessed in the workplace or in simulated workplace environment.



**UNIT OF COMPETENCY : MEASURE WORKPIECE****UNIT CODE : MEE722205****UNIT DESCRIPTOR** : This unit covers the competencies required to measure workpieces using measuring instruments such as steel rules, vernier calipers , micrometers, etc....

<b>ELEMENTS</b>	<b>PERFORMANCE CRITERIA</b> <i>Italicized terms</i> are elaborated in the Range of Variables
1. Select and use measuring tools	1.1 <b>Measuring tools</b> are selected and used according to the level of accuracy required. 1.2 <b>Measurements</b> taken are accurate to the finest graduation of the selected measuring instrument. 1.3 Measuring technique used is correct and appropriate to the device used.
2. Clean and store measuring tools	2.1 Care and storage of devices undertaken to manufacturer's specifications or standard operating procedures.

**RANGE OF VARIABLES**

<b>VARIABLE</b>	<b>RANGE</b>
1. Measuring tools	Measuring tools include: 1.1 Steel tape 1.2 Steel rule 1.3 Straight edge 1.4 Combination square 1.5 Steel square 1.6 Divider or trammel 1.7 Caliper 1.8 Protractor 1.9 Vernier caliper 1.10 Micrometer
2. Measurements	2.1 length 2.2 diameter 2.3 depth 2.4 flatness 2.5 straightness 2.6 squareness

## EVIDENCE GUIDE

1. Critical aspects of Competency	Assessment requires evidence that the candidate: 1.1 Selected and used measuring instruments 1.2 Cleaned and stored measuring instruments
2. Underpinning knowledge	2.1 Types, purposes and accuracy of measuring instruments 2.2 Capability of measuring instruments 2.3 Part dimensions and tolerances 2.4 Techniques for measuring dimensions 2.5 Care and storage procedure of measuring tools
3. Underpinning skills	3.1 Safe handling of measuring tools and materials
4. Resource implications	The following resources <b>MUST</b> be provided 4.1 Tools, equipment and facilities appropriate to the activity 4.2 Specimen component or part to the proposed activity
5. Method of assessment	Competency may be assessed through: 5.1 direct observation 5.2 demonstration 5.3 written or oral short answer questions 5.4 portfolio
6. Context for assessment	Competency may be assessed in the workplace or in simulated workplace environment.

## CORE COMPETENCIES

**UNIT OF COMPETENCY :**      **PERFORM PREVENTIVE MAINTENANCE**

**UNIT CODE**                         **:**      **MEE723301**

**UNIT DESCRIPTOR:**      This unit covers the knowledge, skills and attitudes involved in the prevention or delay of breakdown through routine maintenance work and primarily through scheduled or periodic inspections.

ELEMENTS	PERFORMANCE CRITERIA <i>Italicized terms</i> are elaborated in the Range of Variables
1. Interpret work instructions	1.1 Work instruction interpreted and fully understood . 1.2 Operation manual of <b>machines and parts</b> concerned obtained as reference for manufacturer’s recommendations. 1.3 Work permits obtained
2. Perform routine maintenance work	2.1 Machine parts or entire machine cleaned of dust and dirt according to manufacturer’s recommendations. 2.2 <b>Lubrication</b> points of machine and condition of lubricants checked according to work procedures. 2.3 Minor adjustments made on loose bolts, drive slacks, guards and covers.
3. Perform inspection procedures	3.1 <b>Inspection Checklists</b> gathered as guide for inspection. 3.2 Inspection tools in good condition gathered 3.3 <b>Operational symptoms</b> of malfunction or impending failure observed through the human senses. 3.4 <b>Evidence of symptoms</b> of malfunction or impending failure searched through closer inspection of parts. 3.5 Inspection with the inspection instruments and methods used to detect start of failures such as cracks, unbalance, etc. 3.6 Findings of inspection with recommended course of action noted in a <b>report</b> in accordance with company procedures.

## RANGE OF VARIABLES

VARIABLE		RANGE
1. Preventive Maintenance	1.1 1.2 1.3	Importance of Maintenance Prevention vs repair Planned vs unplanned maintenance
2. Machines, equipment and parts	2.1 2.2 2.3 2.4 2.5 2.6	Process machineries Storage Tanks Pumps and Compressors Fans and Blowers Machine Tools <u>Power transmission elements</u> V-belts & pulleys Chain & sprockets Shafts and keys Shaft couplings Clutches and brakes Bearings: plain and rolling element Gears Seals Packings and O-rings Lip seals Fluid system
3. Lubrication	3.1 3.2 3.3 3.4 3.5	Principles of Lubrication Types of Lubricants Lubricant points Lubrication breakdown Lubrication recommendation
4. Minor Adjustments	4.1 4.2 4.3 4.4 4.5	Alignment Loose bolts Drive tension Chain slacks Guards and covers
5. Operating symptoms	5.1 5.2 5.3 5.4 5.5 5.6 5.7 5.8	Operating Symptoms may also include Unusual noise Overheating Burnt odor Vibration Misalignment Leakages Others as per manufacturer
6. Evidence of Symptoms	6.1 6.2 6.3 6.4 6.5	Evidence of symptoms may include: Wear Fatigue Wear pattern Scoring Others as per Manufacturers manual
7. Forms	7.1 7.2 7.3 7.4	Routine Maintenance Report Inspection Schedules Inspection Report Forms Inspection Checklists Inspection Procedures

## EVIDENCE GUIDE

<p>1. Critical aspects of Competency</p>	<p>Assessment requires evidence that the candidate:</p> <ul style="list-style-type: none"> <li>1.1 Maintenance work instruction fully understood</li> <li>1.2 Performed routine maintenance such as cleaning, lubrication and adjustments.</li> <li>1.3 Maintenance inspection performed using inspection checklists and manuals</li> <li>1.4 Inspection reports and Routine Maintenance Reports submitted.</li> </ul>
<p>2. Underpinning knowledge and attitude</p>	<ul style="list-style-type: none"> <li>2.1 Normal running characteristics of a machine</li> <li>2.2 Interpreting machine assembly and sectional details</li> <li>2.3 Sequence of dismantling parts of a machine</li> <li>2.4 Inspection procedures as per manufacturer</li> </ul>
<p>3. Underpinning skills</p>	<ul style="list-style-type: none"> <li>3.1 Safe use of hand tools and equipment</li> <li>3.2 dismantling and mounting of parts</li> <li>3.3 using inspection report routine maintenance report form</li> <li>3.4 lubricating procedure</li> <li>3.5 coupling alignment</li> <li>3.6 adjusting belt tension and chain slacks</li> <li>3.7 cleaning procedure</li> </ul>
<p>4. Resource implications</p>	<p>The following resources <b>MUST</b> be provided:</p> <ul style="list-style-type: none"> <li>4.1 appropriate hand tools and supplies</li> <li>4.2 drawings and manuals</li> <li>4.3 inspection checklist</li> <li>4.3 inspection and routine maintenance report form</li> </ul>
<p>5. Method of assessment</p>	<p>Competency may be assessed through:</p> <ul style="list-style-type: none"> <li>5.1 Observation with questioning</li> <li>5.2 Demonstration with questioning</li> <li>5.3 Written examination</li> <li>5.4 Portfolio</li> </ul>
<p>6. Context for assessment</p>	<p>Competency may be assessed in the workplace or in simulated workplace environment.</p>

**UNIT OF COMPETENCY :**        **PERFORM PLANNED MAINTENANCE WORK**

**UNIT CODE**                        :        **MEE723302**

**UNIT DESCRIPTOR:**                This unit covers the knowledge, skills and attitude required to perform planned and unplanned (emergency) maintenance work.

<b>ELEMENTS</b>	<b>PERFORMANCE CRITERIA</b> <i>Italicized terms</i> are elaborated in the Range of Variables
1. Obtain work instructions	1.1 <b>Extent of work</b> clearly understood. 1.2 All materials and tools to be used gathered. 1.3 Work permit obtained and all safety precautions arranged such as equipment shutdown and danger tags.
2. Dismantle equipment	2.1 Manual studied to determine sequence and extent of dismantling to gain access to the affected area according to procedure 2.2 Machine dismantled and parts inspected closely and cleaned for closer inspection as per manufacturer's recommended procedure. 2.3 Safety precautions observed in dismantling
3. Inspect closely for cause of failure	3.1 <b>Signs of failure</b> determined through visual inspection or use of other methods such as dye penetrant test. 3.2 <b>Cause of failure</b> of part determined if wear-out, misuse failure or inherent weakness. 3.3 Note down findings for inclusion in <b>report</b> , history card and failure analysis studies.
4. Replace components	4.1 Component replaced and machine re-assembled using the reverse of dismantling procedure. 4.2 Report made and submitted to supervisor
5. Troubleshoot machine breakdown (In case work is emergency and therefore unplanned)	5.1 <b>Background data</b> and <b>operational data</b> . about the machine gathered .to define the problem 5.2 The area suspected where failure is most likely to occur is closely investigated 5.3 Machine divided mentally into functional zones to check each zone separately in the drawing and/or the actual machine itself the input and output 5.4 Eliminate by testing those zones unaffected by the fault, until finally it is isolated to one part of the system

	<p>5.5 Machine dismantled and each element of the zone Investigated by testing to pinpoint the particular element in the assembly where the fault lies.</p> <p>5.6 Eliminate those elements unaffected by fault by bypassing them or substituting components that are known to work.</p> <p>5.7 Cause of failure pinpointed as to wear failure, misuse failure or inherent weakness in design of parts.</p> <p>5.8 Note down findings for inclusion in <b>report</b> , history card and failure analysis studies.</p>
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**RANGE OF VARIABLES**

VARIABLE	RANGE
1. Extent of work	Planned work 1.1 Major overhaul 1.2 Replacement work 1.3 Machine modification  Unplanned work 1.4 Emergency (breakdown maintenance)
2. Signs of failure	2.1 Wear 2.2 Corrosion 2.3 Fatigue 2.4 Plastic flow 2.5 Material damage 2.6 Cracks 2.7 Fraying 2.8 Swelling 2.9 Stretching 2.10 Tooth breakage 2.11 Fretting 2.12 Pitting
3. Causes of failure	3.1 Dirt 3.2 Inadequate lubrication 3.3 Improper assembly 3.4 Misalignment 3.5 Overload 3.6 Moisture 3.7 Lubricant breakdown 3.8 Contamination 3.9 External vibration 3.10 Out of mesh
4. Report	4.1 Job report 4.2 Failure Report
3. Background data	3.1 Manufacturer's information 3.2 Equipment history record 3.3 Systems drawing 3.4 Process drawings 3.5 Troubleshooting charts 3.6 Operator interview
4. Operational data	4.1 Operating records 4.2 Operator's report 4.3 Test readings



## EVIDENCE GUIDE

<p>1. Critical aspects of Competency</p>	<p>Assessment requires evidence that the candidate:</p> <ul style="list-style-type: none"> <li>1.1 Planned work to be done clearly understood</li> <li>1.2 Machine dismantled safely</li> <li>1.3 Replacements made</li> <li>1.4 Troubleshooting made on breakdown of machine</li> </ul>
<p>2. Underpinning knowledge and attitude</p>	<ul style="list-style-type: none"> <li>2.1 Assembly and detail drawings of machine</li> <li>2.2 Inspection Report form</li> <li>2.3 Job Report form</li> <li>2.4 Use of hand tools and equipment</li> <li>2.5 Linear measuring instruments</li> <li>2.6 Signs of failure</li> <li>2.7 Causes of failure</li> <li>2.8 Troubleshooting skills</li> <li>2.9 Report making using forms</li> </ul>
<p>3 Underpinning skills</p>	<ul style="list-style-type: none"> <li>3.1 Use of hand tools</li> <li>3.2 Safe handling of tools and materials</li> </ul>
<p>4. Resource implications</p>	<p>The following resources must be provided</p> <ul style="list-style-type: none"> <li>4.1 Appropriate tools for the job</li> </ul>
<p>5. Method of assessment</p>	<p>Competency may be assessed through:</p> <ul style="list-style-type: none"> <li>5.1 Observation with questioning</li> <li>5.2 Demonstration with questioning</li> <li>5.3 Written examination</li> <li>5.4 Portfolio</li> </ul>
<p>6. Context for assessment</p>	<p>Competency may be assessed in the workplace or in simulated workplace environment.</p>

**UNIT OF COMPETENCY : FABRICATE SIMPLE ITEMS**

**UNIT CODE : MEE723303**

**UNIT DESCRIPTOR :** This unit covers the knowledge, skills and attitude required to fabricate simple parts required for machines being repaired and items required for maintenance work..

<b>ELEMENTS</b>	<b>PERFORMANCE CRITERIA</b> <i>Italicized terms</i> are elaborated in the Range of Variables
1. Interpret work instruction	1.1 Work instruction on the <b>items</b> to be made interpreted clarified and understood. 1.2 Materials required listed as per requirement.
2. Prepare materials and tools	2.1 Materials marked and cut by different <b>cutting methods</b> according to standard procedures 2.2 Materials processed using required <b>fabricating methods</b> according to standard practices 2.3 Materials fitted and assembled using <b>joining methods</b> according to drawing requirements
3. Install items	3.1 Item installed safely using standard <b>installation tools</b> according to workplace procedures.

## RANGE OF VARIABLES

VARIABLE	RANGE	
1 Items	1.1 <u>Safety equipment</u> <ul style="list-style-type: none"> <li>- guards &amp; handrails</li> <li>- Covers</li> <li>- dividers</li> </ul> 1.2 Ladders 1.3 A-frames 1.4 Brackets 1.5 <u>Simple parts</u> <ul style="list-style-type: none"> <li>- baseplates</li> <li>- pins</li> <li>- bushings</li> <li>- shafts</li> <li>- spacers</li> </ul>	-
2. Cutting methods	2.1 Hacksawing 2.2 Oxyacetylene cutting 2.3 Power hacksawing 2.4 bandsawing 2.5 abrasive cutting	
3. Fabricating methods	3.1 Benchwork drilling, tapping 3.2 Turning round workpieces, bushings, pins 3.3 Milling keyseats, keyways, flats 3.4 Sheet metal work simple development and seaming 3.5 Pipe bending	
4. Joining methods	4.1 screwing 4.2 bolting 4.3 gas welding 4.4 arc welding 4.5 seaming	
5. Installation methods	5.1 expansion bolts	

## EVIDENCE GUIDE

<p>1. Critical aspects of Competency</p>	<p>Assessment requires evidence that the candidate:</p> <ul style="list-style-type: none"> <li>1.1 Work instruction understood</li> <li>1.2 Work prepared safely</li> <li>1.3 Material fabricated and assemble safely</li> <li>1.4 Item installed safely</li> </ul>
<p>2. Underpinning knowledge and attitude</p>	<ul style="list-style-type: none"> <li>2.1 Interpreting drawings</li> <li>2.2 Cutting methods</li> <li>2.3 Bench work practices</li> <li>2.4 Machine shop practice               <ul style="list-style-type: none"> <li>Turning</li> <li>Milling</li> </ul> </li> <li>2.5 Off-hand grinding</li> <li>2.6 Gas welding</li> <li>2.7 Arc welding</li> <li>2.8 Pipe fitting</li> </ul>
<p>3. Underpinning skills</p>	<ul style="list-style-type: none"> <li>3.1 Use of hand and power tools</li> <li>3.2 Use of oxyacetylene cutter and welding</li> <li>3.3 Use lathe machine</li> <li>3.3 Use milling machine</li> <li>3.4 Use of arc welder</li> <li>3.5 U of pipe threader</li> </ul>
<p>4. Resource implications</p>	<ul style="list-style-type: none"> <li>4.1 Machines required for the job</li> <li>4.2 Hand appropriate to the job</li> </ul>
<p>5. Method of assessment</p>	<p>Competency may be assessed through:</p> <ul style="list-style-type: none"> <li>5.1 Observation with a group and questioning</li> <li>5.2 Demonstration with questioning</li> <li>5.3 Portfolio</li> </ul>
<p>6. Context for assessment</p>	<p>Competency may be assessed in the workplace or in simulated workplace environment.</p>

**UNIT OF COMPETENCY : INSTALL MACHINERY**

**UNIT CODE : MEE723304**

**UNIT DESCRIPTOR:** This unit covers the knowledge, skills and attitude required to move and install machineries.

<b>ELEMENTS</b>	<b>PERFORMANCE CRITERIA</b> <i>Italicized terms</i> are elaborated in the Range of Variables
1. Prepare designated area	1.1 Equipment and its connections removed from the designated according to worksite procedure  1.2 Area cleared of dirt and marked according to requirement and causeways cleared of obstructions.
2. Move machinery	2.1 Safety practices observed in handling heavy loads.  2.2 Machinery lifted , and moved according to available <b>handling equipment</b> or any <b>manual method</b> .  2.3 Machinery lowered into position, bolted and leveled according to standard procedure.
3. Install machinery	3.1 Machinery installed, cleaned, and compressed air, hydraulic lines and other accessories connected.  3.2 Manual studied for operational procedures and safety precautions for safe star-up procedures.
4. Test machinery	4.1 Test machine with operator

## RANGE OF VARIABLES

VARIABLE	RANGE
1 Handling equipment	1.1 Overhead crane 1.2 Forklift 1.3 A-frames 1.4 Chain Blocks 1.5 Dollies
2. Manual moving methods	2.1 Crowbars 2.2 Jacks 2.3 Wedge 2.4 Rollers 2.5 Shim washers
3. Communication	3.1 Hand signals
4. Accessories	4.1 Foundation 4.2 Anchor bolts 4.3 Hold down bolts 4.4 Leveling screw 4.5 Grout 4.6 Air distribution lines 4.7 Tapping of air lines 4.8 Power pack

## EVIDENCE GUIDE

1. Critical aspects of Competency	Assessment requires evidence that the candidate: 1.4 Designated area and access ways cleared 1.5 Machinery lifted and moved safely 1.6 Machinery installed
2. Underpinning knowledge and attitude	2.1 Principle of operation of machine 2.2 Methods of lifting machines 2.3 Methods of moving machines manually 2.4 Lifting capacity of lifting equipment 2.5 Principle of leveling 2.6 Foundation design
3. Underpinning skills	3.1 Use of hand signals 3.2 Moving machines using manual method 3.3 Use of claw bars, wedges and rollers in moving machines 3.4 Working with a group
4. Resource implications	4.1 Machine to be installed 4.2 Material handling equipment
5. Method of assessment	Competency may be assessed through: 5.1 Observation with a group and questioning 5.2 Demonstration with questioning 5.3 Portfolio
6. Context for assessment	Competency may be assessed in the workplace or in simulated workplace environment.

## SECTION 3. TRAINING STANDARDS

These guidelines are set to provide the Technical and Vocational Education and Training (TVET) providers with information and other important requirements to consider when designing training programs for PLANT MAINTENANCE NC I.

### 3.1 CURRICULUM DESIGN

Course Title : PLANT MAINTENANCE NC Level: NC I

Nominal Training Duration : 358 Hours

This qualification is designed to develop knowledge, desirable attitudes and skills in Plant Maintenance NC I.

It covers the competencies required to Perform Preventive Maintenance, Perform Corrective Maintenance and Install Machinery.

To obtain this, all units of competency prescribed for this qualification must be achieved.

## BASIC COMPETENCIES

Unit of Competency	Learning Outcomes	Methodology	Assessment Approach
1. Receive and respond to workplace communication	1.1 Explain routinary speaking & messages in a workplace 1.2 Follow routinary speaking & messages 1.3 Perform work duties following written notices	<ul style="list-style-type: none"> <li>• Group discussion</li> <li>• Interaction</li> </ul>	<ul style="list-style-type: none"> <li>• Interviews/questioning</li> <li>• Observation</li> </ul>
2. Work with others	2.1 Develop effective workplace relationship 2.2 Contribute to work group activities	<ul style="list-style-type: none"> <li>• Group discussion</li> <li>• Interaction</li> </ul>	<ul style="list-style-type: none"> <li>• Interviews/questioning</li> <li>• Demonstration</li> <li>• Observation</li> </ul>
3. Demonstrate work values	3.1 Define the purpose of work 3.2 Apply work values/ethics 3.3 Deal with ethical problems 3.4 Maintain integrity of conduct in the workplace	<ul style="list-style-type: none"> <li>• Group discussion</li> <li>• Interaction</li> </ul>	<ul style="list-style-type: none"> <li>• Demonstration</li> <li>• Observation</li> <li>• Interviews/questioning</li> </ul>
4. Practice housekeeping procedures	4.1 Sort and remove unnecessary items 4.2 Arrange items 4.3 Maintain work areas, tools and equipment 4.4 Follow standardize work process and procedures 4.5 Perform work spontaneously	<ul style="list-style-type: none"> <li>• Group discussion</li> <li>• Interaction</li> </ul>	<ul style="list-style-type: none"> <li>• Demonstration</li> <li>• Observation</li> <li>• Interviews/questioning</li> </ul>



## COMMON COMPETENCIES

Unit of Competency	Learning Outcomes	Methodology	Assessment Approach
1. Apply safety practices	1.1 Identify hazards 1.2 Use protective clothing and devices 1.3 Perform safe handling of tools, equipment and materials 1.4 Perform first aid 1.5 Use fire extinguisher	<ul style="list-style-type: none"> <li>• Lecture</li> <li>• Group discussion</li> <li>• Interaction</li> <li>• Role playing / Simulation</li> </ul>	<ul style="list-style-type: none"> <li>• Observation</li> <li>• Demonstration</li> <li>• Interview / Questioning</li> </ul>
2. Interpret working drawing and sketches	2.1 Interpret technical drawing 2.2 Prepare freehand sketch of parts 2.3 Interpret details from freehand sketch	<ul style="list-style-type: none"> <li>• Lecture</li> <li>• Group discussion</li> <li>• Interaction</li> </ul>	<ul style="list-style-type: none"> <li>• Observation</li> <li>• Interview / Questioning</li> </ul>
3. Perform shop computations	3.1 Perform four fundamental operations 3.2 Perform basic calculations involving fractions and decimals 3.3 Perform basic calculations involving percentages 3.4 Perform basic calculations involving ratio and proportion 3.5 Perform calculations on algebraic expressions	<ul style="list-style-type: none"> <li>• Lecture</li> <li>• Demonstration</li> <li>• Practical exercise</li> </ul>	<ul style="list-style-type: none"> <li>• Demonstration</li> <li>• Observation</li> <li>• Performance test</li> <li>• Interview / Questioning</li> </ul>
4. Measure workpiece	4.1 Select and use measuring tools 4.2 Clean and store measuring tools	<ul style="list-style-type: none"> <li>• Lecture</li> <li>• Demonstration</li> <li>• Practical exercise</li> </ul>	<ul style="list-style-type: none"> <li>• Demonstration</li> <li>• Observation</li> <li>• Performance test</li> </ul>

## CORE COMPETENCIES

Unit of Competency	Learning Outcomes	Methodology	Assessment Approach
<p>1. Perform Preventive Maintenance</p>	<p>1.1 Explain why prevention is underlying theme of all maintenance work.</p> <p>1.3 Identify <u>external</u> symptoms of malfunction of a running machine</p> <p>1.4 Inspect machine as per Inspection Checklist to find <u>Internal</u> evidence of symptoms</p> <p>1.5 Dismantle accessible portion of machine for cleaning and closer inspection of parts</p> <p>1.6 Adjust loose bolts, belt tension, chain slacks, covers, etc.</p> <p>1.7 Inspect lubrication system for adequacy and correct as required.</p> <p>1.8 Prepare Inspection Report. and recommended actions for submission to superiors.</p> <p>1.9 Perform routine maintenance in all power drive components such as V-belts, chain drives, couplings, clutches, gears, bearings, etc., and fluid power systems</p> <p><b><i>For process machineries,</i></b></p> <p>1.10 Inspect machines as per manufacturer's recommendations</p>	<ul style="list-style-type: none"> <li>• Lecture/ discussion</li> <li>• Self-paced instructions</li> <li>• Demonstration</li> <li>• Dualized training</li> </ul>	<ul style="list-style-type: none"> <li>• Written or oral</li> <li>• Demonstration</li> </ul>

Unit of Competency	Learning Outcomes	Methodology	Assessment Approach
2. Perform planned maintenance	<p>2.1 Perform maintenance work planned in advance.</p> <p>2.2 Gather work instructions about maintenance work to be done; work authorization</p> <p>2.3 Observe safety precautions before and during maintenance work. Tag in/ Tag out</p> <p>2.4 Dismantle equipment to gain access to part to be replaced.</p> <p>2.5 Remove defective item and install the replacement.</p> <p>2.6 Inspect the defective item for cause of failure and note down for inclusion in report.</p> <p>2.6 Re-assemble, align and make minimum checks and/or adjustments</p> <p>2.8 Perform minimum tests required to ensure fault is eliminated.</p> <p><i>For unplanned maintenance (emergency) where failure and cause is unknown</i></p> <p>2.9 Gather all necessary data to find the fault from operators or from data available (operational &amp; background information..</p>	<ul style="list-style-type: none"> <li>• Lecture/ discussion</li> <li>• Self-paced instructions</li> <li>• Demonstration</li> <li>• Dualized Training</li> </ul>	<ul style="list-style-type: none"> <li>• Written or oral</li> <li>• Demonstration</li> </ul>

	<p>2.10 Divide mentally the machine into functional zones to check each zone separately in the drawing and/or the actual machine.</p> <p>2.11 Continue investigating all zones by eliminating those zones unaffected by the fault, until a zone is finally isolated.</p> <p>2.12 Dismantle the zone affected and each element of the zone Investigated by testing to pinpoint the particular element in the assembly where the fault lies.</p> <p>2.13 Investigate the cause of failure: whether wear failure, misuse failure or inherent weakness of the part failure .</p> <p>2.14 Make report of the job using Job Report Form</p>		
<p>3. Fabricate simple items</p>	<p>3.1 Prepare materials as per drawing and instruction</p> <p>3.2 Mark and cut materials using different cutting methods</p> <p>3.3 Process materials using different machining and fitting methods</p> <p>3.4 Assemble and join materials using different joining methods</p> <p>3.5 Install items safely</p>	<ul style="list-style-type: none"> <li>• Lecture/ discussion</li> <li>• Self-paced instructions</li> <li>• Demonstration</li> <li>• Dualized Training</li> </ul>	<ul style="list-style-type: none"> <li>• Written or oral</li> <li>• Demonstration</li> </ul>

<p>4. Install machinery</p>	<p>4.1 Remove equipment and clean area</p> <p>4.2 Move machinery using manual methods and moving machinery safely.</p> <p>4.3 Install machine and auxiliary connections</p> <p>4.4 Bolt down and level machinery</p> <p>4.5 Test machinery</p>	<ul style="list-style-type: none"> <li>• Lecture/ discussion</li> <li>• Self-paced instructions</li> <li>• Demonstration</li> <li>• Dualized Training</li> </ul>	<ul style="list-style-type: none"> <li>• Written or oral</li> <li>• Demonstration</li> </ul>
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## 3.2 TRAINING DELIVERY

The delivery of training should adhere to the design of the curriculum. Delivery should be guided by the 10 basic principles of Competency-Based TVET.

The training is based on curriculum developed from the competency standards;

- Learning is modular in its structure;
- Training delivery is individualized and self-paced;
- Training is based on work that must be performed;
- Training materials are directly related to the competency standards and curriculum modules;
- Assessment is based in the collection of evidence of the performance of work to the industry required standard;
- Training is based both on and off-the-job component;
- Allows for the recognition of prior learning ( RPL ) or current competencies;
- Training allows for multiple entry and exit ; and
- Approved training programs are nationally accredited.

The competency-based TVET system recognizes various types of delivery modes, both on and off-the-job as long as the learning is driven by the competency standards specified by the industry. The following training modalities may be adopted when designing training programs:

- The dualized mode of training delivery is preferred and recommended. Thus programs would contain both in school and in-industry training of fieldwork components. Details can be referred to the Dual Training System ( DTS ) Implementing Rules and Regulations
- Modular / self-paced learning is a competency- based training modality wherein the trainee is allowed to progress at his own pace. The trainer facilitates the training delivery
- Peer teaching / mentoring is training modality wherein fast learners are given the opportunity to assist the slow learners.
- Supervised industry training or on-the-hob training is an approach in training designed to enhance the knowledge and skills of the trainee through actual experience in the workplace to acquire specific competencies prescribed in the training regulations.
- Distance learning is formal education process in which majority of the instruction occurs when the students and instructor are not in the same place. Distance learning may employ correspondence study, or audio, video or computer technologies.

### 3.3 TRAINEE ENTRY REQUIREMENTS

This section specifies the qualifications of trainees and educational experience. Other requirements like health and physical requirements are also stated. Passing entry written examinations may also be indicated if necessary.

- Must possess Certificate of Competency in Benchwork, Turning, Milling
- With good moral character
- Ability to communicate
- Physically and mentally fit

### 3.4 LIST OF TOOLS, EQUIPMENT AND MATERIALS PLANT MAINTENANCE NC I

Recommended list of tools, equipment and materials for the training of 12 trainees for Plant Maintenance NC I

TOOLS					
QTY		QTY		QTY	
<b>Maintenance Equipment</b>					
4	• Workbench	12	• Set of screwdriver	4	• Set of tin snips
8	• Bench vise	12	• Set of open wrench	6	• Hacksaw
4	• Anvil	12	• Set of socket wrench	12	• Chisels
4	• Sledge hammer	12	• Set of Allen wrench	12	• Files
12	• Ball pein hammer	12	• Set of pliers	4	• Set of Scraper
6	• Mallet	6	• Set of drills	1	• Pipe threader
3	• Adjustable reamers	6	• Set of taps with wrench	4	• Adjustable wrench
1	• Hook spanner	1	• Impact spanner	1	• Machinist hammer
2	• Precision level	2	• Straightedge	4	• Steel rule
6	• Knife	6	• Paper cutter	4	• Torque wrench
	• Portable drill		•		•

<b>Measuring Tools:</b>					
6	• Vernier caliper, 150	12	• Steel tape	3	• Micrometer, 50-75
6	• Vernier caliper, 200	3	• Micrometer, 25-50	4	• Outside caliper
12	• Steel measure tape	3	• Vernier depth gage	4	• Spring caliper
4	• Straight edge	3	• Inside caliper	4	• Dial indicator w/ mounting bracket
	• Surface plate	3	• Outside caliper		•

<b>Safety Device:</b>					
3	• First –Aid kit	12	• Face shield	12	Welding gloves
4	• Fire extinguisher	12	• Safety goggles	24	Hand gloves
4	• Welding mask	4	• Welding goggles	4	Welding apron

<b>EQUIPMENT</b>					
<b>QTY</b>		<b>QTY</b>		<b>QTY</b>	
3	Welding machine	2	Bench shear	4	Oxyfuel Cutting
1	Power hacksaw	1	Bench lathe	1	Drill press
1	Bar cutter	1	Bench Miller	1	Bench grinder
1	Puncher	2	Hand truck	1	Forge
1	Arbor press	4	Electric welder	4	Welding table
6	Dollies		Chain block, 5T		
<b>MATERIALS</b>					
1	• Solvents	2	▪ Flat bar 6mm x 150 x 6000 mm		▪ Steel plate, 3mm x 1200 x 2400
1	• Kerosene	6	▪ Steel sheet, 1.2mm1200x 2400		▪ Scissors
<b>Layout materials:</b>					
6	▪ Dividers	12	▪ Scribers	24	▪ Cardboard
6	• Compass	6	• Triangles	24	▪ Cartolina
	•		•	6	▪ Scissors
<b>Housekeeping materials:</b>					
20	▪ Brooms	10	▪ Mops	2	▪ Trash can
10	▪ Clean rags	2	▪ Soap	5	▪ Dustpan



### 3.5 TRAINING FACILITIES PLANT MAINTENANCE NC I

The Drafting workshop must be of concrete structure. Based on class size of 25 students/trainees the space requirements for the teaching/learning and circulation areas are as follows:

SPACE REQUIREMENT	SIZE IN METERS	AREA IN SQ. METERS	TOTAL AREA IN SQ. METERS
• Building (permanent)	10 M X 30 M		300 Sq. M
▪ Trainee working space	2 M X 2 M	4 Sq.M / trainee	100 sq. M.
▪ Lecture Room	8 M X 10 M	80 Sq. M.	80 Sq. M
▪ Learning Resource Center	4 M X 8 M.	32 Sq. M	32 Sq. M
▪ Facilities/ Equipment/ Circulation Area			88 Sq. M.

### 3.6 TRAINER'S QUALIFICATIONS FOR METALS AND ENGINEERING SECTOR

#### TRAINER QUALIFICATION (TQ I)

- Must be a holder of Plant Maintenance NC I
- Must have undergone training on Training Methodology I (TM I)
- Must be computer literate
- Must be physically and mentally fit
- \*Must have at least 2 years job/industry experience
- Must be a civil service eligible (for government position or appropriate professional license issued by the Professional Regulatory Commission)

\* **Optional. Only when required by the hiring institution.**

Reference: TESDA Board Resolution No. 2004 03

### 3.7 INSTITUTIONAL ASSESSMENT

Institutional assessment is undertaken by trainees to determine their achievement of units of competency. A certificate of achievement is issued for each unit of competency.

## **SECTION 4      NATIONAL ASSESSMENT AND CERTIFICATION ARRANGEMENTS**

- 4.1 To attain the National Qualification of Plant Maintenance Mechanic NC I, the candidate must demonstrate competence in all the units of competency listed in Section 1. Successful candidates shall be awarded a National Certificate signed by the TESDA Director General.
- 4.2 Assessment shall focus on the core units of competency. The basic and common units shall be integrated or assessed concurrently with the core units.
- 4.3 The following are qualified to apply for assessment and certification:
  - 4.3.1 Graduates of formal, non-formal and informal including enterprise-based training programs.
  - 4.3.2 Experienced workers (wage employed or self employed)
- 4.4 The guidelines on assessment and certification are discussed in detail in the "Procedures Manual on Assessment and Certification" and "Guidelines on the Implementation of the Philippine TVET Qualification and Certification System (PTOQS)".

**Supermarket of Competencies  
Metals and Engineering Sector**

**PLANT MAINTENANCE NC I**

**CORE  
COMPETENCIES**

Perform Preventive Maintenance	Perform Planned Maintenance	Fabricate Simple Items	Install Machinery
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**COMMON  
COMPETENCIES**

Apply safety practices	Measure workpiece (Basic)	Select and cut workshop materials	Perform preventive and corrective maintenance	Measure workpiece using gages and comparators	
Interpret working drawings and sketches	Perform shop computations (Basic)	Perform routine housekeeping	Perform shop computations (Intermediate)	Measure workpiece using angular measuring instruments	Perform shop computations (Advanced)

**BASIC  
COMPETENCIES**

Receive and respond to workplace communication	Participate in workplace communication	Lead in workplace communication	Solve problems related to workplace activities	Utilize specialist communication skills	Collect, analyze and organize information
Work with others	Work in team environment	Lead small teams	Use mathematical concepts and techniques	Develop team and individual	Plan and organize work
Demonstrate work values	Practice career professionalism	Develop and practice negotiation skills	Use relevant technologies	Apply problem -solving techniques in the workplace	Promote environmental protection
Practice housekeeping procedures	Practice occupational health and safety procedures				

**Legend**



**Plant Maintenance NC I**

## DEFINITION OF TERMS

1. Prevention Maintenance  
A collection of systematic actions performed to retained equipment in satisfactory operational condition and to prevent sudden malfunction. It includes routine, repetitive inspections, calibration, overhauls and lubrication.
2. Breakdown maintenance  
Work on a non-routine, non-repetitive basis performed to restore an item to a satisfactory condition after a malfunction has caused a degradation of the item below the specified performance level. (Sometimes called emergency maintenance)
3. Corrective maintenance  
Study of equipment failures and breakdowns and taking the action necessary to prevent recurrence.
4. Planned maintenance  
Maintenance that requires an extended equipment shutdown that needs to be planned and scheduled in advance.
5. Breakdown
  - Failure that renders a machine totally inoperable or
  - Failure that leads to an unacceptable reduction in performance.
6. Troubleshooting  
A logical system of investigation designed to yield the correct cause of breakdown in the shortest possible time and with least likelihood of error
7. Downtime  
Period of time during which an item is not in a condition to perform its intended use.
8. History card  
A record of usage events and action as appropriate relating to a particular item
9. Incident report  
Document reporting the departure of an item from an acceptable condition has occurred.
10. Job report  
A statement recording the work done and the condition of an item.
11. Work order  
A written instruction detailing work to be carried out.
12. Job specification  
A document describing the work to be done.
13. Work requisition  
A document requesting work to be carried out.
14. Lubrication  
'to make smooth and slippery' two contacting surfaces by introducing a lubricant that separates these surfaces in contact to reduce the effect of friction
15. Wear  
The transformation of matter by use and it results in a diminishing of the dimension of machinery parts.

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